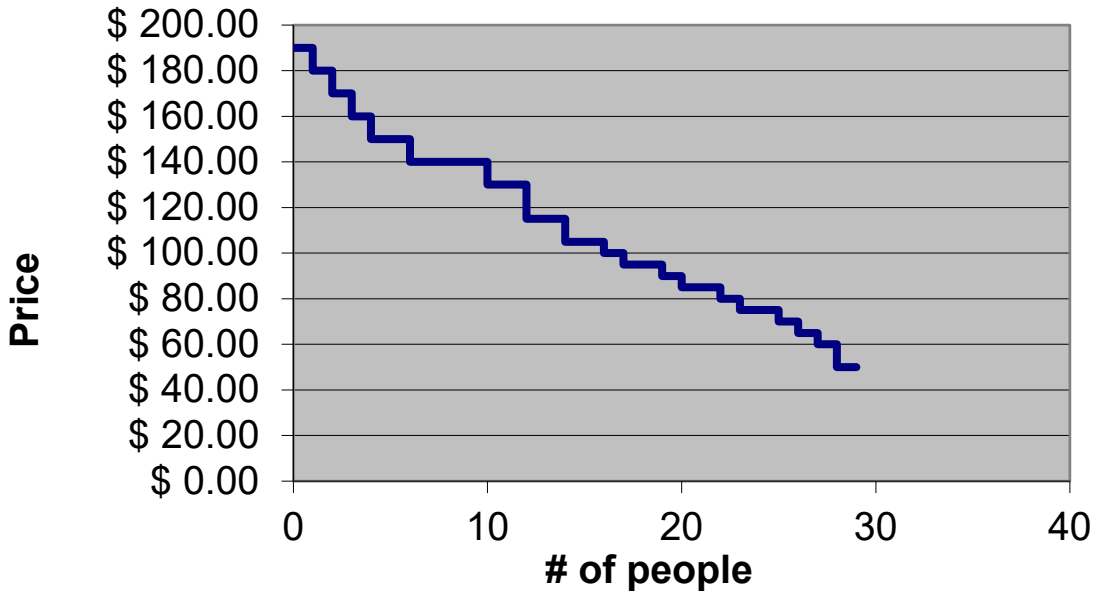
1. More of Pricing (Cabral, Ch 14.2)
    1. General Setup
    2. Two specific examples
        1. Horizonal Differentiation
        2. Vertical Differentiation

Demand Curve and Consumer Surplus with Multiple Products

- Whenever there is one product, consumer surplus and demand has a simple relationship.
- Suppose there are $i = \{1, \cdots N\}$ consumers and consumer i values the good at $\$ v_i$.
- Demand for the good at price p is $\#\{i | v_i \geq p\}$.

- Order v_i from highest to lowest:



Demand Curve and Consumer Surplus with Multiple Products

- Whenever there are more than one product, consumer faces a choice
- Suppose there are $i = \{1, \cdots N\}$ consumers and consumer i values first good at \$ v_i^1 and the second good at \$ v_i^2.
- Consumer buys good 1 if $v_i^1 - p^1 \geq v_i^2 - p^2$ and $v_i^1 - p^1 \geq 0$.
- Consumer buys good 2 if $v_i^2 - p^2 \geq v_i^1 - p^1$ and $v_i^2 - p^2 \geq 0$.
- Consumer does not buy if $v_i^1 - p^1 < 0$ and $v_i^2 - p^2 < 0$.
- Demand for the good 1 at price (p^1, p^2) is

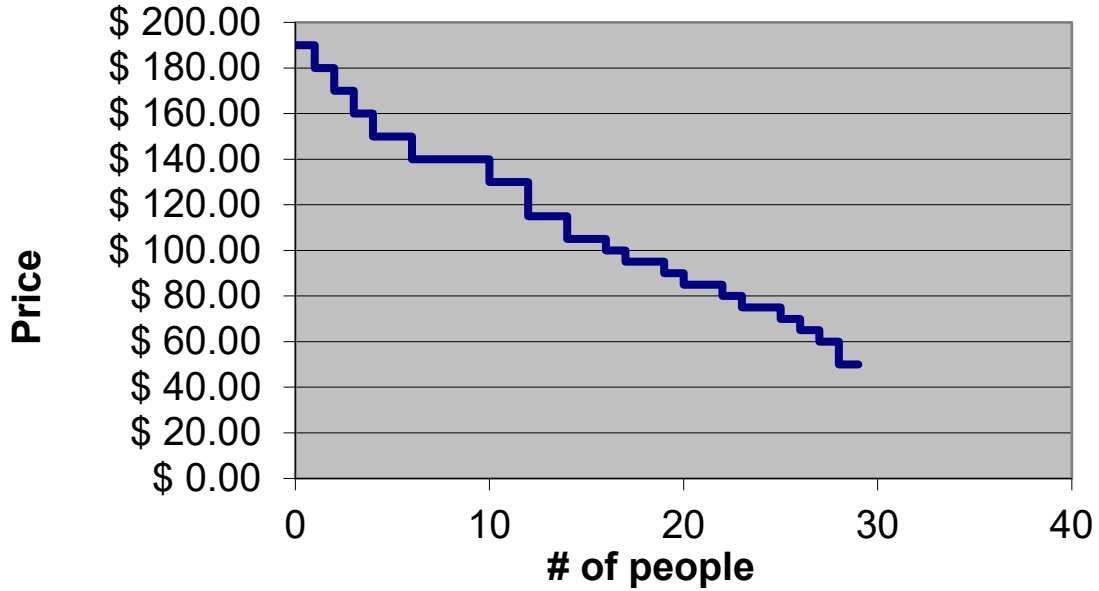
$$\#\{i | v_i^1 - p^1 \geq \max\{v_i^2 - p^2, 0\}\}$$

- For each consumer, define $\tilde{v}_i^1 = v_i^1 - \max\{v_i^2 - p^2, 0\}$
  - $\tilde{v}_i^1$ is the value of good 1 to consumer i relative to the next best product.
- Demand for product 1 is

$$\#\{i | \tilde{v}_i^1 \geq p^1\}$$

Demand Curve and Consumer Surplus with Multiple Products

- Order $\tilde{v}_i^1$ from highest to lowest:



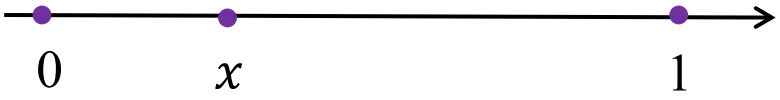
- Consumer surplus from product 1 can be computed by taking the area below the demand and above the price

Deriving demand for specific examples:

- We want to analyze product positioning/ product design
  - What kind of product should I produce?
  - Should I change the characteristic of my products?
- One example of horizontal differentiation, one example of vertical differentiation
  - *Horizontal differentiation*: differentiation in characteristics such as colors, styles, and locations
  - *Vertical differentiation*: differentiation in quality (e.g., durability, shipping speed …)

Horizontal Differentiation

- Two firms selling ice cream on a beach with prices p^1 and p^2.
- Each consumer is located at point x ($x \in [0,1]$) on the beach.
- Consumers are uniformly located between $[0,1]$.
- Ice cream shop 1 is located at point and ice cream shop 2 is located at point 1.
- Consumer's payoff from ice cream is v (constant), but must pay travel cost
- Consumer gets value $v - p^1 - x$ from buying at ice cream shop 1.
- Consumer gets value $v - p^2 - (1 - x)$ from buying at ice cream shop 2.



Horizontal Differentiation

- Consumer gets more value from buying at shop1 if

$$v - p^1 - x \geq v - p^2 - (1 - x)$$

Or

$$x \leq 0.5(p^2 - p^1 + 1)$$

- Because consumers are uniformly distributed on [0,1], demand is

$$q_1 = 0.5(p^2 - p^1 + 1)$$

  - (assuming v is high enough)

- Consumers get more value from buying at shop2 if

$$x > 0.5(p^2 - p^1 + 1)$$

- Demand for product 2 is

$$q_2 = 0.5(p^1 - p^2 + 1)$$

Example: Differentiated Products

- Now, take as given demand for the two shops are given by

$$q_1 = 0.5(p^2 - p^1 + 1)$$

And

$$q_2 = 0.5(p^1 - p^2 + 1)$$

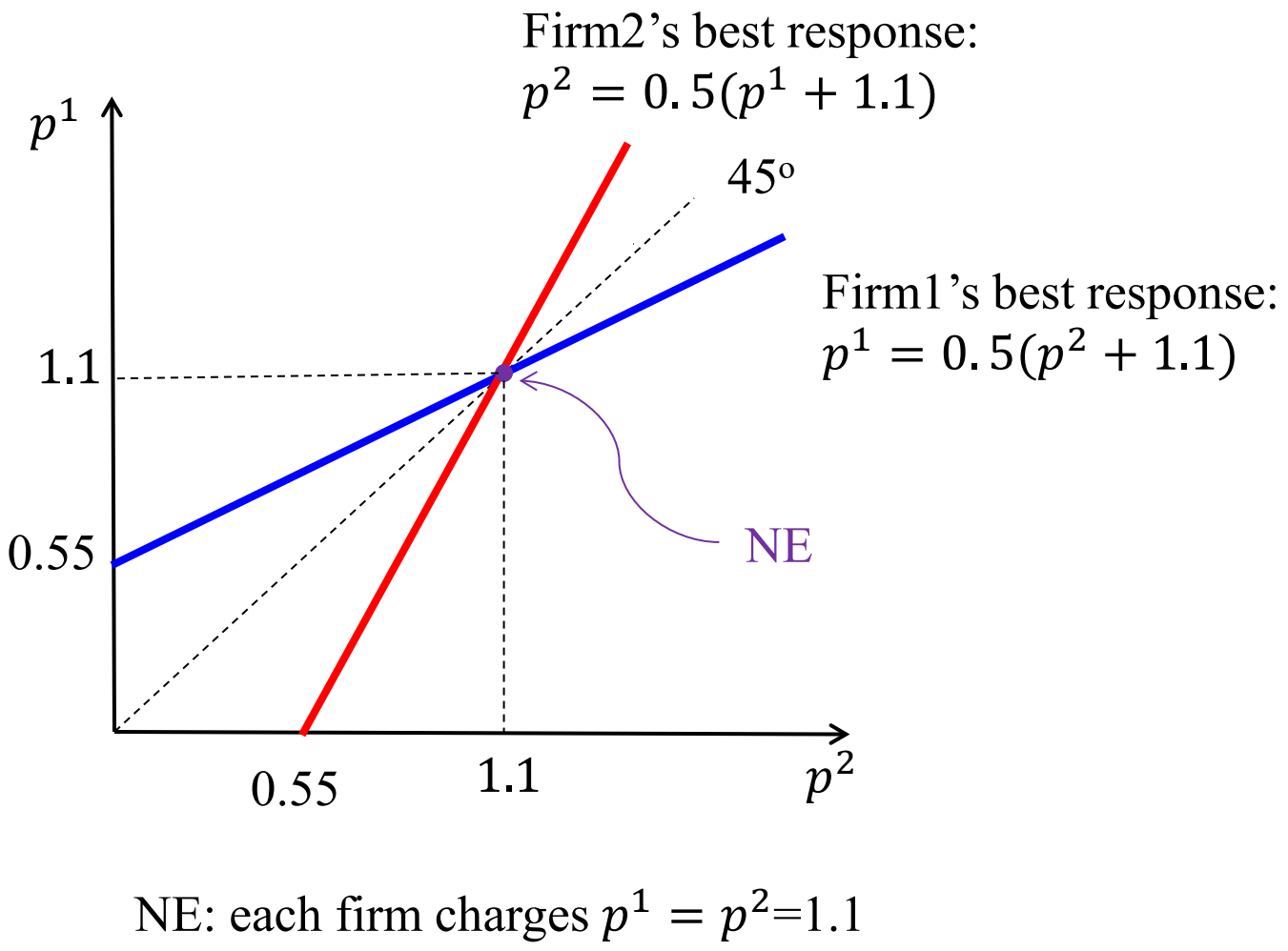
- Find the Nash Equilibrium prices, assuming MC=0.1.

- Consider firm 1's problem, taking as given p^2.
- Profit is

$$(p^1 - 0.1)q_1 = 0.5(p^1 - 0.1)\left(p^2 - p^1 + 1\right).$$

- This expression is maximized at $0.5\left(0.1 + p^2 + 1\right) = 0.5(p^2 + 1.1)$.

- Similarly, consider firm 2' problem taking as given p^1.
- The optimal price is given by $p^2 = 0.5(p^1 + 1.1)$



NE: each firm charges $p^1 = p^2$=1.1

Horizontal Differentiation

- Can be extended to products with multiple attributes:
- Each consumer has a favorite bundle of attributes, $x \in \mathbb{R}^K$.
- Each good j has some attribute is $\boldsymbol{y}_j \in \mathbb{R}^K$.
  - E.g. cereal: sugar content, calories, vitamin content, etc.
- Consumer's utility from good j is $u_j = v - d(y_j, x) - p^j$.
  - $d(\cdot,\cdot)$ is the distance between y_j and x.
- Consumer chooses the good that gives highest utility among $\{u_1, u_2, \cdots u_J, 0\}$

- With these tools, one can study product positioning as well (e.g., which choice of product attribute y_j maximizes my profits?)
  - In our example where to locate my store.

Vertical Differentiation

- Two firms selling cars with prices p^1 and p^2.
- Buying a car gives utility v to consumer.
- Moreover, consumer values car quality: Firm 2's car is "better": quality of car 1 is v^1 and quality of car 2 is v^2 with $v^1 < v^2$.
- Consumers value higher quality, extent to which they care is given by consumer specific parameter $x \in [0,1]$. Let x be randomly distributed (uniform $[0,1]$)
  - A consumer with x=0 does not care about quality.
- Assume consumer with parameter x values car 1 at $v + xv^1 - p^1$ and car 2 at $v + xv^2 - p^2$.
- Consumer buys good 1 if $v + xv^1 - p^1 \geq \max\{v + xv^2 - p^2, 0\}$.
- Consumer buys good 2 if $v + xv^2 - p^2 \geq \max\{v + xv^1 - p^1, 0\}$.
- Consumer buys nothing if $0 \geq \max\{v + xv^1 - p^1, v + xv^2 - p^2\}$.

Vertical Differentiation

- The set of consumers that prefer car 1 to car 2 is

$$v + xv^1 - p^1 \geq v + xv^2 - p^2$$

Or

$$x \leq \frac{p^2 - p^1}{v^2 - v^1}$$

- Given that x is distributed uniform, demand for good 1 is $\frac{p^2 - p^1}{v^2 - v^1}$.
  - (provided v is high enough).
- The set of consumers that prefer car 2 to car 1 is

$$v + xv^2 - p^2 \geq v + xv^1 - p^1$$

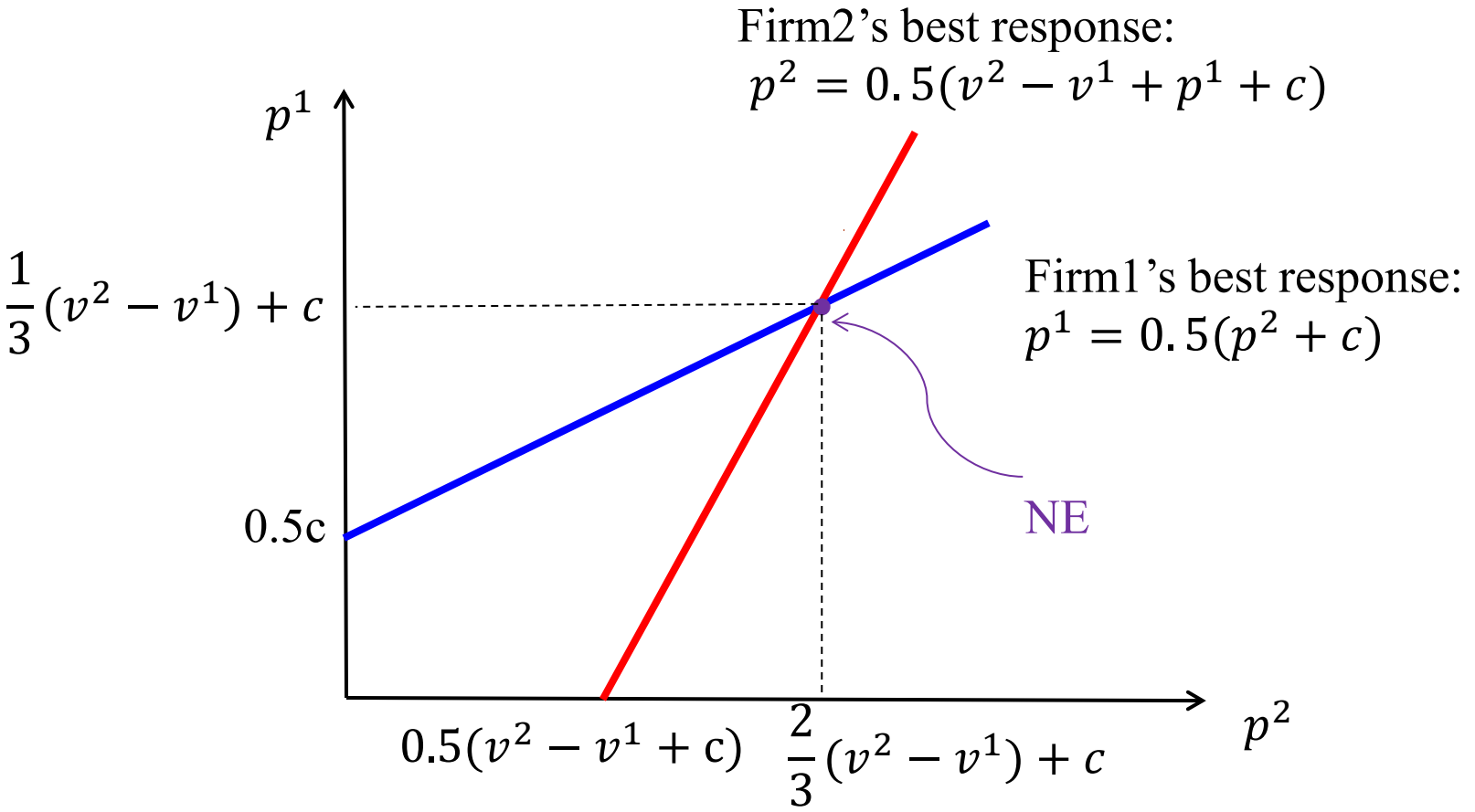
Or

$$x \geq \frac{p^2 - p^1}{v^2 - v^1}$$

- Demand for good 2 is $1 - \frac{p^2 - p^1}{v^2 - v^1}$.
- Given these demand functions, find NE assuming MC = c.

Vertical Differentiation

- Consider firm 1's problem holding fixed p^2.
- Demand for good 1 is $\frac{p^2-p^1}{v^2-v^1}$.
- Profit is $(p^1-c)\frac{p^2-p^1}{v^2-v^1}$.
- This expression is maximized at $\frac{p^2+c}{2}$.
- Now consider firm2's problem holding fixed p^1
- Demand for good 2 is $1-\frac{p^2-p^1}{v^2-v^1}$.
- Profit is $\left(p^2-c\right)\left(1-\frac{p^2-p^1}{v^2-v^1}\right)=\left(p^2-c\right)\left(\frac{v^2-v^1-p^2+p^1}{v^2-v^1}\right)$.
- This expression is maximized at $\frac{v^2-v^1+p^1+c}{2}$.



NE: $p^1 = \frac{1}{3}(v^2 - v^1) + c$

$p^2 = \frac{2}{3}(v^2 - v^1) + c$

Vertical Differentiation

- NE price for firm 1 is $p^1 = \frac{1}{3}(v^2 - v^1) + c$
- NE price for firm 2 is $p^2 = \frac{2}{3}(v^2 - v^1) + c$
- Note that when $v^1 = v^2$, $p^1 = p^2 = c$, and both firms get 0 profits.
  - $v^1 = v^2$ is the case with Bertrand Price competition
- Question: Suppose currently, $v^1 < v^2$, so that car 1 has lower quality than car 2. Firm 1 has an opportunity with no costs to increase quality of its car from $v^1$to v^2. Should it take the opportunity?

Case study: Toothpaste Wars

- In June 1998, P&G paid for full-page ads in about 100 US newspapers. The ads featured side-by-side comparisons between P&G's Crest MultiCare and Colgate's Total on various toothpaste benefits. Both brands checked on a number of items, such as "helps fight cavities" and "helps brush away plaque." However, when it came to "helps reduce and prevent gingivitis and reduce plaque," only the Colgate Total box was ticked. On the other hand, only Crest's MultiCare checked on "better taste" and "fresher feeling breath."
- It is highly unusual for P&G – in fact, for any firm – to cede an advantage to a competitor. P&G asserts that their "policy is to play fair, so our ad did acknowledge the competition's gingivitis claim." However, one can argue that it is in P&G's own interest to act in this way: first, praising the competitor's product makes it more difficult for Colgate to challenge the ad's other claims; and second, one important effect of the ad is to increase the consumers' perception of differences between the two brands, thus softening price competition (p.367, Cabral)

So is this useful?

Senior Principal Economist, Global Media and Advertising Economics Team

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DESCRIPTION

Job summary
The Global Media, Advertising & Corp-Dev Economics Team is seeking a highly experienced economist to develop disruptive new approaches for Amazon's Global Media and Entertainment (GME) businesses. The role will report to the VP economist leader of the GMAC Economics Team, that is a central research team supporting Amazon's GME and Advertising businesses.

Amazon has a portfolio of GME businesses, including Prime Video, Prime Music, Prime Gaming, Audible and Twitch. Certain products and services from these businesses are available to our customers as Prime benefits, and there are also ad-supported and add-on subscription products from Prime members as well products that are available to non-Prime customers. All of these businesses are global and rapidly growing.

The role of the GME economics leader involves 3 key components. First, identification of high impact opportunities that leverage economics and science to drive improvements in each of our GME businesses. This also requires the ability to develop effective solutions, influence and lead the relevant business to adopt and implement these new approaches. Such solutions may require advanced econometrics or other cutting-edge science, and in some cases involves engineering implementation of scalable tools.

Second, as we grow our portfolio of GME businesses, we need tools and solutions that drive joint value among these businesses. E.g., the development of tools that help us to understand and enhance customer journeys across the various GME products; or identifying instances where we can leverage IP across multiple products.

Third, as a senior science leader this person will help in setting direction and prioritization for the work the team does; providing technical leadership and assuring the development of commonsense, rigorous, and reliable science; being an effective advocate for the work of the team; creating and maintaining mechanisms to drive trust and alignment with business partners; and hiring and developing a team of high impact scientists.

Job details

Madison, WI

Economics

Share this job

So is this useful?

BASIC QUALIFICATIONS

Key criteria we seek in the ideal candidate for this role include:

(i) an exceptional record of economic research, utilizing a broad range of econometric methods to address important practical problems. Prior research with direct relevance to media and entertainment is a plus but not necessary. This includes the economics of bundling, subscription services, advertising-supported content and multi-product demand modeling.

(ii) Demonstrated ability to deliver impactful science for a company. This includes the ability to identify opportunities where economics and science can add value, as well inventing solutions that are practical, scalable and impactful. Past work experience with a company or significant consulting experience may suffice.

(iii) Demonstrated abilities as a leader, including experience at influencing decision making, providing vision and setting direction for a team and driving impact.

(iv) Outstanding verbal and written communication skills, ability to engage with leaders from multiple backgrounds, and engage in difficult and high ambiguity discussions.

(v) A PhD in economics or a related field is highly desirable but not essential.

Summary

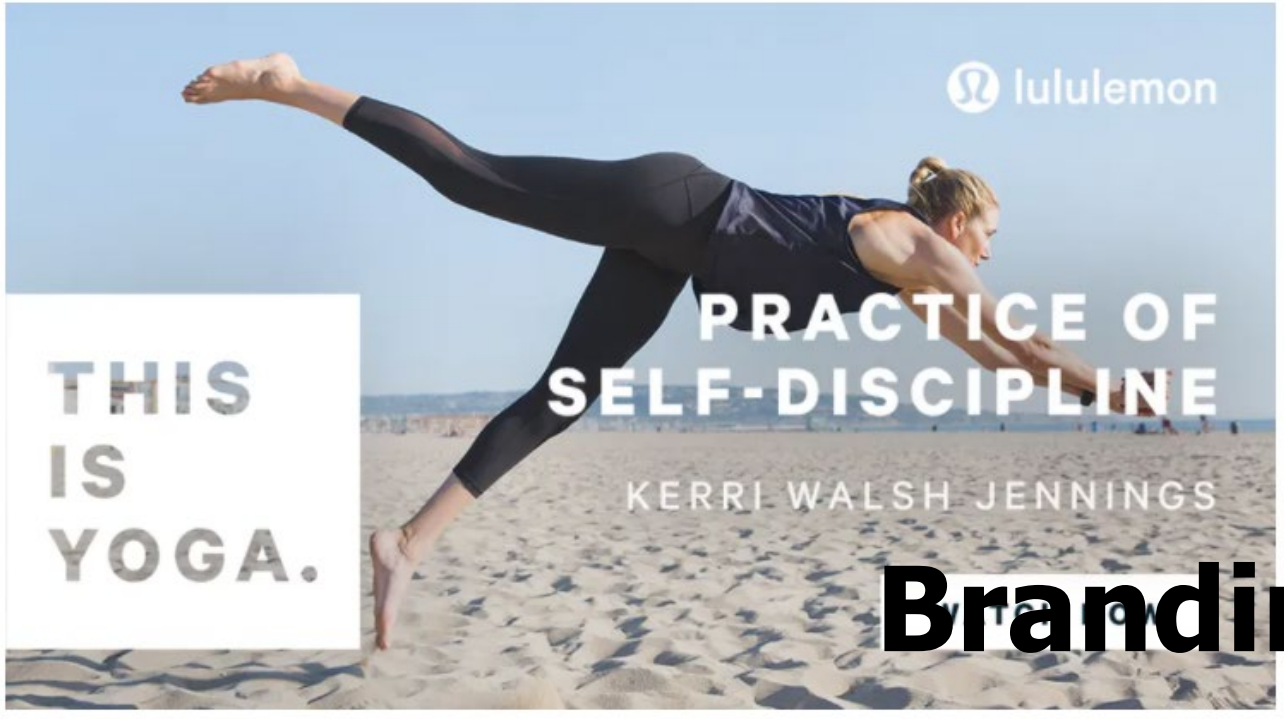
- Whenever products are differentiated, prices tend to be above MC.
- Firms have incentives to choose product attributes so that their goods are different from competitors' products.
- Demand modeling with multiple products/firms is fundamental to business analytics.

1. Advertising (Cabral, Ch 14.3)

Nature of Advertising

- 3 aspects of advertising
- *Informative* Advertising
  - Advertises the product's existence, characteristics (e.g., weight, size, speed), selling terms (price, financing interest rate)
- *Persuasive* Advertising
  - Tries to change consumers' preferences/perception.
  - Ads for coca cola, beer etc. mainly fall into this category
    - No new information, just people enjoying drinking coca cola on a beach
  - Branding:
    - Associate a positive characteristic with the product
      - Lululemon> fit/slim/athletic
      - Lego> creative, smart
      - Many high-end brands> rich
    - If you have a product, people may perceive you in a particular way
- *Signaling*
  - Spending money means it's going to be around for a long time
    - https://adage.com/videos/etrade-wasting-2-million/888

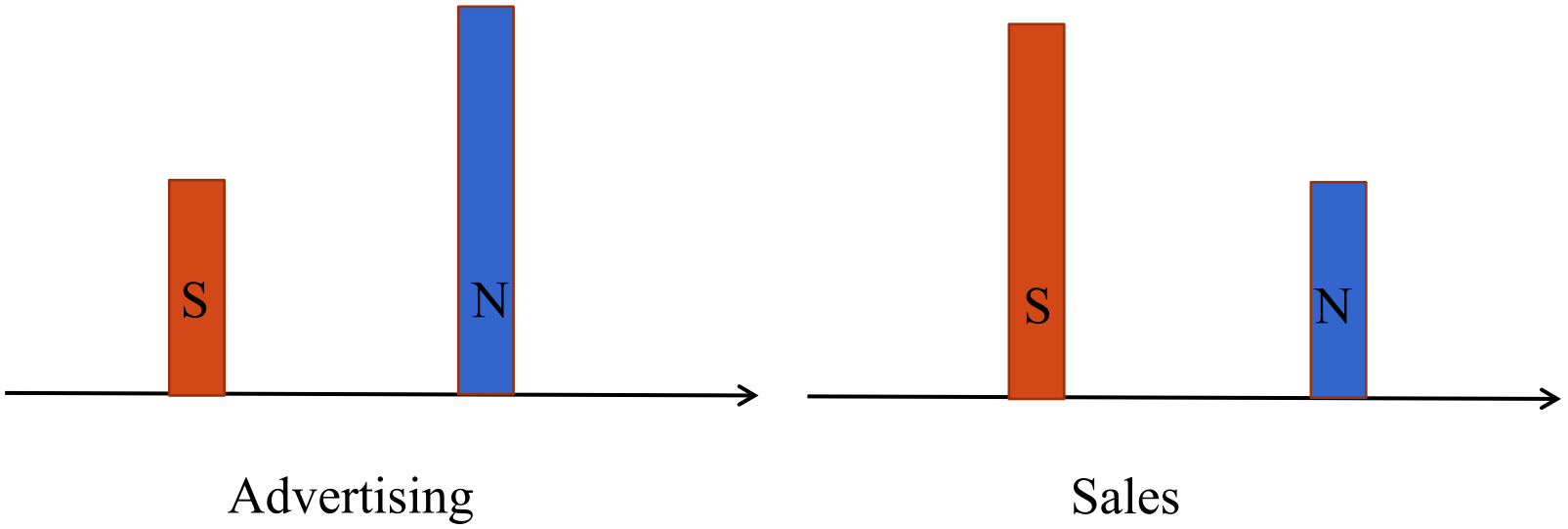
Persuasive



Branding

How effective is advertising? (#1)

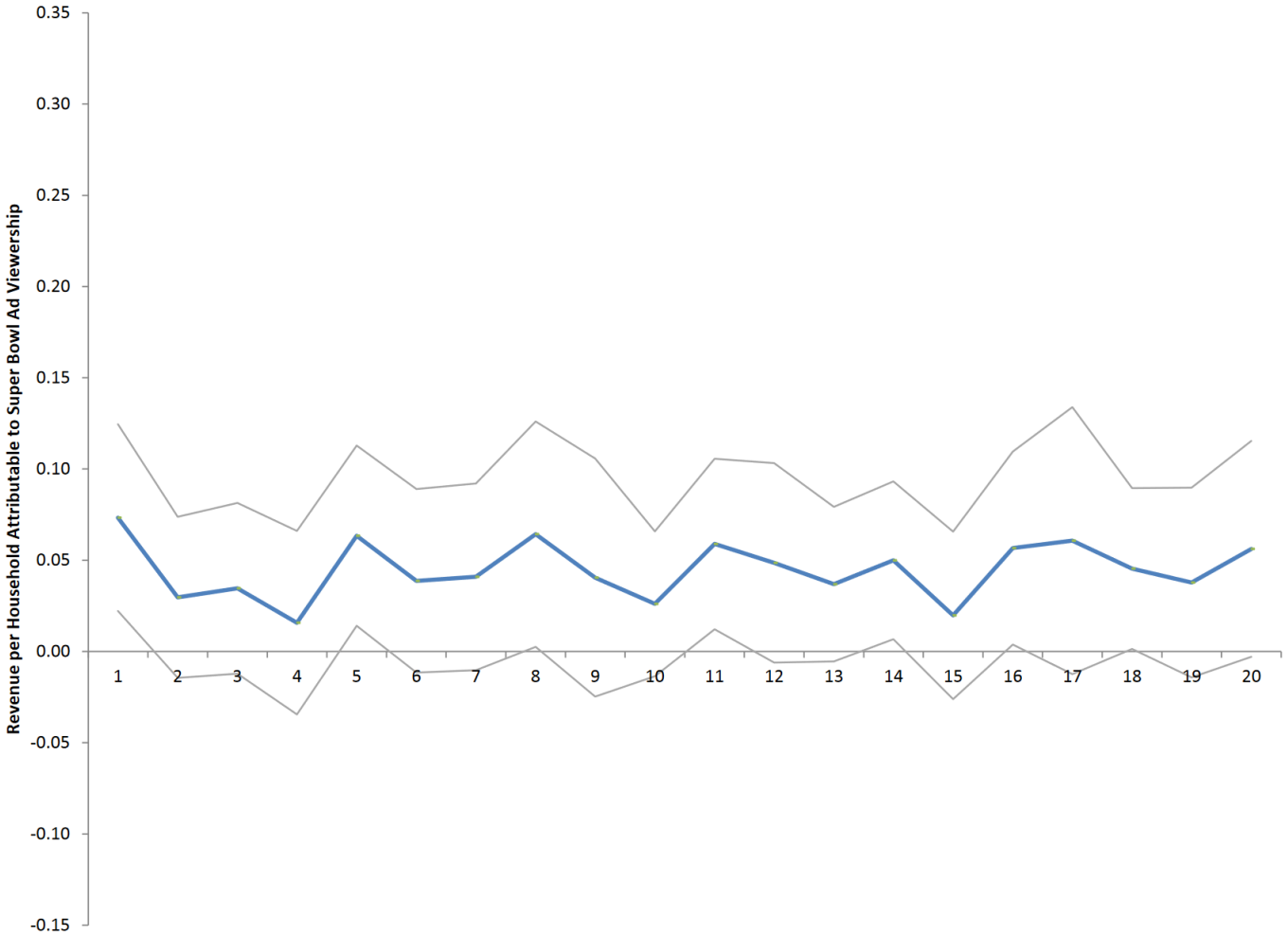
- Premise: simple comparisons are misleading:
  - Example: Two regions, N and S. Product is not doing well in N, but doing well in S
  - Firm spends a lot on ads in N (but little in S)
  - Simple comparison of sales and ad spending will give misleading results: need a cleaner setting



How effective is advertising? (#1)

- Hartmann and Klapper (2015) "Super Bowl Ads"
  - Super bowl ads are sold typically before the NFL season begins.
  - Super bowl ads are the same for all viewers (viewers in SF see same ad as viewers in NY)
  - Viewers depend on the team playing in the super bowl (markets from regions within the city receive about 10-15% higher ratings)
  - Compare Δsales and ratings (across 6 superbowls)

Budweiser


Revenue per Household Attributable to Super Bowl Ad Viewership
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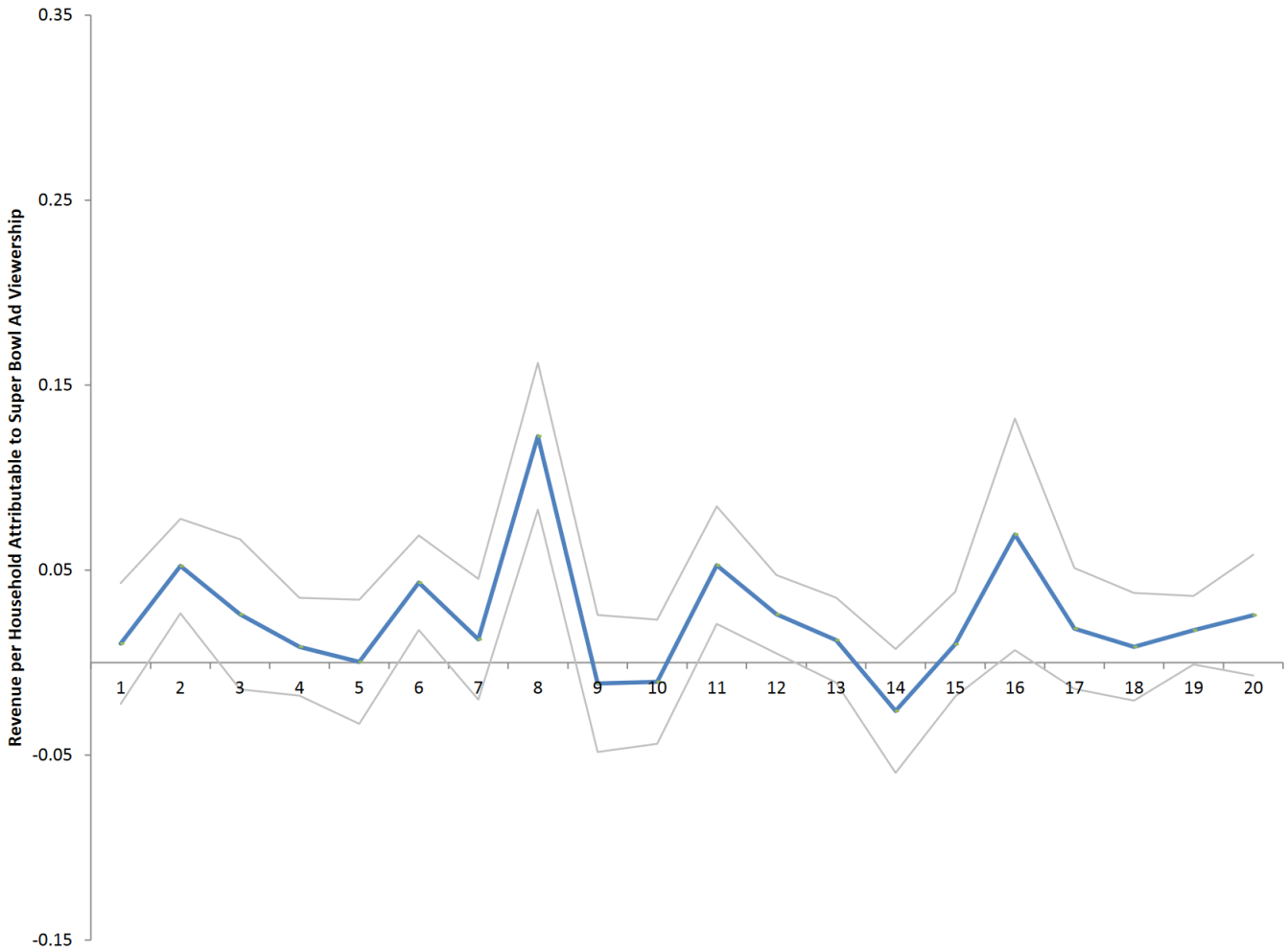
Pepsi/Coke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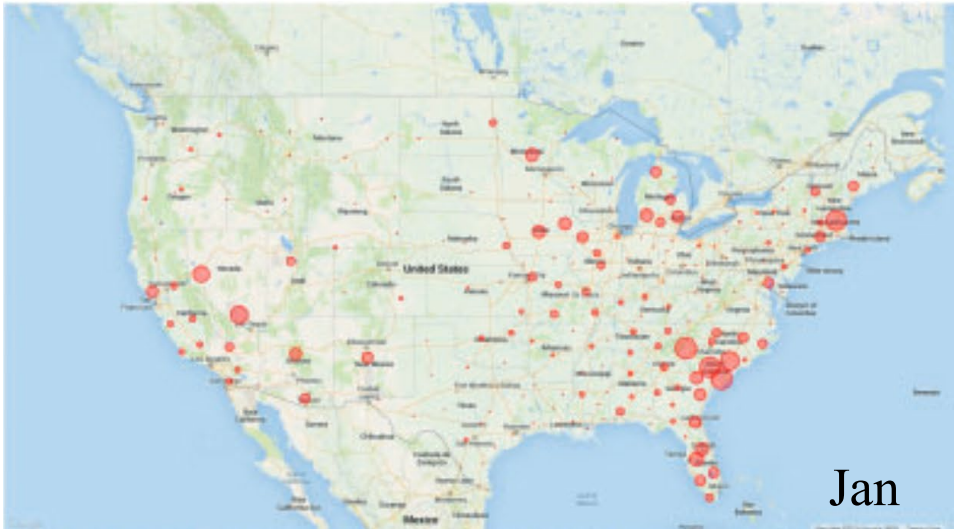
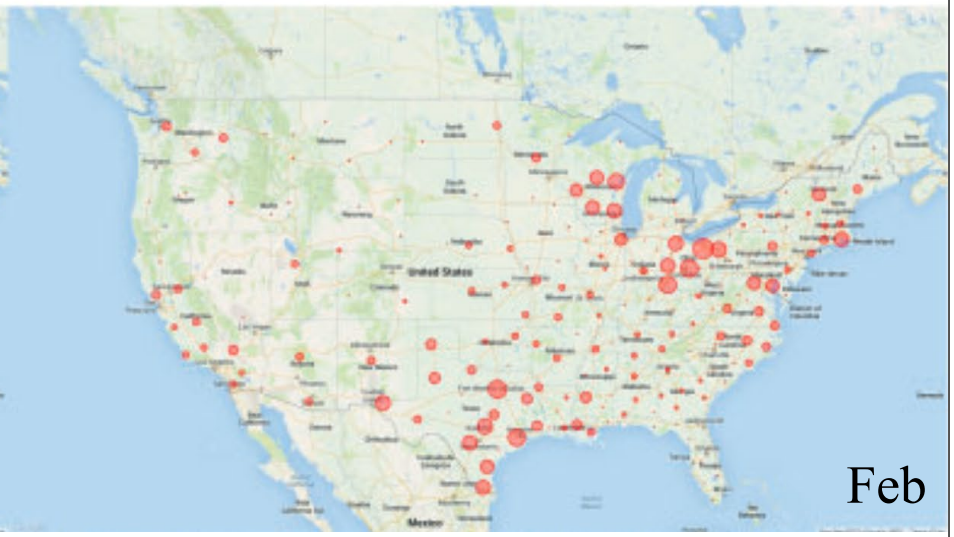
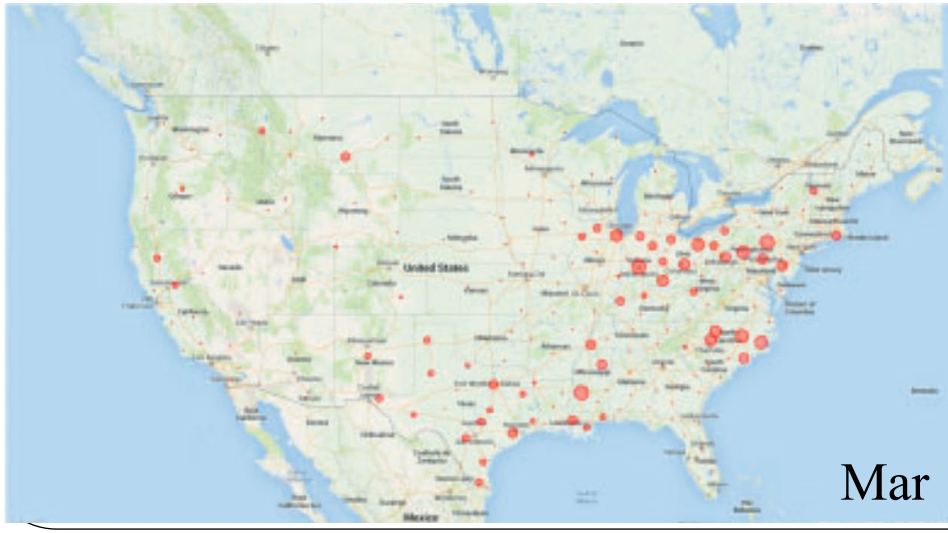
Does advertising work? (#2)

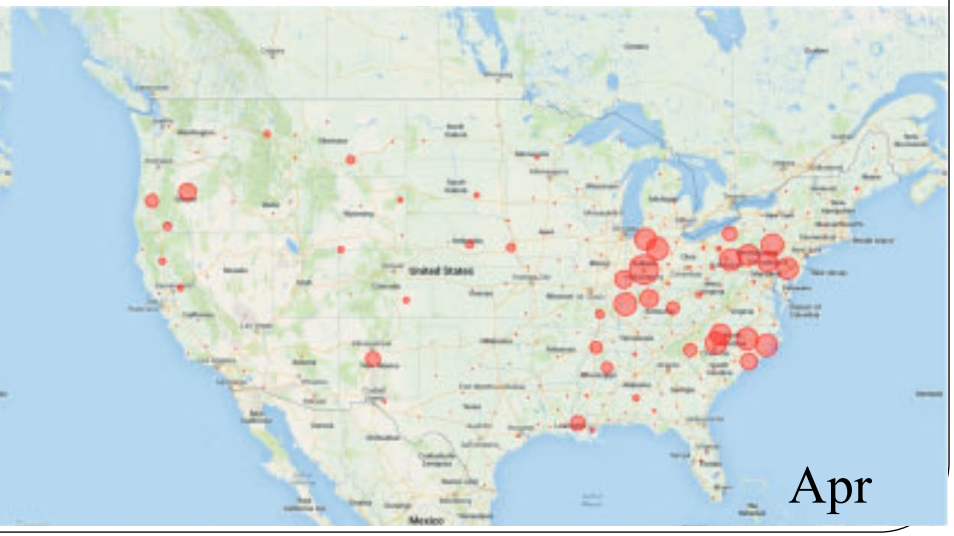
- Sinkinson and Starc and (2019)
- Measure impact of advertising by using displacement of ads for statins (reduces cholesterol)
  - Main drugs: Lipitor, Crestor and other generics
- Idea: use crowd-out of statin advertising from political ads during 2008 election cycle
  - Primary between Obama and Clinton continued into June.
  - In Jan. states such as NH, SC, IA, FL see less ads for statin
  - In Feb. states such as OH, TX see less ads for statin
  - …
- How do temporary reductions in statin ads affect demand?

Political Ads

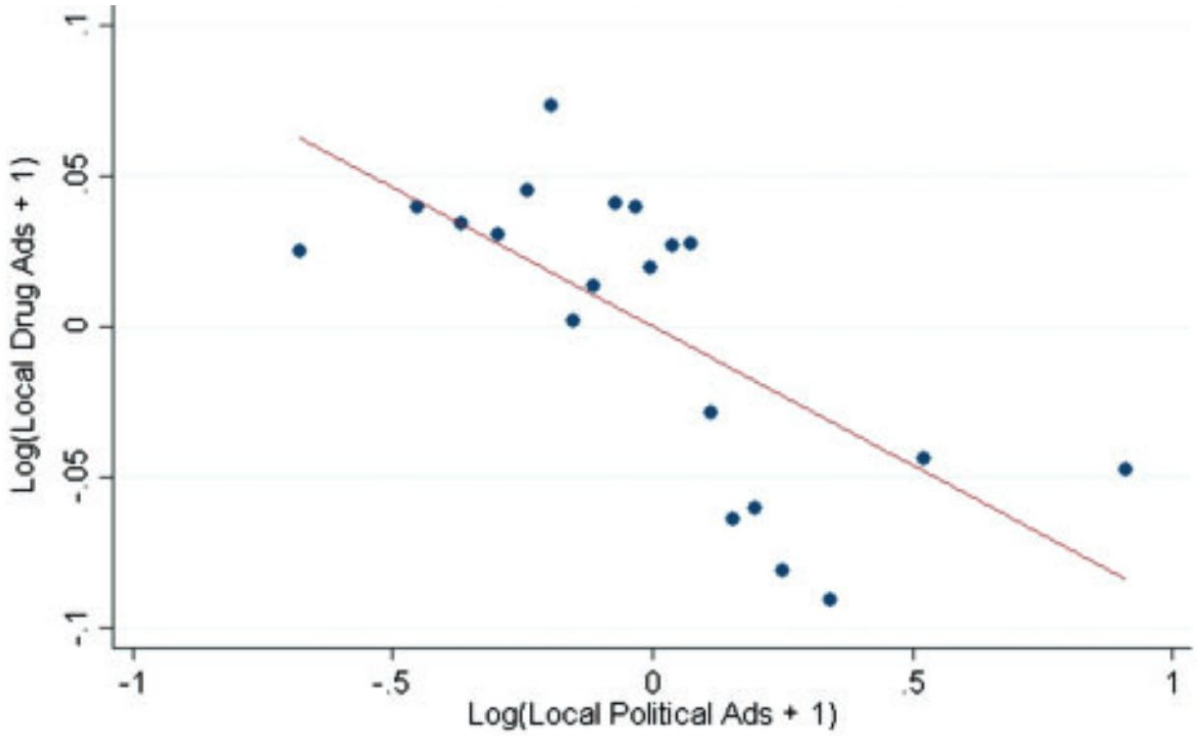




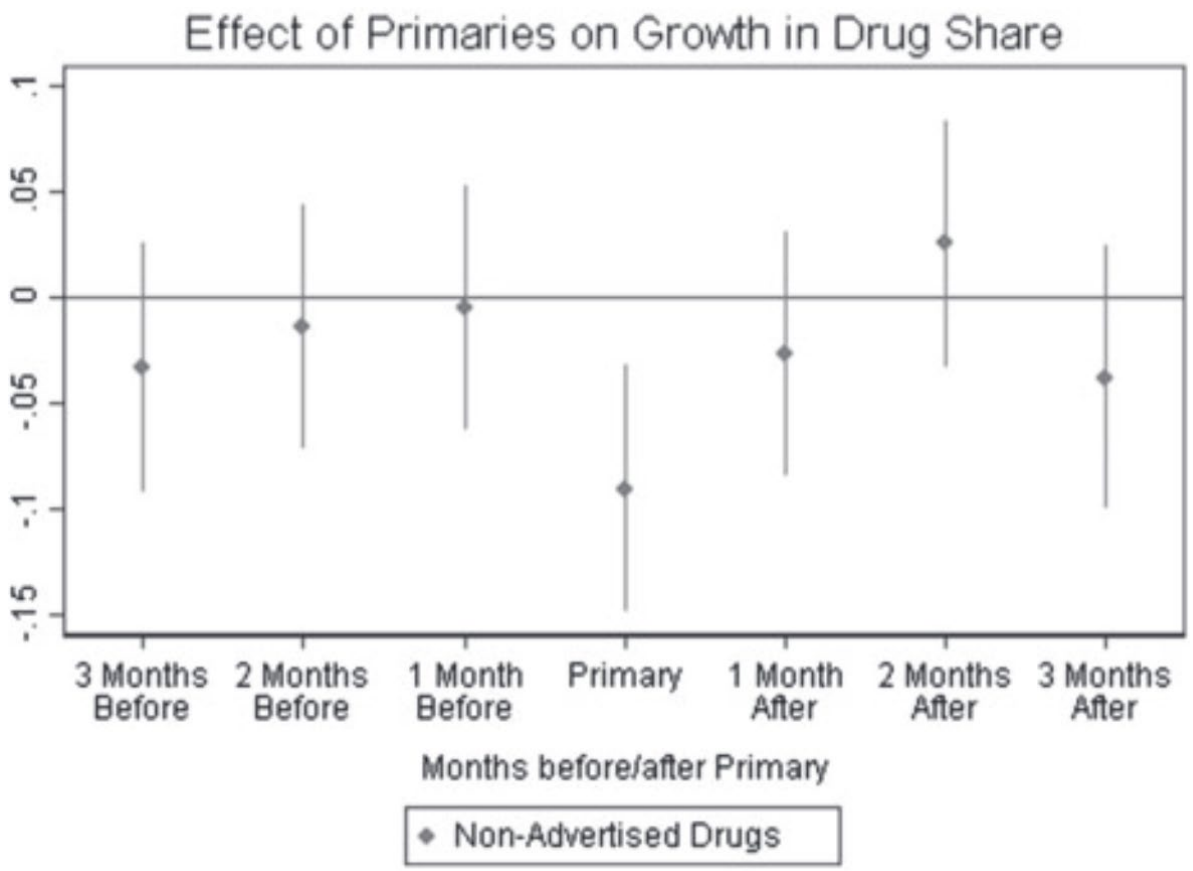




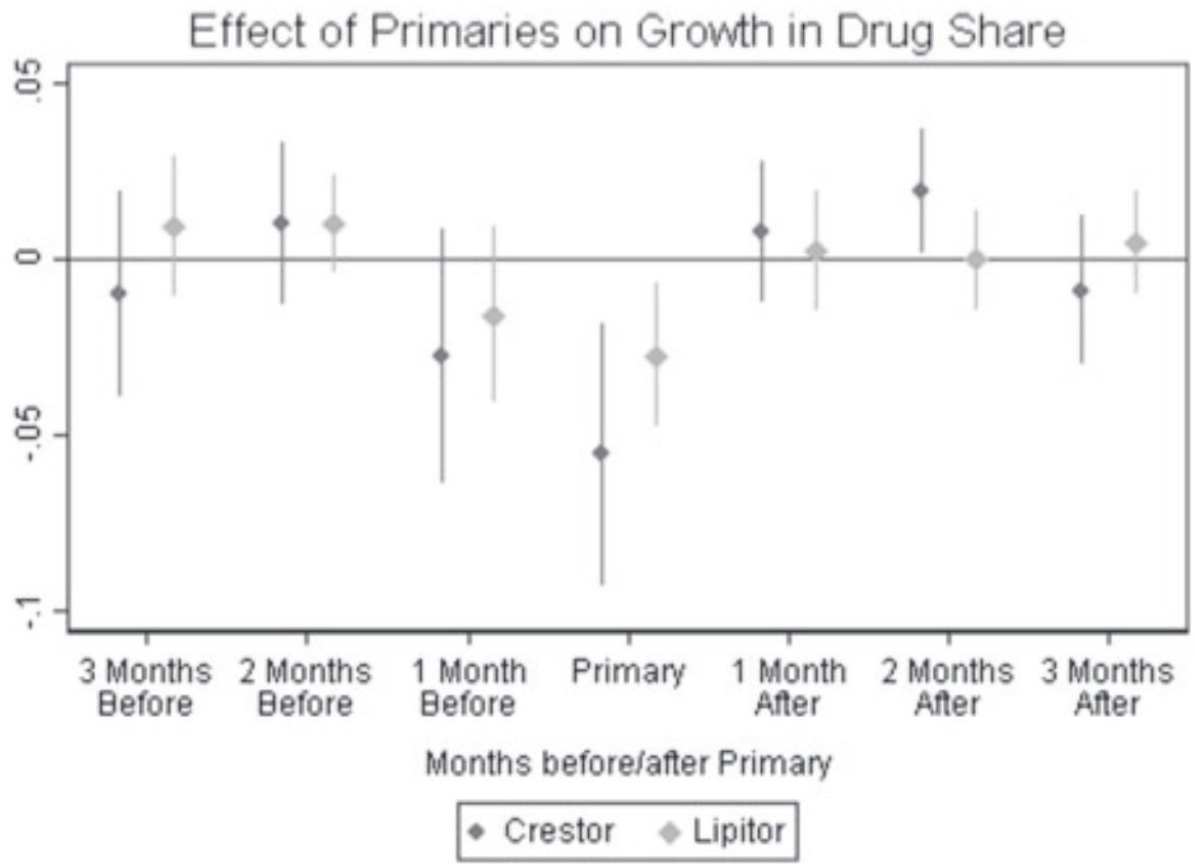
Political Ads displace Statin Ads



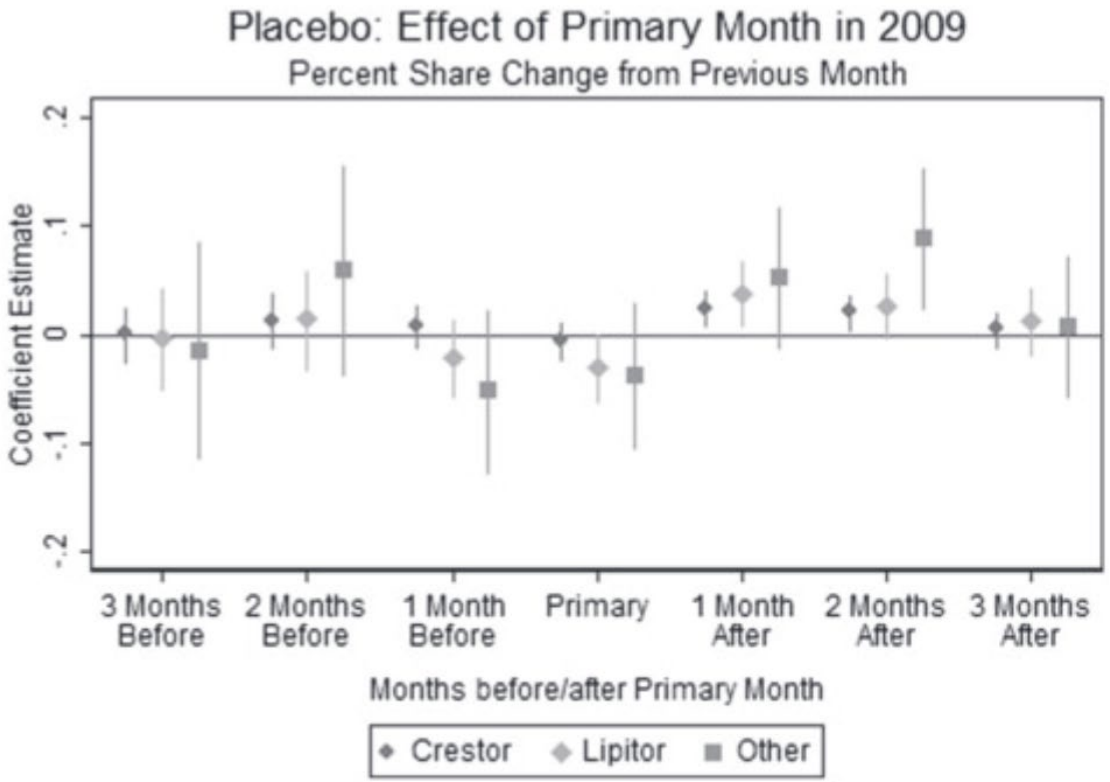
Effect on non-advertised statins



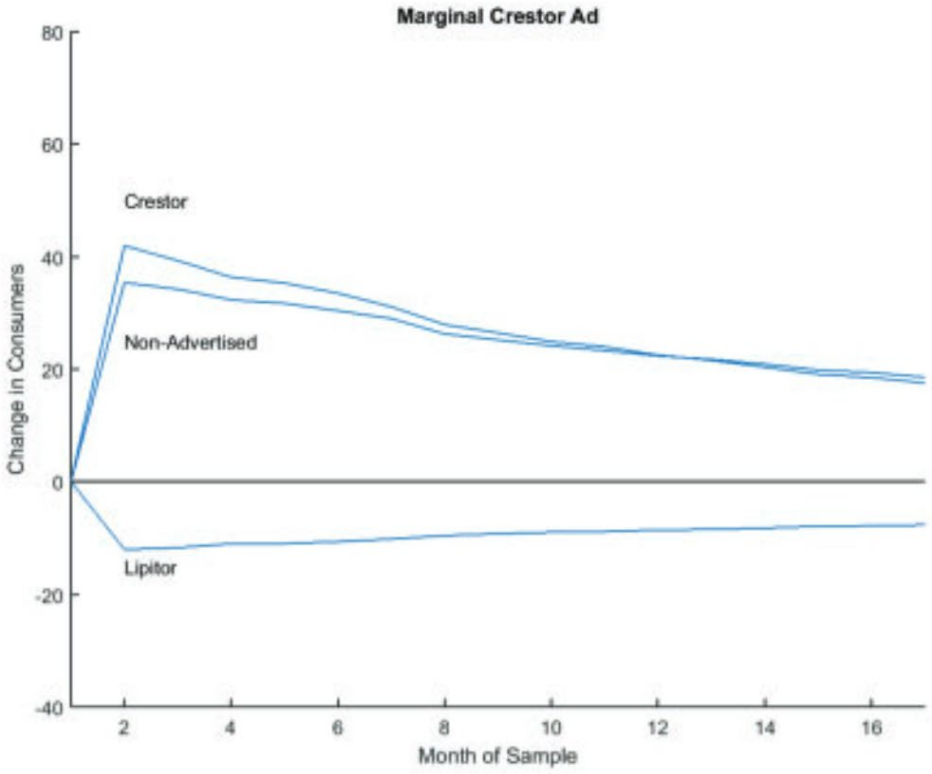
Effect on advertised statins

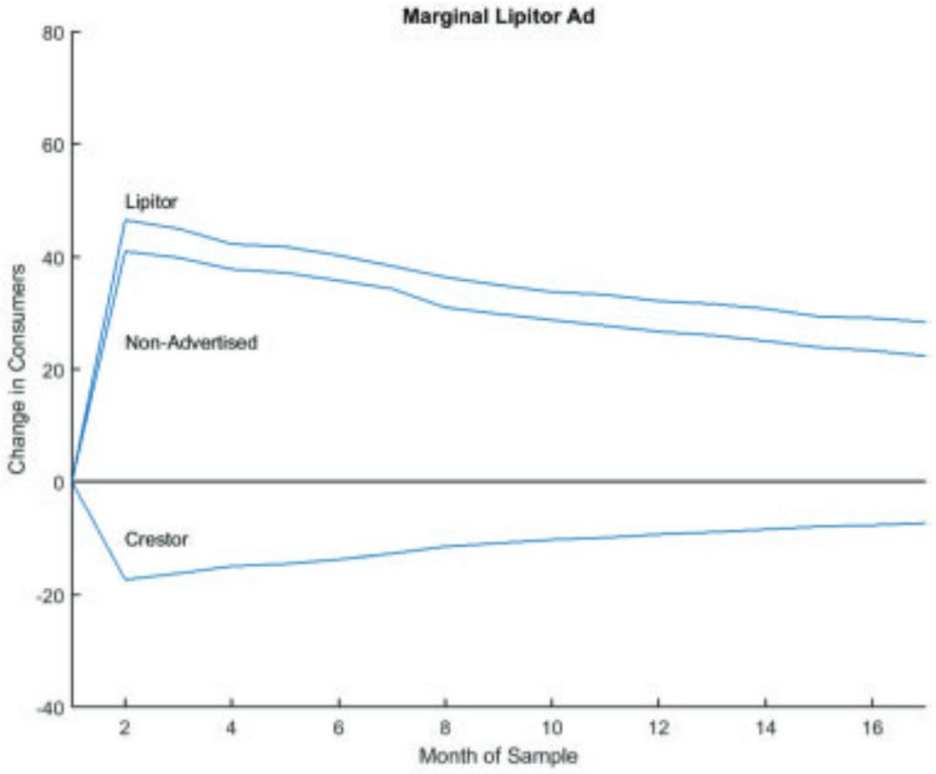


Effect on advertised statins (placebo)



Effect on own and competitor drug





Summary of Sinkinson and Starc

- Sinkinson and Starc summarize their findings as follows:

is as good as randomly assigned. Finally, our IV regression results show an own-advertising elasticity of revenue with respect to the quantity of ads of 0.0761 for a sample of privately insured consumers. We also provide estimates of revenue elasticities with respect to rival advertising: here, we estimate an elasticity of −0.0547. We separately estimate the impact on non-advertised branded and generic drugs and estimate an elasticity with respect to branded advertising of 0.0188. Therefore, advertising has a business-stealing effect among branded, advertised drugs, but a positive spillover effect to non-advertised drugs.

Elasticities are similar in a sample of Medicare Part D beneficiaries, and we cannot reject that our elasticities are the same across the two drugs in both samples. We also examine heterogeneity across different subsets of consumers in the Part D sample. We estimate much larger elasticities for new consumers who have no history of statin use. Both data sets tell a consistent story: DTCA has an economically important impact on drug sales. Competitive interaction between rivals is an important feature of the market, and rival advertising can have a significant business-stealing effect among some drugs, while having a beneficial effect on others.

How much advertising is optimal (for a monopolist)?

- In general, advertising ratio: $\frac{a}{R} = \frac{\eta}{-\varepsilon}$,
  - Where a is advertising spending, R is revenue from product η is elasticity of demand with respect to advertising, and ε is demand elasticity

- Profit: $(p - c)q(p, a) - a$
  - Take derivative with respect to a :
  - $(p - c)\frac{\partial q(p,a)}{\partial a} - 1 = 0$
  - $\frac{(p-c)}{R}\frac{\partial q(p,a)}{\partial a}a = \frac{a}{R}$ (multiply both sides by $\frac{a}{R}$)
  - $\frac{(p-c)}{p}\frac{\partial q(p,a)}{\partial a}\frac{a}{q} = \frac{a}{R}$ (use $R = pq$)
  - Note that monopoly sets prices according to $\frac{(p-c)}{p} = \frac{1}{-\varepsilon}$.
- Assume demand elasticity of Lipitor is -1.5. Using estimate of η in Sinkinson and Starc, derive the implied optimal advertising spending share.
- Optimal level of advertising with many firms is difficult, but can be analyzed using framework discussed last class.

Advertising and price competition

- In principle, advertising can both increase or decrease price competition.
  - E.g., Advertising that increases perceived differences among products
    - Increases/decreases price competition
  - E.g., Advertising that decreases perceived differences among products
    - Increases/decreases price competition
  - E.g., Advertising that focuses on prices
    - Increases/decreases price competition

- If it's likely that advertising is going to increase price competition, then why do firms advertise?
  - Prisoner's dilemma

Case study (Cabral chapter 14.2, page 368), see Milyo and Waldfogel (1999)

- In 1996, the U.S. Supreme Court overturned a Rhode Island ban on advertising the prices of alcoholic beverages.
- After the ban was lifted, both prices (level) and price dispersion went down
  - Similar to the effect of Internet on prices and price dispersion
- Allowing price advertising intensified price competition
- In the neighboring state of Massachusetts, advertising of prices was always legal and there was no secular trend in alcohol prices in Massachusetts.
  - Often industry groups are the ones that lobby for bans on advertising

Summary

- Advertising to sales ratio is greater the greater the advertising elasticity of demand and the lower the price elasticity of demand
- Advertising product characteristics tends to soften price competition (to the extent it increases perceived differentiation)
- Advertising prices tends to increase price competition