

Opt0.4pt

# Tailored Advertising and Consumer Privacy

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## Motivation

- Technological progress in collecting and processing personally identifiable data
  - Firms can better tailor *marketing messages* to individual consumers, according to perceived preferences.
- E.g., stress style or comfort; different emphasis on price.
  - (Formal) presumption: Scope of message is always limited due to restrictions in (air-)time, (billboard, package) space, or consumer attention.

## Key Questions

- Does such *tailored advertising* benefit consumers?
  - Need for regulation (e.g., EC Privacy & Data Protection Directives)?
  - Sufficient to ask for consent on collecting personalized data?
- Role of consumer "naivité/wariness" with respect to this practice?
- Role of competition?
- Interaction with *personalized pricing*?  
[Relevance? Services vs. products?]

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- **Theme 1:** Tailored advertising is *more informative*.  
[Dispersion of ex-ante utility]
  - But distribution of efficiency gains depend on possibility of personalized pricing and competition.
- **Theme 2:** Consumer wariness
  - Even naive consumers may benefit: "Value of information effect" stronger than "bias effect".
  - "Bias effect" disappears with competition!
- **Theme 3:** Differentiation  
[Case: Price discrimination & competition]
  - Tailored advertising then dampens competition.
  - Now ignorance/naivité is of advantage as intensifies competition.

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- With personalized pricing:
  - One rationale for intervention: To protect naive consumers from exploitation by firm with market power.

## Literature

- Stigler (1980), Posner (1981): Greater transparency expands efficiency-enhancing trade.  
→ Here, less immediate as allows firm to selectively communicate.
- We abstract from (potentially "excessive"; Hirshleifer 1971) costs of information acquisition.
- We analyze whether "property rights" over personally identifiable information are enough (cf. Shapiro and Varian 1997).

## Literature (cont.)

- IO literature focus: Personalized price discrimination (e.g., Villas-Boas 1999; including "naive consumers" in Taylor 2004).
- Marketing literature focus: Targeted advertising (e.g., Goldfarb and Tucker 2011).
- Key formal ingredient: Constrained verifiable communication, as in Fishman and Hagerty (1990), Glazer and Rubinstein (2004).  
→ Key difference: "Horizontal differentiation". Akin to Lewis and Sappington (1995), Johnson and Myatt (2006).

## (Non-)Tailored Advertising: Set-Up

- Consider a single firm. And a product with two attributes  $n = 1, 2$ .
- Simplified notation: If consumers knows attributes = learns values  $u_n$ , he knows true valuation

$$u = \sum_{n=1,2} u_n.$$

- Ex-ante:  $u_n$  IID with  $F(u_n)$  on (for now bounded) support  $[\underline{u}, \bar{u}]$ .
- Firm strategy: Reveal  $d \in \{1, 2\}$ .

## Non-Tailored Advertising

- Given symmetry, wlog suppose  $d = 1$  is communicated.  
→ Expected utility:  $U = u_d + E[u]$ .
- Ex-ante distribution with CDF

$$H_N(U) = F(U - E[u]).$$

## Tailored Advertising

- Suppose firm prefers to communicate "highest" attribute (endogenized later).
- Wary consumer's expected utility:  $U = u_d + E[u \mid u \leq u_d]$ .
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- *Naive* consumer's expected utility:  $\hat{U} = u_d + E[u]$ .
- Ex-ante distribution with CDF

$$H_{Tn}(\hat{U}) = F^2(\hat{U} - E[u]).$$

## Comparison: Tail Behavior

- Tailored CDF with wary consumers has more mass *at left-hand tail* than non-tailored CDF (simply as lower bound is no longer  $\underline{u} + E[u]$ , but  $\underline{U} = 2\underline{u}$ ).
- *Right-hand tail*: Same boundary  $\bar{U} = \bar{u} + E[u]$ . And  $H'_N(\bar{U}) \leq H'_T(\bar{U})$  ("more mass" with tailored CDF) if

$$\frac{dE[u \mid u \leq u_D]}{du_D} \leq 1,$$

i.e., implied by logconcavity of  $f$ .

[Also with unbounded support.]

## Comparison (Cont.)

- Uniform distribution and exponential distribution: Rotation property holds generally  
→  $H_N$  and  $H_T$  intersect once.
- Further, though no generalized result, all examples calculated with all logconcave density functions in Table 1 of Bagnoli and Bergstrom (2005) exhibit rotation property.

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- For what follows, we assume rotation property (though for most results mean-preserving spread sufficient):  
 → *Given the distribution  $F(u_n)$ ,  $H_T(U)$  results from  $H_N(U)$  through a rotation around some interior value  $\tilde{U}$ :*

$$H_T(U) \underset{<}{\overset{\geq}{\approx}} H_N(U) \text{ for } U \underset{>}{\overset{\leq}{\approx}} \tilde{U}.$$

## Comparison (Cont.)

- Immediate with naive consumers:

*The distribution of a naive consumer's perceived valuation  $\hat{U}$  under tailored advertising,  $H_{Tn}(\hat{U})$ , dominates the distribution of his true valuation  $U$  under non-tailored advertising,  $H_N(U)$ , in the sense of FOSD.*

## Analysis with Monopolistic Firm

- Also: No personalized price discrimination.
- Simplification: Consumer buys if expected (perceived) valuation is at least  $R$ .

## Analysis with Monopolistic Firm

- *Firm preferences:*  $\rightarrow$  Maximize  $1 - H.(R)$ .
  - Always prefers tailored with naive consumers.
  - Only prefers tailored with wary consumers when  $R$  is sufficiently high (Low ex-ante likelihood of purchase; "niche market").

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  - Only prefers tailored with wary consumers when  $R$  is sufficiently high (Low ex-ante likelihood of purchase; "niche market").
- Commitment?
  - $\rightarrow$  If gathering information is non-observable, then tailored advertising always results.

## Regulation and Consumer Preferences

- Wary consumers: Expected utility (after integration by parts) is higher under tailored advertising if

$$\int_R^{\bar{U}} [H_N(U) - H_T(U)] dU > 0.$$

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- Regulation?
  - Forbidding gathering customer-specific information hurts wary consumers.
  - Also, requiring consumers' consent hurts wary consumers when  $R$  is low.

## Regulation and Consumer Preferences

- Naive consumers: Despite bias they are
  - Equally well-off when  $u_n$  is uniformly distributed.
  - Strictly better off with tailored advertising when  $u_n$  is exponentially distributed.
- Intuition: Trading-off two errors.

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- Additional choice option for firm: Not to reveal any attribute!
- Key: All results survive (weakly).
- Details:
  - Wary consumers: Standard unravelling argument can be used.
  - Naive consumers: Additional case of "no revelation" when  $2E[u] \geq R$ .

## Competition

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- Naive consumers: End up with same decision as wary consumers!  
→ In this sense, protected by competition (=selective communication of both firms!)
- Key result: All consumers always better off under tailored advertising.

## Price Discriminating Monopolist

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- *Wary consumers*: Tailored advertising
  - has no impact on consumers,
  - but strictly increases efficiency (and thus always firm profits).
- *Naive consumers*: Tailored advertising
  - strictly harms consumers ("exploited beliefs"),
  - but may increase efficiency (e.g., strictly with exponential distribution).

## Price Discrimination with Competition

- Assumption: Joint observability of revealed attributes
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- *Wary consumers*: Now harmed by tailored advertising!
  - From ex-ante perspective, this increases differentiation!
- But less so for *naive consumers*!
  - They end up with the same choice as wary consumers, but a lower price
    - They do not update beliefs on unobserved attribute.
    - Always lower perceived difference and thus lower price!

## Concluding Remarks

- Framework to study firms' use of personally identifiable data to individually target (selective) communication.
- Tailored advertising should increase *informativeness* and thus decision efficiency when consumers are wary  
[But this may also more than outweigh bias when consumers are naive.]  
—> Regulation (including asking for consumers' consent !) may be harmful!
- Most "clear cut" case *pro* selective communication: Competition and no personalized *price* discrimination.
- Instead, with personalized price discrimination: In particular, exploitation of naive consumers' beliefs!

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