Location-Based Advertising: What is the Value of Physical Distance on the Mobile Internet?

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The future of the Internet is mobile

Mobile Device Sales 2011*

- 31% Smartphones
- 69% Other mobile devices

Global Mobile vs. Stationary Internet Users**

User (in Mio.)

<table>
<thead>
<tr>
<th>Year</th>
<th>Mobile Internet User</th>
<th>Stationary Internet User</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>600</td>
<td>300</td>
</tr>
<tr>
<td>2008</td>
<td>700</td>
<td>400</td>
</tr>
<tr>
<td>2009</td>
<td>800</td>
<td>500</td>
</tr>
<tr>
<td>2010</td>
<td>900</td>
<td>600</td>
</tr>
<tr>
<td>2011</td>
<td>1,000</td>
<td>700</td>
</tr>
<tr>
<td>2012</td>
<td>1,100</td>
<td>800</td>
</tr>
<tr>
<td>2013</td>
<td>1,200</td>
<td>900</td>
</tr>
<tr>
<td>2014</td>
<td>1,300</td>
<td>1,000</td>
</tr>
<tr>
<td>2015</td>
<td>1,400</td>
<td>1,100</td>
</tr>
</tbody>
</table>

How can LBS influence consumers’ search and purchase behavior?

<table>
<thead>
<tr>
<th>Category</th>
<th>Features</th>
</tr>
</thead>
</table>
| **Product** | - Constant access to product information  
- Local review sites can be used at the POS |
| **Price** | - Constant access to price comparison information  
- Barcode scanning to compare prices  
- Dynamic prices related to consumer’s location |
| **Promotion** | - Localized promotions to trigger sales  
- Target ads based on location, time of day, etc. |
| **Place** | - Mobile: Physical and online access  
- Multi-channel strategy and channel switching |
The aim of the study is to analyze the impact of location-based services on consumer behavior in a mobile advertising context.
Theoretical background

**Consumer search**

- Search cost and incomplete information about prices in the market (Stigler 1961, Weitzman 1979)
- Search costs for digital products are lower online (Bakos 1997)
- Search costs are higher on the mobile internet (Ghose et al. 2011)

**Interplay between online/offline (commerce)**

- Research-shopper phenomenon (Verhoef et al. 2009)
- Internet retailers face strong competition from brick & mortar retailers for mainstream products but not for niche products (Brynjolfsson et al. 2009)
- Offline transport costs (i.e., distance) matter when a store opens locally; consumers substitute online through offline buying (Forman et al. 2009)

**Mobile advertising**

- Research focus on consumers’ intentions and attitudes towards location-based advertising (e.g., Dickinger & Kleijnen 2008)
- Lack of behavioral data
### Research questions and predictions

#### What is the value of physical distance on the mobile internet?

1. **Distance**
   - Physical distance has a negative impact on consumers’ search and coupon choice behavior

2. **Face value**
   - The face value has a positive impact on consumers’ search and coupon choice behavior

3. **Face value vs. Distance**
   - Interplay between face value and distance: physical distance dominates the face value
Data overview (1/3)
Data overview (2/3)

Consumers’ search and choice process

\[ i \in I \text{ Consumers} \]
Data overview (3/3)

Summary statistics

- More than 900 different coupon campaigns
- More than 147,900 logins
- More than 17,300 clicks on coupon profile (i.e., information stage)
- More than 6,100 clicks on coupon redemption code (i.e., redemption stage)
- More than 31,000 different users
- Data collection period: December 2010 – August 2011

### Users’ search process

<table>
<thead>
<tr>
<th>Stage</th>
<th>Count</th>
<th>CTR</th>
</tr>
</thead>
<tbody>
<tr>
<td>#Login</td>
<td>147,907</td>
<td></td>
</tr>
<tr>
<td>#Information</td>
<td>17,394</td>
<td>35.4%</td>
</tr>
<tr>
<td>#Redemption</td>
<td>6,151</td>
<td></td>
</tr>
</tbody>
</table>
Model

Effects on consumers’ choice to redeem location-based coupons

Dependent variables
- Binary choice to learn about (information stage) and to redeem (redemption stage) location-based coupons

Independent variables
- Distance between user and point-of-sale (POS) measured in kilometers (based on GPS data)
- Coupon attributes: face value (in percent), usage condition, categories, rank
- Time of the day: evening, morning, afternoon, night
- Interaction effects: time of the day (afternoon) and category (coffee shop)

Model (fixed-effects sequential logit model)

\[ y_{ijtk} = \alpha_i + \beta_2 \cdot distance_{ijtk} + \beta_3 \cdot coupon\_attributes_{jtk} + \beta_4 \cdot time\_day_{ijtk} + \beta_5 \cdot interaction_{ijtk} + \epsilon_{ijtk} \]

Where \( \alpha_i \) is the consumer-specific fixed effect, \( \epsilon_{ijtk} \) the error term and \( i = \text{consumer}, j = \text{coupon}, t = \text{time}, k = \text{stage} \)
### Results (1/2)

<table>
<thead>
<tr>
<th>Variables</th>
<th>fe logit stage 1</th>
<th>fe logit stage 2</th>
<th>mar. eff. stage 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance</td>
<td>-0.072***</td>
<td>-0.038***</td>
<td>-0.009***</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.004)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>Face value</td>
<td>1.755***</td>
<td>0.394***</td>
<td>0.097***</td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td>(0.092)</td>
<td>(0.024)</td>
</tr>
<tr>
<td>Condition</td>
<td>-0.748***</td>
<td>-0.365***</td>
<td>-0.089***</td>
</tr>
<tr>
<td></td>
<td>(0.015)</td>
<td>(0.061)</td>
<td>(0.015)</td>
</tr>
<tr>
<td>Rank</td>
<td>-0.269***</td>
<td>-0.054***</td>
<td>-0.013***</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.008)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Night</td>
<td>-0.505***</td>
<td>-0.153**</td>
<td>-0.037**</td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td>(0.074)</td>
<td>(0.018)</td>
</tr>
<tr>
<td>Afternoon</td>
<td>-0.042**</td>
<td>-0.076</td>
<td>-0.019</td>
</tr>
<tr>
<td></td>
<td>(0.019)</td>
<td>(0.0631)</td>
<td>(0.015)</td>
</tr>
<tr>
<td>Evening</td>
<td>0.093***</td>
<td>0.135**</td>
<td>0.033**</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td>(0.063)</td>
<td>(0.015)</td>
</tr>
<tr>
<td>Coffee</td>
<td>-0.978***</td>
<td>0.096</td>
<td>0.024</td>
</tr>
<tr>
<td></td>
<td>(0.019)</td>
<td>(0.077)</td>
<td>(0.019)</td>
</tr>
<tr>
<td>Beauty &amp; Wellness</td>
<td>-0.815***</td>
<td>-0.310**</td>
<td>-0.074**</td>
</tr>
<tr>
<td></td>
<td>(0.028)</td>
<td>(0.130)</td>
<td>(0.03)</td>
</tr>
<tr>
<td>Afternoon x Coffee</td>
<td>-0.095***</td>
<td>0.208**</td>
<td>0.052**</td>
</tr>
<tr>
<td></td>
<td>(0.027)</td>
<td>(0.1029)</td>
<td>(0.026)</td>
</tr>
<tr>
<td>Observations</td>
<td>1,479,072</td>
<td>17,394</td>
<td>17,394</td>
</tr>
<tr>
<td>Individuals</td>
<td>31,800</td>
<td>4,638</td>
<td>4,638</td>
</tr>
</tbody>
</table>

**SE in parentheses**

**LR = 62,915.3**  
**LR = 435.6**  
***** p<0.01, ** p<0.05, * p<0.1**  
**Prob>Chi² < 0.001 Prob>Chi² < 0.001**

- Distance has a significant negative impact on the probability to learn about and to choose to redeem coupons
- Face value has a significant positive impact on the probability to learn about and to choose to redeem coupons
- Time of the day has a significant impact on the probability to learn about and to choose to redeem coupons in both stages
- Coupons for coffee are more likely to be redeemed in the afternoon
Results (2/2)

Trade-off: distance vs. face value (stage 2)

- **Marginal Effects***
  - Face value (= 0.097)
  - Distance (= -0.009)

- **Trade-off**
  - 0.097/100
  - -0.009

- **Result**
  - = -0.104 [km per %]

A one percent increase of the face value has the same impact as a reduced distance of 104 meters on the probability to choose to redeem mobile coupons.

* Marginal effects depict the impact of a change of an independent variable on the probability to choose a coupon.

**(0.0967734/100)/-0.0093465 = -0.10353972
Location-based promotions are a promising customer acquisition tool, since offers in close vicinity have potentially high relevance for consumers.

Location-based services also generate new (geo-)data for marketers:
- Consumer preferences can be better identified
- More precise targeting

Data from one country
- No additional offline sales data
- No additional user information outside app usage
Thank you for your attention!

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References


