The Economic Psychology of Television Advertising

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Introduction

Economic Theories of Advertising

Why do firms advertise?
- Broadly: to shift demand (e.g., Dixit & Norman 1978)
- But why are ads effective?
  - Provide direct information: product existence, price, features...
    (e.g., Kaldor 1950, Anderson & Renault 2006)
  - Provide indirect information: quality signaling
    (Nelson 1970, 1974; Milgrom & Roberts 1986)

Non-Economic Theories of Advertising

But is this really the whole story?
- Much ad content (especially on TV) appears to be driven by the repetitive use of particular themes, which appear to have little (direct or indirect) informational value.
- Social psychology characterizes persuasive advertising as acting via either central or peripheral routes (Petty & Cacioppo 1986, Chaiken & Stangor 1987)
- With respect to latter, role of context or situation has been emphasized (e.g., Kilbourne 2000, Hanson & Yosifon 2003).
- Marketing professionals also appear to believe in subtle ways of influencing purchase behavior:
  \textit{Great organizations get to focus on a real rich area, which is our ability to decipher consumers' unarticulated needs and unconscious behaviors}.
  \textemdash Patrick Edson, MillerCoors VP of Marketing and Innovation

Toward a Unified Theory of Advertising

It would be nice to have an economic theory of advertising that predicts and explains these more "psychological" aspects of advertisements.

Aims of this lecture are twofold:
- Briefly present a formal theory of "demand shifting" with implications for ad content.
- Present preliminary findings of a content analysis of television advertisements.

Smith & Tasnádi (2007) derive formal model in which informational cues (possibly false(!)) induce habit formation.

Smith & Tasnádi (2009) realize that Smith & Tasnádi (2007) missed something important: habits are interesting, but their framework also speaks to something (perhaps) more powerful: non-convexities.

**Threshold Utility: Set-up**

Endogenous preferences, product of human evolutionary history:
- Agent maximizes probability of obtaining some threshold level \(k \) of "quality"
- Two goods: \(x \) and \(y \)
- Quality unobservable: \(C_x \) and \(C_y \)
  (random variables, uniformly distributed on \([0 , 1]\))
- Objective:
  \[
  U(x, y) = P(C_x + C_y \geq k)
  \]
- Agent solves:
  \[
  \begin{align*}
  &\max_{x,y} U(x, y) \\
  &\text{s.t. } p_x x + p_y y \leq m \\
  &\quad x, y \geq 0
  \end{align*}
  \]

Assuming (independent) densities \(f\) and \(g\), the density of the sum of random variables \(C_x \) and \(C_y \) is the convolution of their densities. So

\[
U(x, y) = \int_k^\infty \frac{\min\{x, t\}}{\max\{t-x, -y\}} \frac{1}{\sqrt{2\pi}} f\left(\frac{t-x}{\sqrt{2}}\right) g\left(\frac{t-y}{\sqrt{2}}\right) dt,
\]

which requires integration across five distinct regions in \((x, y)\)-space.

**Utility**

Integration yields a functional form for "threshold utility"

\[
U(x, y) = \begin{cases} 
0 & \text{if } 0 \leq x + y \leq k, \\
1 - \frac{x}{y} + \frac{y}{x} + \frac{(k-x)(k-y)}{2xy} & \text{if } 0 + y > k, x \leq k \text{ and } y \leq k, \\
1 + \frac{x}{y} - \frac{y}{x} & \text{if } 0 + y > k, x \leq k \text{ and } y > k, \\
1 + \frac{y}{x} - \frac{x}{y} & \text{if } x + y > k, x < k \text{ and } y \leq k, \\
1 - \frac{x}{y} & \text{if } x + y > k, x < k \text{ and } y > k.
\end{cases}
\]

which is quasi-concave on \( \{ (x, y) \in \mathbb{R}^2 \mid 2k \leq x + y \} \) and quasi-convex on \( \{ (x, y) \in \mathbb{R}^2 \mid k \leq x + y \leq 2k \} \).
### Threshold-Induced Demand Shift

- Note that there is a discontinuous change in demand at $k = m/(2p)$, $p_x > p_y$ (Prop. 1). So for fixed $(p_x, p_y, m)$, this implies that demand will be discontinuous in $k$ (and vice versa).
- Figure 3 shows demand as a function of $k$, for $p_x > p_y = 1$.
- Which suggests that thresholds might have strategic importance.

### A Duopoly Game

- Firms $x$ and $y$ set prices $p_x$ and $p_y$.
- Firms may alter the threshold level by $\delta_x$ and $\delta_y$.
- Unit costs $c_x$ and $c_y$.
- Profit function of firm $i$:

  $$\Pi_i(p_x, p_y, k + \delta_x + \delta_y(p_i - c_i)) - a\delta_i^2,$$

  where $a$ is a positive parameter for advertisement costs.

### Duopoly without Advertising

First, assume $\delta_x = \delta_y = 0$.

**Proposition 2**: If $\frac{m}{p_x} \geq k$ and $\frac{m}{p_y} \geq k$, then there exists a unique Nash equilibrium in which both firms set price $p^* = \frac{m}{p}$. Intuition: each firm chooses the lowest price that ensures opponent will not drive him from the market.
Duopoly without Advertising

First, assume $\delta_x = \delta_y = 0$.

**Proposition 3.** If $\frac{m_x}{c_y} > k > \frac{m_y}{c_x}$, then firm $x$ will drive firm $y$ out of the market by setting a price slightly below $c_y$.

**Proposition 4.** If $\frac{m_x}{c_y} > k > \frac{m_y}{c_x}$, then firm $y$ will drive firm $x$ out of the market by setting a price slightly below $c_x$.

Duopoly with Advertising

Now, assume $c_x < c_y$.

(i) low-cost firm chooses $\delta_x$,
(ii) high-cost firm chooses $\delta_y$,
(iii) then firms choose price simultaneously.

**Proposition 5.** If $\frac{m_x}{c_y} > k > \frac{m_y}{c_x}$, $c_x < c_y$, and

$$\frac{m}{2} - k + \frac{c_x}{2a} c_x + \frac{c_x^2}{4a} < m - \frac{m}{c_y} c_x - a \left( \frac{m}{2c_y} c_y + \frac{c_y}{4a} - k \right)^2,$$

then the more-efficient firm drives the less-efficient firm out of the market by increasing the consumer’s threshold level with advertisements ($\delta_x = \frac{m}{2c_y} + \frac{c_y}{4a} - k$) and setting a price $c_y$.

Ad Sample

<table>
<thead>
<tr>
<th>Target Audience</th>
<th>Autos</th>
<th>Food/Beverage</th>
<th>Home/Personal Services</th>
<th>Toys</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children</td>
<td>1</td>
<td>67</td>
<td>21</td>
<td>26</td>
<td>50</td>
</tr>
<tr>
<td>Adults</td>
<td>36</td>
<td>59</td>
<td>81</td>
<td>38</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>37</td>
<td>126</td>
<td>102</td>
<td>64</td>
<td>51</td>
</tr>
</tbody>
</table>

- Sample collected 06/09/07 - 07/07/07 (convenience sample)
- 380 unique ads from 38 hours of programming
- Coded for content: direct info, indirect info, threshold/situation. Best demonstrated by example.
Table: Ad Content by Target Audience: Information

<table>
<thead>
<tr>
<th>Information</th>
<th>Children</th>
<th>Adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Induced Scarcity</td>
<td>0.1</td>
<td>0.06</td>
</tr>
<tr>
<td>Price Discrimination/Bundling</td>
<td>0.21</td>
<td>0.13</td>
</tr>
<tr>
<td>Vague Claims</td>
<td>0.45</td>
<td>0.66</td>
</tr>
<tr>
<td>Facts</td>
<td>0.94</td>
<td>0.86</td>
</tr>
<tr>
<td>Price</td>
<td>0.1</td>
<td>0.19</td>
</tr>
<tr>
<td>Features</td>
<td>0.8</td>
<td>0.74</td>
</tr>
<tr>
<td>Availability</td>
<td>0.64</td>
<td>0.56</td>
</tr>
<tr>
<td>Costly Signals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Ad</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Celebrity(1)</td>
<td>0.27</td>
<td>0.03</td>
</tr>
<tr>
<td>Celebrity(2)</td>
<td>0.05</td>
<td>0.12</td>
</tr>
<tr>
<td>Guarantee</td>
<td>0.03</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Table: Ad Content by Target Audience: Thresholds

<table>
<thead>
<tr>
<th>Thematic Content</th>
<th>Children</th>
<th>Adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scarcity(1)</td>
<td>0.35</td>
<td>0.15</td>
</tr>
<tr>
<td>Scarcity(2)</td>
<td>0.27</td>
<td>0.1</td>
</tr>
<tr>
<td>Scarcity(3)</td>
<td>0.12</td>
<td>0.03</td>
</tr>
<tr>
<td>thresholds(1)</td>
<td>0.93</td>
<td>0.85</td>
</tr>
<tr>
<td>thresholds(2)</td>
<td>0.88</td>
<td>0.81</td>
</tr>
<tr>
<td>Survival &amp; Health</td>
<td>0.7</td>
<td>0.64</td>
</tr>
<tr>
<td>Survival &amp; Romance</td>
<td>0.74</td>
<td>0.69</td>
</tr>
<tr>
<td>Survival</td>
<td>0.5</td>
<td>0.49</td>
</tr>
<tr>
<td>Romance</td>
<td>0.06</td>
<td>0.14</td>
</tr>
<tr>
<td>Attention/Mood</td>
<td>0.59</td>
<td>0.4</td>
</tr>
<tr>
<td>Gift</td>
<td>0.13</td>
<td>0.1</td>
</tr>
<tr>
<td>Unrelated Bundles</td>
<td>0.05</td>
<td>0</td>
</tr>
</tbody>
</table>
Information about threshold payoffs corresponds to convex (or non-convex) preferences over goods.

Firms may have incentive to provide “messages” about threshold levels to induce discrete shifts in demand.

Represents economic theory of “psychological” content, when behavior interpreted as evolutionary vestige.

Existing economic theories of advertising largely dismiss the influence of such content on consumers.

Preliminary evidence appears to support the hypothesis that television advertisers incorporate thematic “information” about threshold payoffs in their ads.