Who Benefits From Online Privacy?

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Price Discrimination

Buy.com COUPON

Buy.com customers take $10 OFF the purchase of $200 valid in ALL Stores! (Affiliate).*

* Terms and Conditions:

- Valid for first time Buy.com customers only.
- Orders must be placed on or before 11/30/2009 11:59:00 PM PT.

Limit one per buyer. We will apply the $10 discount to your first purchase of $10 or more (before shipping & tax). To receive the offer, sign-up before February 15, 2007.
Price Discrimination

- Common in e-commerce (Dell, Buy, Amazon)
- Consumers are not helpless – it can be circumvented
- Sellers’ practices mostly follow voluntary guidelines
Towards Policy

- Transparency and Consumer Control (FTC, 07)
- Online Privacy Bill of Rights (Edward Markey)
- Customer Proprietary Network Information (CPNI)
- CAN-SPAM Act of 2003

General direction: make it easier for consumers to maintain anonymity

Key differences from traditional markets:
- It is already easier for consumers to become anonymous
- But, also easier for sellers to store and use consumer data

Is easier-to-obtain anonymity desirable? Is it clear who benefits/loses?
Game

- Firm(s) and many consumers
- 3 parts:

  1. **Identification:**
     - past purchases $\rightarrow$ disclose information
  
  2. **Anonymity Decisions:** consumers decide whether to maintain their anonymity
  
  3. **Purchasing & Discrimination:** firm has some information about consumers’ valuations, sets prices to maximize profit
Literature

- **Intertemporal Price Discrimination** (Stokey 1979, Salant 1989, Riley & Zeckhauser 1983, Salant 1989);
  - **Ratchet Effect** (Freixas et al. 1985, Hart & Tirole 1988)


Model

- Two purchasing periods
- Firm produces non-durable good, 0 marginal cost
- Continuum of strategic consumers with mass 1
- Each period: a consumer has unit demand
- Valuation $v$ drawn from cdf $F$ on $[0,1]$
  - Private info, same in both periods
- Costs $c$ to opt out, expended in second period
Extensive Form Sketch
Results Overview

• Given
  – Firm cannot commit to future prices
  – Technical assumptions

• Firm’s profit is non-monotonic, highest when cost of opting out is zero

• Consumer surplus may increase (with more consumers participating) in the cost of opting out, but only up to a point; then it decreases

• Social surplus, extensions
Preliminaries

• Socially optimal: all consumers purchase in each period

• If there is no consumer recognition, firm sets the monopoly price in each period

• If firm can commit to future prices + opting out is prohibitively costly (full recognition) → commits to monopoly prices

• If firm can commit to future prices + opting out → still commits to monopoly prices
Characterization

• Consumers can opt out at a cost $c$

• **Proposition:** If $c=0$, all (perfect Bayesian) equilibria have the following properties:
  
  – (On path) prices = *monopoly prices*
  
  – Consumers with *valuation above price* purchase in both periods and opt out *(all consumers stay anonymous)*
  
  – No Customer Recognition outcome
  
  – (This is what the firm wants!)
Opting out is associated with a negative externality on other consumers:

- Individually, a consumer wants to opt out to have access to cheaper prices
- As a result, anonymous consumers pay more
  - because the firm targets more high valuation consumers in the anonymous pool
- Prisoner’s Dilemma / Tragedy of the Commons / Braess’s Paradox
Stage 3: Price Discrimination, $c>0$

- Let $\alpha$ be the proportion of purchasing consumers maintaining anonymity.
- Seller sets two prices: to anonymous consumers and to identified consumers
  \[ p^0_2 = \arg\max_{p \leq \underline{v}} p \left( F(\underline{v}) - F(p) + \alpha(1 - F(\underline{v})) \right) \]
- Identified consumers:
  \[ p^1_2 = \arg\max_{p \geq \underline{v}} (1 - \alpha) p(1 - F(p)) \]
- Ratchet effect
Stage 2: Choosing Anonymity

- Consumers will opt out until,
  \[ p_2^1 = p_2^0 + c \]

- Derive \( \alpha \)

- Braess’s Paradox:
Stage 1: Pricing & Identification

- Solve firm’s first period problem

\[
\max_{p_1} (1 - F(\tilde{v})) (p_1 + \delta (1 - \alpha) p_2^1 + \delta \alpha p_2^0) + \delta (F(\tilde{v}) - F(p_2^0)) p_2^0
\]

Repeat Consumers

New Consumers

\[
\text{\(\alpha = 1\), No Recognition} \quad \quad 0 < \alpha \leq 1 \quad \quad \alpha = 0, \text{ prices change} \quad \quad \alpha = 0, \text{ Full Recognition}
\]

\[
\hat{c} \quad \quad \bar{c}
\]

\(c\)
Comparative Statics (uniform)
Comparative Statics (uniform)
Extension: Commitment

• Firm can commit not to charge identified consumers more (Amazon.com after DVD experiment)

• Consumer valuation follows a Markov process

• Process is common knowledge, but current and past valuations are private

• Firm learns about valuation through purchases

• **Loyalty program**: prices have to be low enough to incentivize consumers to buy (using their membership account) w/o manipulating the program
Extension: Competition

• Two firms, a market leader (A) selling the brand-name product and a follower (B) selling a generic

• Consumers with valuation \( v \) for A’s good have valuation \( \gamma v \) for B’s good (\( \gamma \leq 1 \))

• Three regimes: No Recognition, Asymmetric Recognition, Full Recognition

• Firms set prices simultaneously, observe past prices, compete in price
Competition

**Consumer Surplus**

**Social Surplus**
Conclusions

• Max profit for firm when 0 cost for anonymity
• Facilitating opting out can increase & also decrease welfare and consumer participation
• Non-monotonicity in surplus, profit
• Extensions: commitment, competition

Thank you for your attention!
Comparative Statics (uniform)

When $c$ is deadweight loss

When $c$ is collected