

# ADVERTISING IN MEDIA MARKETS

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- shortened version -

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Based on joint work with

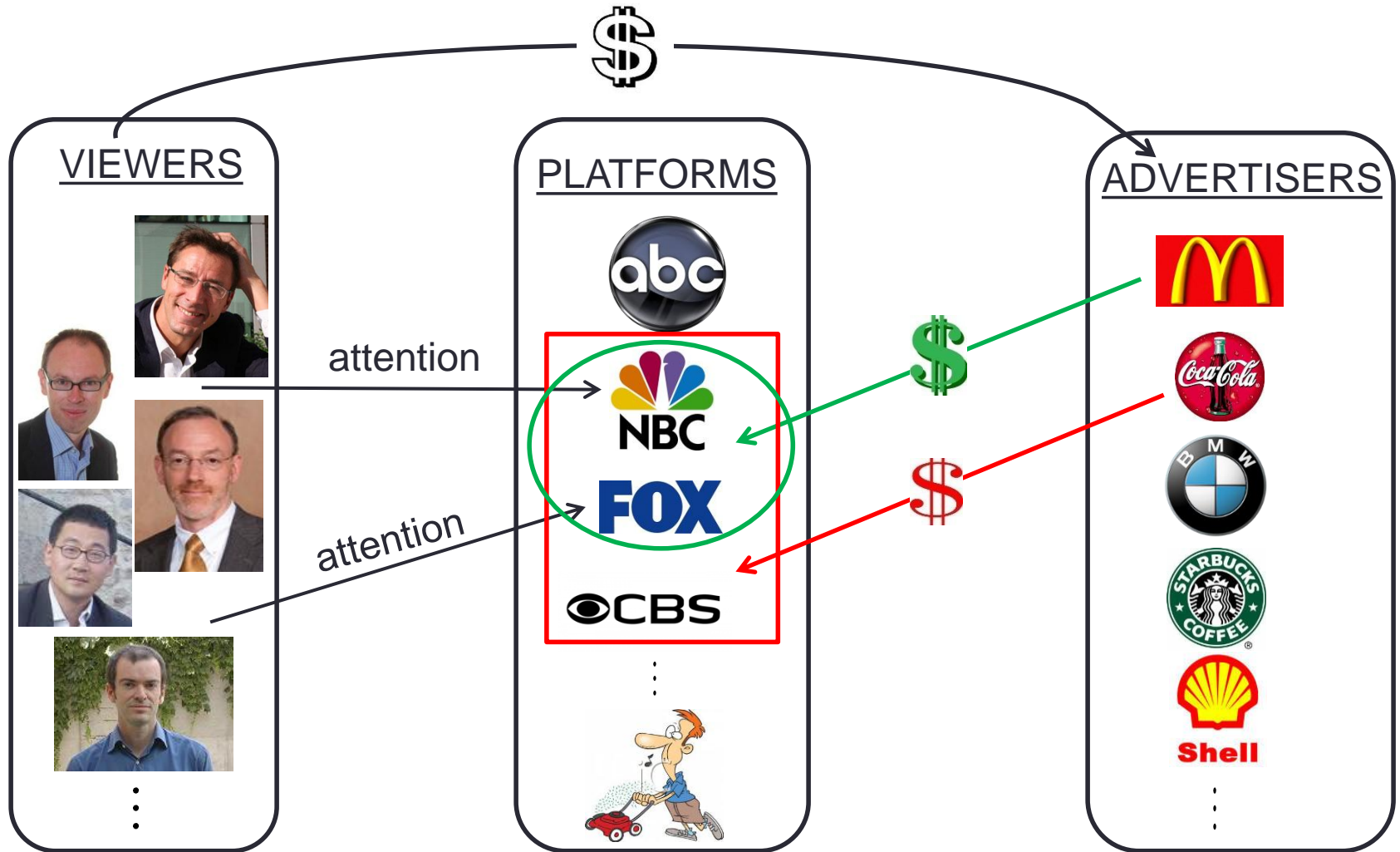
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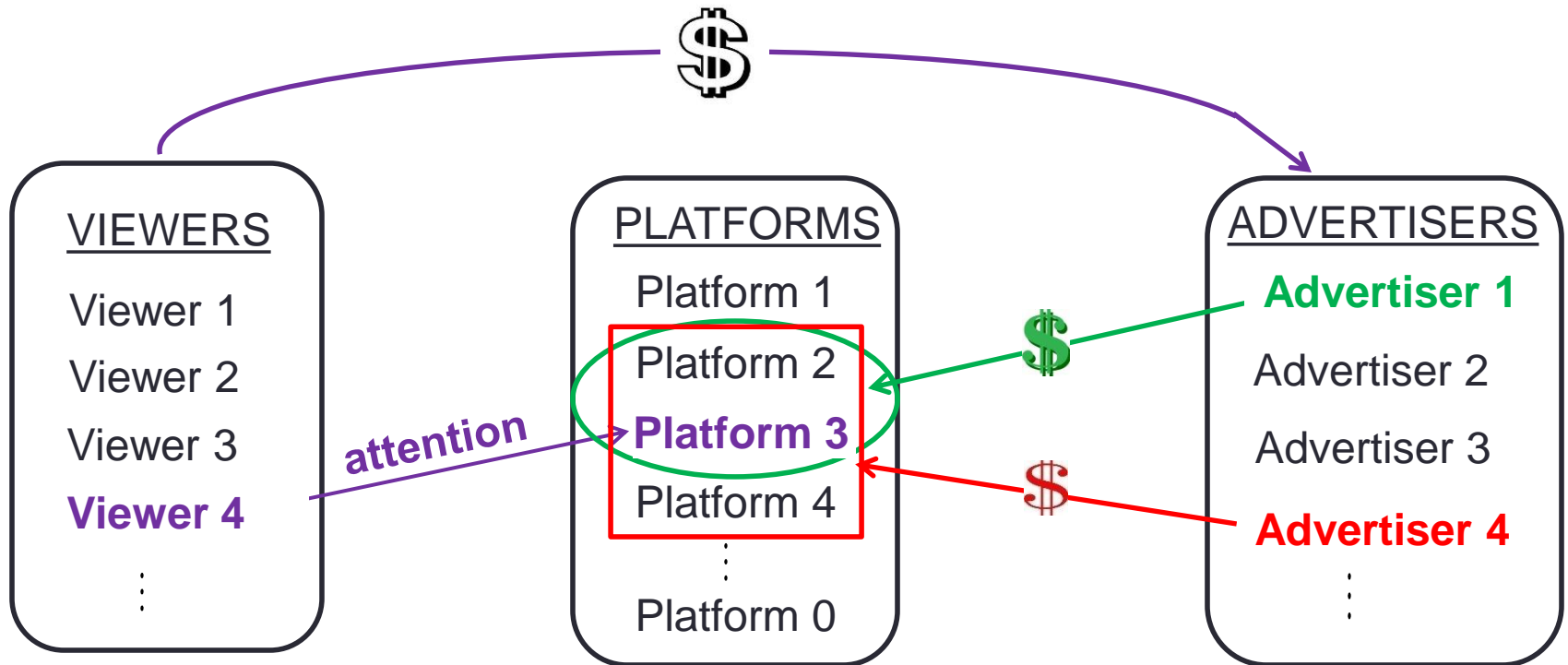
# Background

- advertising-financed media (traditional + new media)
- some strong properties in standard (AC) model due to monopoly bottleneck, no direct competition for advertisers.
  - entry lowers advertising levels, entry does the opposite
  - at odds with empirical findings on media mergers and firm entry
- Need for tractable platform models with competition for/interaction on the advertiser side
  - ad congestion in media economics
    - access pricing under ad congestion
  - multi-homing viewers
  - other approaches?
  - harness aggregative game structure to deliver description of asymmetric industry structure
- New results on the effects of media mergers

# Media business model



# 2-sided business model



# AC media economics 1/5

- Anderson and Coate, RES 2005
- “Single-homing” viewers + ad gets through with probability one (no congestion)
- Two-sided market balance condition
- Delivering viewers to advertisers whose ads annoy them!
- Monopoly bottleneck
  - i.e., each channel holds the sole access to its viewers, no direct interaction between advertisers
- Key: Competition in ad-nuisance for viewers analogous to price competition in differentiated product markets

# AC media economics 2/5

- $P_i$  price per ad,  $a_i$  number of ads
- Now write in explicitly (SH) viewers,  $N_i(a_i, a_{-i})$
- ad revenue per viewer  $R(a_i)$
- So  $\Pi_i(a_i, a_{-i}) = a_i P_i = a_i p(a_i) N_i(a_i, a_{-i}) = R(a_i) N_i(a_i, a_{-i})$
- Foc: 
$$\frac{R'}{R} = \frac{-N_i'}{N_i}$$
- LHS decreases in  $a_i$
- equilibrium value of RHS increases in  $n$ 
  - $n/t$  for circle
  - $n/(n-1)\mu$  for multinomial logit
- An increase in RHS (higher  $n$ ) reduces ad levels

# AC media economics 3/5

- Given monopoly bottleneck, competition in nuisance costs for viewers – analogous to price in standard Bertrand differentiated products
- Entry: nuisance (“price” – here ad level) goes DOWN.
  - Hence, price/ad/viewer rises;
  - change of price/ad ambiguous (since viewer numbers fall)
- Mergers: increase ad levels of self and rivals (strategic complements).
  - Hence, decrease in price/ad/viewer.
  - Merged platform’s viewers drop, so that price/ad falls.
- BUT: lack of supporting empirical evidence

# AC media economics 4/5

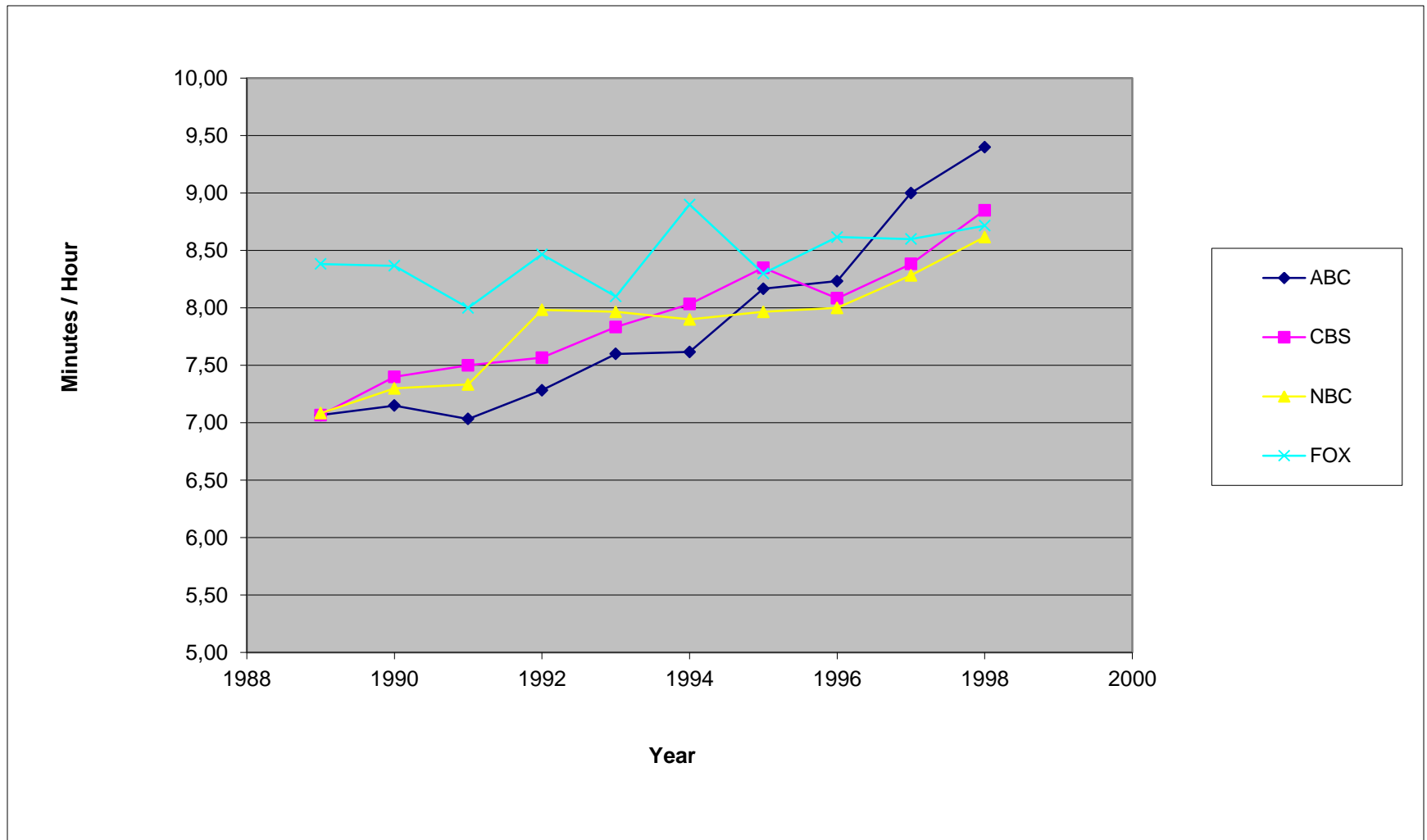
- AC: duopoly market with exogenous content
- remarks on the literature:
  - Peitz and Valletti (IJIO 2008):
    - endogenous content differentiation
    - comparison between free-to-air and pay tv, i.e. advertising-financed and, at least partly, directly viewer-financed media (media with pay wall)
    - commercial media have socially too little content differentiation
  - Jullien et al. (JIndE 2009)
    - multiple media platforms on a circle
    - effects of entry
  - Anderson (Handbook of the Digital Economy, OUP 2012)
    - explores the properties in an AC setting with multiple platforms and multinomial logit demand for viewers



# AC media economics 5/5

- AC model prediction of higher concentration / merger
  - ad levels ↑
  - ad prices ↓
- Chipty (2006), Sweeting (2010), Tyler Mooney (2011): no systematic relationship between concentration and ad levels/ad prices
- Brown and Williams (2002): higher local ownership concentration implies ad prices ↑
- Brown and Alexander (2005): higher local ownership concentration implies ad prices ↑
- Jeziorski (2011): higher concentration due to merger implies ad levels ↓

# Fox entry (lower concentration)



# New directions

1. Advertising congestion across platforms - viewer allocation fixed  
[Characterization results; effects of entry, mergers]
2. Advertising congestion with endogenous viewing behavior (full two-sided market)
3. Multi-homing viewers
4. Targeted advertising

# (1) Advertising congestion 1/9

# (1) Advertising congestion 2/9



“Whatever is common is despised. *Advertisements are now so numerous* that they are very negligently perused, and it is therefore become *necessary to gain attention* by magnificence of promises, and by eloquence sometimes sublime and sometimes pathetic.” Samuel Johnson, issue 40, The Idler, **January 20, 1759**

# (1) Advertising congestion 3/9

- Use tools from aggregative games to analyze model of two-sided platform competition with congestion in advertising
- Combination of
  - Work on media markets – the AC model
  - Work on information congestion (including Anderson and de Palma, Rand 2009)
  - Results for aggregative games

# (1) Advertising congestion 4/9

- Information congestion
  - van Zandt, Rand 2004; Anderson and de Palma, Rand 2009
  - Competition for Attention in the Information (Overload) Age
    - ... attention as common property resource
  - Herb Simon: What information consumes is rather obvious: it consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention, and a need to allocate that attention efficiently among the overabundance of information sources that might consume it.
  - Remember only 1 of XXX ads seen
- Modeling information congestion
  - Simplest way: fixed pipe  $\varphi$  of ads remembered
  - If  $A$  ads seen, recall probability with congestion is  $\varphi/A$
  - Our model: pricing of access by multiple platforms

# (1) Advertising congestion 5/9

- Rank advertisers in decreasing order of willingness to pay to contact prospective customers
- Wtp  $p(a)$  if the product makes contact (attracts the viewer's attention)
- With congestion, wtp is  $p(a) \varphi / A$
- $A$  is total number seen by viewer (across multiple channels – hence channel interdependence on advertiser side)
- If  $a_i$  ads on channel  $i$ , ad price is wtp of marginal advertiser, i.e.,  $p(a_i) \varphi / A$
- Assume regularity (e.g. logconcavity of  $p$ ) so that a  $p'/p$  is decreasing in  $a$



# (1) Advertising congestion 6/9

- Suppose that viewers watch channel  $i$  with fraction  $\lambda_i$  of their time
- Channel  $i$  sells to  $a_i$  (multi-homing) advertisers
- Viewer exposed to  $A = \sum_j \lambda_j a_j$  ads, so
- Likelihood that an ad on channel  $i$  makes an impression is  $\lambda_i \varphi/A$
- Profit of channel  $i$  is  $\Pi^i = a_i \lambda_i (\varphi/A) p(a_i)$ 
  - [aggregative game: Write objective function  $\Pi^i(\psi_i, \Psi)$  depending on own action (or monotone transformation)  $\psi_i$  and the aggregator,  $\Psi \equiv \sum_j^n \psi_j$ ]
  - action variable ad exposure on channel  $i$ ,  $\psi_i = a_i \lambda_i$ , so that
$$\Pi^i = \psi_i (\varphi/\Psi) p(\psi_i / \lambda_i)$$
- Thus, can use tools for aggregative games.

# (1) Advertising congestion 7/9

- Recall  $\Pi^i = \psi_i (\phi/\Psi) p(\psi_i / \lambda_i)$
- Cumulative best reply function from

$$\frac{d\Pi^i}{d\psi_i} = \frac{\phi p(\psi_i / \lambda_i)}{\Psi} \left\{ \left( 1 - \frac{\psi_i}{\Psi} \right) + \frac{\psi_i}{\lambda_i} \frac{p'(\psi_i / \lambda_i)}{p(\psi_i / \lambda_i)} \right\}$$

Term in  $\{.\}$  first positive then negative, so a unique max, the cumulative best reply

- Upward-sloping cumulative best replies (strategic complements)
  - internalize less of congestion effect
- Can show that bigger platforms have fewer ads despite higher “actions”

# (1) Advertising congestion 8/9

## Effect of Entry

- Suppose that all new viewers come from outside [similar results with symmetric shares]
- Aggregator (congestion) rises
- Other platforms' ads rise (internalize less congestion effect)
- price/ad/viewer falls,  
number of viewers same or falls:
- hence, price/ad falls as well
  
- Contrast AC: ads fall, price/ad/viewer rises
- Here, more competition leads to lower prices in ad market

# (1) Advertising congestion 9/9

## Media mergers

- Aggregator down; less congestion  
rivals better off and they advertise less.
- Merged firm advertises less on each channel
- So price/ad/viewer rises [viewer levels rise when endogenous, later!]: so price/ad rises
- Contrast AC (increase ad nuisance, others follow, price/ad falls)
- here: less competition in ad market and higher ad prices, less advertising

## (2) Endogenous viewers 1/2

- Advertisers as before
- Viewers: Suppose time-use utility is:

$$V = \sum_j (s_j (1-a_j) \lambda_j)^\alpha \quad \text{with} \quad \sum_j \lambda_j = 1$$

net “quality-time”, where  $s_i$  quality of program  $i$

- logit type: viewer demand is

$$\lambda_i = \frac{(s_i (1-a_i))^\alpha}{\sum_j (s_j (1-a_j))^\alpha}$$

- $\Pi^i = a_i \lambda_i (\phi/A) p(a_i)$
- Let now  $\psi_i = a_i (s_i (1-a_i))^\alpha$
- Thus, also an aggregative game

$$\Pi^i = \frac{\psi_i \phi}{\Psi} p(a_i(\psi_i))$$

## (2) Endogenous viewers 2/2

- Same qualitative results as with fixed  $\lambda$
- Congestion effect is dominating viewer effect
- Note that without congestion we get AC type results from this viewer set-up (variant of an AC model)
  - This suggests that we can get intermediate results for intermediate congestion functions, and, hence, vary the strength of the congestion effect.
  - Hence, entry can either increase or decrease ad levels (the latter if viewer effect dominant).

## (3) Multi-homing viewers 1/4

- If viewers multi-home, advertisers have alternative channels to reach viewers.
  - Previous model: While viewers mixed channels, advertising on multiple platforms was assumed to be perfectly coordinated and at most one ad per platform.
  - If advertisers can post multiple ads on a platform, some impressions may be wasted.
  - Previous work on multi-homing:
    - Anderson, Foros, and Kind (2011)
    - Ambrus, Calvano, Reisinger (2012), based on a much older draft by Ambrus and Reisinger
  - Anderson and Peitz, 2012b, work in progress: multi-homing model that allows to investigate the effects of mergers and entry

## (3) Multi-homing viewers 2/4

- Setting 1:
  - each advertiser can post any number of ads on each of several platforms
  - Advertising is not coordinated
  - viewers switch between channels (independent of whether or not ads are shown), exogenous viewing behavior
  - advertising platforms set total ad levels, ad prices clear the market
  - advertisers are heterogeneous with respect to the value of an impression
- High-value advertisers advertise more than low-value advertisers
- Game has the structure of quality-augmented Cournot model



## (3) Multi-homing viewers 3/4

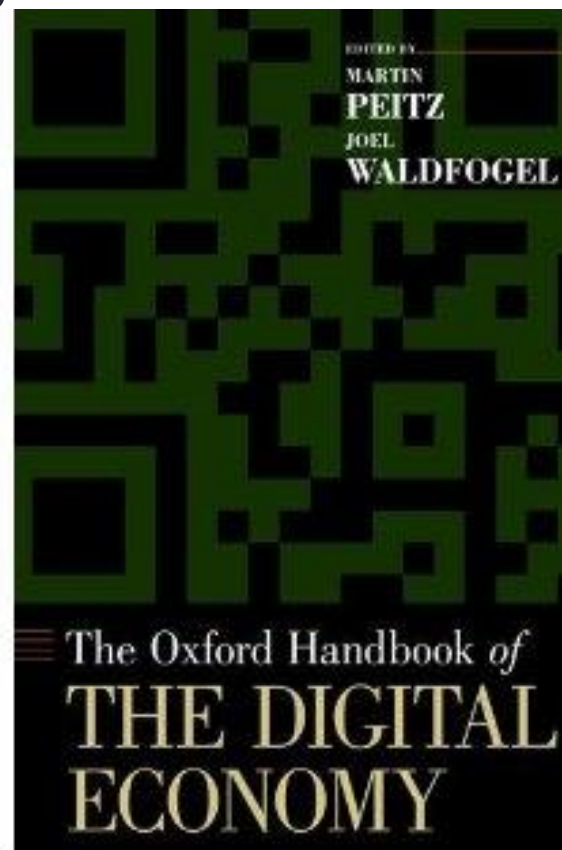
- BUT: The resulting demand for ads implies that advertising levels are strategic complements
- can write the game as an aggregative game
- A merger leads to a lower ad level for the merged entity, and also reduce them for the others.
- The opposite holds under entry
  
- Endogenize viewing behavior; two versions
  1. Each channel monopolist on the viewer side (competition against an outside good)
  2. Channels compete for viewers

# (3) Multi-homing viewers 4/4

- Version 1: We consider several specifications of viewer's utility function
  - maintain aggregative game properties
  - quality of each channel partly determined by the advertising level
  - we replicate the results under exogenous viewer behavior
- Version 2: logit version of viewer demand
  - can solve around symmetric equilibrium
  - can numerically solve for asymmetric situations; but we lose aggregative game property;
  - no clear-cut results yet, in progress

## (4) Tailored and targeted advertising 1/2

- How to get an ad to the right audience
- Possibility 1: segmented audience (different channels, different magazines etc.), advertising tailored to content
  - see Bergemann and Bonatti (Rand 2011)
- Example: Announce a book to the relevant audience
- audience: YOU                      book:



## (4) Tailored and targeted advertising 2/2

- Possibility 2: Do not match ads to content, but rather infer viewer characteristics based on viewer tracking
  - Thus, the same content may carry different ads depending on which viewer connects to the content.
  - Importance of the tracking technology
  - Athey and Gans (AER P&P 2010) consider the effect of tracking technology on market outcomes:
    - Improving the targeting technology leads to the growth of general outlets at the expense of tailored outlets
  - targeted advertising and privacy concerns: viewers may be put off by targeting, may be seen as intrusive (see Goldfarb and Tucker, Marketing Science 2011)
- Effects of mergers / effects of entry?

# Other issues

- “Shouting” by advertisers: multiple messages by highest wtp advertisers to both increase chance of getting through to a viewer plus get through to those coming from other channels (ongoing work with Simon Anderson)
- The role of public broadcasting
  - Public broadcasters can easily be included into the congestion model
  - Comparative statics with respect to public provision of broadcasting
- Content provision: specialization and quality provision
  - Jeon and Nasr Esfahani, mimeo 2012: the role of news aggregators
  - Other issues:
    - mergers and repositioning of channels
    - mergers and incentives to provide quality content
- The link between classical media (newspapers, television) and new media (blogs, twitter, youtube, ...); see Athey, Calvano, and Gans (mimeo 2012)
- A closer look at advertisers (ongoing work with Marc Bourreau) – raising attention

# Conclusion 1/2

- Anderson and Coate predictions with respect to the effects of mergers and entry on volume of advertising (and advertising prices) not in line with empirical findings.
- Advertising congestion may reverse standard results in media models
  - Pipe for attention common resource for media platforms
  - Introduces “competition” between platforms on the advertiser side,
  - Model can be written as an aggregative game to exploit comparative statics results from aggregative games
  - considering exogenous and endogenous viewer behavior (in the latter advertising enters viewers’ utility function as a nuisance)
  - For a short preview, see Anderson, Foros, Kind, and Peitz (IJO 2012)

# Conclusion 2/2

- Multi-homing viewers introduces competition on the advertiser side. Effects of merger and entry model-dependent, AC findings can be overturned.
- Targeted and tailor advertising may lead to segmentation of the advertisers: matching ads to buyers; this may be content driven (tailoring) or based on viewer tracking (targeting).
  - connection between tailored / targeted advertising and media mergers is a topic for future research