Nonlinear pricing of information goods

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Motivation

Examples of pricing for information goods

• Usage-based pricing
  – Digital music (iTunes)
  – Wireless internet service (AT&T)
  – Corporate software (Oracle, WebLogic, …)
  – Industry research (Abberdeen)

• Fixed-fee (unlimited usage) pricing
  – Wireline internet service (AOL)
  – Online newspapers (Wall Street Journal)
  – Wireless internet service (Sprint)
  – Industry research (Jupiter MediaMetrix)
  – Digital music (MusicNet’s initial pricing)

• Both fixed-fee and usage-based
  – Corporate software (IBM zSeries)
  – Long-distance service (Sprint, AT&T)
  – Corporate internet service
  – OCLC library information service

Outline of model

Standard one-dimensional-type model

• Monopolist, one good, variable quantities
• Customers indexed by type \( \theta \in [0, 1] \)
  
  \[ u(q, \theta, p) = U(q, \theta) - p \]

• (Standard) assumptions on \( U, F \) that usually make separation of types optimal
• Upper bound on \( U : v(0) = \lim_{q \to \infty} U(q, \theta) < \infty \)

Cost structure

• Zero variable costs of production/distribution
• Usage-based pricing: Transaction costs \( C(q) \)

Feasible pricing schedules (contracts)

• Usage-based: \( q(\theta), \tau(\theta) \)
• Fixed-fee (unlimited-usage): \( T \)

Possible explanations:

• Distribution of customers is the kind that causes bunching at the top
• Multi-dimensional types

Is there a simpler explanation?

• Near-zero marginal costs?
  – Make unlimited-usage feasible
  – But by themselves, do not make it optimal
• Network effects?
• “Step-function” variable costs?
• Imperfect competition?
• Transaction costs of usage-based pricing?
  – Seller-side (administering and billing)
  – Buyer-side (keeping track of usage)
Results
Segmentation due to a fixed fee $T$

Optimality of fixed-fee
- For every transaction cost function satisfying $C(q) > 0$ for $q > 0$
  offering a fixed-fee $T$ improves profits from any usage-based pricing contract

Outline of model (again)
More assumptions on transaction costs

1. $C(q) = 0$ for $q = 0$
2. $C(q) = K + c(q)$ for $q > 0$
   (a) $K \geq 0$
   (b) $\frac{c(q)}{c_1(q)} > \frac{U_{11}(q)}{U_1(q)} (< 0)$

(2b) is sufficient (ensures quasiconcavity of profit function in $q$), may not be necessary

Example
$U(q, \theta) = \begin{cases} (w + \theta)q - \frac{1}{2}q^2, & q < \theta + w \\ \frac{1}{2}(w + \theta)^2, & q \geq \theta + w \end{cases}$

$f(\theta) = b(1-\theta)^{(b-1)}$

$C(q) = K + c q$

1. Impact of increasing $c$ or $K$
2. Impact of increasing $w$
3. Impact of decreasing $b$
Example
Changes in profits as $c$ increases

Changes in consumer surplus as $c$ increases

Example
Changes in total surplus as $c$ increases

Example
Changes in total surplus: a closer look

Conclusion and related work
Summary
- Established a simple explanation for the widespread prevalence of fixed-fee pricing
- Separability of design of usage-based schedule and fixed-fee is promising (but…)
- Guidelines for companies who price information goods

Ongoing and related work
- Network effects and nonlinear pricing
  - separation is optimal for “small” customers
  - fixed-fees are optimal for finite-sized customers
- Step-function variable costs
  - with bounded usage, fixed fees are often optimal
- Piracy reduces the desirability of fixed fees
- Imperfect competition