Targeted Promotions on an E-Book Platform: Crowding Out, Heterogeneity, and Opportunity Costs

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Nathan Fong,
Are you looking for something in our Literary Fiction eBooks department? If so, you might be interested in these items.

<table>
<thead>
<tr>
<th>Literary Fiction eBooks</th>
<th>Oryx and Crake</th>
<th>Price: $8.72</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The Year of the Flood</td>
<td>Price: $8.56</td>
</tr>
<tr>
<td></td>
<td>The Blind Assassin: A Novel</td>
<td>Price: $7.99</td>
</tr>
</tbody>
</table>
What is the Opportunity Cost?

- Typically optimize for direct response
- Exploit similarity to previously purchased/clicked items
Targeting and Customer Search

• Targeting decreases search activity
  – Web content (Tam and Ho 2006)
  – Product listings (Dellaert and Häubl 2012)
  – Targeted email promotions (Fong 2017)

• Generally seen as efficient (saves effort)
  – Positive spillovers (Anderson and Simester 2013, Sahni 2016)

• Targeting could limit exposure
  – Hypothesis: negative spillovers for dissimilar products
Field Experiments on a Mobile Platform

• E-book app
• Promotes new titles using push notifications

• “Tapstream” data
  – 5 months pre-test
  – 3 weeks post-test
Study 2 Design

- Preference defined by cutoff in share of reading
  - 67% cutoff: 19,522 eligible users
Targeting Increases Direct Response (Promoted Book)
Spillover Effects

Same Genre: Positive

Cross-Genre: Negative
Robustness to Targeting Definition

- Cutoff is arbitrary
- Does not account for volume
- Trying a lot of books increases genre share
- Are genres really categories?

- Test sensitivity to cutoffs
- Use continuous measures of fit
- Target based on completion
- Use broader categories in product hierarchy
Source of the Negative Spillovers?

• Pure substitution?
  – Study 1: Differences in total purchasing

• Reactance to targeting?
  – Positive same-genre spillovers
Targeting Affects Depth of Search

Unique Titles Inspected Without Purchase

Same Genre

Cross-Genre
Targeting Affects Breadth of Search

Unique Categories Searched

Same Genre

Cross-Genre
Search Depth and Breadth Mediate Crowding Out Effects

Targeting Effect

-0.18

Cross Genre Books Searched

0.60**

Same Genre Books Searched

1.11** (Ind: 0.66 [0.43, 0.87])

Same Genre Purchases

-0.80**

Ind: -0.48 [-0.65, -0.31]

Cross Genre Purchases

0.89**

Ind: 0.89 [0.66, 0.87]

Same Genre Search Incidence

0.17**

Ind: 0.15 [0.09, 0.23]

Other Genres Searched

-0.17**

Ind: -0.20 [-0.33, -0.09]
Quantifying the Opportunity Cost

• Targeting for direct vs. total response
• Fit causal tree for each promotion $g$ and outcome $o$, predict $\delta_{g,i}^o$ for each user $i$
• Targeted treatment: $t_i^o = \arg\max_g \{\delta_{g,i}^o\}$
• The “opportunity cost” of optimizing one outcome $o$ in terms of suboptimal result for other outcome $p$:

$$\sum_i \left( \delta_{t_i^p,i}^p - \delta_{t_i^o,i}^p \right)$$
### Targeting for Direct Response Exploits

### Genre Preferences

<table>
<thead>
<tr>
<th>Targeting on Direct Response</th>
<th>Genre D Share</th>
<th>Genre E Share</th>
<th>Genre F Share</th>
<th>Total Sales</th>
<th>Books Finished</th>
<th>Search</th>
<th>Dispersion</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Promo</td>
<td>13.7%</td>
<td>12.3%</td>
<td>0.2%</td>
<td>69.6</td>
<td>2.3</td>
<td>51.1</td>
<td>2.0</td>
<td>2,767</td>
</tr>
<tr>
<td>Genre D</td>
<td>18.2%</td>
<td>14.8%</td>
<td>0.9%</td>
<td>83.3</td>
<td>3.9</td>
<td>66.7</td>
<td>1.4</td>
<td>41,148</td>
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<tr>
<td>Genre E</td>
<td>6.2%</td>
<td>26.2%</td>
<td>1.7%</td>
<td>22.9</td>
<td>0.7</td>
<td>16.0</td>
<td>1.1</td>
<td>30,061</td>
</tr>
<tr>
<td>Genre F</td>
<td>5.4%</td>
<td>11.9%</td>
<td>18.5%</td>
<td>27.6</td>
<td>1.9</td>
<td>16.7</td>
<td>2.0</td>
<td>3,540</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Targeting on Total Sales</th>
<th>Genre D Share</th>
<th>Genre E Share</th>
<th>Genre F Share</th>
<th>Total Sales</th>
<th>Books Finished</th>
<th>Search</th>
<th>Dispersion</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Promo</td>
<td>7.7%</td>
<td>53.6%</td>
<td>0.4%</td>
<td>341.8</td>
<td>5.4</td>
<td>329.7</td>
<td>2.0</td>
<td>1,382</td>
</tr>
<tr>
<td>Genre D</td>
<td>8.6%</td>
<td>8.5%</td>
<td>1.4%</td>
<td>185.4</td>
<td>7.1</td>
<td>159.1</td>
<td>1.8</td>
<td>7,849</td>
</tr>
<tr>
<td>Genre E</td>
<td>14.8%</td>
<td>19.9%</td>
<td>2.2%</td>
<td>25.3</td>
<td>0.7</td>
<td>17.6</td>
<td>1.2</td>
<td>51,071</td>
</tr>
<tr>
<td>Genre F</td>
<td>9.1%</td>
<td>18.1%</td>
<td>1.6%</td>
<td>69.1</td>
<td>5.4</td>
<td>47.7</td>
<td>1.5</td>
<td>17,214</td>
</tr>
</tbody>
</table>

Average: 12.8% 19.0% 2.0% 56.9 2.5 44.2 1.3 77,516
Targeting Schemes Differ Substantially

*Incremental Effect by Targeting Scheme*

**Outcome: Direct Response**
- 32% of optimal
- 22% of optimal

**Outcome: Total Sales**
- -5% of optimal
- 29% of optimal
Conclusions

• Targeted promotions can generate negative spillovers for dissimilar products
  – Active search redirects sales
  – Direct response metrics can mislead

• Purchasing breadth important for:
  – High variety-seeking markets (e.g. content)
  – Retailers with wide assortments
Targeting on Completion

Direct Response

Spillover Effects

Note: Sample includes all those completing at least one full book during pre-test period (35,704 users). Targeting based on completing a book in the promoted genre (3,002 users).
Targeting on Broader Categories

Direct Response

Spillover Effects

Promoted Product

Same Genre

Cross-Genre

Note: Targeting based on 10 broader categories instead of 239 narrow genres