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

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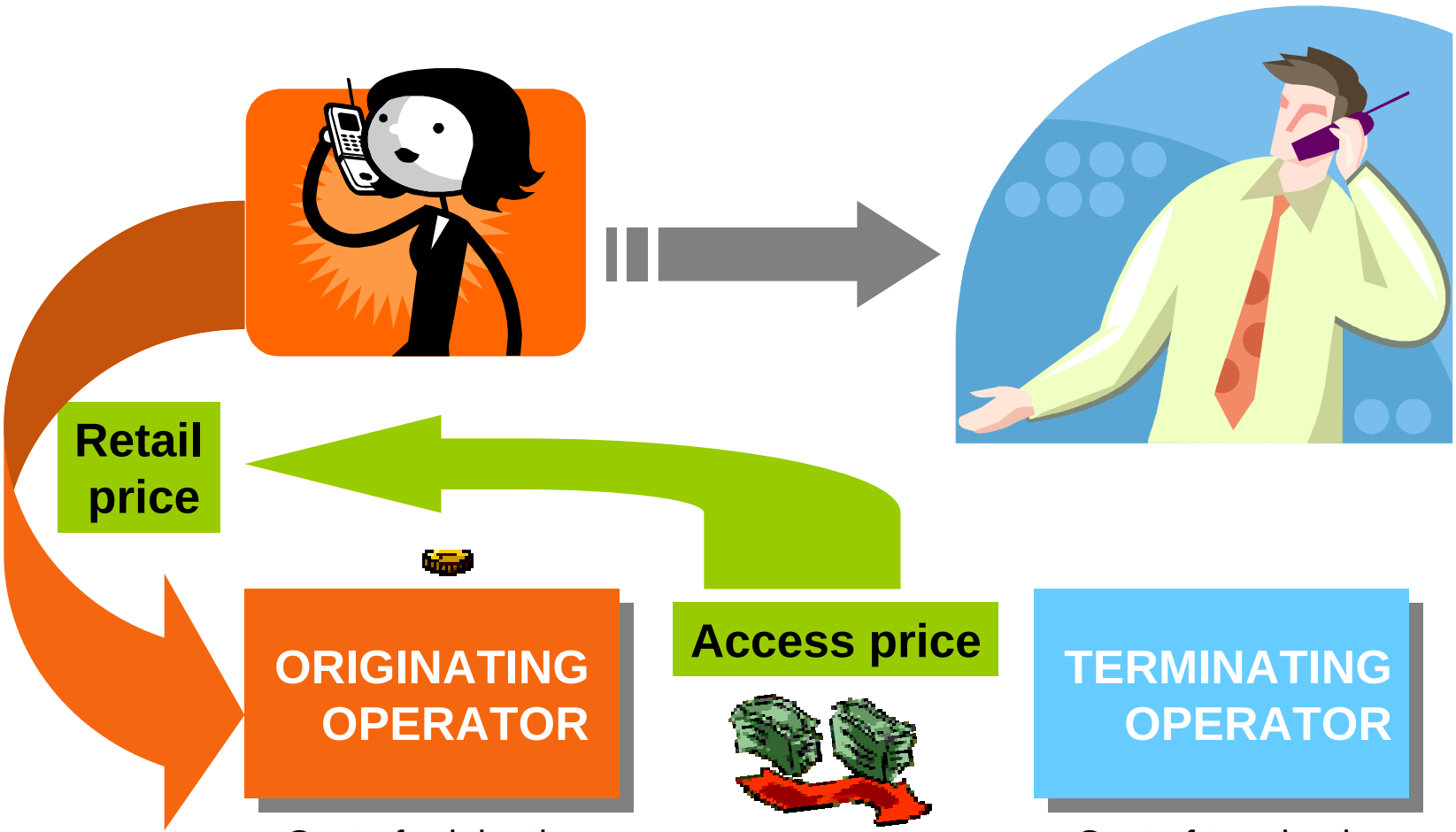
Network competition: access pricing



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:

$$U_1 = V_1 + \mu\varepsilon_1 = \beta_1 v(p_1) + \beta_2 v(\hat{p}_1) - F_1 + \mu\varepsilon_1$$

$$U_2 = V_2 + \mu\varepsilon_2 = \beta_2 v(p_2) + \beta_1 v(\hat{p}_2) - F_2 + \mu\varepsilon_2$$

$$U_0 = V_0 + \mu\varepsilon_0$$

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 $\mu > v(c)/4$.

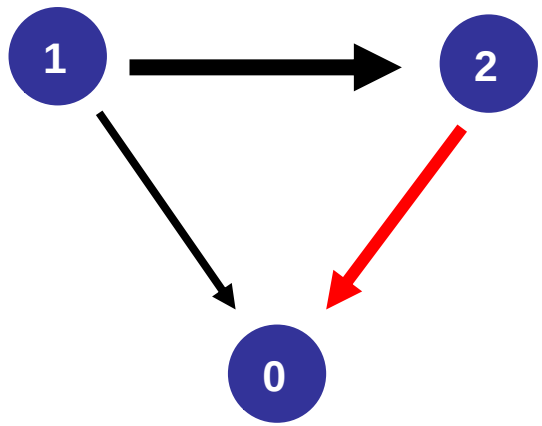
Model: Rational Expectations

An increase in F_1 causes

a decrease in α_1

a decrease in $\alpha_1 + \alpha_2$

an ambiguous effect in α_2



$$\frac{\partial \alpha_2}{\partial F_1} > 0 \Leftrightarrow \Delta = \mu - \alpha_0 v(\hat{p}_2) > 0$$

Net Business Stealing

$$\frac{\partial \alpha_2}{\partial F_1} < 0 \Leftrightarrow \Delta = \mu - \alpha_0 v(\hat{p}_2) < 0$$

Net Network Externality

Fixed Access Charge h

$$R(p) = (p - c)q(p)$$

$$\Pi_i = \alpha_i \underbrace{\left[\alpha_i R(p_i) + \alpha_j R(\hat{p}_i) + F_i - f\right]}_{\text{Retail profit per customer}}$$

$$+ \underbrace{\alpha_i \alpha_j (a - c_T)(q(\hat{p}_j) - q(\hat{p}_i))}_{\text{Net Access Revenue}}$$

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

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

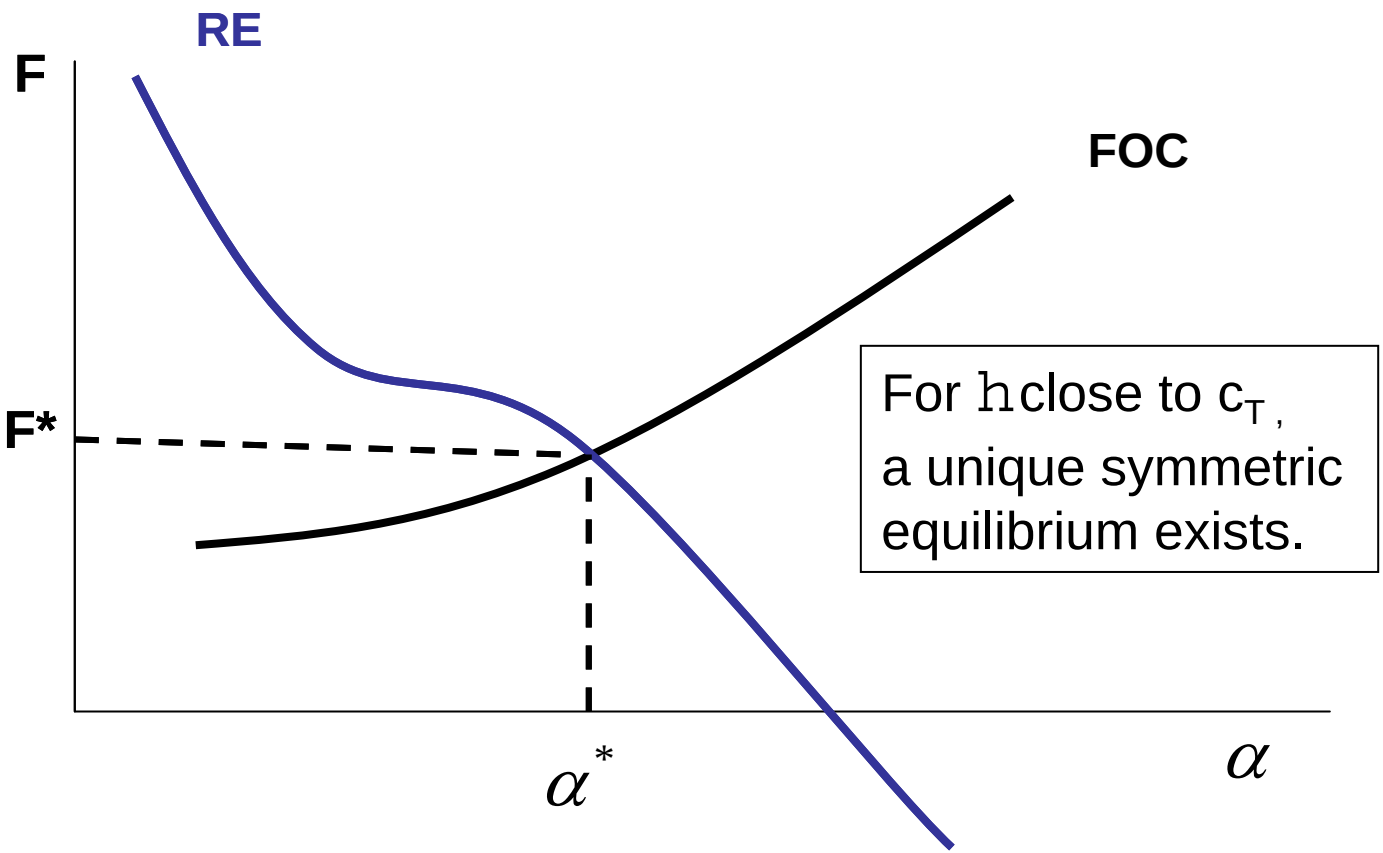
$$\Pi_i = \alpha_i \left[\alpha_j R(\hat{c}) + F_i - f \right]$$

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

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

$$F = F^{RE}(\alpha, a) := \alpha(v + \hat{v}) - V_0 - \mu \ln\left[\frac{\alpha}{1 - 2\alpha} \right]$$

Fixed Access Charge h

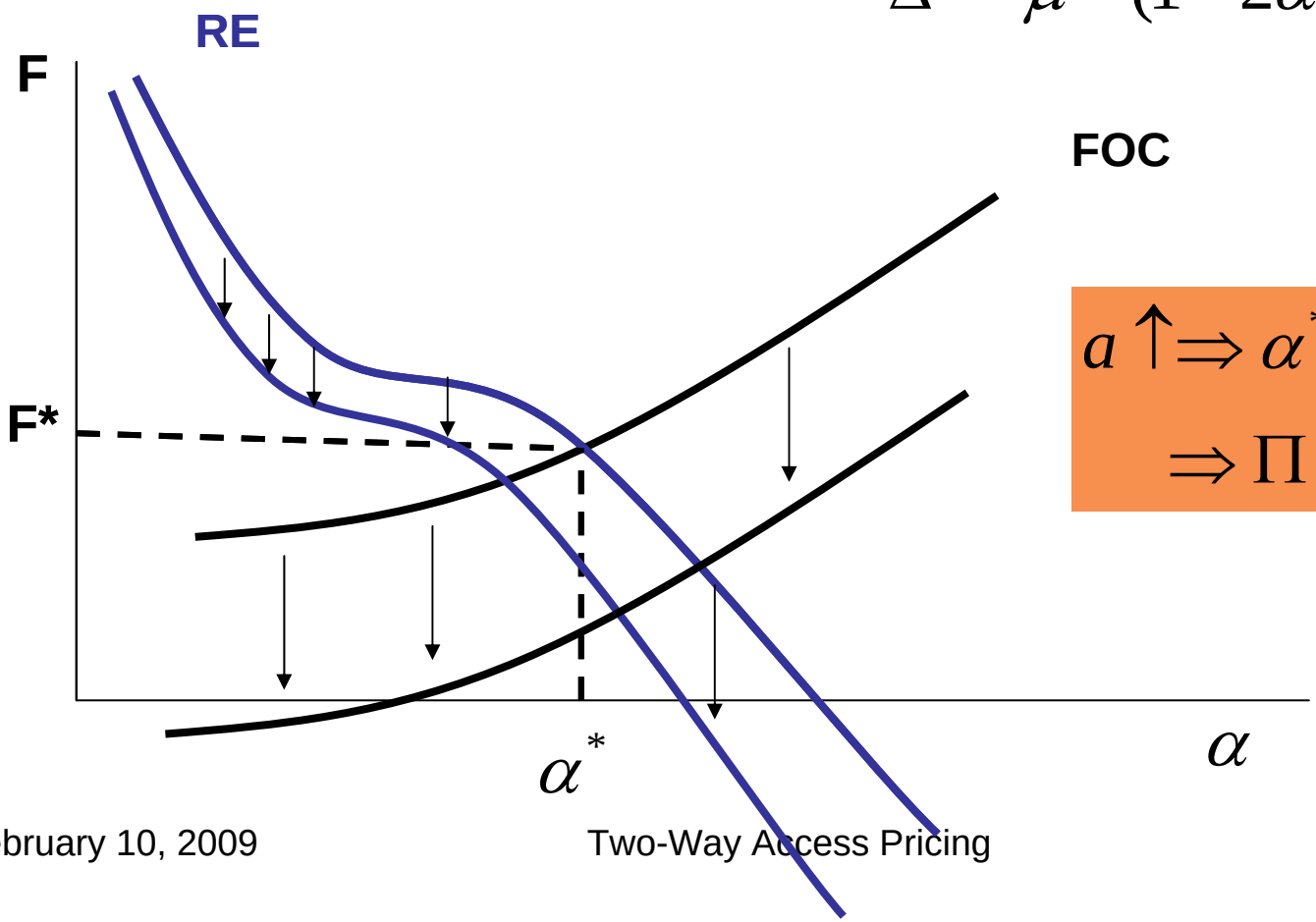


For h close to c_T, a unique symmetric equilibrium exists.

Comparative statics at $h=c_T$

Net Business Stealing Effect

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

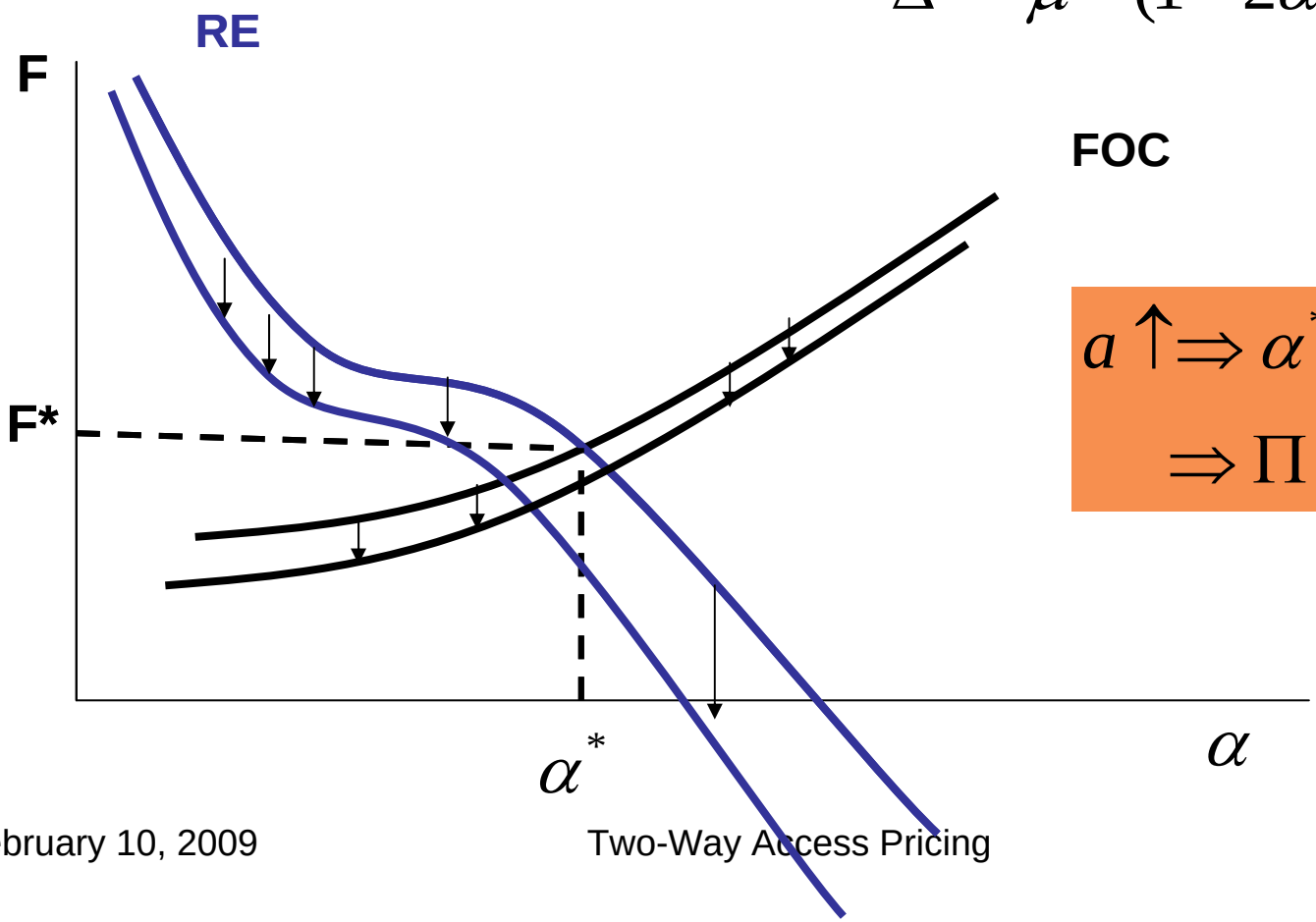


$$a \uparrow \Rightarrow \alpha^* \uparrow$$
$$\Rightarrow \Pi \downarrow, CS \uparrow, TS \uparrow$$

Comparative statics at $h=c_T$

Net Network Externality

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



$$a \uparrow \Rightarrow \alpha^* \downarrow$$
$$\Rightarrow \Pi \downarrow, CS \downarrow, TS \downarrow$$

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:

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

Max. Π_i is equivalent to max $\pi_i(a)$ if k≤1.

Hence, perceived marginal cost pricing:

$$p_i = c, \hat{p}_i = \hat{c},$$

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

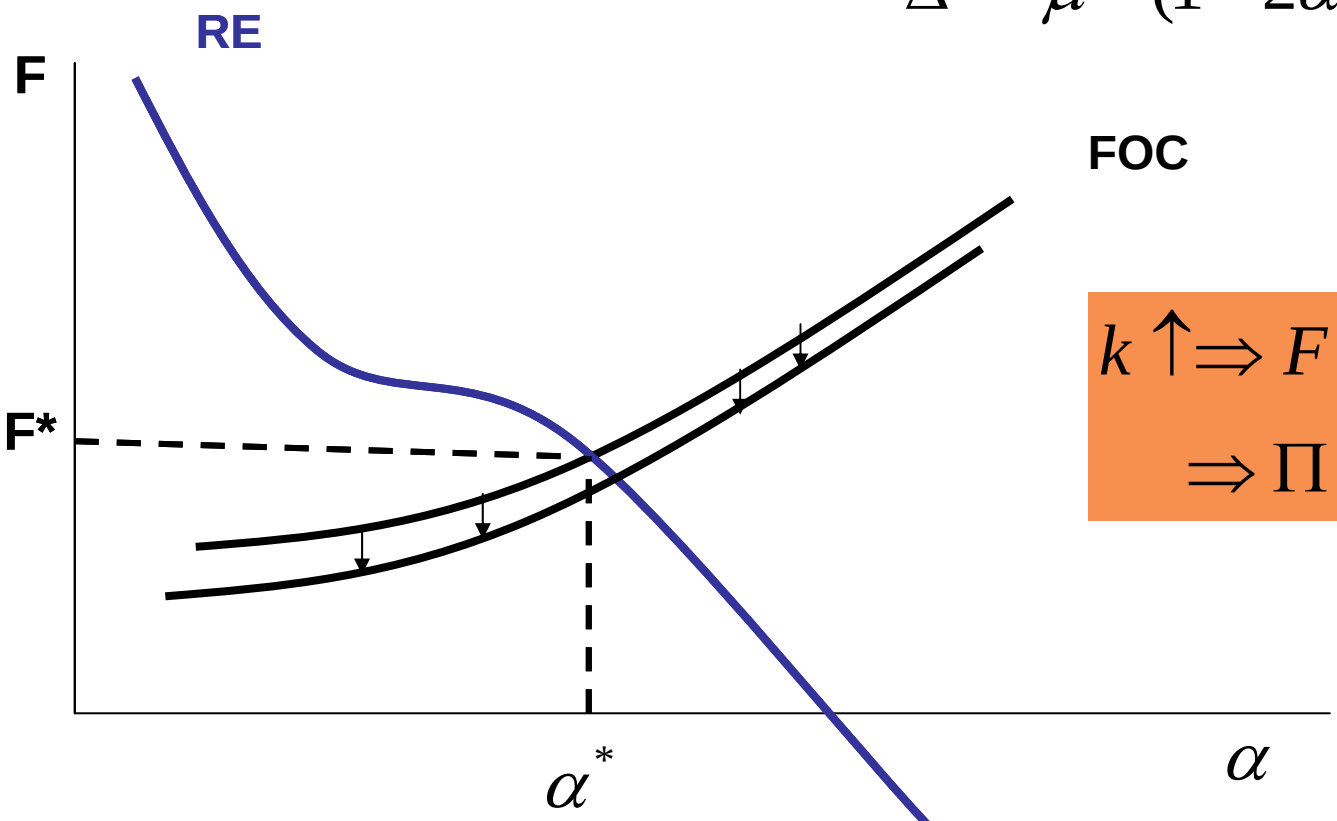
Consider $\lambda(a,k)$ with $a \approx c_T$ and $k \leq 1$

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

Comparative statics

Net Network Externality

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

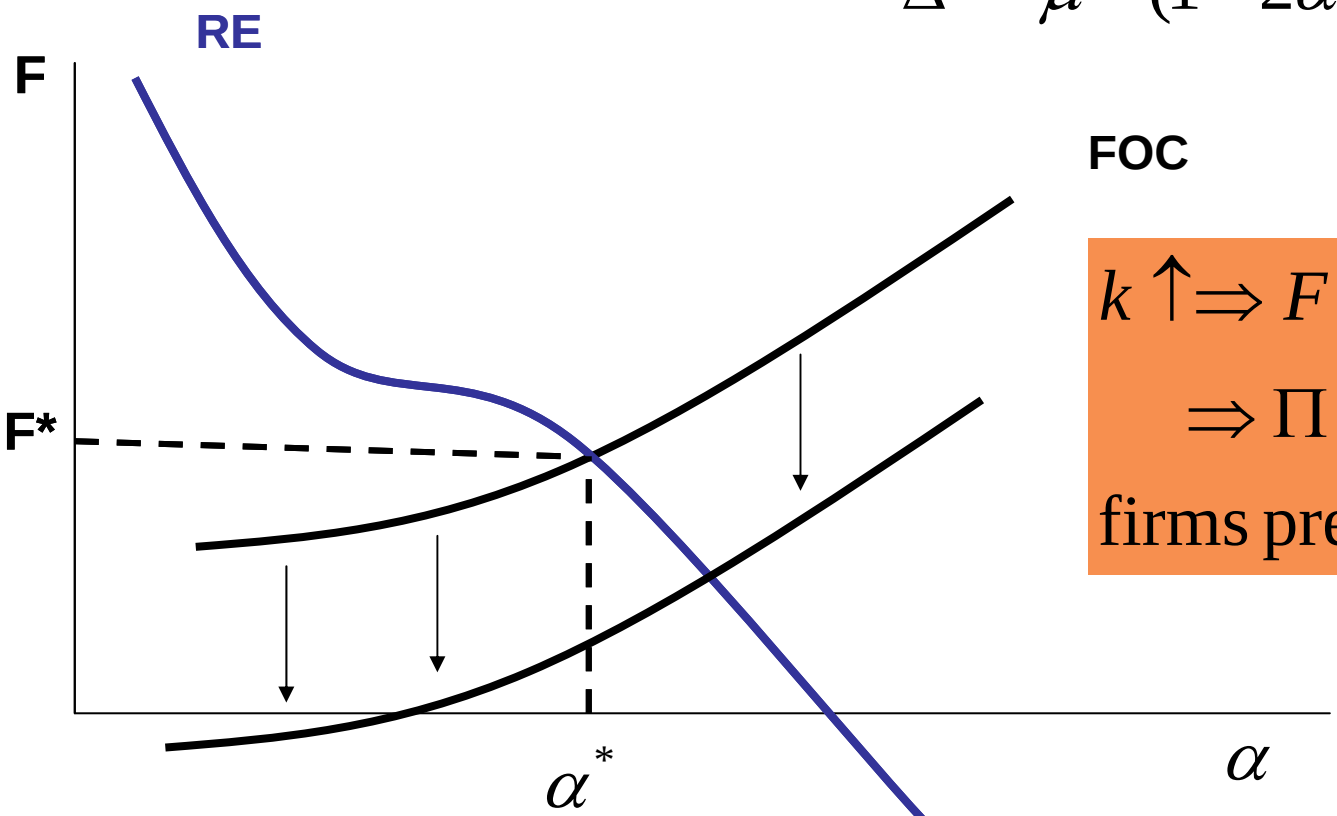


$$k \uparrow \Rightarrow F \downarrow, \alpha^* \uparrow$$
$$\Rightarrow \Pi \uparrow, CS \uparrow, TS \uparrow$$

Comparative statics

Net Business Stealing Effect

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



$$k \uparrow \Rightarrow F \downarrow, \alpha^* \uparrow$$

$$\Rightarrow \Pi \downarrow, CS \uparrow, TS \uparrow$$

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)