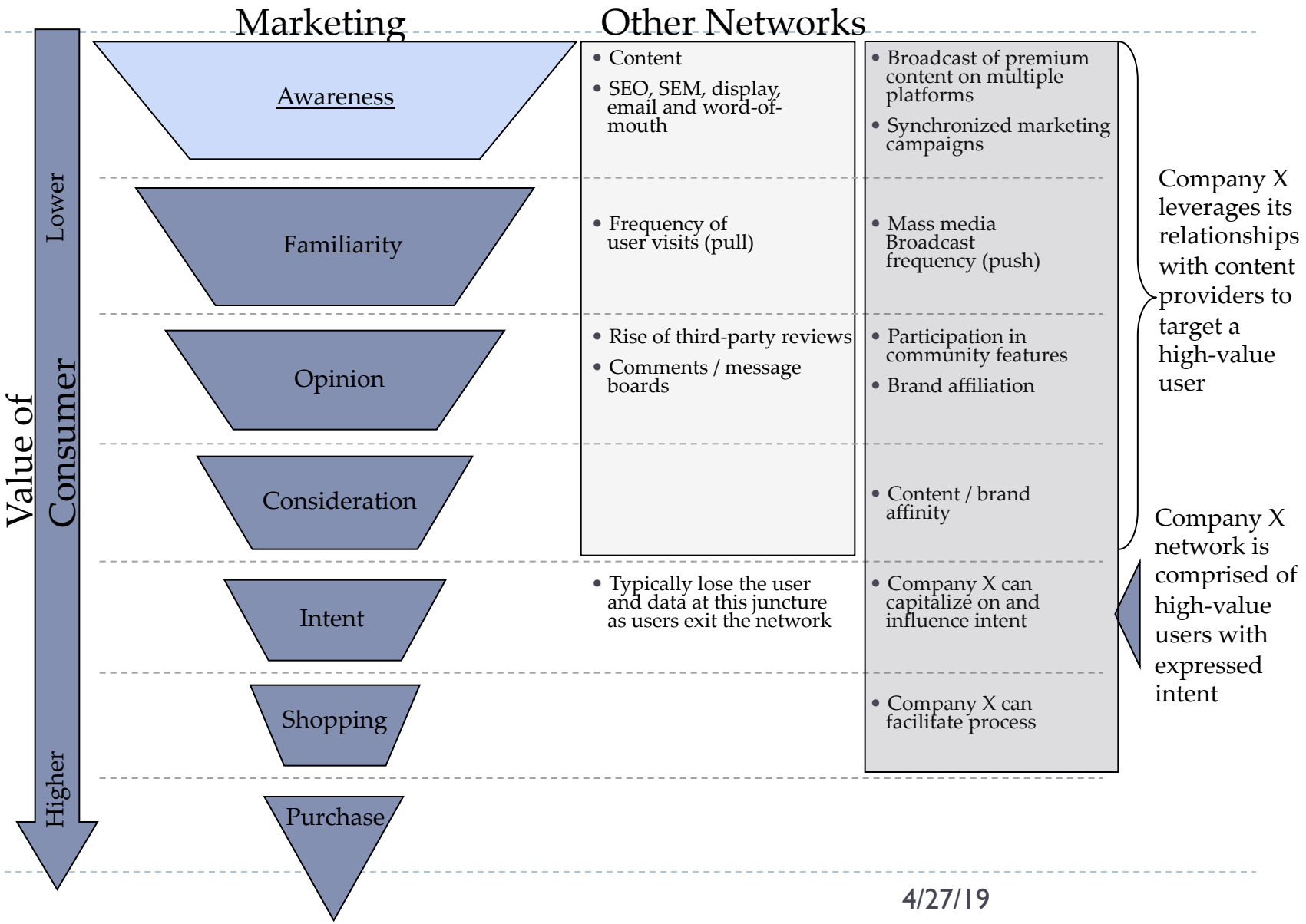
The Economics of E-commerce and Technology

Monetization: Prices and Advertising

The Stages of Buying (The Marketing Funnel)



Basic Monopoly Pricing

Monopoly Pricing: Recap

- Constant marginal cost, c.
- Firm chooses quantity to maximize profits

$$\Pi(q) = q(p(q) - c)$$

- First-order condition

$$MR(q) = c$$

- Inverse elasticity rule

$$\frac{p - c}{p} = \frac{1}{e} \quad \text{where} \quad e = -\frac{p}{q}\frac{dq}{dp}$$

Multi-product monopolist

- Microsoft sells XBox and Halo
  - If sell separately optimal prices p_X=300, p_H=50.
  - But they sell both: how should they price them?
- Walmart sells Xbox and PS3
  - If sell separately optimal prices p_X=300, p_{PS}=400.
  - But they sell both: how should they price?
- Economist sells print and online editions
  - How should they price?

Multi-product monopolist

- Firm chooses (q_1,q_2) to maximize

$$\Pi(q_1,q_2) = q_1(p_1(q_1,q_2) - c_1) + q_2(p_2(q_1,q_2) - c_2)$$

- Inverse elasticity rule for p_1

$$\frac{p_1 - c_1}{p_1} = \frac{1}{e_{11}} - \frac{(p_2 - c_2)q_2}{p_1 q_1 e_{11}} e_{12} \quad \text{where} \quad e_{12} = -\frac{p_1}{q_2}\frac{dq_2}{dp_1}$$

- Substitutes: $e_{12}<0$
  - Negative externality so increase p_1.
- Complements: $e_{12}>0$
  - Positive externality so reduce p_1.

New Products and Cannibalization

- When launching new product, do cost-benefit analysis.
- But products are often complements/substitutes for old:
  - Netflix launches Video on Demand
  - Apple launches iPad
  - Amazon launches Kindle
- Relation matters:
  - If compliment then introduce product earlier
  - If substitute then delay because of cannibalization
- This relates to last slide:
  - Having a product unavailable is like price being infinity.
  - Need to take externalities into account when launching.

Price Discrimination

Three types of price discrimination

1. Third-degree (group pricing)
   - Price as function of observables
   - Examples: Student status, zip code, assets.
2. Second-degree (menu pricing, indirect price discrimination)
   - Offer menu of options and let people self-select.
   - Examples: Versioning, quantity discounts (nonlinear pricing).
3. First-degree
   - Perfect price discrimination.
   - Combines individual pricing and nonlinear pricing.

- Pricing often has both group pricing and menu pricing.
  - Enterprise software can see how many employees firm has, but may also offer different versions.

First-Degree Price Discrimination

- Suppose know customer's demand curve, p(q).
- Firm can extract all consumer surplus
  - Let welfare maximizing quantity be q^*, so that $p(q^*)=c$.
- Three ways to extract
  1. Block pricing: sell q^* units at $W(q^*)=\int_0^{q^*} p(q)dq$
  2. Two-part tariff: price $p=c$ and fee $CS(q^*)= W(q^*)=\int_0^{q^*} [p(q)-c]dq$
  3. Nonlinear prices: Sell q^{th} unit for price $p(q)$.
- Big assumptions
  - Know customers demand.
  - Can charge different prices to different customers.
- Example: Elsevier and Universities

Third-Degree Price Discrimination

- Firm can observe customer characteristics
  - Country (e.g. book prices)
  - Student status (e.g. airline tickets)
- Optimal pricing: Use inverse elasticity rule for each group.
  - Lower price to most sensitive groups.
- Assumptions
  - No resale (e.g. international editions of textbooks)
  - No cost to setting different prices
  - Cannot change characteristics (e.g. hide student card)
  - No ethical issues (e.g. racial discrimination in car sales)
  - Consumer demand and observable characteristics are correlated
- Has internet made easier or harder?

Second-Degree Price Discrimination

- Offer menu of products and see which consumers choose
  - High and low quality products (vertical differentiation).
  - Indian and American textbook (horizontal differentiation).
  - Quantity discounts.

- Big idea
  - Choose options so different types of customers self-select.
  - Want to separate groups that have different WTP.
  - Need customers with different WTP to value features differently

Versioning: Selling Printers

- Equal numbers of Businesses and Consumers
- Basic model of printer
  - Businesses value at $1000, Consumers at $400.
- Make slow version

	Businesses	Consumers
Basic	$1000	$400
Slow	$300	$400

- Make ugly version

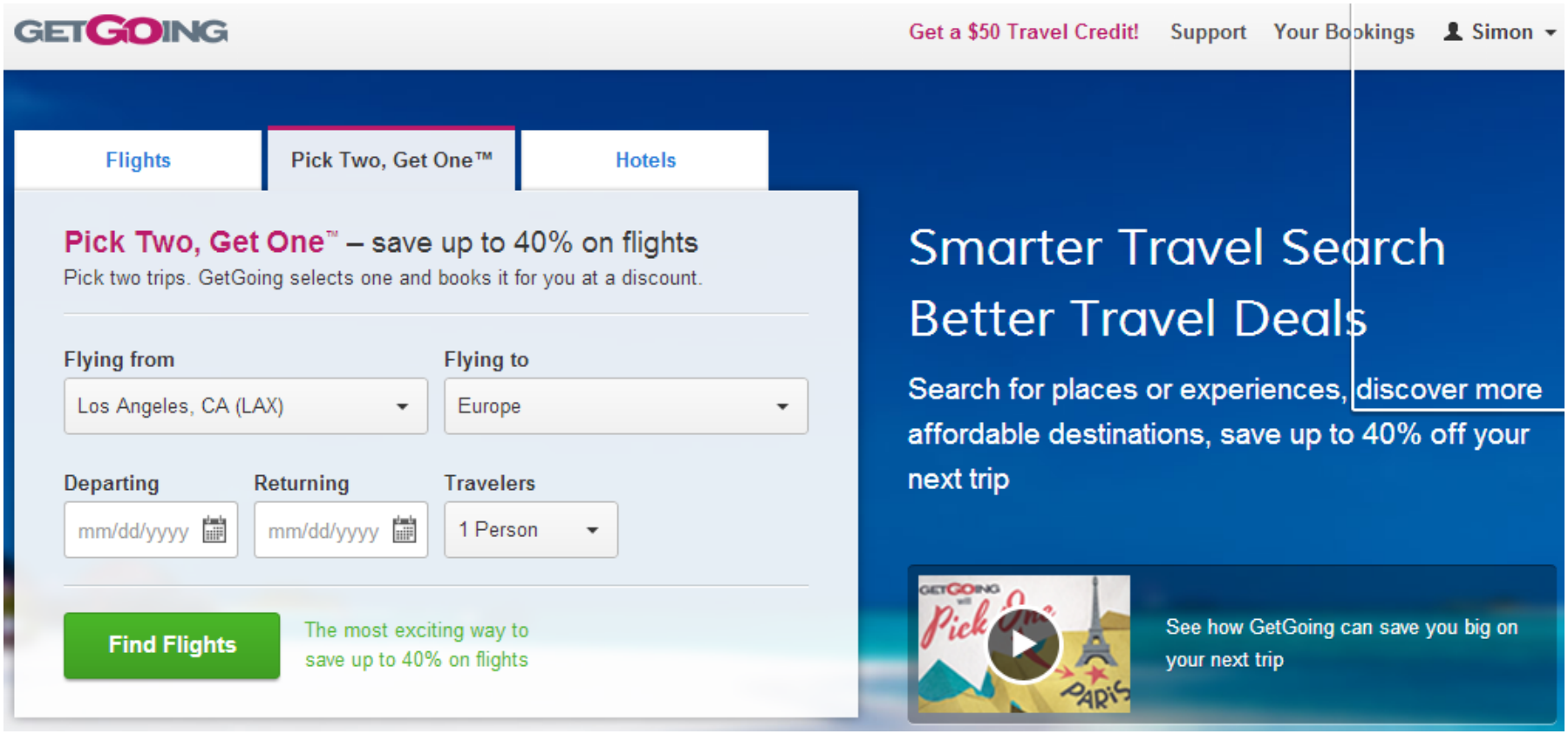
	Businesses	Consumers
Basic	$1000	$400
Ugly	$750	$300

Versioning: A Classic Example

It is not because of the few thousand francs which would have to be spent to put a roof over the third-class carriages or to upholster the third-class seats that some company or other has open carriages with wooden benches. […] What the company is trying to do is to prevent the passengers who can pay the second-class fare from traveling third class; it hits the poor, not because it wants to hurt them, but to frighten the rich.

Jules Dupuit, 1849

Versioning: A Modern Example



Versioning: Naïve Price Discrimination

- What if we just ignored other goods?
  - Example: Utility $u=vx-p$, $v \sim U[0,1]$ and $x \in \{x_L, x_H\}$.
  - Naïve pricing: $p_L = \frac{1}{2}(x_L + c_L)$ and $p_H = \frac{1}{2}(x_H + c_H)$
- What are optimal prices?
  - Demand for each good:

$$q_H = 1 - \frac{p_H - p_L}{x_H - x_L} \quad \text{and} \quad q_L = \frac{p_H - p_L}{x_H - x_L} - \frac{p_L}{x_L}$$

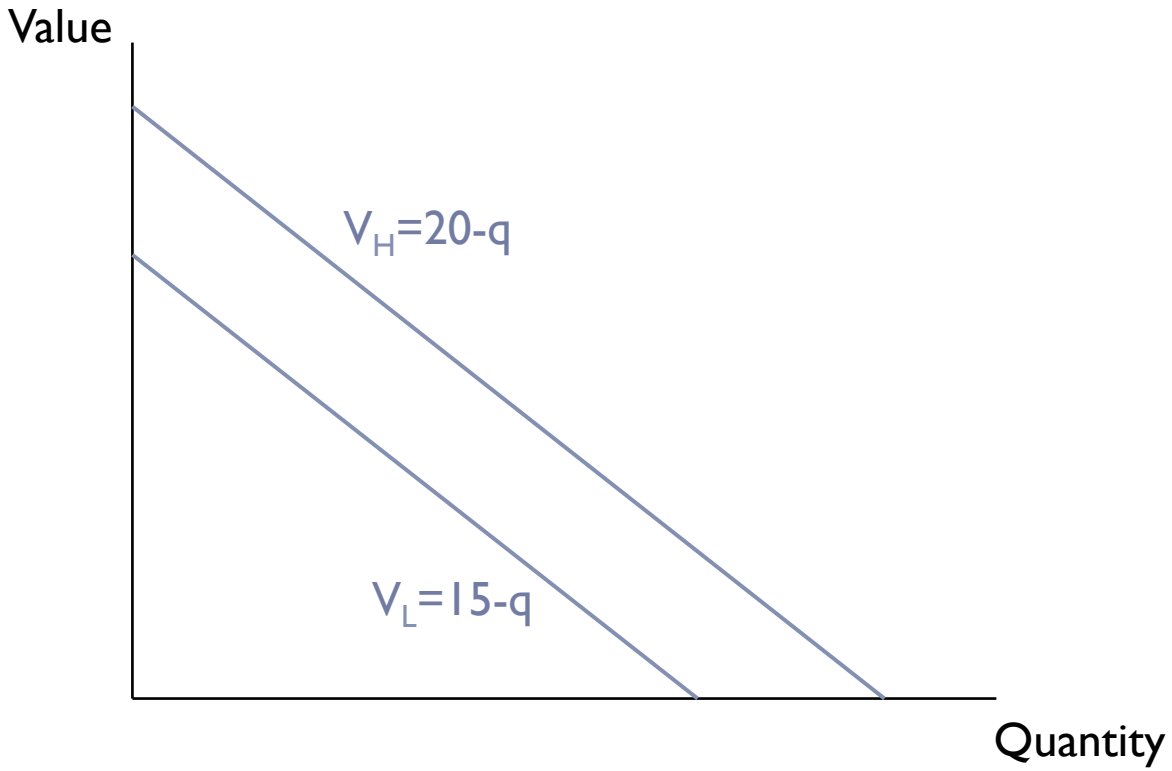
  - Firm's profits: $\pi = q_L (p_L - c_L) + q_H (p_H - c_H)$.
  - Differentiating w.r.t. (p_L, p_H), the naïve prices are optimal!
  - Note: This worked because v is uniform.

Practical Issues of Versioning

- How many versions?
  - Want to cleanly separate consumers (e.g. business vs. leisure)
  - Cost to maintaining different product lines (e.g. airlines)
  - Customer confusion from too many options (e.g. cinemas)
  - Different options may reduce network effects. (e.g. wordpad)
- Degraded versions
  - Need to ensure customers cannot undo (e.g. unlock software).
  - Use degraded version to promote regular one (e.g. mathematica)
- Framing
  - People like "middle" option.

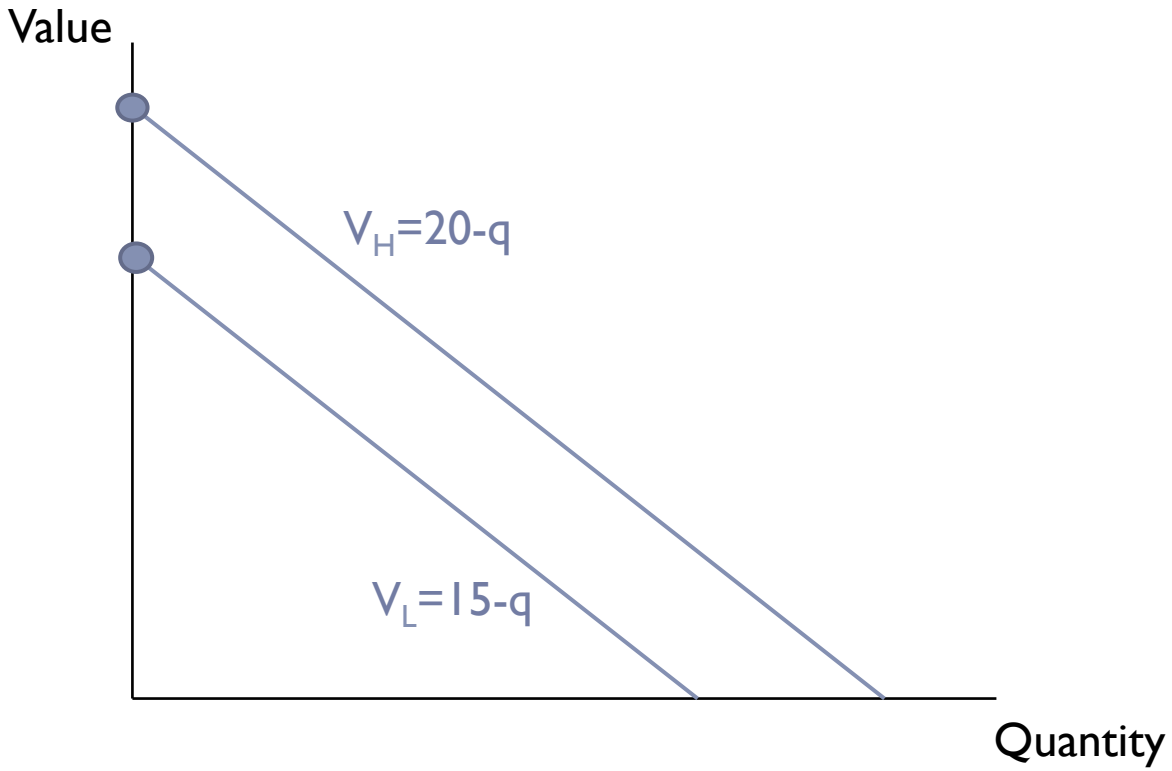
Quantity Discounts (i.e. Nonlinear Pricing)

- Suppose there are equal numbers of two types of agents
- Agent H has values quantity (or quality) more than agent L
- Firm's costs are zero



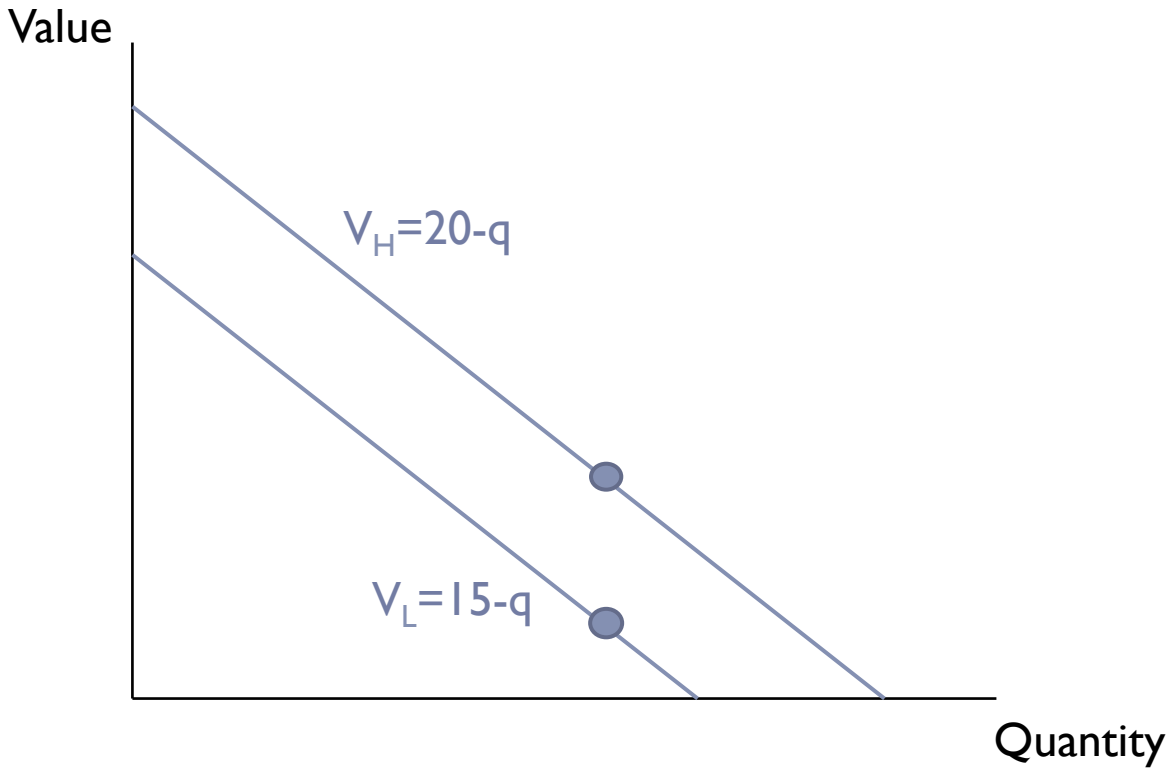
Consider selling the 1st unit alone

- Agent H has value 20, while agent L has value 15
- Monopolist will sell to both agents for revenue 30.



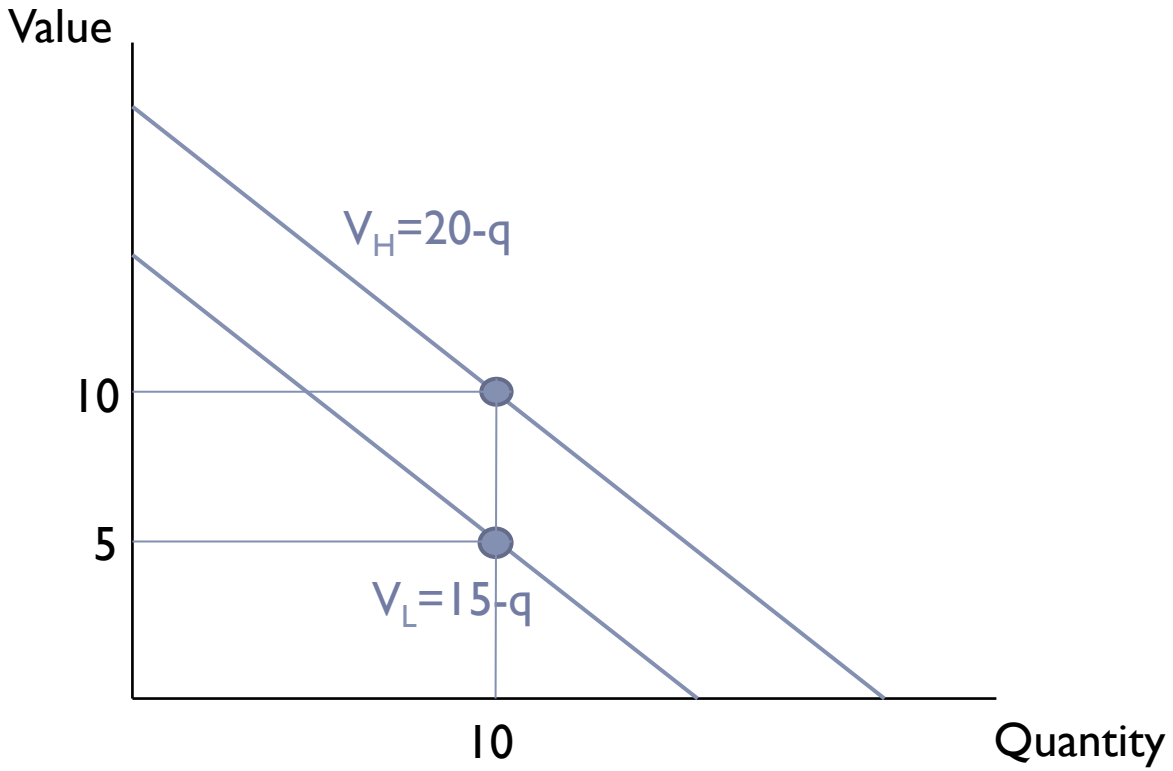
Consider selling the 12th unit alone

- Agent H has value 8, while agent L has value 3
- Monopolist will sell to agent H for revenue 8.



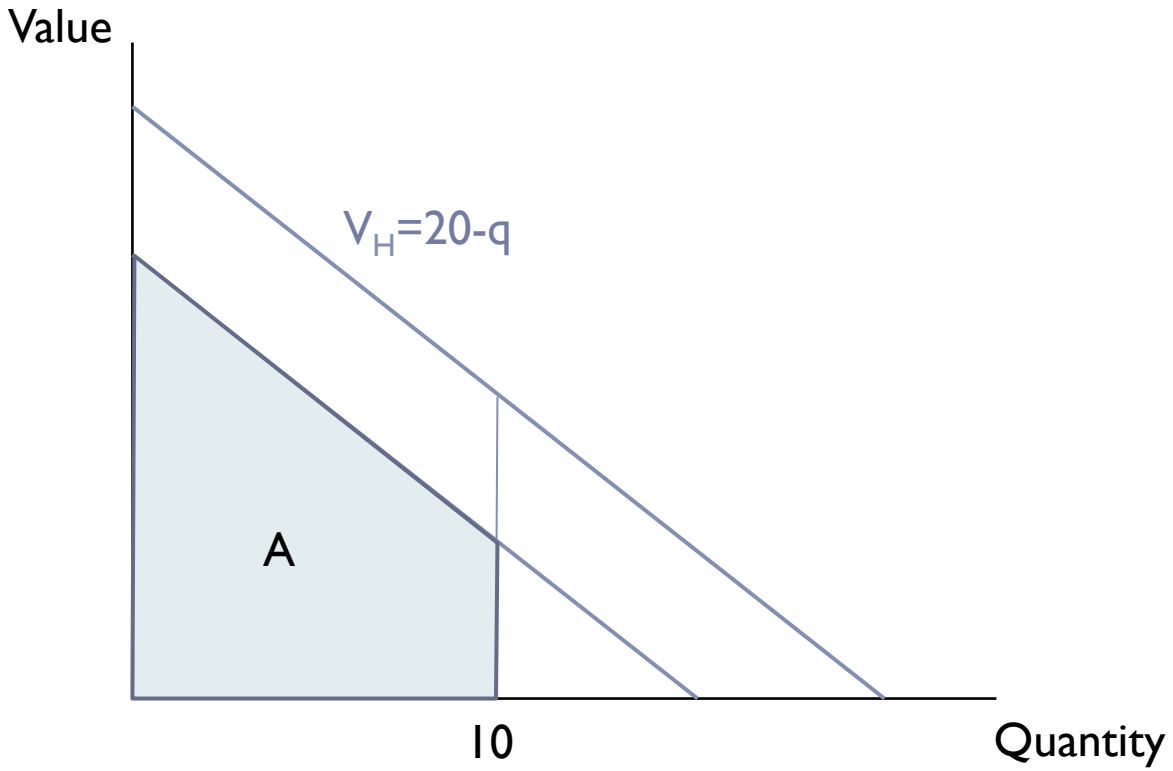
Consider selling the 10th unit alone

- Agent H has value 10, while agent L has value 5
- Monopolist is indifferent about selling to one or both



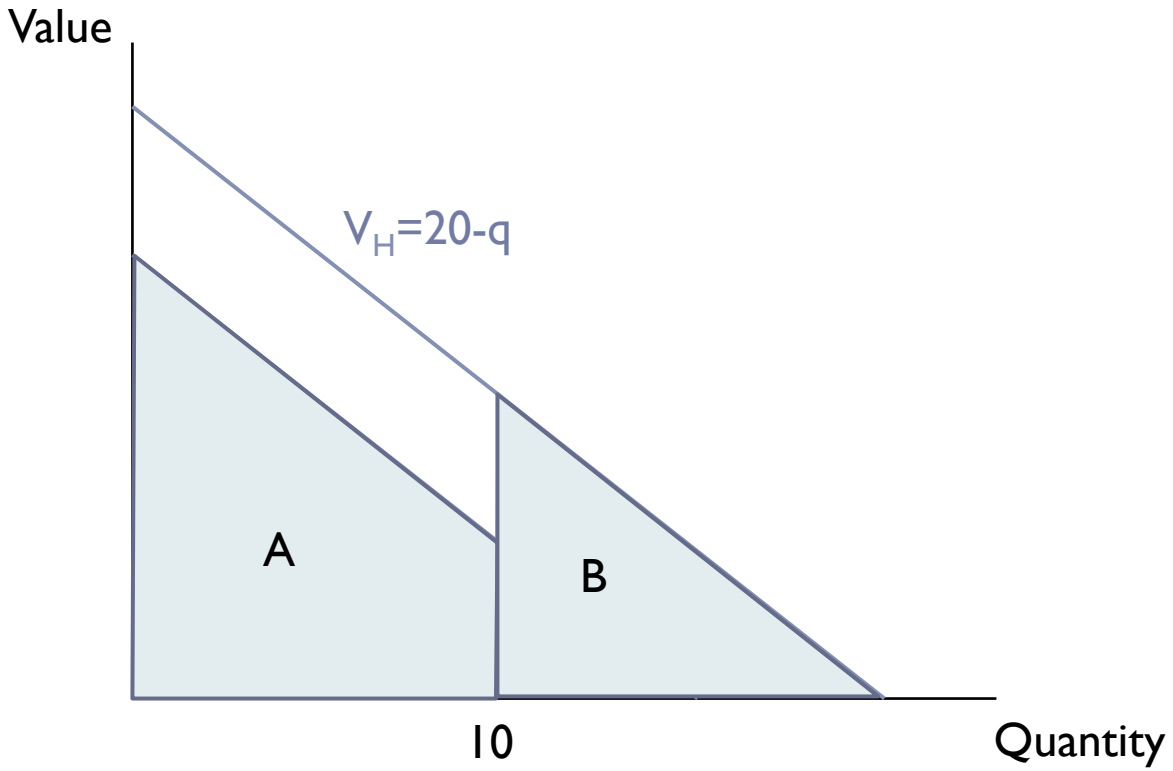
Optimal Nonlinear Price

- Sell 10 units to L for her WTP, $A = \int_{0<q<10} V_L(q)dq$
- Hence agent L gets no surplus



Optimal Nonlinear Price

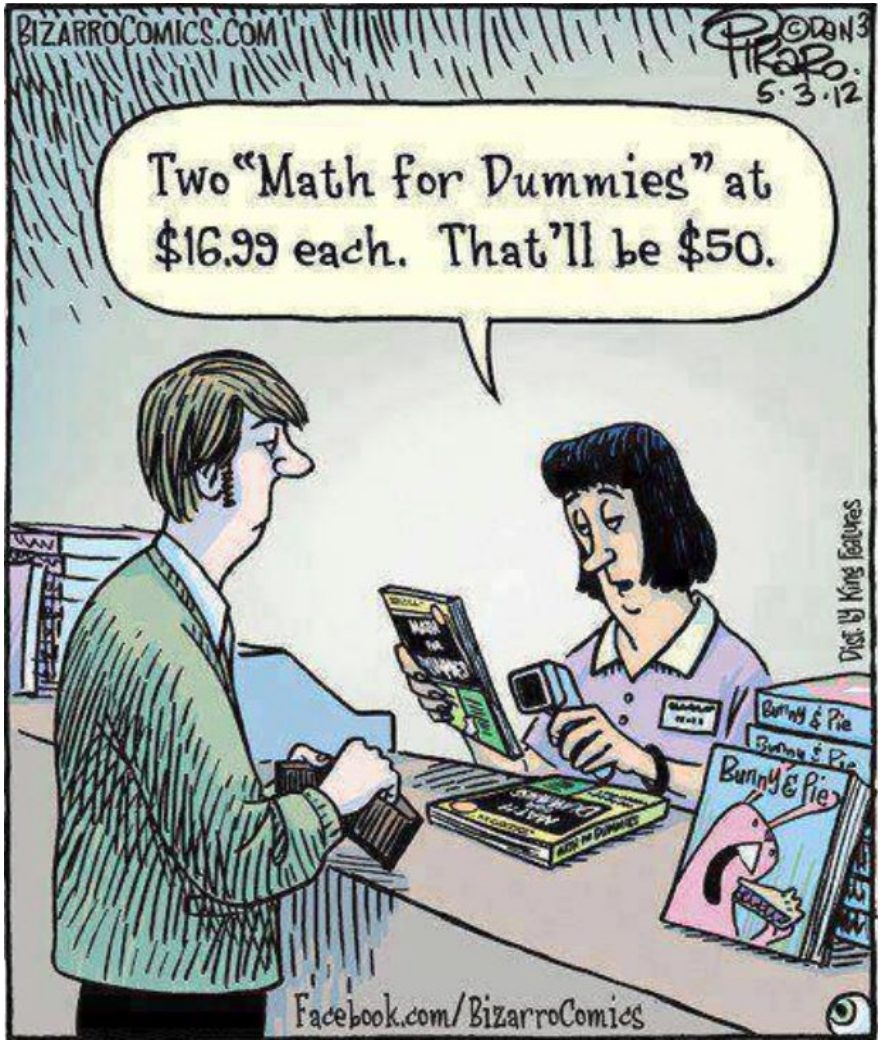
- Sell 15 units to H for A + B, where $B = \int_{10<q<15} V_H(q)dq$
- Hence agent H gets some surplus, and efficient quantity.



(Non)linear Pricing in Supply Chains

- Example (the cable business)
  - HBO sells input to TW; TW sells output to customers.
  - Market demand is q=100-p. Both firms have zero costs.
- Maximal Industry Profits
  - Charge p=50, sell quantity q=50. Profits = 50*50 = 2500.
- What if HBO charges transfer price t?
  - Then TW maximizes $\pi_{TW}=(p-t)(100-p)$
  - Chooses p=50+t/2 and sells q=50-t/2, treating 't' as input cost.
- What input price does HBO choose?
  - HBO maximizes $\pi_{HBO}=t(50-t/2)$, implying t=50, q=25 and p=75.
- Firms charge more than monopoly price!
  - Intuitively, each firm exert negative externality on the other.
  - Can raise profits by merging or using two-part-tariff

What form is discrimination is this?



Other Aspects of Pricing

Bundling

- Bundling is very common
  - Bundling of functions (e.g. Excel)
  - Bundling of programs (e.g. MS Office)
  - Bundling of people (e.g. MS Office site licenses)
- Pure and Mixed Bundling
  - Pure: only sell bundle.
  - Mixed: see bundle and components separately.

Bundling and Price Discrimination

- Bundling can reduce the dispersion of consumers' WTP.
- Ann and Bob have values for Excel and Word

	Excel	Word
Ann (accountant)	100	60
Bob (bureaucrat)	60	100

- If sell separately
  - Prices: $60 for Word, $60 for Excel.
  - Profits $240.
- If sell as bundle
  - Prices: $160 for bundle.
  - Profits: $320.

Roll over image to zoom in

Share your own customer images

Listen to samples

Now 47: That's What I Call Music

Now That's What I Call Music (Artist) | Format: Audio CD

(31 customer reviews)

Price: $11.88 & **FREE Shipping** on orders over $25. Details

AutoRip : Includes **FREE** MP3 version of this album.
Provided by Amazon Digital Services, Inc. Terms and Conditions. Does not appl
orders.

In Stock.
Ships from and sold by **Amazon.com**. Gift-wrap available.

Want it Monday, Sept. 23? Order within **20 hrs 27 mins** and choose **One-Day Shipping**
Details

Complete your purchase to save the MP3 version to Cloud Player.

35 new from $8.58 2 used from $11.16

Share

Formats	Amazon Price	New from	Used from
MP3 Music, 20 Songs, 2013	$9.49	$9.49	--
Audio CD, 2013	$11.88	$8.58	$11.16

Listen to Samples and Buy MP3s

View the MP3 Album.

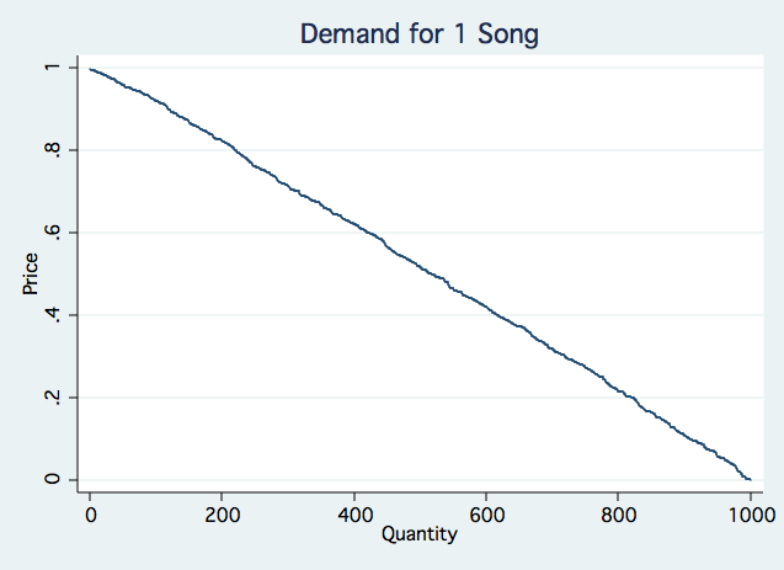
Listen to all Try our music sampler to hear song samples from this album.

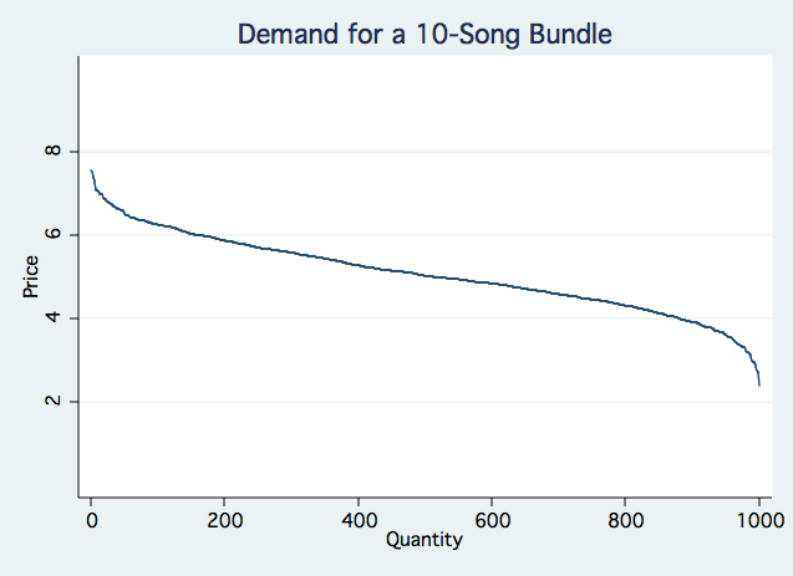
Samples Preview all songs

Song Title	Artist
1. I Love It [feat. Charli XCX]	Icona Pop
2. Mirrors	Justin Timberlake
3. #Beautiful [feat. Miguel]	Mariah Carey
4. Come & Get It	Selena Gomez
5. Radioactive	Imagine Dragons
6. When I Was Your Man	Bruno Mars
7. Beneath Your Beautiful [feat. Emeli Sandé]	Labrinth
8. Clarity [feat. Foxes]	Zedd
9. I Need Your Love [feat. Ellie Goulding]	Calvin Harris

Bundling and Price Discrimination

- Bundling can reduce the dispersion of consumers' WTP.
- This is easy to see when there are many goods
  - 1000 customers and 10 songs.
  - Each customers' value per song is uniformly distributed on [0,1]





Other Reasons to Bundle

- Complimentary consumption (e.g. shoes)
- Complimentary production (e.g. CDs)
- Reduce the number of payments (e.g. newspaper articles)
- Blocking entry (e.g. Microsoft)

Price Complexity

- Airline Pricing
  - Airline prices used to be very complex: price depends on whether single/return, on how match flights etc.
  - Increasingly sell single tickets (e.g. Virgin America)
- Complex prices
  - May be optimal form of price discrimination
  - Makes price comparison hard, and softens competition
- But…
  - Confuses customers
  - People may think differential pricing is unfair

Framing

- Anchoring
  - People overweight first piece of information
- Status quo bias
  - Endowment effect
  - Prospect theory
- Context effects
  - Choose middle option (compromise effect)
  - Choices affected by dominated alternatives (attraction effect)
- Mental accounting
  - People subdivide expenditures (e.g. insurance on computer).
- Don't overwhelm consumers (choice overload)
  - People more likely to buy nothing.

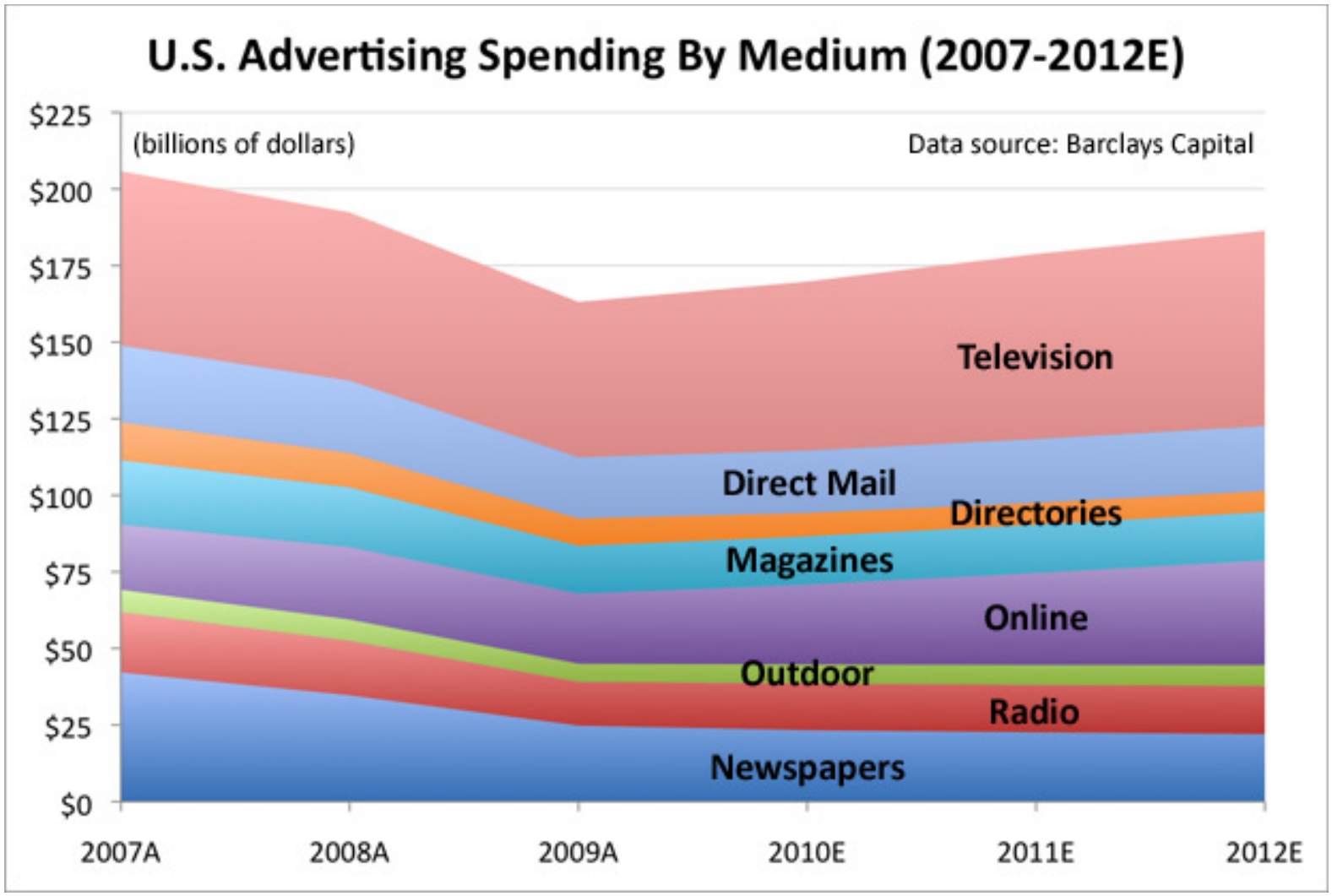
Zero Prices

- Zero prices are commonplace.
  - Email accounts, Internet hotspots, Online newspapers
- How earn money?
  - Advertising (e.g. gmail)
  - Selling complementary goods (e.g. support with Sun's MySQL)
- Advantages of zero price (over small prices)
  - Avoid customers thinking about whether to use product.
  - No transactions costs (billing, usernames, passwords)
  - Create environment of experimentation
  - Maintain privacy
- Problems
  - Overconsumption if MC≠0 (e.g. data plans, email spam)
  - Hoarding (e.g. IP addresses)

Advertising

Facts

Online Advertising



Online Advertising

- Advantages of online advertising
  - Highly targeted (IP, time, registration info, previous pages, GPS)
  - Low fixed cost
- Major types of ad
  - Display ads - visual appeal, branding
  - Search ads – very contextually specific
  - Text ads – specific, unobtrusive
  - Mobile ads – time and location sensitive
- Earned media/Publicity
  - Celebrity endorsements, press releases
- Social media
  - Online word of mouth

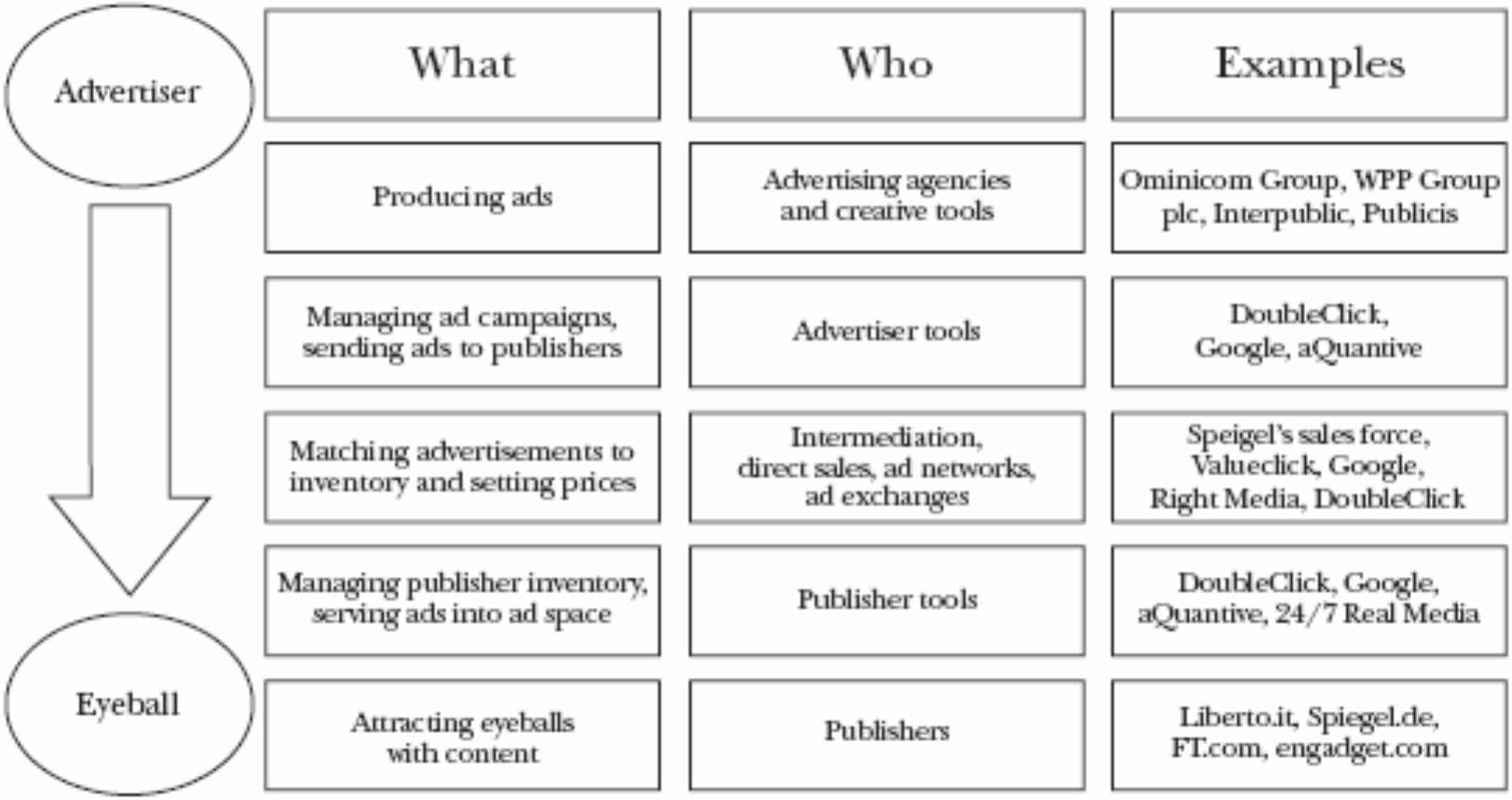
	Share of advertising coming from this format								
Advertising format	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*
Display related	**78%**	**72%**	**60%**	**42%**	**39%**	**34%**	**32%**	**34%**	**33%**
Banners	48%	36%	29%	21%	19%	20%	22%	21%	21%
Sponsorships	28%	26%	18%	10%	8%	5%	3%	3%	2%
Rich media	2%	2%	5%	8%	10%	8%	7%	8%	7%
Slotting fees	0%	8%	8%	3%	2%	1%	0%	0%	0%
Digital video	0%	0%	0%	0%	0%	0%	0%	2%	3%
Search	**1%**	**4%**	**15%**	**35%**	**40%**	**41%**	**40%**	**41%**	**45%**
Classifieds	**7%**	**16%**	**15%**	**17%**	**18%**	**17%**	**18%**	**16%**	**14%**
Lead generation	**4%**	**2%**	**1%**	**1%**	**2%**	**6%**	**8%**	**7%**	**7%**
E-mail	**3%**	**3%**	**4%**	**3%**	**1%**	**2%**	**2%**	**2%**	**2%**
Interstitials	**4%**	**3%**	**5%**	**2%**	**0%**	**0%**	**0%**	**0%**	**0%**
Other	**3%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
Total (million $)	8,087	7,134	6,010	7,267	9,626	12,542	16,879	21,206	23,400

Ad Formats Definitions: Display ads on websites look like those in newspapers and magazines. A **banner** is a space (usually rectangular) on a web page that shows the advertiser's message; this category includes all display ads except for the other specialized categories listed below it. **Sponsorships** represent custom content and/or experiences created for an advertiser that may or may not include ad elements (for example, reskinning a section of a website with the advertiser's branding). **Rich media** refers to advertisements that incorporate animation, sound, and/or interactivity in any format. **Slotting fees** are the fee charged for premium ad placement and/or exclusivity. **Digital video format** includes commercials that appear in live, archived, and downloadable streaming content. **Search** refers to paying Internet companies to present an advertisement linked to a specific search word or phrase. It includes paid listings (text links appear at the top or side of search results for specific keywords); contextual search (text links appear in an article based on the context of the content rather than on the basis of a user-submitted keyword); and paid inclusion (guarantees that a marketer's URL is indexed by a search engine). Although this data source includes "contextual advertisements" in the search category, these ads are targeted display ads that are not based on the use of a search engine and are treated as part of display ads in the remainder of this paper. Contextual advertisements accounted for about 8 percent advertising revenue in 2008. "**Classifieds"** refer to the posting of a product or service in an online listing for a fee. "**Lead generation**" indicates referrals to qualified purchase inquiries. **E-mail ads** include banner ads, links, or advertiser sponsorships that appear in commercial e-mail communication. **Interstitials** are ads displayed during a transition from one Web page to the next.

Examples of online ads

- Advertising on search site
  - Second price auction for adwords
  - Bids ranked, and slots allocated with highest first
  - Pay per click
  - Price depends on word ($99 for mesothelioma; typically $0.4)
- Advertising on other websites
  - Pay per view for display
  - Media site: $12 per 1000 impressions
  - Social networks historically lower: $0.5 per 1000 impressions
  - Large firms find own advertisers for display.
  - Otherwise use advertising network (e.g. Doubleclick)

Market Structure



Advertising

Theory

Motives for Advertising

- Informative (e.g. restaurants)
  - Inform customers of products existence
  - Advertise specific features or price
  - Signal quality through commitment to product
- Persuasive (e.g. branded drugs)
  - Change customer's view of product
  - Jam their memory, so first think of your product.
- Why do different product advertise?
  - E.g. movie pre-release and post-release
- How affect demand curve?
  - Pivot vs shift.

Intensity of Advertising

- The intensity of advertising varies a lot across industries

Industry Sector	Ad to Sales Ratio %
Natural Resources & Materials	0.8
Oil, Gas & Chemicals	0.3
Consumer Products	6.6
Health Care	3.5
Retail	1.8
Financial Services	0.9
Electronics & Scientific Instruments	2.2
Computers & Software	2.0

- The type of advertising varies across firms
  - Pepsi – negative "taste test"
  - Coke – positive "Life tastes good"
- More advertising in comp. industry, oligopoly or monopoly?
- More advertising with small firm or large firm?

A Model

- Firm profits:

$$\pi(a)=s(a)Q(a)[p-c]-k(a)$$

- Demand expansion effect
  - Depends on elasticity of whole sector
  - Depends on market share of firm
- Business stealing effect
  - Depends on differentiation
- Markup
  - Depends on competitiveness of industry
- Efficiency of advertising
  - Depends on ability to target customers

How Measure Sensitivity/Effectiveness?

- Existing Data ("Secondary Research")
  - Investor reports: annual report data, financial info, etc.
  - Scan data, databases, set top boxes, subscriber lists, public company data
- Analytics (Behavioral data)
  - Internal databases
  - Digital behaviors
  - Trend data
  - Behavioral patterns

- New Data ("Primary Research")
  - Quantitative – surveys, social monitoring
  - Qualitative – Focus groups, online chats, in-home interviews
  - Measurement – real behaviors, not self reported

Advertising Strategy

- Single firm
  - Suppose advertising shifts the demand curve.
  - Care about the WTP of the marginal customer.
  - Analogous to vertical differentiation.
  - Like quality, advertising is also investment in brand equity.
- What if there are many firms?
- Advertising about features can soften price competition
  - Consumers realize products differentiated.
  - Spurious product differentiation (e.g. Nutrasweet vs. generics)
- Advertising about prices can increase price competition
  - If prices known, firms can cut price to get more customers.

Advertising – The Platform's Perspective

- Suppose you are Facebook, Twitter, or the NYTimes
  - Key formula: Value = #users × engagement × $/unit
- Raise number of users
  - Appeal to new demographic; add value to new customers
- Raise engagement
  - Add new features
- $/unit
  - Raise quality of ad via better targeting
  - Make ads more integral
- How should Facebook, Twitter, NYTimes, best raise value?