Wholesale Markets in the Telecommunications Industry

M. Bourreau[1] J. Hombert[2] J. Pouyet[3] N. Schutz[2]

[1]ENST/SES & CREST-LEI

[2]Paris Jourdan Sciences Economiques

[3]Ecole Polytechnique & CEPR

Introduction

Two types of competitors in the telecommunications industry: *"facility-based"* firms and *"service-based"* firms.

Facility-based or vertically-integrated firms invest in proprietary networks to provide services to end-users.

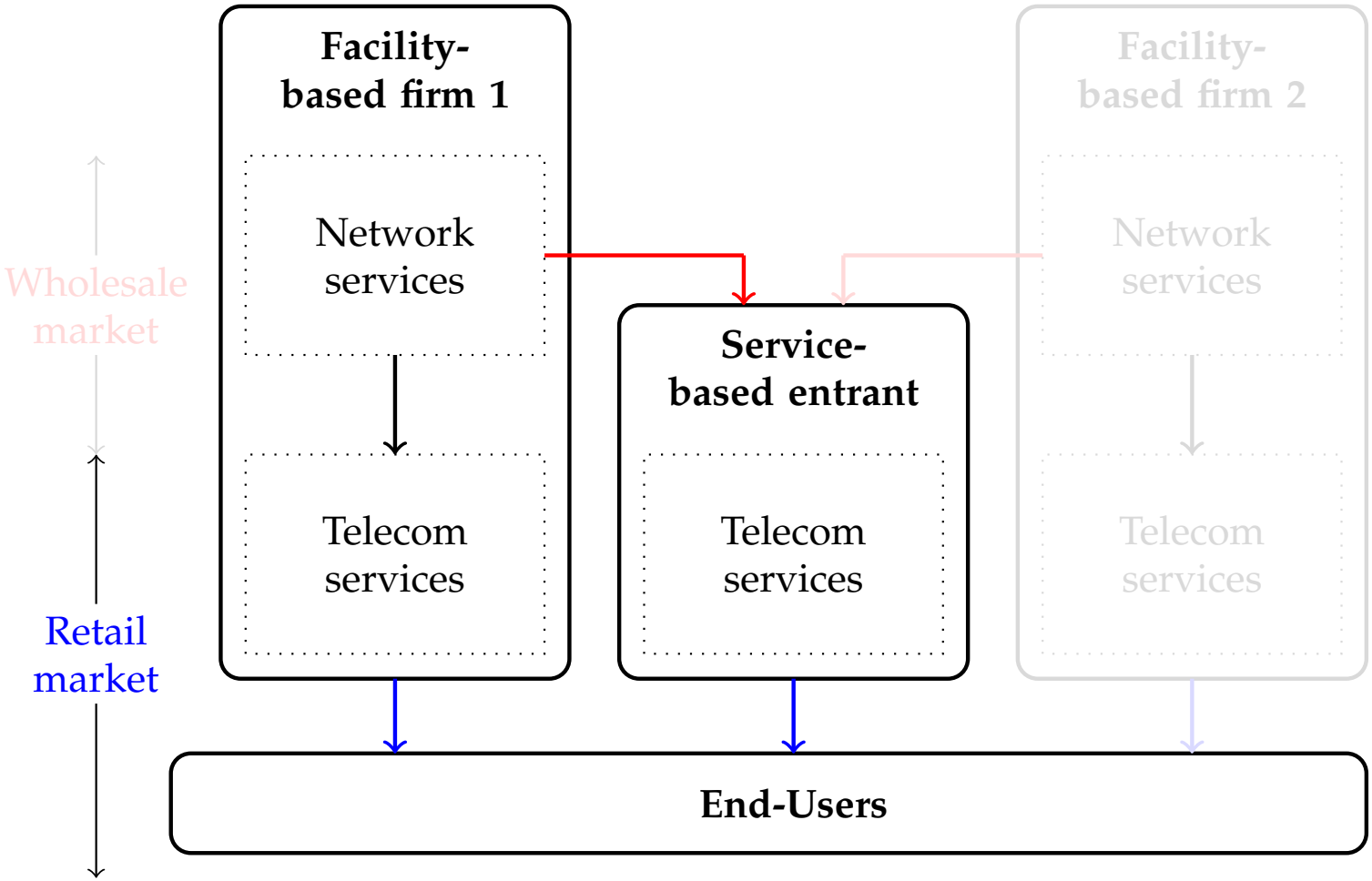
Service-based or pure downstream firms don't invest.

All types of firms compete on the downstream market.

Facility-based firms can provide intermediate services to service-based firms: Wholesale markets in telecoms.

Introduction

Wholesale and retail markets with vertically-integrated and pure downstream firms.



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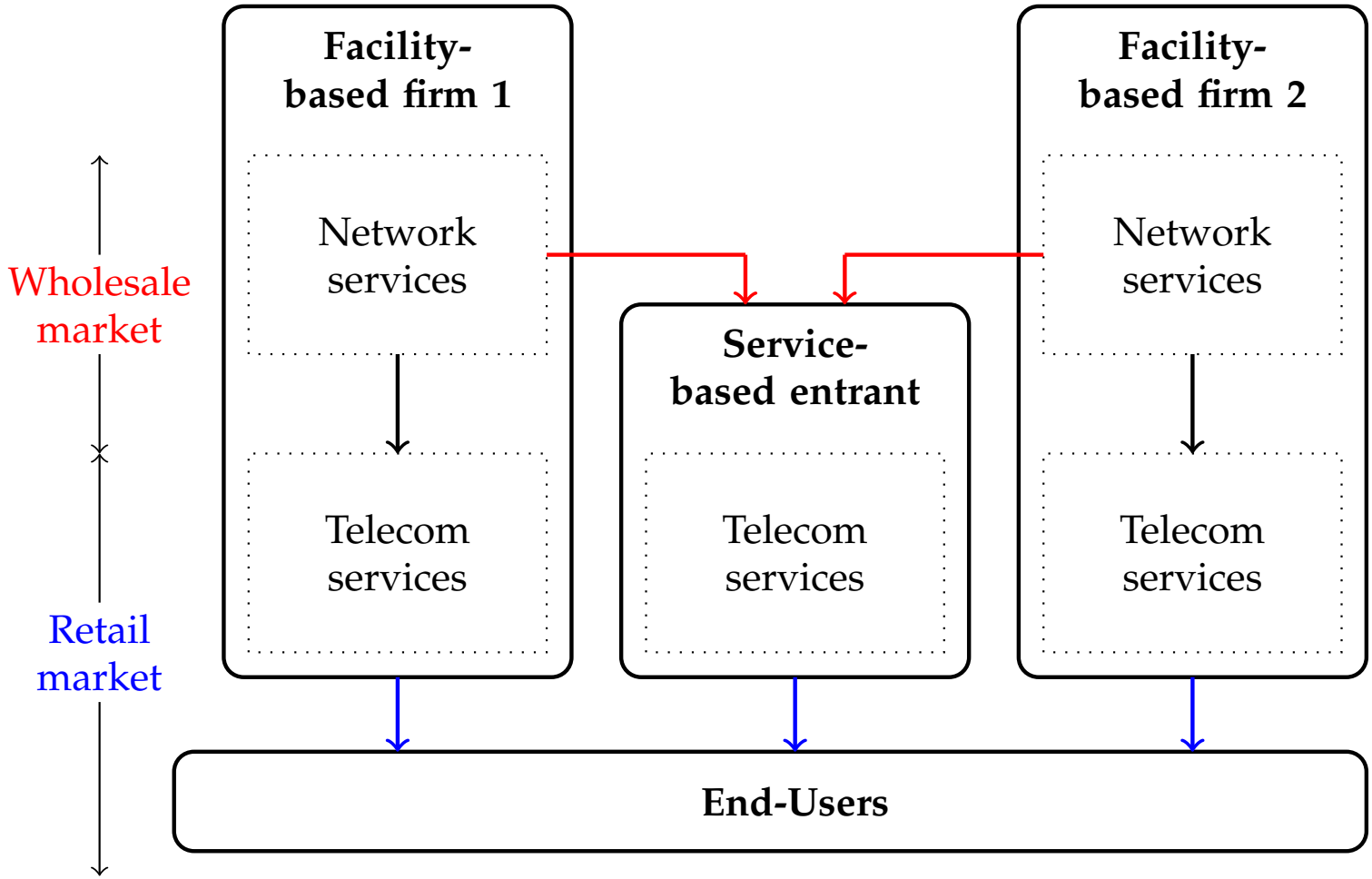

Introduction

Examples:

- Mobile market: mobile network operators (vertically-integrated firms) provide wholesale services to mobile virtual network operators (pure upstream firms). MNOs and MVNOs offer mobile services to end users.

- Broadband market: ILECs and/or facility-based CLECs provide bitstream access services to service-based (pure upstream) competitors. ILECs and facility- and service-based CLECs offer broadband services.

Introduction

The presence of pure downstream firms intensifies competition on the retail market... provided that the wholesale market is competitive.

Questions:

- Will the upstream market be competitive?
- Is regulation needed to ensure that wholesale markets are competitive?
- Nature of the strategic relationships b/w wholesale and retail markets?

The goal of our analysis is to provide some answers to these questions.

Outline

A model of upstream-downstream competition: Integrated firms compete on the upstream market to offer an intermediate input to pure downstream firms. All firms compete on the downstream market.

Our goal: Analysis of the competitiveness of upstream markets.

Main result: Even under the a priori 'most favorable' conditions, the upstream market might not always be 'perfectly competitive'.

Implications: Competition policy and regulation for vertically-linked markets, links with the literature.

Related Literature

Competition in telecommunications:

- One-way access pricing: Competition b/w one facility-based and one or more service-based operators [eg, Foros (2004), Bourreau-Doğan (2005) for broadband]. → Monopolistic wholesale markets by construction
- Competition b/w facility-based firms and two-way access pricing [Laffont-Rey-Tirole (1998) for mobile industry]. → No wholesale market by construction
- Ordover-Shaffer (2007), Brito-Pereira (2006), Höffler and Schmidt (2008), Arya, Mittendorf and Sappington (2008)

Theories of foreclosure:

- 'Traditional theory' (60s): Integrated firms have incentives to raise their downstream rivals' cost through the upstream prices.
- 'Chicago school': vertical integration does not annihilate the competitive pressure on the upstream market.
- 'Reconciliation' of both views! Links w/ recent work on vertical mergers: Ordover-Saloner-Salop (1990), Hart-Tirole (1990), Chen (2001), etc.

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Model: Firms

Two types of firms:

- Two vertically integrated firms (1 and 2), composed of:
  - an upstream unit, which produces an intermediate input at a constant unit cost of c_u;
  - a downstream unit, which uses the intermediate input on a one-to-one basis to produce the final good at a cost of $c(.)$.
- One pure downstream firm (d), which must purchase the intermediate input from one of the integrated firms. Firm d produces the final good at cost $c(.)$.

Model: Downstream Market

Price competition with product differentiation:

- p_k is the final price of firm $k \in \{1, 2, d\}$.
- $D_k(p_1, p_2, p_d)$ is firm k's demand, with $\partial D_k/\partial p_k < 0$ and $\partial D_k/\partial p_{k'} > 0$.
- Demands are symmetric: $D_1(p_1, p_2, p_d) = D_2(p_2, p_1, p_d)$ and $D_d(p_1, p_2, p_d) = D_d(p_2, p_1, p_d) \rightarrow$ Integrated firms are symmetric.

Remark: No assumption on the strategic interaction b/w downstream prices.

Model: Upstream Market

Price competition with homogenous products:

- a_i is the unit wholesale price set by vertically-integrated firm $i \in \{1, 2\}$.
- No differentiation b/w upstream products.

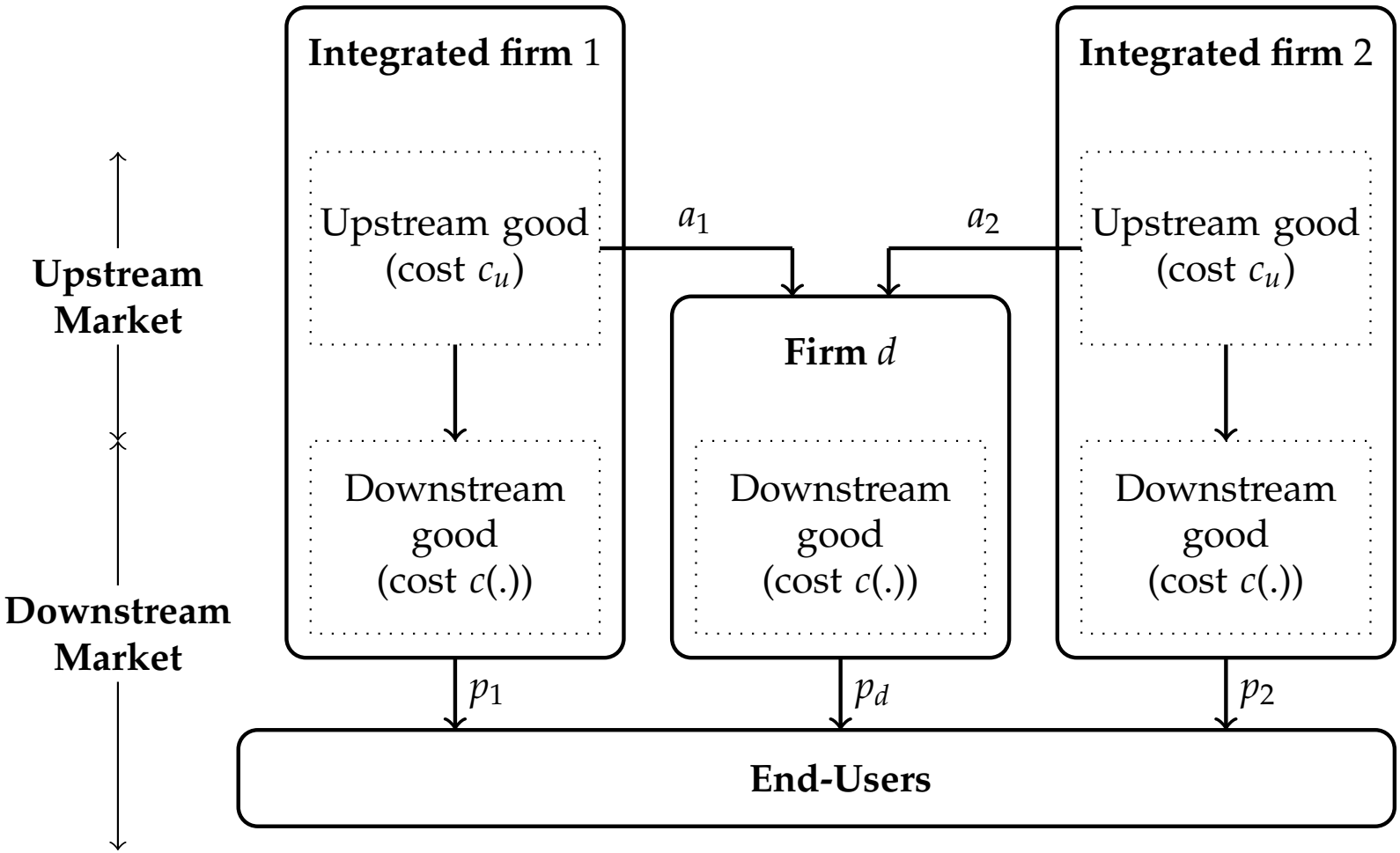
Remark: Best environment for tough competition on the wholesale market.

Model: Timing

1. Upstream competition: Vertically integrated firms 1 and 2 set simultaneously their upstream offers (a_1, a_2). The pure downstream firm elects its upstream supplier.
2. Downstream competition: All firms 1, 2 and d set simultaneously their downstream prices (p_1, p_2, p_d).

Model: Summary

Structure of the model.



Downstream Equilibrium

Firm d has chosen firm $i \neq j \in \{1,2\}$ as its upstream supplier.

Profits:

$$\tilde{\pi}_i^{(i)}(p, a_i) = \overbrace{(p_i - c_u)D_i(p) - c(D_i(p))}^{\text{Downstream Profit}} + \overbrace{(a_i - c_u)D_d(p)}^{\text{Upstream Profit}},$$

$$\tilde{\pi}_j^{(i)}(p) = (p_j - c_u)D_j(p) - c(D_j(p)),$$

$$\tilde{\pi}_d^{(i)}(p, a_i) = (p_d - a_i)D_d(p) - c_d(D_d(p)).$$

Assumption: For $k \in \{1,2,d\}$, the best-response in downstream prices $BR_k^{(i)}$ is uniquely defined, bounded and satisfies $|\partial BR_k^{(i)}/\partial p_{k'}| < 1$.

At the subgame equilibrium:

- Prices $p_k^{(i)}(a_i)$.
- Profits $\pi_k^{(i)}(a_i) \equiv \tilde{\pi}_k^{(i)}(p^{(i)}(a_i), a_i)$.

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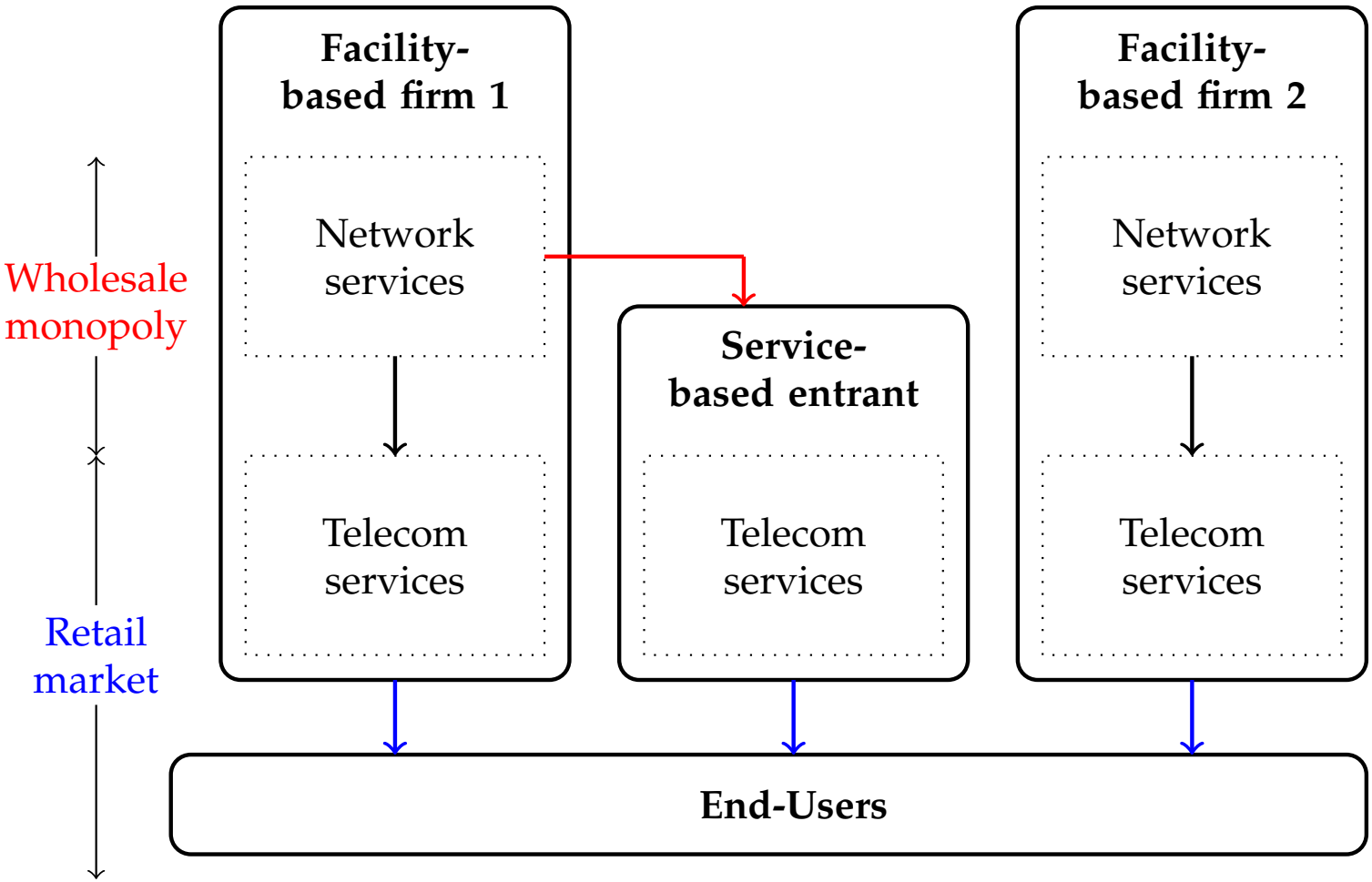
Pure Downstream Firm's Decision

The pure downstream firm prefers buying the upstream good on the upstream market rather than exiting iff:

$$\underbrace{\max_{i\in\{1,2\}} \pi_d^{(i)}(a_i)}_{d \text{ uses the upstream market}} \geq 0.$$

Benchmark: Exogenous Monopoly Outcome



Benchmark: Exogenous Monopoly Outcome

Define the upstream price that would be set by firm i if the upstream market were exogenously monopolized:

$$a_m \in \arg\max_{a_i} \pi_i^{(i)}(a_i) \text{ s.t. } \pi_d^{(i)}(a_i) \geq 0.$$

Assumption: $a_m > c_u$ and $\pi_d^{(i)}(a_m) > 0$.

Remarks:

- Complete vs. partial foreclosure: trade-off b/w lessening of competition by elimination of one rival and upstream profits (and how the industry is affected by the exit of one competitor).
- Focus on partial foreclosure: possibility of bypass of the upstream market, regulation, etc.

Upstream Equilibrium

On the upstream market, vertically-integrated firms compete in prices w/ homogenous products.

Does the usual Bertrand logic apply in our game? That is, if firm i offers an upstream price a_i to the pure downstream firm, does firm j have an incentive to undercut firm i on the upstream market?

→ Comparison of the profit of the vertically-integrated firm i which supplies the upstream market and the profit of vertically-integrated firm j which remains inactive on the upstream market.

Upstream Equilibrium: Incentives to Undercut

Lemma (Softening Effect)

If firm i supplies the upstream market at price $a_i > c_u$, then it charges a larger downstream price than its integrated rival j:

$$p_i^{(i)}(a_i) > p_j^{(i)}(a_i).$$

Intuition: The integrated firm which supplies the upstream market has an incentive to raise its downstream price to preserve its upstream revenues:

$$\begin{aligned}
\frac{\partial \tilde{\pi}_i^{(i)}}{\partial p_i}(p, a_i) &= D_i + (p_i - c'(D_i) - c_u)\frac{\partial D_i}{\partial p_i} + \overbrace{(a_i - c_u)\frac{\partial D_d}{\partial p_i}}^{>0} = 0, \\
\frac{\partial \tilde{\pi}_j^{(i)}}{\partial p_j}(p) &= D_j + (p_j - c'(D_j) - c_u)\frac{\partial D_j}{\partial p_j} + 0 = 0.
\end{aligned}$$

Upstream Equilibrium: Incentives to Undercut

Lemma (Comparison of downstream profits)

If the upstream market is supplied by integrated firm i at an upstream price $a_i > c_u$, then integrated firm j earns strictly larger downstream profits than firm i:

$$\overbrace{\left[p_i^{(i)}(a_i) - c_u\right] D_i(p^{(i)}(a_i)) - c\left(D_i(p^{(i)}(a_i))\right)}^{\text{Downstream profit of the upstream supplier } i} < \underbrace{\left[p_j^{(i)}(a_i) - c_u\right] D_j(p^{(i)}(a_i)) - c\left(D_j(p^{(i)}(a_i))\right)}_{\text{Downstream profit of integrated firm } j \text{ inactive on the upstream market}}$$

Upstream Equilibrium: Incentives to Undercut

Consequence: The comparison of total profit b/w the integrated firm which supplies the upstream market (downstream + upstream profits) and the integrated firm which does not (downstream profit only) is ambiguous:

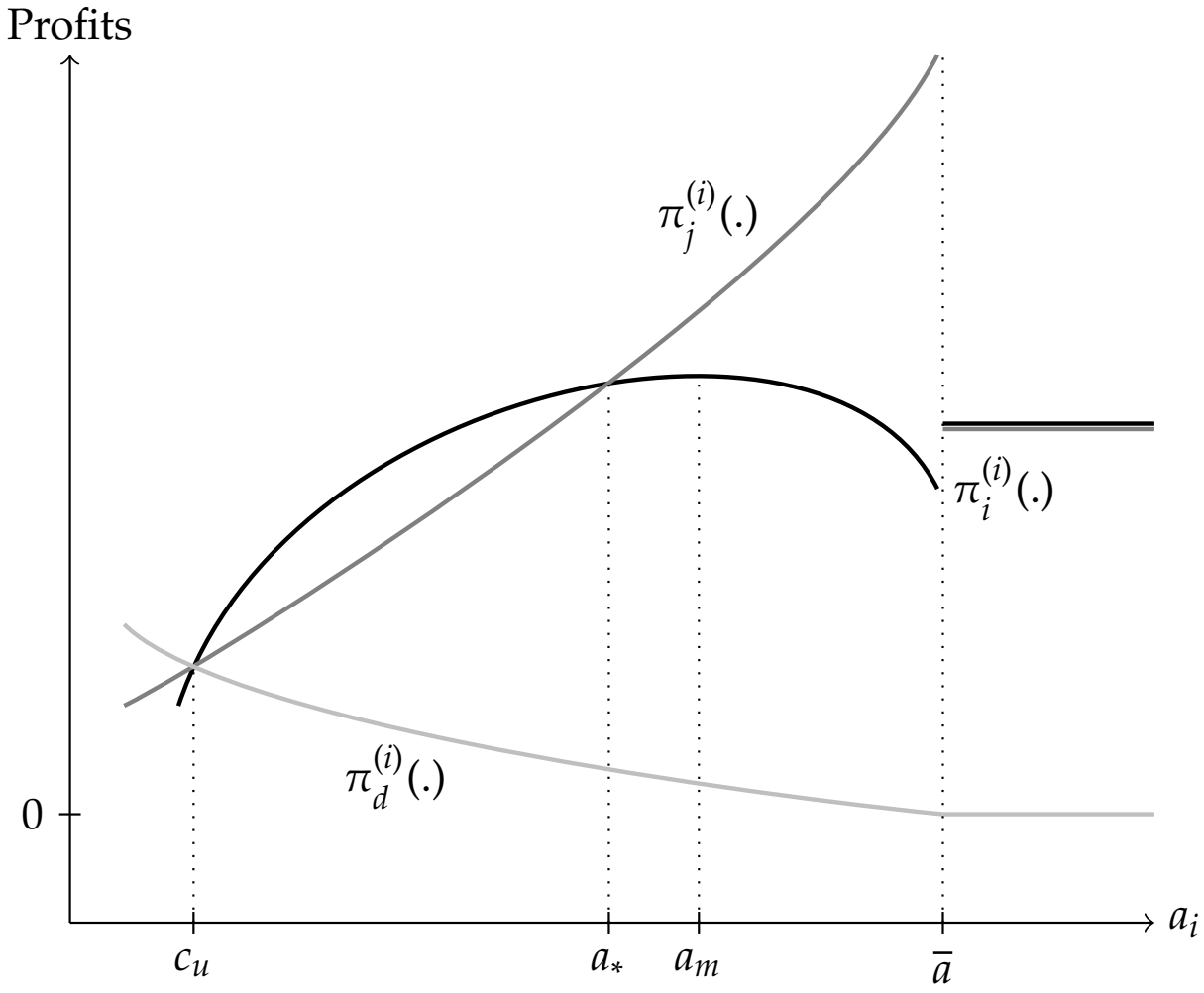
$$\overbrace{\left[p_i^{(i)}(a_i) - c_u\right] D_i(p^{(i)}(a_i)) - c\left(D_i(p^{(i)}(a_i))\right) + \left[a_i - c_u\right] D_d(p^{(i)}(a_i))}^{\text{Total profit of the upstream supplier } i}$$

$$\gtrless \quad \underbrace{\left[p_j^{(i)}(a_i) - c_u\right] D_j(p^{(i)}(a_i)) - c\left(D_j(p^{(i)}(a_i))\right) + 0}_{\text{Total profit of integrated firm } j \text{ inactive on the upstream market}}$$

$\rightarrow$ Potential failure of competitive forces on the upstream market.

Downstream vs. Upstream Competitiveness

Illustration 1: Linear demands $D_k(p) = 1 - p_k - \gamma(p_k - \bar{p})$ with zero costs.



Condition: Strong downstream substitutability ($\gamma \geq \gamma'$).

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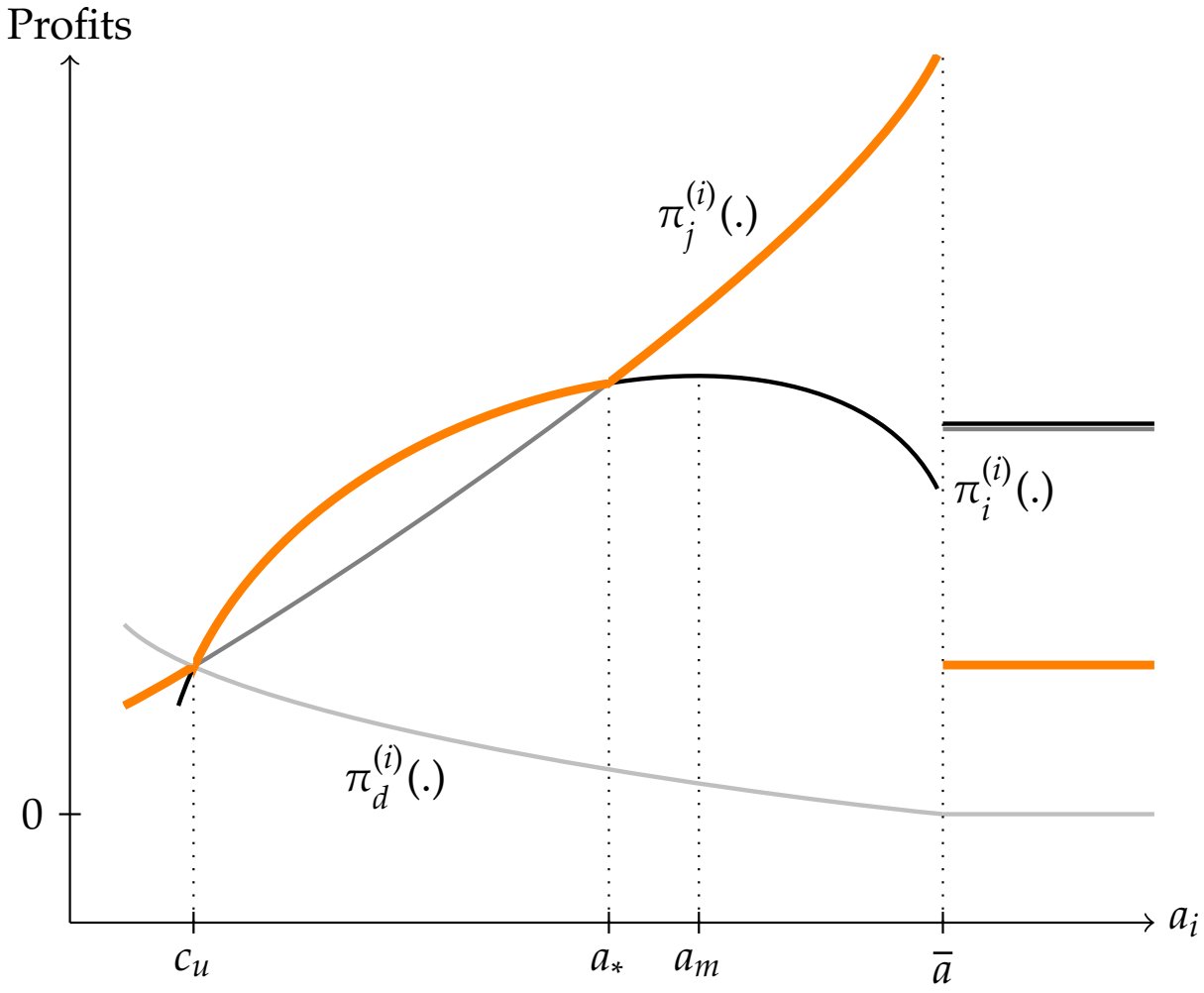

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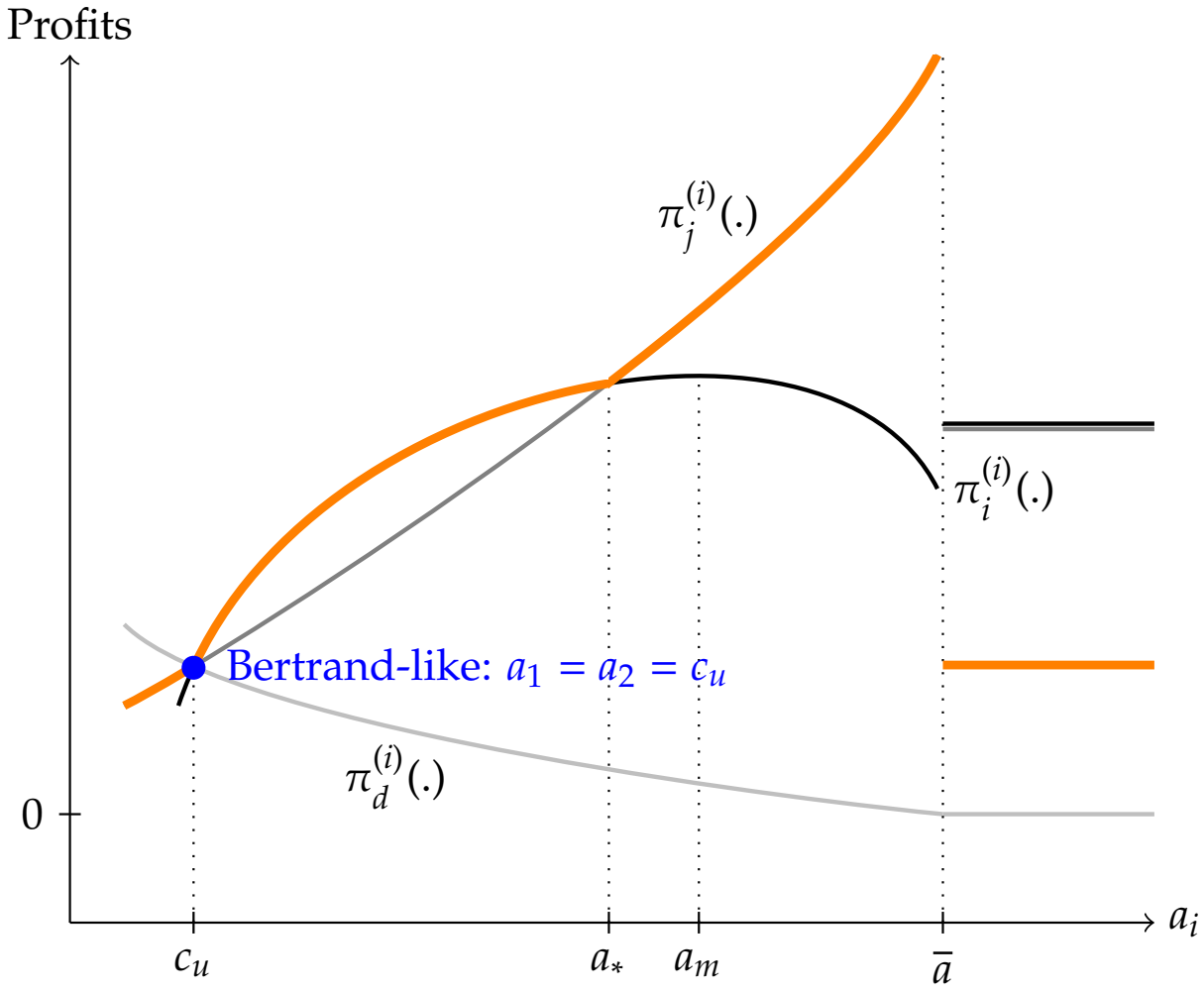

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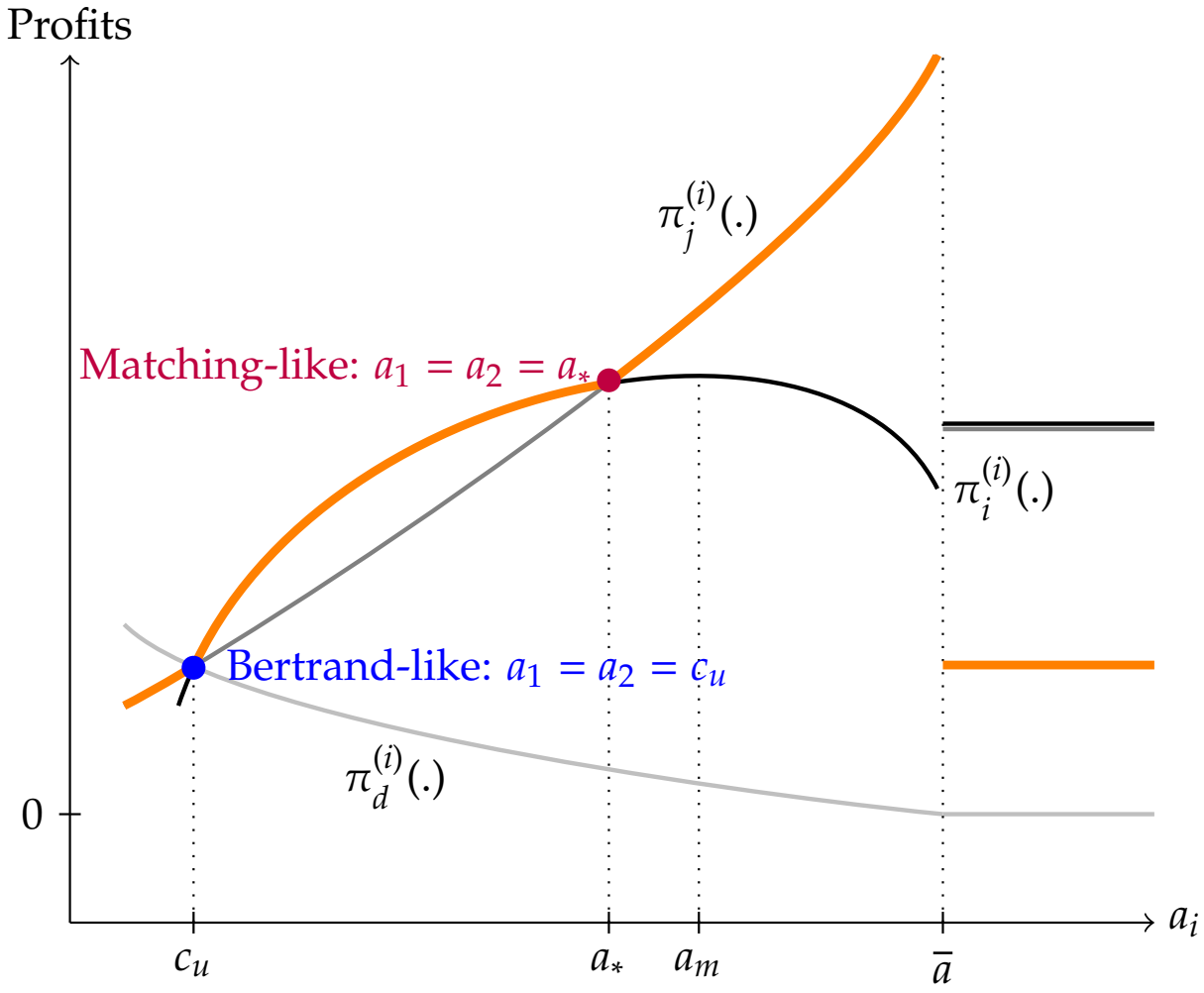

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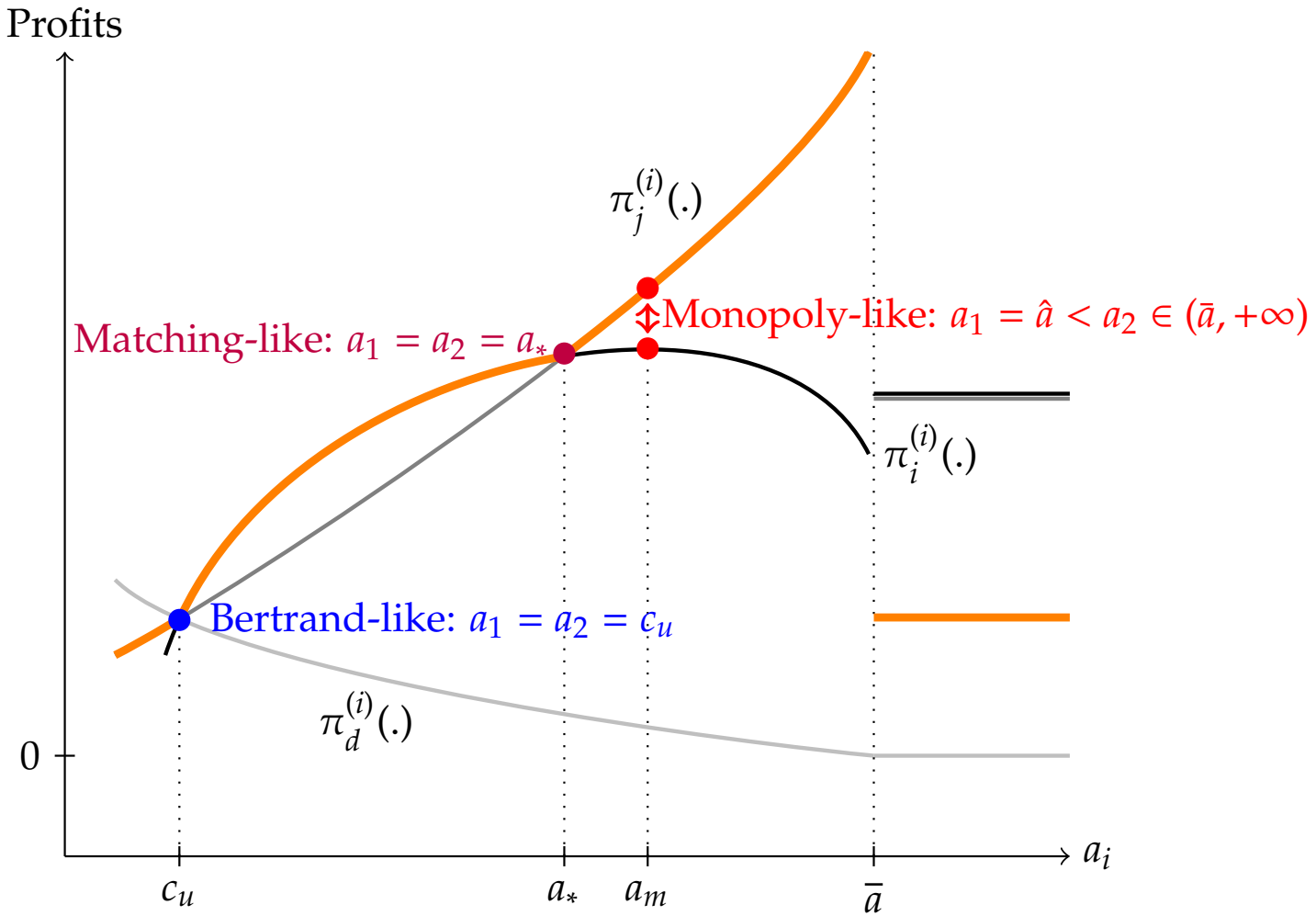

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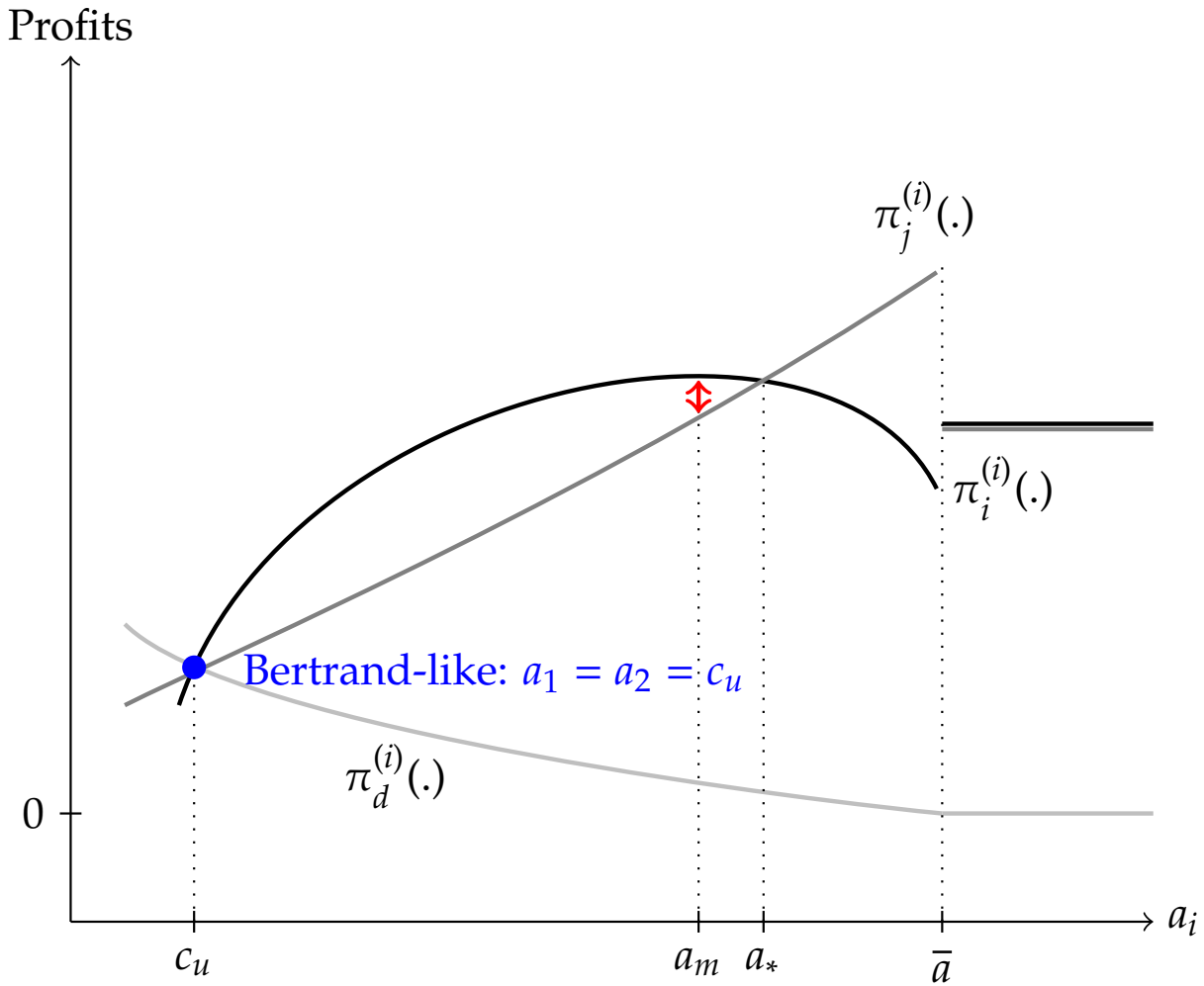
Downstream vs. Upstream Competitiveness

Illustration 1 (cont'd): Linear demands $D_k(p) = 1 - p_k - \gamma(p_k - \bar{p})$ w/ zero costs.



Conditions: Weak downstream substitutability ($\gamma \leq \gamma'$).

Downstream vs. Upstream Competitiveness

Proposition (Equilibria in the linear case)

There exists $\gamma' > 0$ such that:

If $\gamma \geq \gamma'$, then there exist four subgame-perfect equilibria: a Bertrand-like equilibrium, a matching-like equilibrium, two monopoly-like equilibria.

Otherwise, i.e., when $\gamma < \gamma'$, there exists only one Bertrand-like equilibrium.

Intuition: As downstream products become less differentiated, the softening effect is stronger, and the incentives to undercut on the upstream market weaken.

Remark: Reconciliation of the traditional theory and the Chicago school.

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Policy Implications: Competitiveness of Wholesale Markets

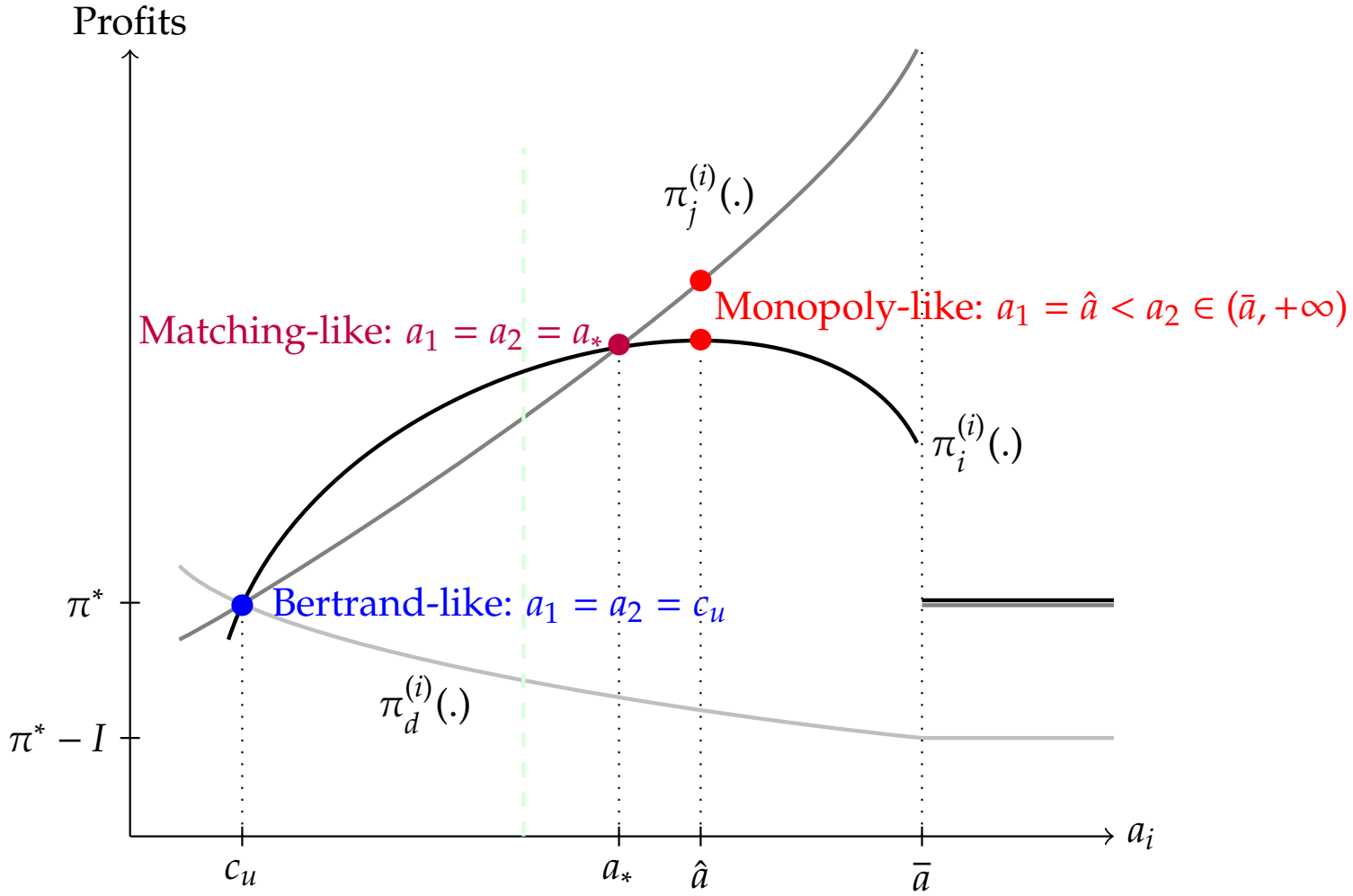
- We should not expect too much from facility-based competition.
- Assessing the potential for competition on wholesale markets requires to study the related retail markets.
- Assessing the incentives of integrated firms to wage fierce price competition on wholesale markets requires to study the factors which affect the softening effect.
- Large retail differentiation $\Leftrightarrow$ Competitive wholesale market.
- Large possibilities of bypass or low cost of building an infrastructure $\Leftrightarrow$ Competitive wholesale market.

Policy Implications: Regulatory Tools

- Ambiguous effect of vertical separation → Competitive wholesale market only if the degree of strategic substitutability is not too high.
- Other interpretations: investments by municipalities; pure upstream firm (e.g., Covad/Northpoint for broadband; MVNEs for the mobile market).
- A sufficiently low price cap on the wholesale price can prevent the emergence of non-competitive equilibria.

Price Cap on the Upstream Market

A sufficiently low cap on the upstream offer of at least one integrated firm restores the competitiveness of the wholesale market.



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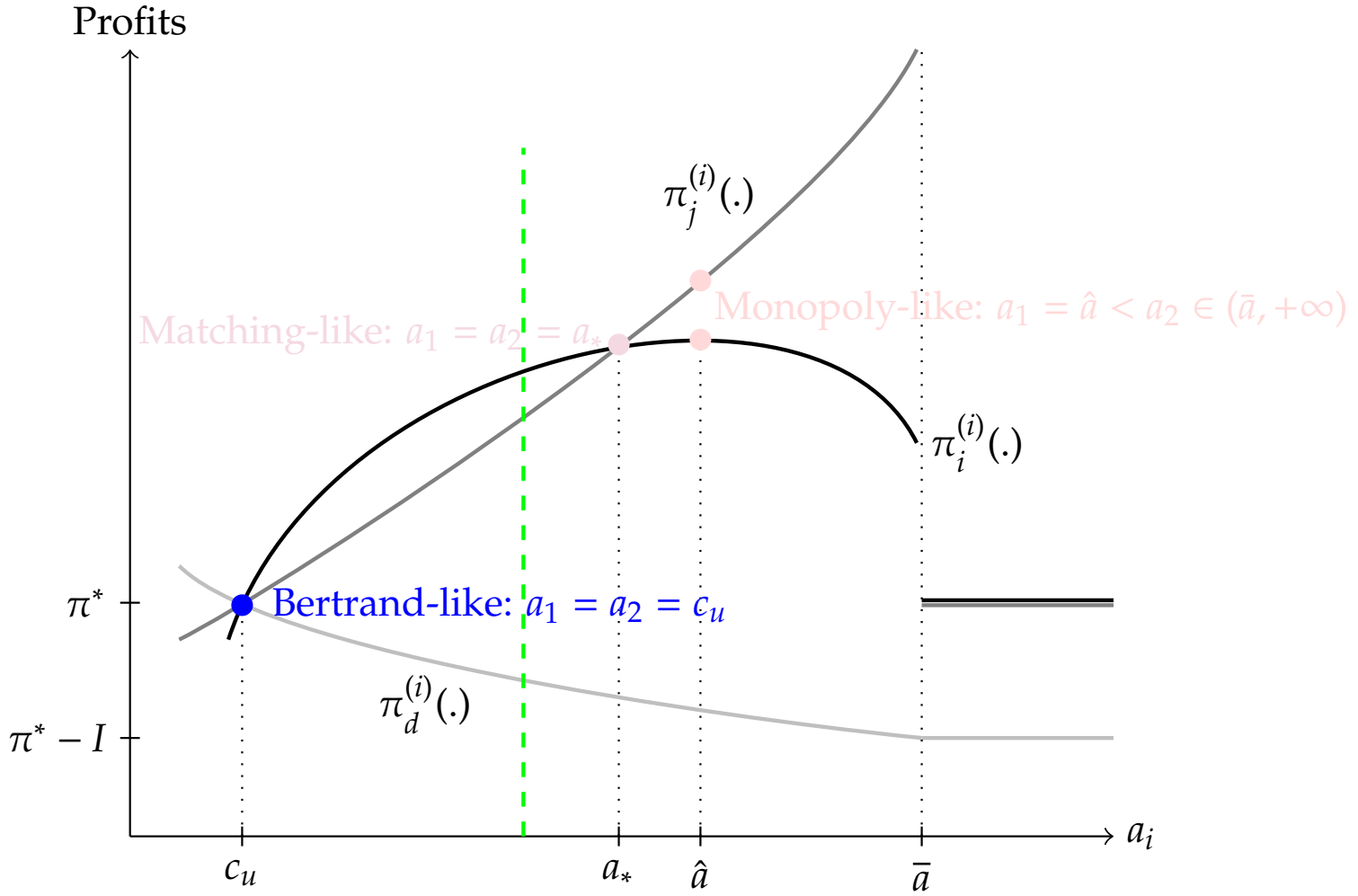

Conclusion

- A model to analyze competition in markets with vertically-integrated firms and pure downstream firms, such as the telecommunications markets.
- The logic of standard Bertrand competition may be a poor guide to understand such markets.
- Main message: The upstream market is unlikely to be competitive.

Possible extensions:

- Account for the role of local loop (broadband) or interconnection flows b/w integrated operators (mobile telephony).
- Evolution of market structure: How do the links b/w upstream and downstream market affect entry by facility-based and service-based firms?