

Gliederung der Vorlesung

- | | |
|---|--|
| A) Introduction | F) Static Games |
| B) Competition and Monopoly | G) Dynamic Games, First and Second Movers |
| C) Technology and Cost; Industry Structure | H) Horizontal Product Differentiation |
| D) Price Discrimination and Monopoly | I) Vertical Product Differentiation |
| E) Product Variety and Quality under Monopoly | J) Advertising  |
| | K) Research & Development |

Introduction

- Advertising has played a central role in development of marketing
 - allows manufacturers to reach customers directly with information about their products and prices
 - removes need for specialized sellers providing expertise
- Modern phenomenon of retailers selling wide array of different products and many versions of the same product owes much to mass media and advertising
- But important issues remain:
 - Does advertising foster market power/suppress competition?
 - How does advertising work? What information is provided?
 - Is there too much or too little advertising?

Slides from PRN, Quantitative Analysis, Chapter 14 (with small changes)

Stylized Facts About Advertising

- Volume of advertising expenditures is large. For the US, advertising consumes over 2% of GDP
- Underneath this national total is a wide variety in firm advertising behavior
- Car makers (e.g., GM) and household product firms (e.g., Procter & Gamble) spend the most on advertising
 - Some directly in mass media
 - Some indirectly in mailings, catalogs, coupons, etc.
- Basic patterns that emerge are:
 - Correlation between advertising & market power
 - Consistency of advertising behavior within industries—big advertisers remain big over time and across countries

Key questions/presumptions of early studies (Galbraith): Does advertising have a rather negative effect, because it is persuasive therefore increasing market power and the differentiation achieved by advertising is not „real“. Therefore, ads are wasteful in terms of costs. Argument very much like rent-seeking.

Advertising and Monopoly Power

- Assume a firm faces a downward-sloping demand inverse curve but one that shifts depending on the amount of advertising α (messages) that the firm does

$$P = P(Q, \alpha)$$

- Profit maximization requires that marginal revenue = marginal cost c at optimal Q^*

$$MR(Q^*, \alpha) = P(Q^*, \alpha) + \frac{\partial P(Q^*, \alpha)}{\partial Q} Q^* = c$$

- This condition can be expressed in terms of the Lerner Index, LI

$$\frac{P^* - c}{P^*} = \frac{1}{\eta_p} \quad \text{Where } \eta_p \text{ is the price elasticity of demand}$$

Better start with profit maximization problem:

Advertising and Monopoly Power 2

- Now consider optimal advertising. At any output Q , more advertising will raise the price $P(Q, \alpha)$
 - revenue will rise by the price increase times output Q .
 - Profit maximization requires equating this marginal revenue with the advertising marginal cost T at optimal advertising α^*

$$\frac{\partial P(Q, \alpha^*)}{\partial \alpha} Q = T$$

- Multiplying each side by α^*/P^* and dividing by Q^*

$$\frac{\alpha^*}{P^*} \frac{\partial P(Q^*, \alpha^*)}{\partial \alpha} = \frac{\alpha^* T}{P^* Q^*} = \text{Advertising-to-sales ratio}$$

At any output Q , more advertising will raise the price $P(Q, \alpha) = \text{WTP!}$

Advertising and Monopoly Power 3

- Consider carefully this last equation

$$\frac{\alpha^* \frac{\partial P(Q^*, \alpha^*)}{\partial \alpha}}{P^*} = \frac{\alpha^* T}{P^* Q} = \text{Advertising-to-sales ratio}$$

- We can rewrite $\partial P(Q^*, \alpha)/\partial \alpha$ as

$$\frac{\partial P(Q^*, \alpha^*)}{\partial \alpha} = \frac{\partial P(Q^*, \alpha^*)}{\partial Q} \frac{\partial Q}{\partial \alpha} \quad \text{to obtain}$$

$$\frac{\alpha^* \frac{\partial P(Q^*, \alpha^*)}{\partial Q} \frac{\partial Q}{\partial \alpha}}{P^*} = \frac{\alpha^* T}{P^* Q} \quad \text{Multiply the LHS by } Q^*/Q^*$$

$$\frac{\alpha^* \frac{\partial P(Q^*, \alpha^*)}{\partial Q} Q^* \frac{\partial Q}{\partial \alpha}}{P^*} = \frac{\alpha^* T}{P^* Q} = \frac{\alpha^*}{Q^*} \frac{1}{\eta_p} \frac{\partial Q}{\partial \alpha}$$

Advertising and Monopoly Power 4

- However, the elasticity of output demand with respect to advertising η_A is defined as

$$\eta_A = \frac{\partial Q / Q}{\partial \alpha / \alpha} = \frac{\alpha}{Q} \frac{\partial Q}{\partial \alpha}$$

- So, we may write

$$\frac{\alpha^* T}{P^* Q} = \frac{\alpha^*}{Q^*} \frac{1}{\eta_P} \frac{\partial Q}{\partial \alpha} = \frac{\eta_A}{\eta_P} = \text{Advertising/sales ratio}$$

Dorfman-Steiner Condition: *For a profit-maximizing monopolist, the advertising-to-sales ratio is equal to the ratio of the elasticity of demand with respect to advertising relative to the elasticity of demand with respect to price.*

Advertising and Monopoly Power 5

- The Dorfman-Steiner Condition is the starting point for thinking about the relationship between advertising and market power. It yields several important insights
 - Recall that the Lerner Index $(P - c)/P$ equals $1/\eta_D$. Hence, we can write the Dorfman-Steiner condition as:
Advertising-to-Sales Ratio = $\eta_A LI$
 - The observed positive correlation between advertising intensity and market power has a theoretical basis **BUT** the causality is reversed—market power (high **LI**) induces more advertising; advertising does **not** cause market power
 - Industries with high responsiveness of sales to advertising (high η_A) will have high advertising intensity
 - Advertising similarity across industries and over time is to be expected if η_A and η_D are similar

Advertising, Information, and Signaling

- Does advertising provide information? If so, what is the content of that advertising?
- Consider alternative types of goods:
 - *Shop Goods*: Relatively expensive goods that are infrequently purchased, e.g., cars, televisions, computers. Here consumers invest in time and information gathering by shopping around
 - *Convenience Goods*: Relatively inexpensive goods that are bought with high frequency, e.g., shampoo, laundry detergent, soft drinks. Here, it is not worth investing time in information gathering.
- Conjecture: Consumers will rely on advertising for info about convenience goods because it is free and spending time to gather information about such goods is not worthwhile. Conversely, consumers will not rely on advertising for Shop Goods but instead gather their own information

Advertising as information or persuasion; different functions are of importance for different products.

Advertising, Information & Signaling 2

- Within the Shop Goods/Convenience Goods distinction there is a further distinction
 - *Search Goods*: Consumers know quality and function of different brands but need to search for best deals
 - *Experience Goods*: Consumers need to try goods and experience them before they can know quality
- Conjecture: Consumers will be more responsive to advertising for experience goods as it provides an inexpensive way to learn about the good.
- Implications: Elasticity with respect to advertising η_A should be highest for convenience/ experience goods and lowest for shop/search goods

Advertising, Information & Signaling 3

- Advertising as Percent of Sales by Good Type

Cosmetics	11.1
Amusement Parks/Arcades	10.5
Soft Drinks/Beverages	10.2
Hotels and Motels	3.6
Motor Vehicles	3.5
Mobile Homes	1.9

- Note high percentage of sales revenue devoted to frequently bought convenience goods. For big ticket items that are infrequently bought consumers shop around to get information on their own so advertising is less important.
- What role does signaling play in either case?

Anecdotal evidence

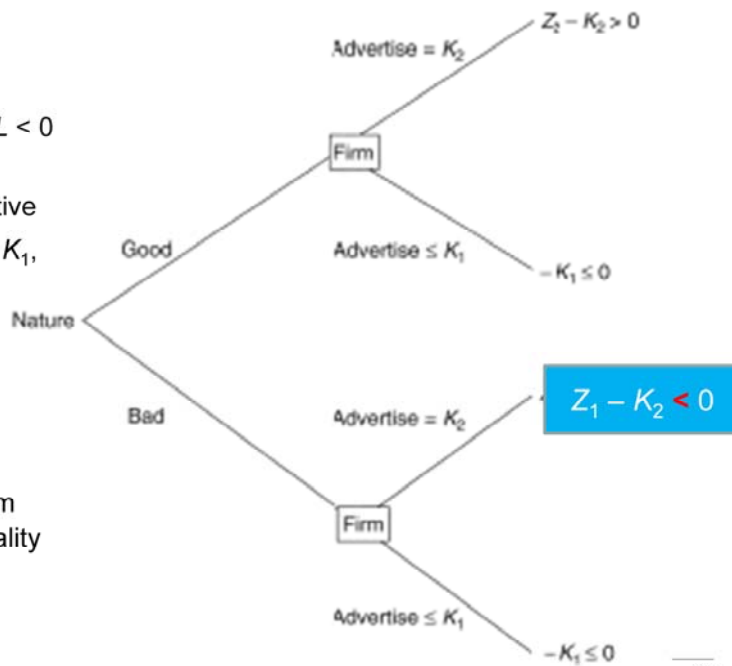
Advertising, Information & Signaling 4

- Nelson's (1970 and 1974) signaling model
 - Experience Goods have Information Asymmetry
 - Producers know true quality (high or low)
 - Consumers can only guess about quality
 - Producers interested in repeat purchases
 - If producer has high quality experience good, consumers who try it will purchase it again
 - If producer has low quality good, consumers who try it will not be back
 - Advertising works to get consumers to try the good but it is expensive
 - Only sellers of high quality goods can afford to advertise heavily because only they will get the repeat business
 - Consumers infer that heavy advertising \Rightarrow high quality

Advertising as a signal of product quality

Assumptions:

- $E(U) = p G + (1 - p) L < 0$
 \Rightarrow Expected utility from consumption is negative
- Advertising levels: 0, K_1 , K_2
- PDV of profits: Z
 - High quality Z_2
 - Low quality Z_1
- $Z_2 > K_2 > Z_1 > K_1$
 \Rightarrow Separating equilibrium with only the high quality firm advertising



Z : Present value of current and future profits

Advertising, Information & Signaling 5

- Nelson's model suggests reason that advertising may have little information content
 - The fact of advertising is itself the message
 - High advertising signals high quality
- Problems with Nelson's model
 - Assumes profit margin from selling high quality more than once (i.e. at least twice) exceeds margin from selling low quality once, i.e., if profit from a low quality sale is really big, low quality firms will have the incentive to advertise
 - If advertising expense signals quality, firms should announce their advertising costs
 - Model applies to all experience goods but much more intense advertising for consumer experience goods

Advertising, Information & Signaling 6

- Milgrom and Roberts (1986) suggest that price can be used together to signal quality
- Fluet and Garella (2001) show that combination of high price and high advertising can signal high quality
- Empirical Evidence:
 - Archibald, Haulman, and Moody (1983) and Caves and Green (1996) finds little relation between advertising and quality
 - Similarly, little indication that price signals quality
 - **NOTE:** Quality is in the eye of the consumer. Perhaps the fact that the product is advertised and therefore well-known enhances product quality because then consumers can talk about the product with others in confidence that others will know what they are talking about

Advertising, Information & Signaling 7

Price & Quality in the Upright Vacuum Cleaner Market

Brand/Model	Quality (0-100)	Price
Kenmore Progressive	74	\$300
Hoover Wind Tunnel	69	\$250
Eureka Boss	68	\$150
Electrolux Oxygens	67	\$400
Kirby Sentria	67	\$1350
Riccar Superlite	66	\$350
Bissell Healthy	64	\$300
Oreck XL21	63	\$750
Panasonic MV-V7720	63	\$200
Dyson DC 14	62	\$550

Anecdotal evidence: in Germany: Stiftung Warentest as provider of „objective“ product quality measure??

Suppressed Advertising Content

- Evidence on signaling is mixed. No clear relation between advertising and product quality seems to emerge in practice.
- This leaves the informational role of advertising somewhat ambiguous.
- In fact, the idea of advertising as information is further challenged by the fact that much advertising has little informational content. It does not mention price or quality but seems, instead, to project only general feature or perhaps just a product image.
- Why might firms advertise but suppress the informational content of that advertising?

Suppressed Advertising Content 2

- Anderson & Renault (2006) offer a model of suppressed advertising content
- Imagine three types of consumers each with different willingness to pay for each of three different widgets

		Consumer Willingness to Pay		
		Consumer 1	Consumer 2	Consumer 3
Widget Type	Red	\$40	\$15	\$20
	Yellow	\$20	\$40	\$15
	Blue	\$15	\$20	\$40



Suppressed Advertising Content 3

- Consumers also incur a transport cost \$5.01 in visiting the store.
- Consumers expect that a store has each type of widget with probability $1/3$
- Consider a store that has only Red Widgets. If it advertises this fact then
 - Consumer types 2 and 3 will not visit the store. The store will never charge less than \$15 (the minimum willingness to pay) for a widget. Since both consumer types value a red widget less than \$20.01, neither type will come
 - Consumer type 1 will not come either. If she does, she will indicate her type to the store including her high value for a Red widget. Since the transport cost is sunk once she arrives at the store, the store-owner can charge her the full \$40 value.
 - Foreseeing this combined expense of \$45.01, Consumer 1 will not respond to a Red Widget advertisement either

Suppressed Advertising Content 4

- Consider now a strategy of advertising simply that the store has widget
 - All consumer types will now visit the store. Given that the probability of any particular type of widget is $1/3$, each will work out an expected value of \$25.
 - Not knowing which customers are which, the store will charge \$15 (the minimum willingness to pay) for a red widget. This will give it a maximum revenue of \$45 as all consumers buy a red widget at this price.
 - Consumers understand the above pricing in advance. That is why it is worth it for each of them to come since, even with the transport cost, the expected total payment of $\$15 + \5.01 is less than the expected value of \$25.
 - The store does better suppressing information in its advertising.
 - Laws that require full disclosure might lead to breakdown of the market!

Advertising and Competition

- Advertising is a weapon in the competition between firms
- Creating & securing a brand identity can be helpful to consumers
 - ***Consumers may have a taste for variety; each consumer may like a different version of a particular product***
 - ***Advertising can match consumers with the version they most prefer***
 - ***But advertising can also be an uninformative and wasteful form of competition***
- Evaluation of advertising's competitive role requires an understanding or clear model of how advertising works
- Consider a simple model where firms can either spend a little or a lot on advertising
- If advertising by one firm largely cancels the advertising of its rival, then this can result in an "advertising" war with both firms spending excessively on advertising

Advertising as Wasteful Competition

Example of a Wasteful Advertising War

		<i>Gamma</i>	
		<i>Low Advertising Expenditure</i>	<i>High Advertising Expenditure</i>
<i>ZIP</i>	<i>Low Advertising Expenditure</i>	<i>\$450, \$450</i>	<i>\$375, \$500</i>
	<i>High Advertising Expenditure</i>	<i>\$500, \$375</i>	<i>\$400, \$400</i>

Adv

Nash Equilibrium is for both firms to choose the high level of advertising expenditures. This does not maximize their joint profit. Each firm's advertising undoes the promotional efforts of its rival. The result is excessive advertising that largely cancels itself out with little gain to consumers and lower profit for firms

		Low Advertising Expenditure	High Advertising Expenditure
ZIP	Low Advertising Expenditure	\$450, \$450	\$375, \$500
	High Advertising Expenditure	\$500, \$375	\$400, \$400

Advertising, Information, & Product Differentiation

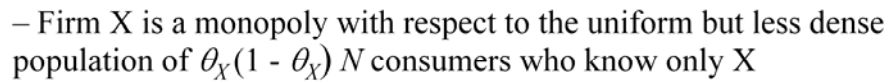
- Recall the Hotelling Model
 - N Consumers distributed uniformly along a line
 - Two firms—one at each end of the line



- Each consumer is willing to pay V for the basic product
- But consumers incur “transport” cost of t per unit of distance traveled to firm
- Equilibrium prices (with the entire market being served):

$$p_1 = p_2 = c + t$$

- Now apply Grossman and Shapiro (1984) approach:
 - Each firm chooses advertising expenses aimed at reaching the fraction θ_X or θ_Y of the N consumers
 - From perspective of firm X , a fraction $\theta_X(1 - \theta_Y)$ of consumers will know of its product only and a fraction $\theta_X \theta_Y$ will know of both X and Y



Advertising, Information, Product Differentiation 3

- Firm X competes with firm Y for the also less dense but uniform population of $\theta_X\theta_Y$ who know of both goods
- Assume that equilibrium p_X is low enough that all consumers in monopoly segment buy 1 unit of X

– So, total demand facing firm X is:

$$Q_X = \theta_X(1 - \theta_Y)N + \theta_X\theta_Y\left(\frac{p_X + t - p_Y}{2t}\right)N$$

- Firm Y faces a similar demand
- Each firm must choose
 - how much advertising to do, i.e., how big θ should be
 - What price to charge?

Advertising, Information, Product Differentiation 4

- Assume that advertising expense TA_i for firm i where i equals either X or Y , depends on the total number of consumers reached as follows:

$$TA_i = \frac{\alpha}{2} \theta_i^2 N$$

Then the marginal cost of advertising $dTA_i / d\theta_i$ is:

$$TA'_i = \alpha \theta_i N$$

- Profit maximization at both firms now results in two best response functions, one for prices and one for advertising. Solving these jointly then yields the equilibrium price and advertising expenditures at each

$$p_i = c + \sqrt{2\alpha t} \quad \text{and} \quad \theta_i = \frac{2}{1 + \sqrt{2\alpha/t}}$$



Advertising, Information, Product Differentiation 5

- Note that α must be greater than $t/2$ in order to maintain our assumption that $\theta_i < 1$ for each firm, i.e., we must assume that advertising is a bit expensive relative to consumer taste for variety in order to have some consumers uninformed
- In turn, this means that the equilibrium price is now higher than it was in our benchmark Hotelling case that assumed all consumers were perfectly informed



Equilibrium Price

Fully Informed Case

Imperfectly Informed Case

$$p_i = c + t$$

$$p_i = c + \sqrt{2\alpha t}$$

Information is costly. The cost of providing it through advertising has to be reflected in the product price.

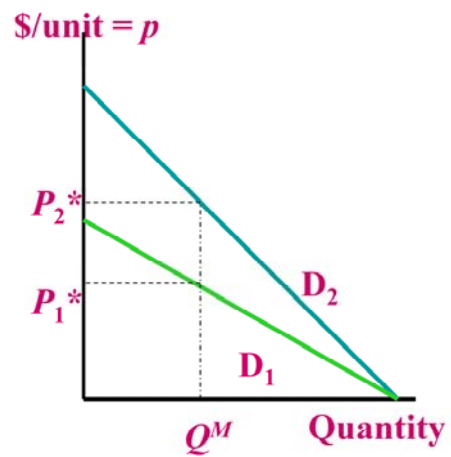
Advertising, Information, Product Differentiation 6

- Two additional insights also follow
 - Advertising increases as the consumer taste for variety t increases.
 - Recall equilibrium advertising level is $\theta_i = \frac{2}{1 + \sqrt{2\alpha/t}}$
 - This increases as t increases.
 - ⇒ Product differentiation and advertising are positively linked
NOT because advertising causes product differentiation
BUT because specialized consumer tastes leads firms to advertise.
 - Profits rise as advertising becomes more costly (as α rises).
 - Firm profitability is: $\Pi_i = \frac{2\alpha N}{(1 + \sqrt{2\alpha/t})^2}$
 - As α rises, firms do less advertising and fewer consumers know about both products
⇒ softer price competition/more profits.

Building Brand Value vs. Extending Brand Reach

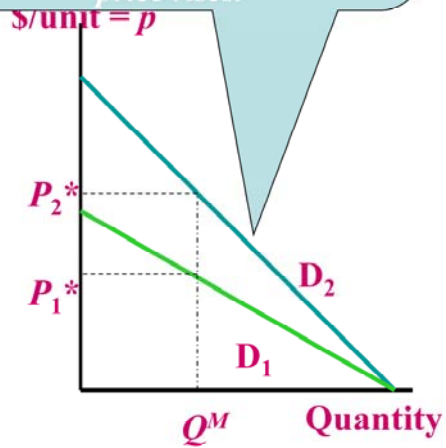
- Advertising in the Grossman and Shapiro model is pure information. This begs the question as to how advertising precisely works
- Becker and Murphy (1993) argue that advertising works as a complement to the product, i.e., it enhances consumer valuation of the good or service
- Two ways complementary advertising can work
 - Consumers prefer to purchase brands that are well known, i.e., advertising builds brand value in that consumers are willing to pay more for a well-known brand. This is close to an “advertising as persuasion” view
 - Advertising provides information that enhances product value, e.g., where to go for related services such as hotels advertising nearby tourist sites. Here, advertising is truly informative and works therefore to bring in new customers, that is, to extend the brand’s market reach

Building Value vs. Extending Reach 2

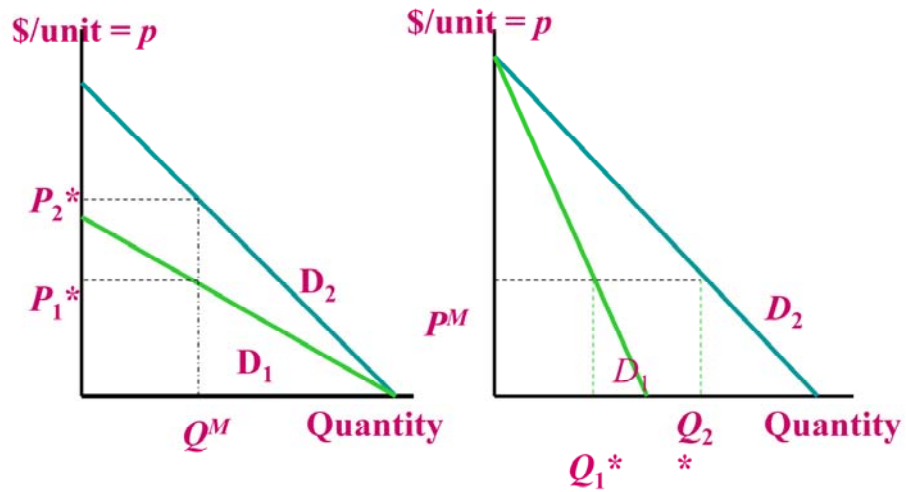


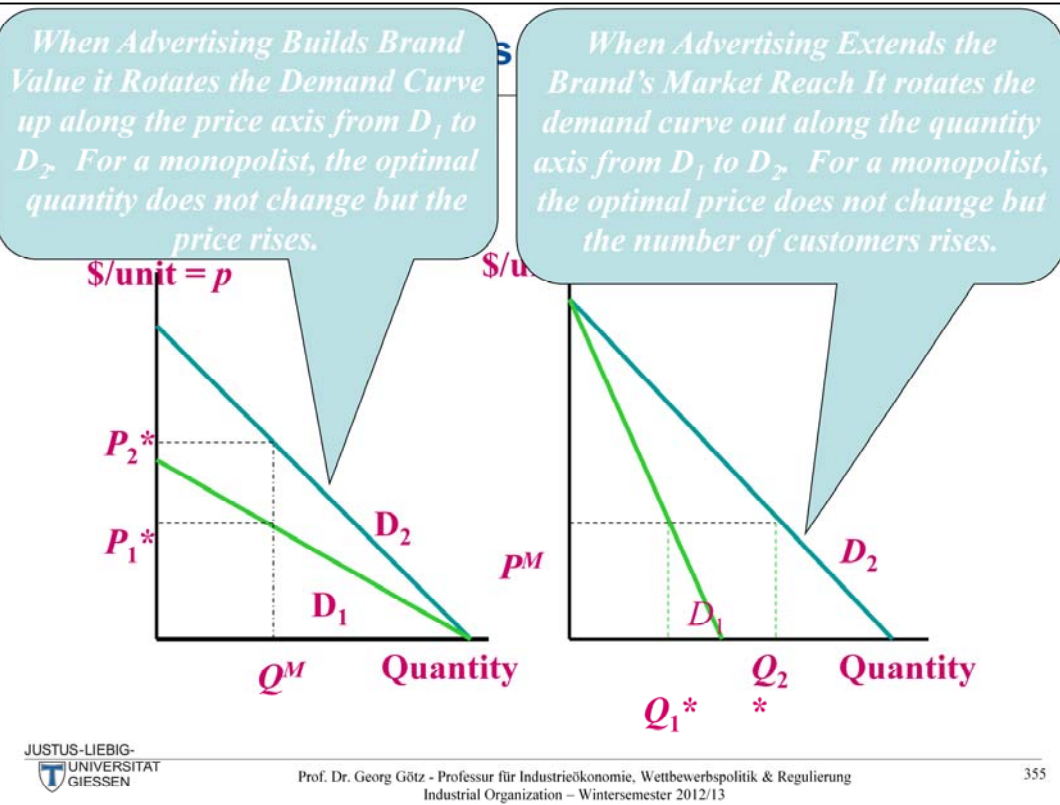
s. Extending Reach 2

When Advertising Builds Brand Value it Rotates the Demand Curve up along the price axis from D_1 to D_2 . For a monopolist, the optimal quantity does not change but the price rises.



Building Value vs. Extending Reach 2





Building Value vs. Extending Reach 3

- The evaluation of advertising efforts from a social welfare or efficiency point of view requires that we understand whether advertising predominantly builds value or extends market reach
- This is even more true when we add in some competition.
 - When there is more than one firm and advertising extends market reach advertising may well be excessive
 - Now advertising works by stealing customers from rivals
 - Much greater possibility that game is like the wasteful advertising game
 - When advertising works to build value, excessive advertising is less likely because advertising now works to permit charging existing customers a higher price—not by taking customers from rivals.

Building Value vs. Extending Reach 4

- Amount of advertising is also likely to depend critically on nature of price competition and number of firms
 - When price competition is naturally fierce, firms may advertise a lot to differentiate their product and soften price competition
 - When the number of firms is small, firms may again advertise more because most of the gains of a firm's advertising flow to that firm itself and not to its rivals
 - Note the potential interaction of these two effects.
 - Since advertising is largely a sunk cost, the need to do a lot of advertising to soften price competition may limit the equilibrium number of firms
 - As number of firms falls, each one advertises more
 - Advertising/sales ratio may be high in concentrated industries but again causality is not from advertising to concentration
 - ReaLemmon Case

Empirical Application: Information versus Prestige in Advertising

- Can we devise clear empirical tests that truly identify the precise role of advertising?
- Akerberg (2001) is an effort to do just that. He looks at the impact of advertising that accompanied the introduction of a new, low-fat yogurt product by Yoplait in 1987-88.
- Specifically, Akerberg tests whether this advertising was primarily informative or instead worked by appealing to the status consciousness of the consumer

Empirical Application: Information versus Prestige in Advertising 2

- The Data
 - In April of 1987, Yoplait made its first entry into the low-fat, low-calorie yogurt category with Yoplait 150.
 - This corresponds to the time period in which A. C. Nielsen collected information on about 2,000 households split between Sioux Falls, South Dakota and Springfield, Missouri
 - Monitors were attached to the TV's in these households;
 - Scanner data was used to monitor their trips to the supermarket and what they bought

Empirical Application: Information versus Prestige in Advertising 3

- The Nielsen data cover 12 months starting three months after the April intro of Yoplait 150
- Thus these data give Akerberg measures of the exposure of these households to Yoplait 150 television commercials as well as records of their Yoplait 150 purchases (if any)
- In particular, Akerberg can measure whether the consumer is a first-time or previous user of Yoplait 150 and how many ads they have seen

Empirical Application: Information versus Prestige in Advertising 4

- For each town or market, Akerberg creates two time series from the data covering specific market days over the 12-month period
 - One series is the number of first-time purchases of Yoplait 150 as a fraction of the number of shopping trips that day
 - The other is the number of repeat purchases of Yoplait 150 as a fraction of the number of trips that day
 - He also has data on the Yoplait 150 price (PRICE) for each day in each market as well as for the number of television advertisements (ADS) for Yoplait 150 to which the buyer had been exposed

Empirical Application: Information versus Prestige in Advertising 5

- As a preliminary step, Akerberg (2001) runs two separate OLS regressions

$$\text{First time purchases} = a_0 + a_1 \text{PRICE} + a_2 \text{ADS} + a_3 \text{MARKET} + e_i$$

$$\text{Repeat purchases} = b_0 + b_1 \text{PRICE} + b_2 \text{ADS} + b_3 \text{MARKET} + u_i$$

- Here, MARKET is a dummy variable equal to 1 if the data are from Springfield but 0 if from Sioux Falls
- Akerberg's argues that if advertising is mainly information, it will have a much bigger effect on first time buyers than on experienced ones
- In other words, a_2 should be larger than b_2

Empirical Application: Information versus Prestige in Advertising 6

Ackerberg's preliminary results are shown below

Dependent Variable

	Initial Purchases		Repeat Purchases	
	Coefficient	Std. Error	Coefficient	Std. Error
PRICE	-0.038	(0.013)*	-0.029	(0.014)*
ADS	0.030	(0.015)*	0.014	(0.017)
MARKET	0.002	(0.001)*	0.006	(0.001)*

*Indicates significant at the five percent level.



Empirical Application: Information versus Prestige in Advertising 7

Akerberg's preliminary results thus show:

- 1) Yoplait 150 price increases reduce demand significantly
- 2) Springfield consumers like Yoplait 150 more than Sioux Fall consumers
- 3) Advertising only raises demand significantly for first time buyer

⇒ The last finding is the important one. It confirms the view that advertising is mostly informative and, in particular, informative about the product's existence and its primary characteristics

Empirical Application: Information versus Prestige in Advertising 8

- Since any purchase is a 1,0 decision, Ordinary Least Squares (OLS) is not the best estimation technique.
- Instead, one needs to use a probit or logit approach
- Also, one should in principle allow for other factors such as the price of rival yogurts.
- Akerberg (2001) makes all these modifications but still finds his basic result. Advertising has by far its biggest and most statistically significant effect on first-time buyers.

⇒ Advertising is primarily information