ADVERTISING IN MEDIA MARKETS

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Are you ready?

Video
Advertising facts 1/4

US Advertising Market by Media Revenue – 2010 (In billions)

- TV Distribution: $28.6
- Internet: $26.0
- Newspapers: $22.8
- TV: Cable Networks: $22.5
- TV: Broadcast Networks: $17.6
- Radio: $16.3
- Directories: $11.5
- Consumer Magazines: $10.2
- Trade Magazines: $7.4
- Out of Home: $6.1

Source: IAB (2011), PwC

Advertising facts 2/4

Annual Online Ad Revenues

(US $ in billions)

2002-2011

<table>
<thead>
<tr>
<th>Year</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>6.0</td>
<td>7.3</td>
<td>9.6</td>
<td>12.5</td>
<td>16.9</td>
<td>21.2</td>
<td>23.4</td>
<td>22.7</td>
<td>26.0</td>
<td>21.7</td>
</tr>
</tbody>
</table>

Source: IAB, PwC
**Advertising facts 3/4**

*Advertising Format Share (% of Total Revenue)*

*Format definitions may have changed over the time period depicted, both within the survey process and definitionally by survey respondents.*

PwC

**Advertising facts 4/4**

*Internet Ad revenues by major industry category, 2009 vs. 2010*

Source: IAB (2011), PwC
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 between advertisers
  * ad congestion in media economics
  * access pricing under ad congestion (contribution to info 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

Diagram showing the interaction between viewers, platforms, and advertisers, with attention and money flows illustrated.
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

- $\Pi_i(a_i, a_{-i}) = P_i a_i$
- Now write in explicitly (SH) viewers, $N_i(a_i, a_{-i})$
- ad revenue per viewer $R(a_i)$
- So $\Pi_i(a_i, a_{-i}) = a_i p(a_i) N_i(a_i, a_{-i}) = R(a_i) N_i(a_i, a_{-i})$
- Foc: \[ \frac{R_i'}{R} = \frac{-N_i'}{N_i} \]
- 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
  - Julien 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 ↓
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 1/10

(1) Advertising congestion 2/10
“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 4/10

- 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 5/10

- 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 $\phi$ of ads remembered
  - If $A$ ads seen, recall probability with congestion is $\phi/A$
  - Our model: pricing of access by multiple platforms

(1) Advertising congestion 6/10

- 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 $p(a) \phi/A$
- $A$ 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., $p(a_i) \phi/A$
- Assume regularity (e.g. logconcavity of $p$) so that a $p'/p$ is decreasing in $a$
(1) Advertising congestion 7/10

- Suppose \( \lambda_i \) watch channel \( i \) at some moment
- Sell to \( a_i \) (multi-homing) advertisers
- Viewer exposed to \( A = \sum_j \lambda_j a_j \) ads, so
- Profit is: \( \Pi_i = a_i \lambda_i \left( \frac{\phi}{A} \right) p(a_i) \)
  - [aggregative game: Write objective function \( \Pi_i(\psi_i, \Psi) \) depending on
    own action (or monotone transformation) \( \psi_i \) and the aggregator,
    \( \Psi = \sum_i \psi_i \)]
  - action variable ad exposure on channel \( i, \psi_i = a_i \lambda_i \), so that
    \[ \Pi_i = \psi_i \left( \frac{\phi}{\Psi} \right) p \left( \frac{\psi_i}{\lambda_i} \right) \]
- Thus, can use tools for aggregative games.

(1) Advertising congestion 8/10

- Recall \( \Pi \equiv \psi_i \left( \frac{\phi}{\Psi} \right) p \left( \frac{\psi_i}{\lambda_i} \right) \)
- Cumulative best reply function from
  \[ \frac{d\Pi_i}{d\psi_i} = \frac{\phi p(\psi_i, / \lambda_i)}{\Psi} \left[ 1 - \frac{\psi_i}{\Psi} \right] + \frac{\psi_i p'(\psi_i, / \lambda_i)}{\lambda_i p(\psi_i, / \lambda_i)} \]
  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 9/10

**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 10/10

**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:
  \[ V = \sum_j \left( s_j \left( 1 - a_j \right) \right)^{\lambda_j} \]
  with \[ \sum_j \lambda_j = 1 \]
  net “quality-time”, where \( s_j \) quality of program \( i \)
- logit type: viewer demand is
  \[ \lambda_i = \frac{(s_i (1 - a_i))^{\alpha}}{\sum_j (s_j (1 - a_j))^{\alpha}} \]
- \( \Pi = a_i \lambda_i (\psi / A) p(a_i) \)
- Let now \( \psi' = a_i (1 - a_i)^{\alpha} \)
- Thus, also an aggregative game
  \[ \Pi' = \frac{\psi' \phi}{\psi} p(a_i (\psi')) \]

(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 loose 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 a 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)
<table>
<thead>
<tr>
<th>Other issues</th>
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<tbody>
<tr>
<td>&quot;Shouting&quot; 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)</td>
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<tr>
<td>The role of public broadcasting</td>
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<tr>
<td>- Public broadcasters can easily be included into the congestion model</td>
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<tr>
<td>- Comparative statics with respect to public provision of broadcasting</td>
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<tr>
<td>Content provision: specialization and quality provision</td>
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<tr>
<td>- Jeon and Nasr Esfahani, mimeo 2012: the role of news aggregators</td>
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<tr>
<td>- Other issues:</td>
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<tr>
<td>- mergers and repositioning of channels</td>
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<tr>
<td>- mergers and incentives to provide quality content</td>
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<tr>
<td>The link between classical media (newspapers, television) and new media (blogs, twitter, youtube, …); see Athey, Calvano, and Gans (mimeo 2012)</td>
</tr>
<tr>
<td>A closer look at advertisers (ongoing work with Marc Bourreau) – raising attention</td>
</tr>
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</table>

| Raising attention |

[Image of surfboards and a car]
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 tailored 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.

Thanks!