The Impact of Consumer Multi-homing on Advertising Markets and Media Competition

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Introduction

New Media Changes Media Consumption

Traditional Newspapers: Single-homing

Online News Websites: Multi-homing

What is the impact of consumer multi-homing on advertising markets?
Introduction

Intuition behind this paper

Traditional Newspapers: Single-homing

They are not overlapped

⇒ Advertisers can reach them by buying advertisements from both publisher.
Introduction

Intuition behind this paper

Traditional Newspapers: Single-homing

They are not overlapped

⇒ Advertisers can reach them by buying advertisements from both publisher.

Online News Websites: Multi-homing

They might be overlapped

⇒ Advertisers can reach them by buying advertisements from both publisher, but some customers are exposed to the same adv. (inefficient).
Model

Overall Model

Loyal to publisher 1

Switcher

Loyal to publisher 2

Adv. Capacity : $a_1$

Publisher 1

Adv. Capacity : $a_2$

Publisher 2

Adv. unit bought : $(n_1, n_2)$

Advertisers

value per reached customer

$D_i^l + D_j^l + D^s = 1$
Model

Overall Model

Loyal to publisher 1

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Adv. unit bought: \( (n_1, n_2) \)

Advertisers

value per reached customer

\[ D_i^l + D_j^l + D^s = 1 \]
Model

Consumer Attention and Advertising Inventory

Loyal to publisher 1

Switcher

Loyal to publisher 2

$D^l_1$

$D^s$

$D^l_2$

$D^l_i + D^l_j + D^s = 1$

Adv. Capacity : $a_1$

Publisher 1

Publisher 2

Adv. Capacity : $a_2$

Assumption:
Publishers provide 2 contents
Customers read 2 contents

Consume 2 from P1

Loyal to P1

Consume 1 from P1 & 1 from P2

Switcher

Total supply of impressions
$(2D^l_1 + D^s)a_1$
Loyal to publisher 1

Switcher

Loyal to publisher 2

\[ D_1^l + D_2^l + D^s = 1 \]
Model

Overall Model

Loyal to publisher 1

Switcher

Loyal to publisher 2

Publisher 1

Publisher 2

Adv. Capacity : $a_1$

Adv. Capacity : $a_2$

Adv. unit bought : $(n_1, n_2)$

Advertisers

value per reached customer

$D_i^l + D_j^l + D^s = 1$
Model

Advertiser Preferences and Advertising Products

Advertisers’ Utility
= \text{value per reached customer} \times (\# \text{ of unique customers}) - \text{cost for advertising} \times (\# \text{ of impressions bought})

\# of unique customers
\Phi(n_1, n_2)
= n_1 + n_2 - \frac{n_1n_2}{4 \cdot (D_1 + \frac{1}{2} D_s)(D_2 + \frac{1}{2} D_s)} D_s

\# of impressions bought
n_1, n_2

Publisher 1
Adv. Capacity : a_1

Publisher 2
Adv. Capacity : a_2

Advertisers
Adv. unit bought : \( n_1, n_2 \)

value per reached customer
v
Model

Advertiser Preferences and Advertising Products

Adversers’ Utility

\[ \Phi(n_1, n_2) = n_1 + n_2 - \frac{n_1n_2}{4 \cdot (D_1^l + \frac{1}{2} D_s)(D_2^l + \frac{1}{2} D_s)} D_s \]

\[ n_1/(D_1^l + \frac{1}{2} D_s) \quad n_2/(D_2^l + \frac{1}{2} D_s) \]
### Model

#### Advertiser Preferences and Advertising Products

**Advertisers' Utility**

\[ \text{Utility} = v \times \text{(# of unique customers)} - p \times \text{(# of impressions bought)} \]

**Value per reached customer**

\[ v = \Phi(n_1, n_2) \]

\[ \Phi(n_1, n_2) = n_1 + n_2 - \frac{n_1 n_2}{4 \cdot (D_1^l + \frac{1}{2} D_s)(D_2^l + \frac{1}{2} D_s)} \cdot D_s \]

**# of unique customers**

\[ n_1 / (D_1^l + \frac{1}{2} D_s) \quad n_2 / (D_2^l + \frac{1}{2} D_s) \]

They assume:

\[ n_1 = (D_1^l + \frac{1}{2} D_s) \]

\[ n_2 = (D_2^l + \frac{1}{2} D_s) \]

**Adv. Capacity**

\[ (2D_1^l + D_s) a_1 \]

\[ (2D_2^l + D_s) a_2 \]

**Adv. unit bought:**

\( (n_1, n_2) \)

**Publisher 1**

Publisher 1

**Publisher 2**

Publisher 2

Loyal to publisher 1

Switcher

Loyal to publisher 2

\[ D_i^l + D_j^l + D_s = 1 \]
Model

Advertiser Preferences and Advertising Products

Advertisers' Utility

\[ \text{Adv. unit bought: } (n_1, n_2) \]

\[ \text{Advertsers' Utility } = v \ast (\text{# of unique customers}) - p \ast (\text{# of impressions bought}) \]

Payoffs of Advertiser

i. Single-home on 1 \((v - p_1)(D_1^l + \frac{1}{2}D^s)\).

ii. Single-home on 2 \((v - p_2)(D_2^l + \frac{1}{2}D^s)\).

iii. Multi-home \(v(D_1^l + D_2^l + \frac{3}{4}D^s) - p_1D_1^l - p_2D_2^l -(p_1 + p_2)\frac{1}{2}D^s\)

### Publisher 1

\[ \text{Adv. Capacity: } a_1 \]

\[ (2D_1^l + D^s)a_1 \]

### Publisher 2

\[ \text{Adv. Capacity: } a_2 \]

\[ (2D_2^l + D^s)a_2 \]

\[ D_1^l + D_2^l + D^s = 1 \]
Model

Advertiser Preferences and Advertising Products

Advertisers' Utility

\[ \text{Advertisers' Utility} = v \times (\text{# of unique customers}) - p \times (\text{# of impressions bought}) \]

Payoffs of Advertiser

i. Single-home on 1 \((\nu - \nu_1)(D_1^{l} + \frac{1}{2}D_s)\).
ii. Single-home on 2 \((\nu - \nu_2)(D_2^{l} + \frac{1}{2}D_s)\).
iii. Multi-home \(\nu(D_1^{l} + D_2^{l} + \frac{3}{4}D_s) - p_1D_1^{l} - p_2D_2^{l} - (p_1 + p_2)\frac{1}{2}D_s\)
Analysis

Market Equilibrium

Do not act

\[ D_i^l + D_i^f + D^s = 1 \]
Analysis

Market Equilibrium

Do not act

Loyal to publisher 1

Switcher

Loyal to publisher 2

Adv. Capacity : $a_1$

Publisher 1

$(2D_1^l + D^s)a_1$

Adv. unit bought : $(n_1, n_2)$

Advertisers

value per reached customer

Publisher 2

Adv. Capacity : $a_2$

$(2D_2^l + D^s)a_2$

Adv. Capacity : $a_1$

Publisher 1

Loyal to publisher 1

Switcher

Loyal to publisher 2

$D_i^l + D_i^l + D^s = 1$

Decide price
Analysis

Market Equilibrium

Do not act

Decide which publisher to advertise on (both, publisher1, publisher2)

Decide price

\[ D_l^1, D_l^2, D^s = 1 \]

\[ (2D_l^1 + D^s)a_1 \]

\[ (2D_l^2 + D^s)a_2 \]

Adv. unit bought: \((n_1, n_2)\)
Analysis

Market Equilibrium

Loyal to publisher 1

Switcher

Loyal to publisher 2

Do not act

Decide which publisher to advertise on (both, publisher1, publisher2)

Decide price

Market Equilibrium: Advertising Supply = Demands

$D_1^l + D_2^l + D^s = 1$

Decide price

Adv. unit bought: $(n_1, n_2)$

Advertisements

$\text{value per reached customer}$
Analysis

Market Equilibrium

i. Single-home on 1 \((v - p_1)(D_1^l + \frac{1}{2}D^s)\).
ii. Single-home on 2 \((v - p_2)(D_2^l + \frac{1}{2}D^s)\).
iii. Multi-home \(v(D_1^l + D_2^l + \frac{3}{4}D^s) - p_1D_1^l - p_2D_2^l - (p_1 + p_2)\frac{1}{2}D^s\)

Case \(D^s > 0\)

\[ \nu_s = p \]

\[ \nu_m = \frac{D_1^l + \frac{1}{2}D^s}{D_1^l + \frac{1}{4}D^s}p \]

\(\nu = 1\)
Analysis

Market Equilibrium

i. Single-home on 1 \((v - p_1)(D_1^l + \frac{1}{2}D^s)\).

ii. Single-home on 2 \((v - p_2)(D_2^l + \frac{1}{2}D^s)\).

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Case \(D^s > 0\)

None \(\nu_s = p\)

Single-home on 1 or 2

\(\nu_m = \frac{D_1^l + \frac{1}{2}D^s}{D_1^l + \frac{1}{4}D^s}p\)

Multi-home \(\nu = 1\)

Single-homing gives 0 payoff
Analysis

Market Equilibrium

i. Single-home on 1 \((v - p_1)(D_1^l + \frac{1}{3}D^s)\).

ii. Single-home on 2 \((v - p_2)(D_2^l + \frac{1}{2}D^s)\).

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Case \(D^s > 0\)

None \(\nu_s = p\)

Single-home on 1 or 2

Multi-home \(\nu_m = \frac{D_1^l + \frac{1}{2}D^s}{D_1^l + \frac{1}{4}D^s}p\)

Single-homing gives 0 payoff

Single-homing = Multi-homing

\(\nu = 1\)
**Analysis**

**Market Equilibrium**

1. Single-home on 1 \((v - p_1)(D_1^l + \frac{1}{2}D^s)\).
2. Single-home on 2 \((v - p_2)(D_2^l + \frac{1}{2}D^s)\).
3. Multi-home \(v(D_1^l + D_2^l + \frac{3}{4}D^s) - p_1D_1^l - p_2D_2^l - (p_1 + p_2)\frac{1}{2}D^s\)

\[v_s = p\]

\[\nu_m = \frac{D_1^l + \frac{1}{2}D^s}{D_1^l + \frac{1}{4}D^s}p\]

\(v = 1\)

**Single-homing gives 0 payoff**  
**Single-homing = Multi-homing**

**Equilibrium AD price**  
\[\hat{p} = \left(\frac{2(2 - D^s)}{4 - D^s}\right)(1 - 2a)\]

\[\hat{\pi} = \hat{p}a\]

**Proposition 1.** Under symmetry, equilibrium ad prices and publisher profits are decreasing in \(D^s\).
Analysis

Market Equilibrium

i. Single-home on 1 \((v - p_1)(D_1^l + \frac{1}{2}D^s)\).

ii. Single-home on 2 \((v - p_2)(D_2^l + \frac{1}{2}D^s)\).

iii. Multi-home \(v(D_1^l + D_2^l + \frac{3}{4}D^s) - p_1D_1^l - p_2D_2^l - (p_1 + p_2)\frac{1}{2}D^s\)

Equilibrium AD price

\[
\hat{p} = \frac{D_1^l + \frac{1}{2}D^s}{D_1^l + \frac{1}{4}D^s}p
\]

\[
\hat{\pi} = \hat{p}a
\]

Proposition 1. Under symmetry, equilibrium ad prices and publisher profits are decreasing in \(D^s\).

# of Single-home Advertiser: increases if # of switchers grows
Analysis

Market Equilibrium

i. Single-home on 1 \((v - p_1)(D_1^1 + \frac{1}{2}D^s)\).
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Case \(D^s > 0\)

- None
- Single-home on 1 or 2
- Multi-home

Equilibrium AD price

\[
\hat{p} = \frac{D_1^1 + \frac{1}{2}D^s}{D_1^1 + \frac{1}{4}D^s}p
\]

\[
\pi = \hat{p}a
\]

Proposition 1. Under symmetry, equilibrium ad prices and publisher profits are decreasing in \(D^s\).

# of Single-home Advertiser: increases if # of switchers grows

1. Consumer switching results in an increased share of advertisers single-homing on individual publishers.
2. Consumer switching is associated with a fall in publisher advertising prices and profits.
Analysis

Market Equilibrium

What if publishers choose advertising capacity?
(Simultaneously Game, each chooses $a_1$ and $a_2$)

Proposition 2. In the game where both publishers simultaneously set their capacities and publishers are symmetric, a PSNE exists and it is unique if and only if $D^s \geq \frac{4}{9}$ with $a_1^* = a_2^* = \frac{1}{3}$. In addition, equilibrium ad prices and publisher profits are decreasing with switching $(D^s)$. 
Analysis

Market Equilibrium
Impact on Content Strategy

1) Change in # of Loyal Consumers

4. Publishers with higher readership shares attract higher per-consumer revenues.
5. Consumer switching increases a publisher’s incentives to invest in quality content that attracts a greater share of consumers.

2) How much contents publisher provide (Depth)

6. Consumer switching reduces a publisher’s incentives to provide full content that can serve each consumer’s full attention relative to offering shallower content that engages users for short time periods; that is, reach becomes relatively more valuable than depth of readership.
Analysis

Market Equilibrium
Impact on Content Strategy

3) High-reach Outlet v.s. Traditional Publishers

Assumption: Contents of publishers are provided also by HR
3) High-reach Outlet v.s. Traditional Publishers

<table>
<thead>
<tr>
<th>Publisher 1</th>
<th>Publisher 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>한겨레</td>
<td>조선일보</td>
</tr>
</tbody>
</table>

**Assumption:** Contents of publishers are provided also by HR

<table>
<thead>
<tr>
<th>Reach</th>
<th>Number of impressions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-home on HR</td>
<td>$d^r$</td>
</tr>
<tr>
<td>Multi-home on 1 and 2</td>
<td>$d^r + (1-d^r)(2d^r + \frac{3}{4}d^s)$</td>
</tr>
<tr>
<td>Multi-home on $i$ and HR</td>
<td>$d^r + (1-d^r)(d^r + \frac{1}{2}d^s)$</td>
</tr>
<tr>
<td>Single-home on $i$</td>
<td>$\frac{1}{2}d^r + (1-d^r)(d^r + \frac{1}{2}d^s)$</td>
</tr>
</tbody>
</table>

Overall Share: $1 - d^r$
Analysis

Market Equilibrium
Impact on Content Strategy

3) High-reach Outlet v.s. Traditional Publishers

Assumption:
Contents of publishers are provided also by HR

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<td>$d' + (1 - d')(2d' + \frac{3}{2}d^s)$</td>
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<td>Multi-home on i and HR</td>
<td>$d' + (1 - d')(d' + \frac{1}{2}d^s)$</td>
</tr>
<tr>
<td>Single-home on i</td>
<td>$\frac{1}{2}d' + (1 - d')(d' + \frac{1}{2}d^s)$</td>
</tr>
</tbody>
</table>

Overall Share: $1 - d'$

First-best allocation: $2a$ is allocated to an advertiser with higher $v$

\[ \hat{p}_r = 1 - 2a > \hat{p}_1 = \hat{p}_2 \]

\[ v_s = p \]

\[ v_m = \frac{D_1 + \frac{1}{2}D^s}{D_1 + \frac{1}{4}D^s} \]

\[ v = 1 \]
Managerial Implications Found

1) Increase in advertiser single-homing
2) Fall in publisher profits (AD price)
3) Higher readership guarantees higher revenue (incentive to invest in quality)
4) Consumer’s full attention is not valuable (incentive not to provide full content)
5) High-reach publishers have an advantage over traditional publishers

• **Summary and Conclusion**
  – Describes the current advertising market: Switchers
  – Tries to figure out the impact of switchers
  – Derives interesting insights