# INTERCONNECTION AMONG COMPETITORS AND THE REGULATION OF TELECOMMUNICATIONS

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# I. INTRODUCTION

- ✓ Network externalities can be reaped in two ways:
  - multi-homing (credit cards, software,...),
  - compatibility and interconnection charges (telecoms, Internet,...).

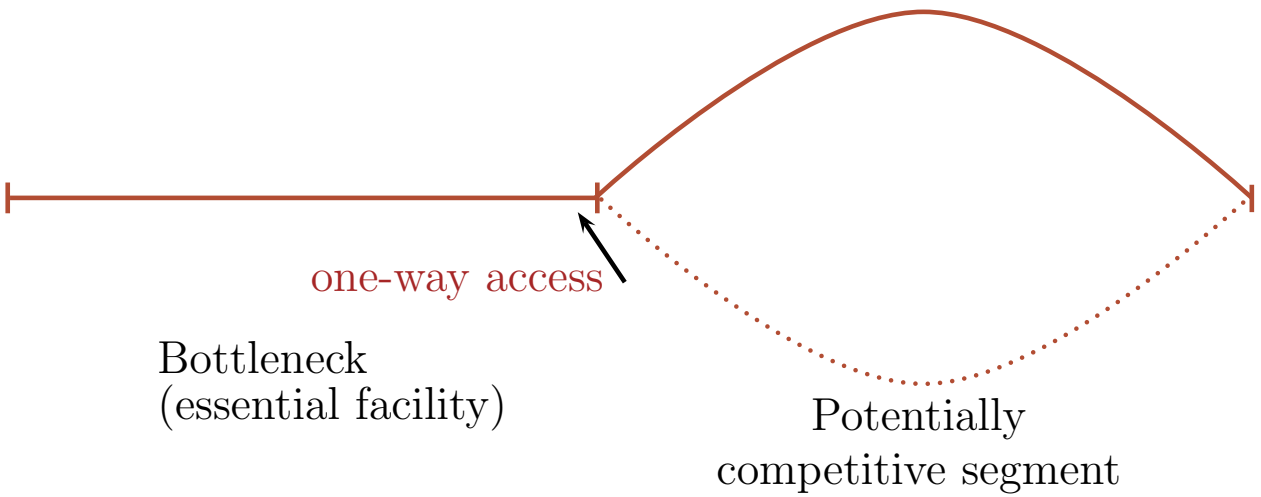
    Beware: mode can be country/epoch dependent (real estate).

- ✓ Cooperation among competitors, increasing returns to scale, network externalities: sources of concern for regulators and antitrust authorities, with particular attention paid to:
  - foreclosure (exclusion of entrants),
  - collusion (among incumbents).

# One- and two-way access

- ✓ 1980s: introduction of competition in long-distance services.

  Problem: local loop was a natural monopoly (duplication involved a high fixed cost).




- ✓ Related: local loop unbundling and resale.

| Industry | Bottleneck | Potentially competitive segment |
|---|---|---|
| Telecommunications | Local loop | Long distance |
| Electricity | Transmission grid | Generation |
| Gas | Pipelines | Generation |
| Rail transportation | Tracks, stations | Passenger and freight services |
| Postal services | Local delivery network | Complementary segments (consolidations, presort bureaux,...) |

✓ Rationales for entry

- differentiated services,
- cost efficiency/superior technologies,
- yardstick for incumbents.

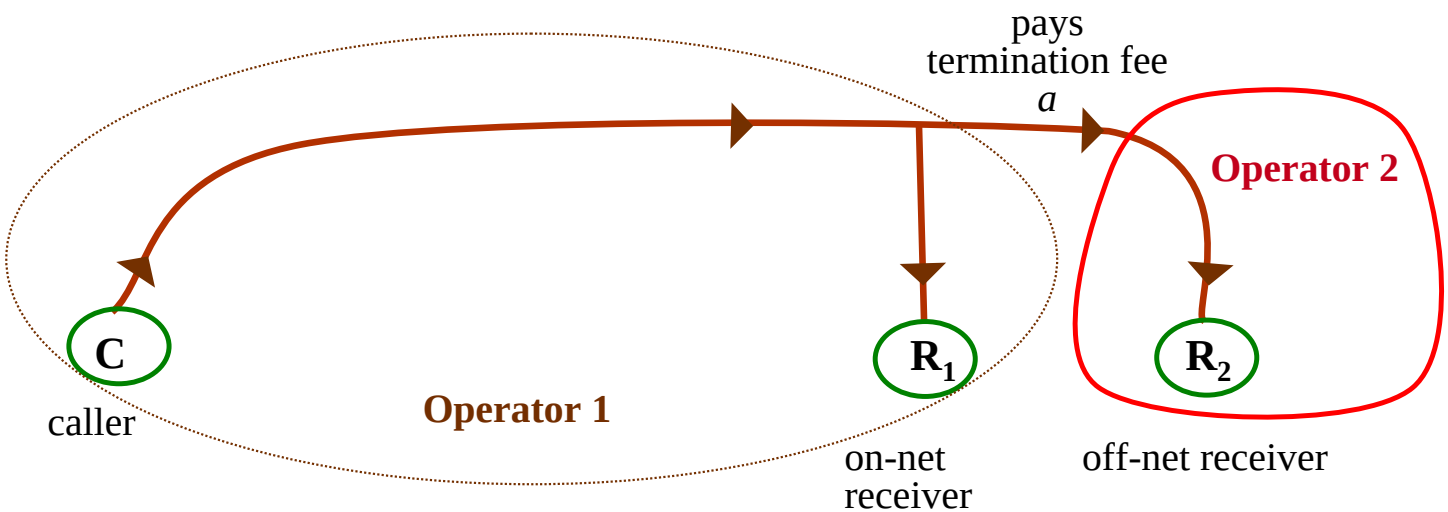
# Challenges for one-way access price setting

- ✓ Get *level* right
  - *too high* ⇒ a) erects barriers to entry by efficient entrants and comforts incumbent in monopoly position,
    b) creates inefficient bypass and duplication of the bottleneck.
  - *too low* ⇒ a) entry by inefficient entrants,
    b) low incentives to build and maintain the bottleneck,
    c) incentives to deny access to rivals through non price methods.
- ✓ Get *structure* right (example of issue: creamskimming)

✓ 1990s: Internet, multiplication of local loops.

Problem of two-way access.

Examples: M2M, F2M, backbone interconnection



# Outline

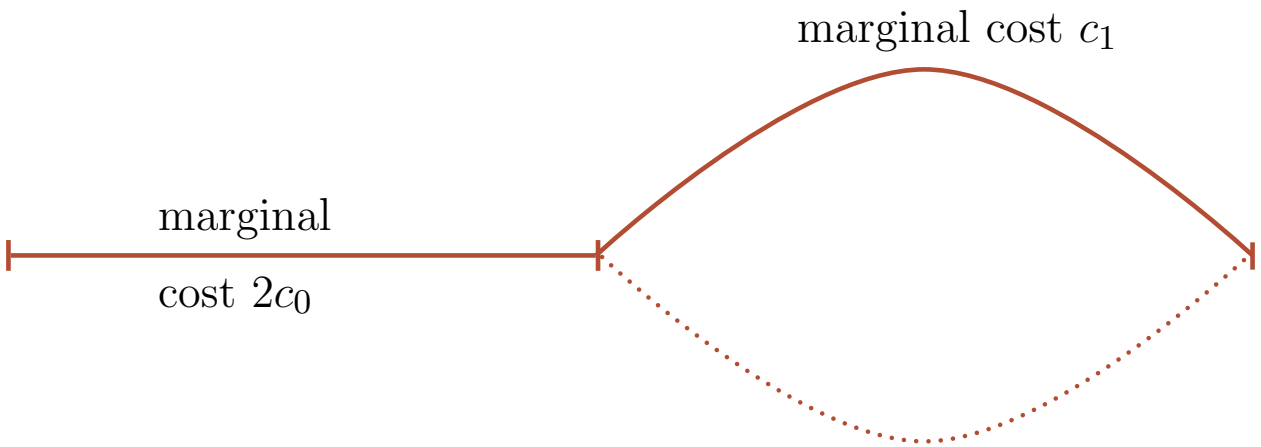
Review broad pricing principles:

- ✓ one-way access,
- ✓ two-way access.

Public policy?

# II. ONE-WAY ACCESS

Plain old long-distance-entry paradigm:




Should access be given at $a = 2c_0$ (marginal cost)?

- ✓ Essential facility/bottleneck's origin = large fixed cost, which must be covered through "taxes" above marginal cost.

  Essence of Ramsey pricing.

# Digression: Ramsey pricing (similar to standard business pricing principles in private sector)

- ✓ Taxes/contributions to fixed-cost recovery:
  - inverse elasticity rule: charge according to what the market can bear

    [example: rate rebalancing]
  - complementarities: lower prices
    substitutabilities: raise prices.
  - downstream market power: lower prices
- ✓ Implementation: price cap!

Concerns about Ramsey pricing:

- redistributive concerns

  [examples: no bypass opportunity; monthly subscriber fees. Discussion of universal service obligations],
- regulatory capture,
- takings

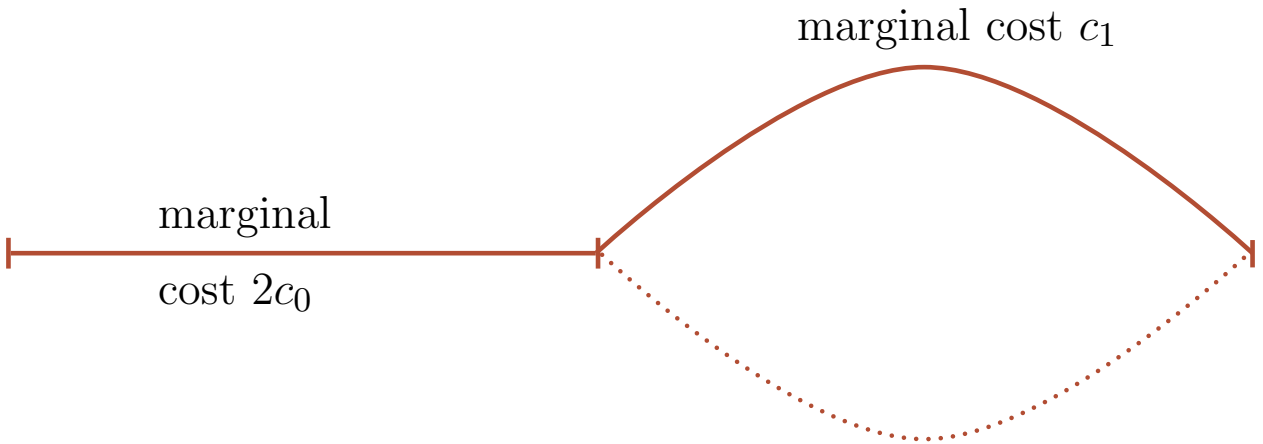
  [non-discrimination rules],
- potential benefits of budget compartmentalization.

Concerns about price caps

- Choice of weights (incomplete information).
- Nonlinear tariffs.
- Tied sales.
- Treatment of new services, upgrades;

  phasing out old services.
- Lack of intertemporal price cap
  - long-term contracts with customers?
  - investments in goodwill (is shadow price constant?)
- Ratchet effect.
- Need for monitoring the provision of a service priced below marginal cost.

# Back to access pricing problem




✓ Vertically integrated incumbent is

- *in long distance market* : sells $q_1$ units ; marginal cost $2c_0 + c_1$, price $p_1$.
- *in other retail market* : e.g. local calls, sells $q_0$ units ; marginal cost $2c_0$, say, price $p_0$.
- *in wholesale market* : if entrants sell $q_2$ units of long distance service, incumbent sells $q_2$ units of access to entrants ; marginal cost $2c_0$, price $a$.

- ✓ Entrants are perfectly competitive, face marginal cost $c_2$

$$\Rightarrow p_2 = a + c_2.$$

  Entrants offer a differentiated service.

- ✓ Incumbent incurs fixed cost $k_0$ of local network. Total cost

$$C = k_0 + (2c_0)q_0 + (2c_0 + c_1)q_1 + (2c_0)q_2.$$

# OPTIMAL (RAMSEY) PRICING

- ✓ Key is to envision "subcontracting" : Incumbent produces two long-distance services:
  - one internally at cost $2c_0 + c_1$
  - one outsourced at cost $2c_0 + c_2$.

  This "make-or-buy" insight denies specificity of wholesale services vis-à-vis retail services.
- ✓ Ramsey prices reflect
  - marginal costs
  - elasticities of demand
  - complementarity/substitutability of services.

Markups on retail services : $p_k > 2c_0 + c_k$.
Since $a = p_2 - c_2$,

$$a > 2c_0$$

*Efficient access prices are not (purely) cost-based.*

Level playing field : no reason to recoup fixed cost solely through a markup on internally supplied services (here long-distance service 1, or local calls).

# RELATIONSHIP TO ECPR (EFFICIENT COMPONENT-PRICING OR BAUMOL-WILLIG RULE)

✓ Rule : access price = incumbent's opportunity cost on competitive segment

$$a = p_1 - c_1$$

$c_1$ = avoided cost
Railroads
Telecommunications

- embraced by New Zealand Supreme Court (1994),
- adopted for local resale by US Telecommunications Act (1996),
- used (in a modified form) by Oftel in UK, but abandonned in 1997.

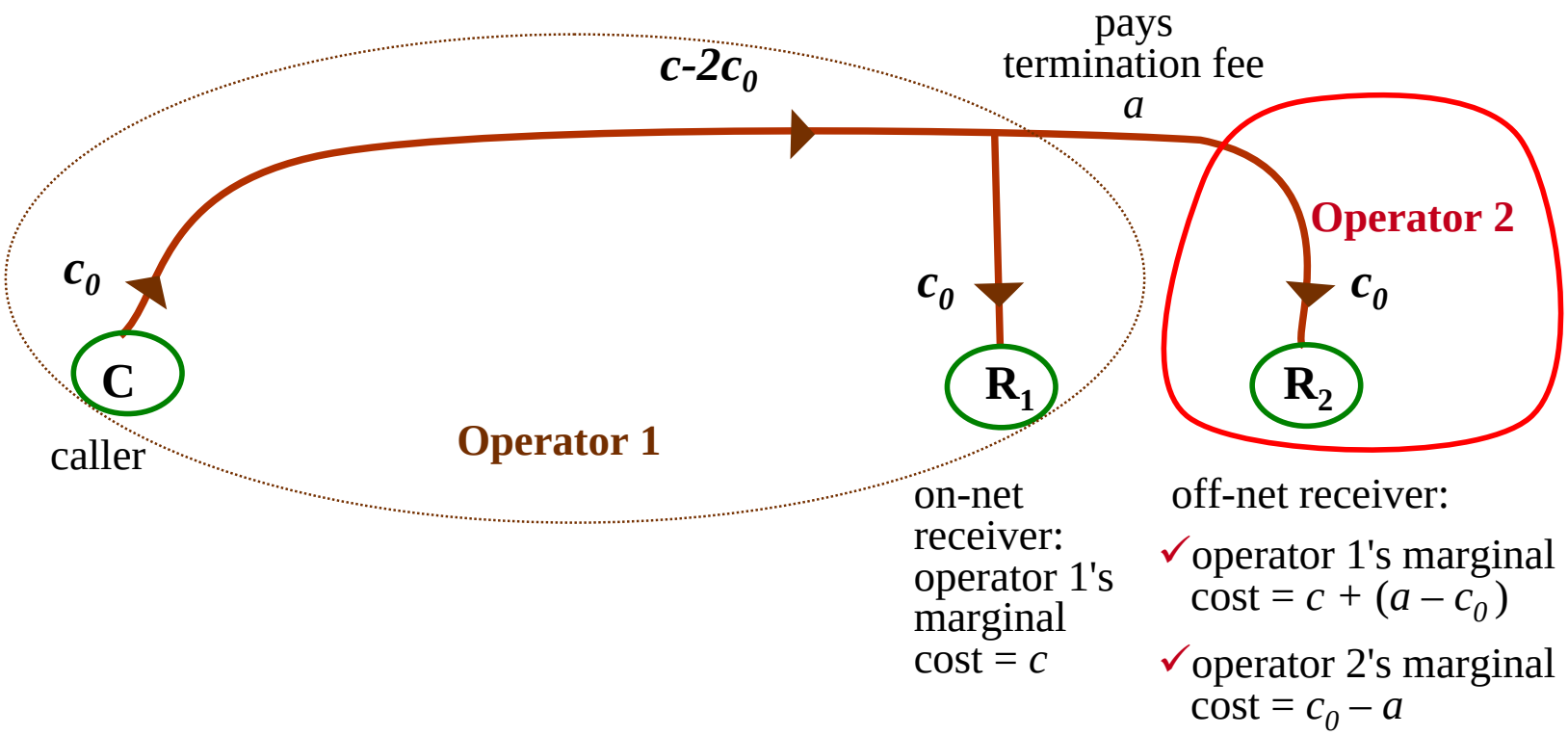
- ✓ Partial rule : criticized for not constraining $p_1$.
- ✓ Implied by Ramsey pricing if *full symmetry*:
  - cost of providing access is identical,
  - entrants have no market power,
  - symmetrical demands in competitive segment,
  - same cost in competitive segment ($c_1 = c_2$).

  Proof : $a = p_2 - c_2$ together with $p_1 = p_2, c_1 = c_2$
  $\Rightarrow a = p_1 - c_1$ !

## Forward-looking long-run incremental cost

- ✓ Benefit: high-powered incentive scheme.
- ✓ Concerns:
  - complexity
    [cost of equipment depends on demographics, offerings,...; forecast of usage; economic depreciation,...]
  - not in phase with theoretical benchmark
  - (related) marginal cost pricing creates incentive for non-price exclusion
    [heavy-handed regulation?]
- ✓ Alternative: global price cap (including wholesale activities).

# III. TWO-WAY ACCESS




- ✓ Different ways of fixing $a$: (i) entire freedom for each network; (ii) negotiation; (iii) regulation.
- ✓ FCC order (August 1996): LRIC ($a = c_0$), symmetrical, nondiscrimination.

## (1) Non-cooperative termination charge setting is a bad idea

- for society,
- but also for the industry.

[Yet it is common.]

✓ *Among equals*: double marginalization problem ($a \gg c_0$).

- Termination is
  - an input into the production of calls,
  - monopolistically supplied even in a very competitive telecom industry.
- If operators do not compete (national monopolies/international calls in old times): two monopoly markups: prices even higher than monopoly markups.
- If they compete: can tax rival.

✓ *Foreclosure*: incumbent may make it hard for an entrant to enter.

(2) Negotiated termination charges:

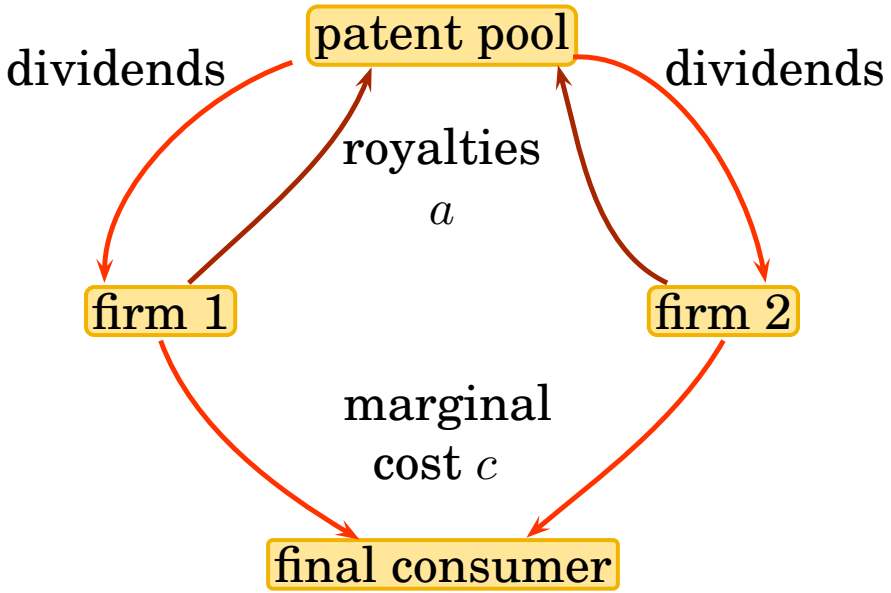
Is the regulatory concern about collusion warranted?

Consider the following analogy:

- ✓ Two IP owners, each with one patent. Patents have same functionality / allow production of the same good downstream.

  Initially: cutthroat competition in downstream market.

- ✓ Formation of patent pool (transfer patents to pool).




Marginal cost $= c + \frac{a}{2}$

$\Longrightarrow$ can induce monopoly price downstream despite perfect competition ($a$ such that $p^{\text{monopoly}} = c + \frac{a}{2}$).

✓ Is this a good analogy?

Analysis: assume (for the moment)

- reciprocal termination fee $a$,
- no off-net / off-net price discrimination,
- no receiver benefits / payments (CPP).

✓ Collusion intuition [Armstrong 1998, Laffont-Rey-Tirole 1998a]

- If half of the calls are off net, operators' marginal cost per call is $c + \frac{a - c_0}{2}$.
- Hence if linear pricing, "raising-each-other's cost" strategy raises price to consumer.

Note: in equilibrium no transfer between operators.
"Termination charges do not matter if no or small inter-operator transfers" is a fallacy.

✓ Yet analogy and standard regulatory concerns need to be revisited

[Laffont-Rey-Tirole 1998a.]

(a) *Instability of competition* (if $a \gg c_0$/ close substitutes) unlike in case of patent pool, can avoid paying tax to rival (capture market).

(b) *Displacement of competitive locus*
Highly profitable consumers $\Longrightarrow$ competition intense in other dimensions (monthly subscription charges or connection fees, handset subsidies).

(c) *Ability to affect price level depends on CPP* (see below discussion of RPP: Intuitively, when $a$ increases, the reduction in the net cost of termination, $c_0 - a$, leads to a reduction in reception charges under RPP).

(d) *Asymmetric calling patterns*
Increase in $a$: little (big) incentive to attract callers (receivers).

## Concerns about foreclosure are also weaker (under reciprocal access charges)

- Intuitively, if each consumer has calling volume $V$, $N_1$ and $N_2$ are the number of operator 1 and 2's customers, then net off-net revenue =

$$\left(N_1 N_2 V - N_2 N_1 V\right)\left(a - c_0\right) = 0.$$

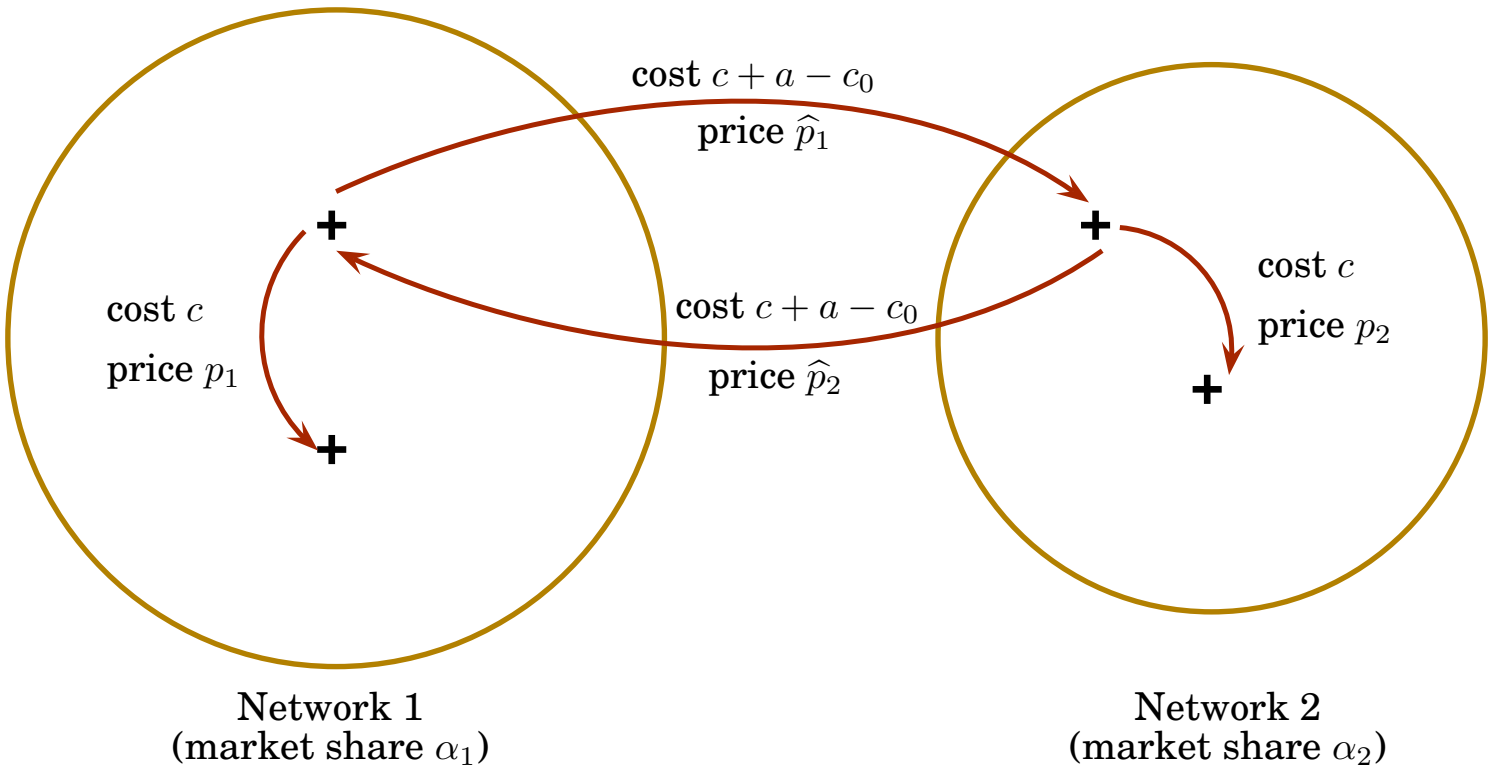
- Of course volumes / types of customers are endogenous (and may be asymmetric*), but this reasoning sets a benchmark.

* E.g., Carter-Wright (2003).

# On net/ off net price discrimination

[Laffont-Rey-Tirole 1998b]

Price $p_i$ for on net calls
Price $\widehat{p}_i$ for off net calls



## Tariff-mediated network externalities

- ✓ If $a > c_0$ , $\widehat{p}_i > p_i$,
- ✓ If $a$ large, then networks are de facto incompatible and equilibrium may fail to exist.
- ✓ Concern about foreclosure if asymmetric networks.
- ✓ [Gans-King 2001, Calzada-Valetti 2005]

  Cooperative determination of the termination fee: $a < c_0$ (discount). Then customers wish to belong to small network $\Longrightarrow$ price competition is muted.

  Bill and keep may be bad for consumers (high fixed charges), who prefer cost-based termination charges.

## Receiver pay principle [Jeon-Laffont-Tirole 2004]

[ See also Laffont-Marcus-Rey-Tirole 2003]

Suppose $\begin{cases} \text{caller's utility is } u(q) \ (q \text{ length of call}) \\ \text{receiver's utility is } \beta u(q). \end{cases}$

$p^C\left(p^R\right)$ = per minute caller (receiver) charge.

✓ Social optimum (same for monopoly operator):

Samuelson rule for public goods: $p^C + p^R = c$

Efficient allocation between the two sides: $p^R = \beta p^C$

## ✓ Platform competition

- Off-net-cost pricing rule: in equilibrium, traffic is priced *as if* it were entirely off-net:

$$p^C = c + (a - c_0)$$
$$p^R = c_0 - a$$

[Note: satisfies Samuelson rule.]

- $\Longrightarrow$ socially optimal termination charge:

$$a = c_0 - \frac{\beta c}{1+\beta}$$

[Cost-based termination charge has caller bear entire burden]

- Random utilities $(u^C(q,\omega),\ u^R(q,\omega))$

$p^C + p^R < c$ at the social optimum.

## On/ off net price discrimination

[Jeon-Laffont-Tirole 2004]

Competition among operators may easily lead to de facto lack of network connectivity.

High off net caller prices hurt receivers on other networks. High off net receiver prices hurt callers on other networks.

# IV. MANY OTHER ISSUES...

(1) F2M

- ✓ One justification for termination premia if subscription elasticity for mobile greater than that for fixed (new mobile subscribers create positive externalities on fixed line subscribers.)
- ✓ Bypass:
  - "hérissons",
  - fixed/ mobile substitution and convergence.

(2) Competition in termination
[e.g., two SIM cards].

(3) Unbundling.

(4) Net neutrality.

## Overall message

- ✓ Access/ termination charges are an important determinant of
  - entry,
  - competition among incumbents,
  - allocative efficiency and utilization of telecom networks.
- ✓ Economic problems arise more generally, and in various guises, in many other industries ("multi-sided markets").