A Retail Benchmarking Approach to Efficient Two-way Access Pricing: Termination-Based Price Discrimination with Elastic Subscription Demand

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Network competition: access pricing

- Retail price
- Access price
- Cost of origination
- Cost of termination
Market for termination is monopoly

Scope for ex-ante regulation:
• Bilateral negotiation of reciprocal access charges (collusion?)
• Regulate (= fix) access charges
  (Bill and Keep, Cost Based, Cost + return)
• Regulate access charge by fixing a benchmarking rule (Jeon-Hurkens, 2008)
Results from fixed two-way access
(without termination-based PD;
with inelastic subscription demand)

• Linear pricing:
  – Collusion possibility
  – Optimal (Ramsey) access fee below cost

• Two-part tariffs:
  – Profit neutrality
  – Total welfare maximizing fee equal to cost
Results from retail benchmarking
(without termination-based PD; with inelastic subscription demand)

- **Linear pricing**: there is one linear benchmarking rule that achieves the Ramsey prices.

- **Two-part tariffs**: there is a class of benchmarking rules (indexed by $k$) resulting in marginal cost pricing, with higher $k$ leading to lower fixed fees.

- **Regulator needs no information on demands.**
Results from retail benchmarking
(without termination-based PD;
with inelastic subscription demand)

Intuition: When the access charge to be paid by a network depends positively on its own (average) retail price, the network has incentive to lower retail price. Such a retail benchmarking approach thus intensifies competition in the retail market.
This paper: Extensions

• Termination-based price discrimination
  – Fixed fee, on-net and off-net var. prices
• Elastic subscription demand
  – Consumers may remain unsubscribed
  – Lower fixed fees will increase subscription

  – Logit model (with outside option)
Outline

1. Logit Model with Outside Option:
   • Rational expectations
2. Fixed Access Charges
   • Equilibrium
   • Business stealing vs. Network externalities
   • Comparative statics
3. Retail Benchmarking Rule
   • Equilibrium, Profits, Welfare, Subscription
4. Conclusion
Model: Supply

Costs:

- $f$: fixed cost of serving a customer
- $c_T$: the marginal cost of terminating a call
- $c$: the marginal cost of a call

Duopolists set $(F_i, p_i, \hat{p}_i)$
Model: Demand for Calls

- \( u(q) \): concave increasing utility from calls of length \( q \)
- \( q(p) \): demand function with \( u'(q(p)) = p \)
- \( v(p) = u(q(p)) - pq(p) \)
Model: Demand for subscription

Consumers form expectations about number of subscribers

\[ \beta_0, \beta_1, \beta_2 \geq 0 \text{ with } \beta_0 + \beta_1 + \beta_2 = 1. \]

Random utility from subscribing to network:

\[ U_1 = V_1 + \mu \varepsilon_1 = \beta_1 v(p_1) + \beta_2 v(p_1) - F_1 + \mu \varepsilon_1 \]

\[ U_2 = V_2 + \mu \varepsilon_2 = \beta_2 v(p_2) + \beta_1 v(p_2) - F_2 + \mu \varepsilon_2 \]

\[ U_0 = V_0 + \mu \varepsilon_0 \]

Subscribers:

\[ \alpha_i = \frac{\exp[V_i / \mu]}{\sum_{k=0}^{2} \exp[V_k / \mu]} \]
Model: Rational Expectations

Expectations are rational iff $\alpha_i = \beta_i$.

Rational expectations exist for any pricing schedules.

Rational expectations are unique if $\mu > \nu(c) / 4$. 
Model: Rational Expectations

An increase in $F_1$ causes
a decrease in $\alpha_1$

a decrease in $\alpha_1 + \alpha_2$

an ambiguous effect in $\alpha_2$

\[
\frac{\partial \alpha_2}{\partial F_1} > 0 \iff \Delta = \mu - \alpha_0 \nu(\hat{p}_2) > 0
\]

\[
\frac{\partial \alpha_2}{\partial F_1} < 0 \iff \Delta = \mu - \alpha_0 \nu(\hat{p}_2) < 0
\]
Fixed Access Charge \( h \)

\[
R(p) = (p - c)q(p)
\]

\[
\Pi_i = \alpha_i \left[ \alpha_i R(p_i) + \alpha_j R(\hat{p}_i) + F_i - f \right]
\]

Retail profit per customer

\[
+ \alpha_i \alpha_j (a - c_T)(q(\hat{p}_j) - q(\hat{p}_i))
\]

Net Access Revenue

Maximizing profit requires perceived marginal cost pricing:

\[
p_i = c, \hat{p}_i = c + a - c_T
\]
Fixed Access Charge $h$

Given perceived marginal cost pricing

$\hat{c} = c + a - c_T$

$\Pi_i = \alpha_i [\alpha_j R(\hat{c}) + F_i - f]$  

Symmetric equilibrium fixed fees and subscription are given by FOC and RE

$F = F^{\text{equil}} (\alpha, a)$

$F = F^{\text{RE}} (\alpha, a) := \alpha (v + \hat{v}) - V_0 - \mu \ln \left[ \frac{\alpha}{1 - 2\alpha} \right]$
For $h$ close to $c_T$, a unique symmetric equilibrium exists.
Comparative statics at $h = c_T$

Net Business Stealing Effect

$$\Delta^* = \mu - (1 - 2\alpha^*)v(c) > 0$$

$\alpha^* \uparrow \Rightarrow \Pi \downarrow, CS \uparrow, TS \uparrow$
Comparative statics at $h = c_T$

Net Network Externality

$$\Delta^* = \mu - (1 - 2\alpha^*) \nu(c) < 0$$

$\alpha \uparrow \Rightarrow \alpha^* \downarrow$

$\Rightarrow \Pi \downarrow, CS \downarrow, TS \downarrow$
Comparative statics at $h = c_T$

- Firms always prefer $h < c_T$
  - Either to soften competition (Gans & King, 2000; Calzada & Valletti, 2008)
  - Or to internalize network externality (Dessein, 2003)
- Regulator prefers $h < c_T$ only when the network externality effect dominates.
Retail Benchmarking Approach

Retail profit/customer gross of fixed cost

\[ \pi_i(a) = \alpha_i R(p_i) + \alpha_j (\hat{p}_i - (c + a - c_T))q(\hat{p}_i) + F_i \]

Total profit:

\[ \Pi_i = \alpha_i[\pi_i(a) + \alpha_j (a - c_T)q(\hat{p}_j) - f] \]

Define access charge to be paid by i:

\[ \lambda(a, k) = a + k \frac{\pi_i(a)}{q(\hat{p}_i)} \]
Retail Benchmarking Approach

Total profit can be rewritten as:

\[ \Pi_i = \alpha_i \left[ (1 - k\alpha_j)\pi_i(a) - f \right] + k\alpha_i\alpha_j \left[ \pi_j(a) + (a - c_T)q(\hat{p}_j) \right] \]

Max. \( \Pi_i \) is equivalent to max \( \pi_i(a) \) if \( k \leq 1 \).

Hence, perceived marginal cost pricing:

\[ p_i = c, \quad \hat{p}_i = \hat{c}, \]
Retail Benchmarking Approach

Now

\[ \Pi_i = \alpha_i [F_i + \alpha_j R(\hat{c}) - f] - k \alpha_i \alpha_j [F_i - F_j] \]

Competition in fixed fee, fiercer for larger k!
Retail Benchmarking Approach

Consider \( \lambda(a, k) \) with \( a \approx c_T \) and \( k \leq 1 \)

1. Marginal cost pricing
2. Fixed fee decreases in \( k \).
3. Can increase subscription without (further) distorting usage prices
Comparative statics

Net Network Externality

\[ \Delta^* = \mu - (1 - 2\alpha^*) v(c) < 0 \]

- FOC
- RE

\[ k \uparrow \Rightarrow F \downarrow, \alpha^* \uparrow \]

\[ \Rightarrow \Pi \uparrow, CS \uparrow, TS \uparrow \]
Comparative statics

Net Business Stealing Effect

\[ \Delta^* = \mu - (1 - 2\alpha^*)v(c) > 0 \]

- \( F \) and \( F^* \) are the firms.
- \( F \) is the firm in the network.
- \( F^* \) is the firm in the network.
- \( k \) is the parameter of the model.
- \( \alpha \) is the parameter of the model.
- \( \alpha^* \) is the critical value of \( \alpha \).
- \( \Pi \) is the profit.
- \( CS \) is the cost of subscription.
- \( TS \) is the total subscription.

Firms prefer \( k < 0 \).
Conclusion

Retail benchmarking approach works:
• $k > 0$ increases competition in fixed fees
• And thus increases subscription
• Without distorting usage prices
• Any fixed termination charge is Pareto dominated by some retail benchmarking rule (possibly $k < 0$)