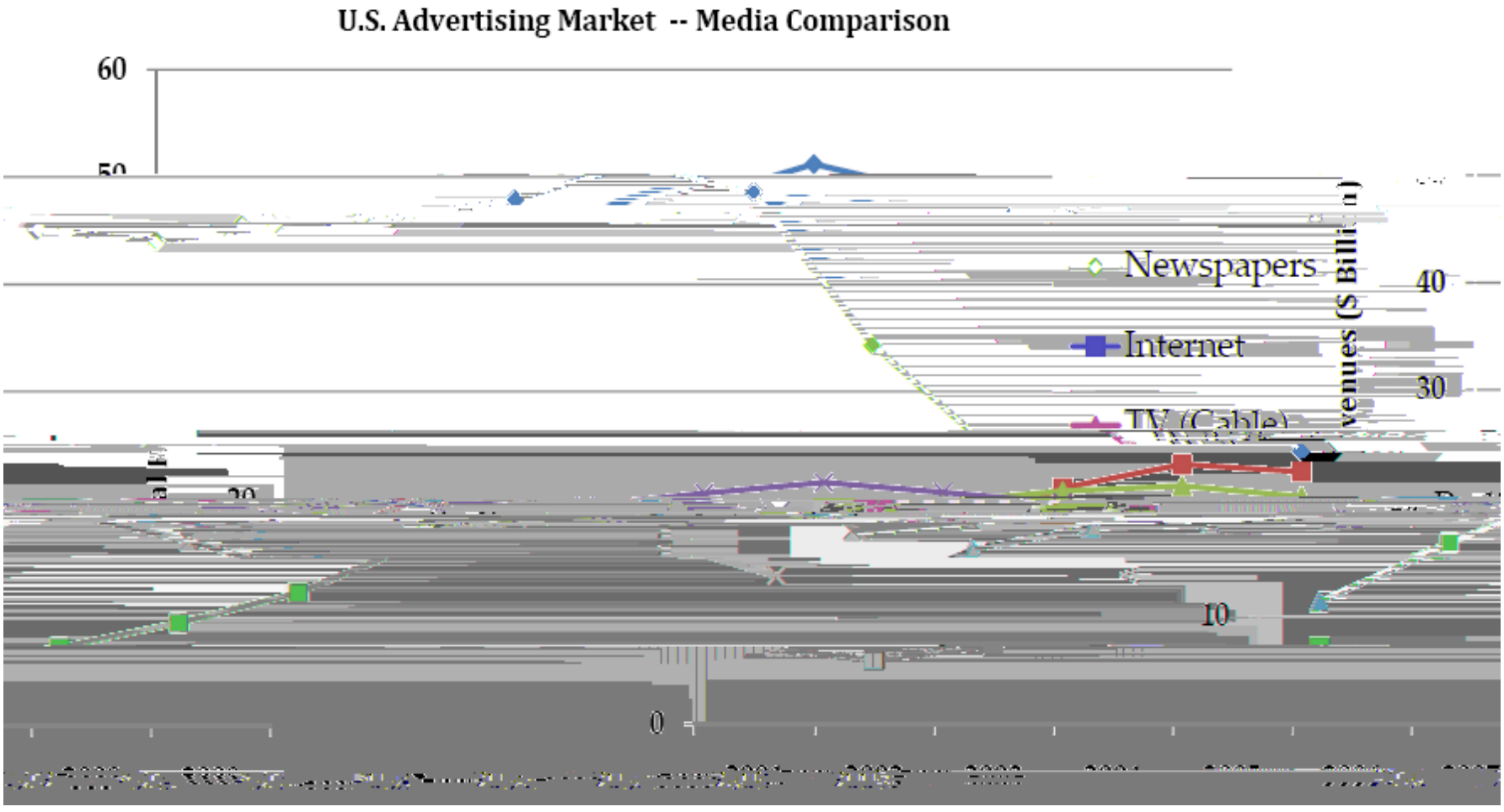
Introduction

Some Data


U.S. Advertising Market -- Media Comparison
60
50
40
30
10
0
Newspapers
Internet
TV (Cable)

Targeting with Many Markets/Products

- to o¤er a model of targeting in advertising markets in the presence of
  - many distinct advertising markets
  - many distinct advertisers
- we trace out the implications of targeting for:
  - the allocation of advertisement messages;
  - the social value of advertising;
  - the equilibrium price of advertising;
  - the equilibrium revenues of new and old media.

A Model of Advertising as Matching

- Advertising matches a consumer and a product.
- An advertisement message turns a potential, interested consumer into an actual customer.
- Advertising markets operate under substantial frictions:
  1. messages may reach the wrong consumer;
  2. messages may reach the same consumer repeatedly.
- Targeting reduces matching frictions.

Advertising and Product Markets

- A continuum of distinct advertising markets

$$a \in [0, \infty),$$

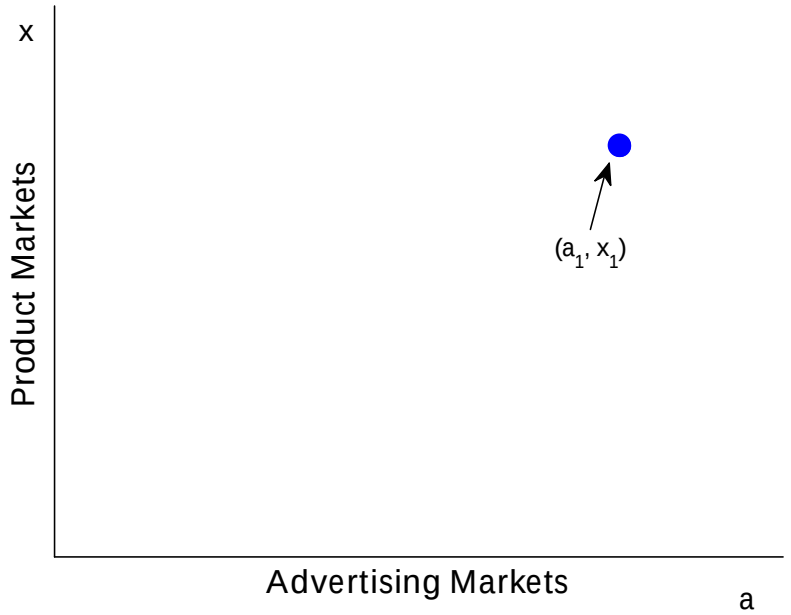
  representing outlets, channels, websites, searches.
- A continuum of distinct products (= ...rms),

$$x \in [0, \infty).$$

- A unit mass of consumers with two-dimensional type (a, x):
  - each consumer is located in a speci...c advertising market a;
  - each consumer is interested in a speci...c product x.

Consumer Characteristics...

- A consumer is characterized by (a, x):
  1. his location in a speci...c advertising market a,
  2. his preference for a speci...c product x



- market structure: joint density $s(a, x)$ over (a, x) :

$$\int_0^{\infty} \int_0^{\infty} s(a, x)\, da\, dx = 1.$$

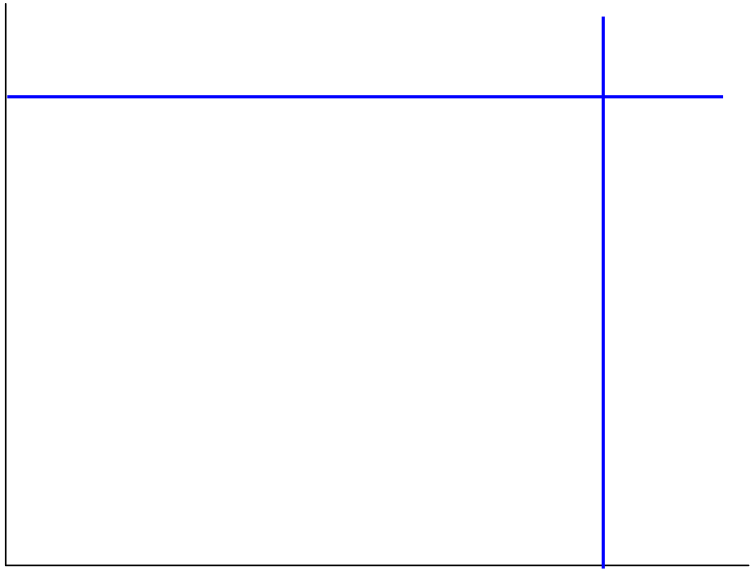
... and Market Characteristics

- advertising market a : distribution over consumer preferences

$$s(x\,|a) = \frac{s(a, x)}{\int_0^\infty s(a, x')\,dx'}$$

- ...rm x: distribution of its consumers over advertising media:

$$s(a\,|x) = \frac{s(a, x)}{\int_0^\infty s(a', x)\,da'}$$



Consumer Preferences...

- we maintain the distribution over consumer preferences:

$$s(x) = \int_0^{\infty} s\left(a', x\right) da',$$

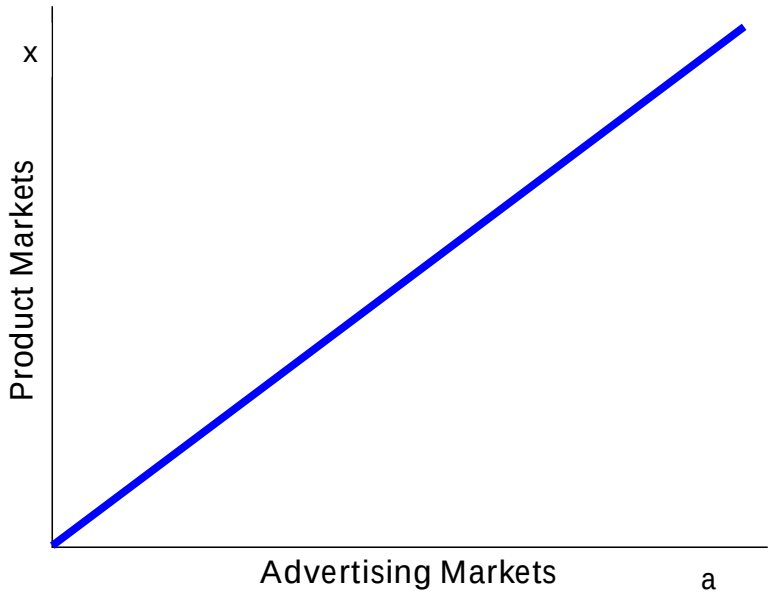
  the share $s(x)$ of each product in the consumer market
- we order x (without loss of generality) so that:

$$s'(x) \leq 0,$$

- there are products with a broad audience $x \approx 0$ and products with a narrow audience $x \approx \infty$ (the long tail of Anderson (2006))

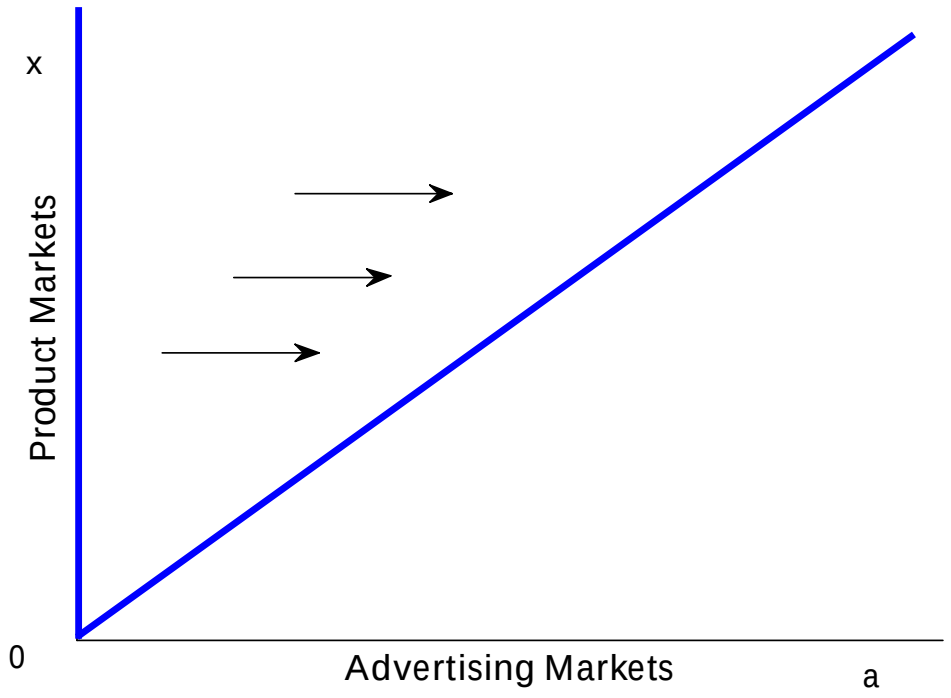
...and Targeting

- we investigate the impact of di¤erent distributions of consumers across advertising markets..
- the distribution of consumer across advertising markets range
  - from perfect targeting
  - to zero targeting
- and ask how does an increase in targeting impact the allocation and the price of advertising across media markets



Impact of Targeting

- an increase in targeting then has two e¤ects:
  1. consumers move from mass market publications to more specialized, narrower media
  2. in every media market, the naturally targeted audience has a larger relative population share



Distribution in Product Markets

- Exponential distribution of consumers' interests:

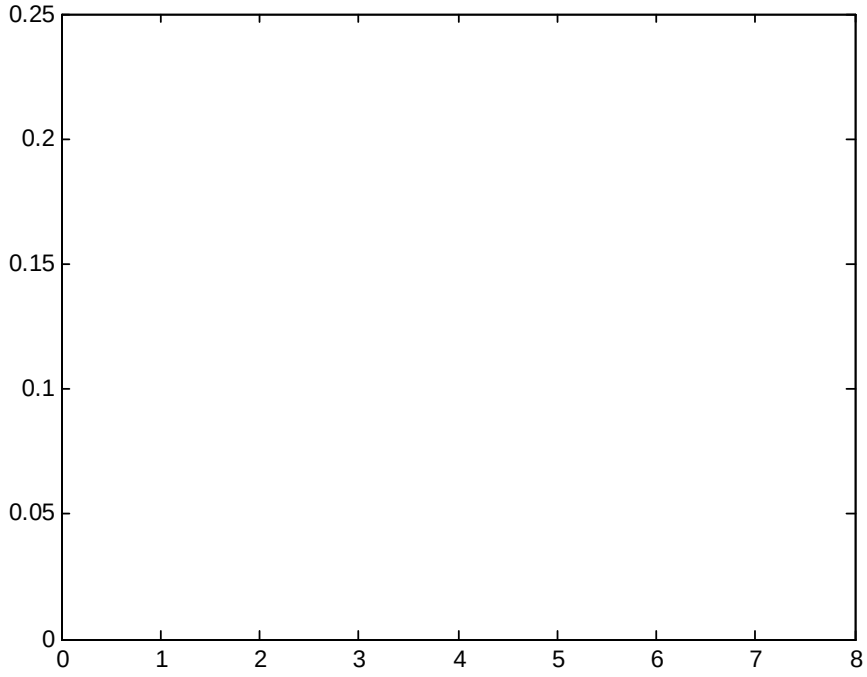
$$s_x := \lambda e^{-\lambda x}.$$

- λ measures concentration of consumers in product markets.
- Market shares s_x are declining in x.
- Hierarchical structure of products:
  - popularity: bicycles, music, watches, travel destinations;
  - mass vs. niche products, mainstream vs. fringe ...rms.

Distribution in Advertising Markets

- Conditional distribution of consumers x in markets a:

$$s(x \mid a) = \gamma e^{\gamma(x - a)}, \qquad \text{for all } 0 \leq a \leq x.$$



- Distribution across markets is upper triangular (stationary):

$$s(x \mid a) = 0 \quad \text{for all } x < a,$$

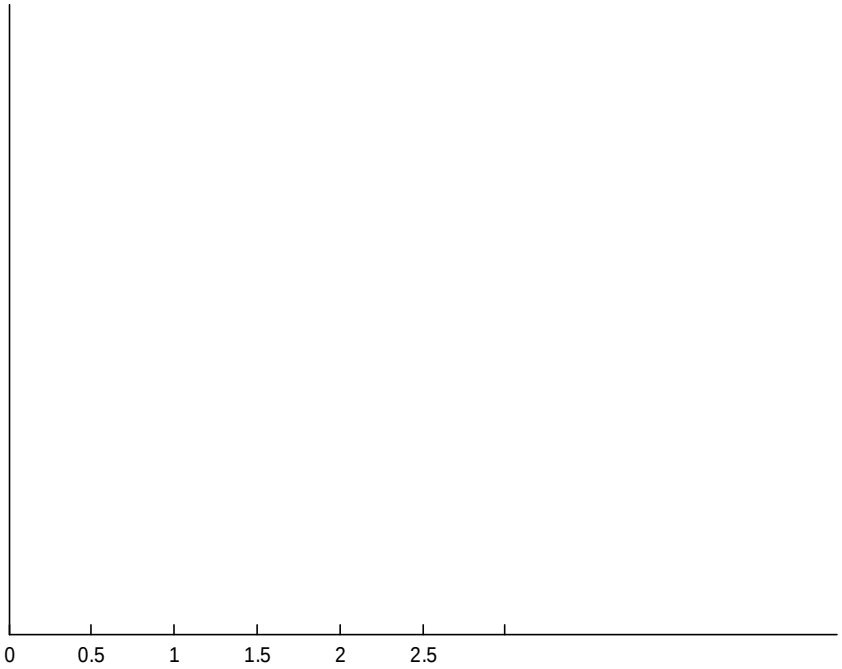
Size of Advertising Markets

- an increase in the targeting technology y has a size e¤ect...:

- y measures consumer concentration in advertising markets.
- high y) the consumers of x move to nearby markets a x.

Composition of Advertising Markets

- ... and an increase in targeting y has a composition e¤ect:



- y measures consumer concentration in advertising markets.
- high y) most consumers in a have nearby preferences x a.
- a higher y facilitates targeting.

Advertising Policy

- an advertising policy of …rm x:

$$f m_{a,x} g_{a=0}^{x}$$

- advertising intensity in advertising market a:

$$\frac{m_{a,x}}{s_a}$$

- the gross revenue of $m_{a,x}$ is given by

$$s_{a,x} \quad f\ (m_{a,x}, s_a) = s_{a,x} \quad (1 \quad \exp(\ \ m_{a,x}\ / s_a))$$

- an optimal advertising policy seeks to minimize the role of:
  1. irrelevant messages: $1 \quad s_{a,x}$
  2. duplicating messages: $\exp(\ \ m_{a,x}\ / s_a)$

Competitive Equilibrium

- price of message in advertising market a is competitive equilibrium price p_a

$$p_a$$

- M is time/attention of consumer devoted to advertisments
- supply of messages M_a in advertising market a is given by:

$$M_a = s_a \quad M$$

-

The Firms's Problem

- Each sale generates revenue \$1, …rms only di¤er in size s (x).
- Firm x ch.ooses $m_{a,x}$ to maximize pro…t:

$$\pi_{a,x} = \max_{m_{a,x}} \quad s_{a,x} \quad 1 \quad \exp \quad \frac{m_{a,x}}{s_a} \qquad p_a \quad m_{a,x} \quad .$$

- advertising policies are separable across advertising markets:

$$m_{a,x} = s_a \quad \ln \frac{\gamma + \lambda}{p_a} \quad (\gamma + \lambda)(x \quad a)$$

for all \$

Competitive Equilibrium Price

- Equilibrium prices p_a are equalized across advertising market:

$$p_a = p = (\lambda + \gamma)\, e^{\frac{p}{2(\lambda+\gamma)M}}, \quad \text{for all } a.$$

- For any γ 0, all …rms advertise somewhere
- positive targeting) "long tail".

The Social Value of Targeting

- an improvement in targeting technology as increase in y
- what is the impact in terms of the social welfare?
  - less irrelevant messages are received
  - more messages are sent by smaller ...rms

Proposition (Targeting and Social Welfare)

As targeting improves the social value of advertising increases.

- the total number of matches between advertisers and consumers increases
- even, the number of matches of each ...rm (product) increases

Targeting and the Pro…le of Demand

- as the social value of advertising increases, how does the composition in the demand for advertising change?

Proposition (Targeting and Demand)

As targeting improves:

1. the large …rms purchase less, the small …rm purchase more messages (across all markets);
2. the number of participating …rms X_a a decreases in every advertising market;
3. The number of messages per capita $m_{a,x} / s_a$ increases for all x $(a + X_a) / 2$.

- conversely, every …rm is present in fewer advertising markets

Related Empirical Evidence

- Chandra and Kaiser (2010) “Target Advertising in Magazine Markets":
  - advertiser value more homogenous groups of readers (in subscriber characteristics of age, gender, income, etc.)
- Rutz and Bucklin (2010): "From Generic to Branded: A Model of Spillover Dynamics in Paid Search Advertising,” compare generic (e.g., “Hotels LA”) and branded (e.g., “Hilton Hotels LA”) searches
  - ...nd that branded keywords have lower prices than generic keywords "Sheraton Hotel NYC" vs "Hotel NYC;
  - ...nd that long, narrower keywords “Hotels LA Westwood” have lower prices than shorter ones “Hotels LA"

Media Competition

- allow for multi-homing of consumer and thus multiple opportunities for advertiser to match with a customer
- online versus o- ine media, targeted vs. non-targeted medium
- total exposure to advertising, given by M, is now divided between media, A and B :

$$M_A + M_B = M$$

- suppose ...rm x reaches a fraction a_x of its consumers on medium A, and a fraction b_x on medium B.
- the total fraction of s_x reached is

$$a_x + b_x \quad a_x \quad b_x .$$

Online vs. O- ine Media

- general (o- ine, A) and perfectly targeted (online, B) advertising $m^A_{x\prime}\, m^B_{a,x}$.
- supply in the (single) o- ine market is M_A.
- supply in online market

Related Empirical Evidence

- Goldfarb and Tucker (2010): “ Search Engine Advertising: Channel Substitution when Pricing Ads to Context" use natural experiment - ambulance-chaser regulations across states.
- when lawyers cannot contact clients by mail, advertising prices per click for search engine advertisements are 5-7% higher. Therefore, online advertising substitutes for o- ine advertising
- consistent with Chandra and Kaiser (2010) who document the positive valuation of homogenous, targeted audiences; and hence imply di¤erential revenue across media with di¤erential targeting abilities