Price Discrimination in Input Markets

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Motivation

- Imposing non-discriminatory terms of supply is a frequent policy response in regulated industries (e.g., Telecoms).
- But also in unregulated industries, antitrust provisions can restrict discriminatory pricing (Robinson-Patman, Article 82(c)).
- In addition, in Europe geographic price discrimination may contradict single market doctrine.

Motivation (cont.)

- Large literature on price discrimination. Our focus: PD in input (intermediary) markets.
- Key contributions: Katz 1987, DeGraba 1990, Yoshida 2000.
- Approach in existing papers: Monopolistic supplier chooses linear input price(s) to maximize profits.
- Our departure: Scope for demand-side substitution, albeit at costs and to potentially inferior supplier.
- Supplier can still be dominant, but no longer unconstrained monopolist.

The Model

- Single supplier, two downstream firms i = 1, 2.
- Supplier has zero production costs, firm i has own costs k_i.
- **Case I** without competition:
  - Each firm is monopolist in symmetric market
- **Case II** with competition:
  - Firms compete in quantities in same market
  - Inverse demand $P(q_1+q_2)$

The Model (cont.)

- Alternative supply option:
  - At costs F > 0 get access to alternative source of supply with constant marginal costs w^.
  - Thus, with input price w_i can sell at

$$c_i = k_i + w_i$$

  - And under alternative (outside) option can sell at

$$\widehat{c}_i = k_i + \widehat{w}$$

The Model (cont.)

- The alternative supply option gives rise for each i = 1, 2 to the respective participation constraint:

$$\begin{aligned} \pi(c_i) &= \max_q q\,[P(q) - c_i] \\ &\geq V_i^A = \pi(\widehat{c}_i) - F \end{aligned}$$

- **Assumption:** The “unconstrained” input prices would be too high as the outside option is sufficiently attractive for both firms.

I - Analysis with Separate Markets

- **Benchmark** (unconstrained supplier)
  - More efficient firm is charged higher price. This implies a "volume premium".
- The imposition of uniform pricing
  - benefits the more efficient (larger) firm and hurts the less efficient (smaller) firm;
  - may lead to the exclusion of the less efficient (smaller) firm.

- **Our model** (supplier constrained by demand-side substitution)
  - Under PD, input prices set s.t. participation constraints bind.
  - **More efficient (larger) firm receives discount**.
- The imposition of uniform pricing now
  - allows the less efficient firm to obtain the same lower price as the more efficient firm under PD;
  - unambiguously increases consumer surplus and welfare (in the short run) if both firms are still supplied;
  - may make it unprofitable to supply the more efficient (larger) firm, which switches to its alternative option.

Analysis with Separate Markets: Long Run

- In t = 1, both downstream firms can invest in a reduction of their own marginal costs.
- **Benchmark**
  - Investment benefits are "taxed" via a higher input price. Less so under uniform pricing.
  - DeGraba (1990): With linear demand and quadratic investment costs, UP increases consumer surplus and welfare in the long run.

- **Our model**
- Under PD incentives are given by

$$-\frac{d\pi(c_i)}{dk_i} = -\pi'(c_i)\left(1+\frac{dw_i}{dk_i}\right)$$

- Under UP, *ex-post* more efficient firm has same incentives. Incentives lower for *ex-post* less efficient firm.
  - If firms have initially symmetric costs, one firm chooses the same investment, the other firm strictly less.
  - Consumer surplus lower in the long run (and with linear demand also welfare).

II - Downstream Competition: Short Run

- **Benchmark**
  - Still, more efficient firm with larger market share must pay higher input price.
  - With linear demand, no "interaction": If k_1 down, only w_1 up but w_2 unchanged.
  - UP leads to "average" price, hurting the less efficient firm.
  - More efficient firm's market share *smaller* under PD.

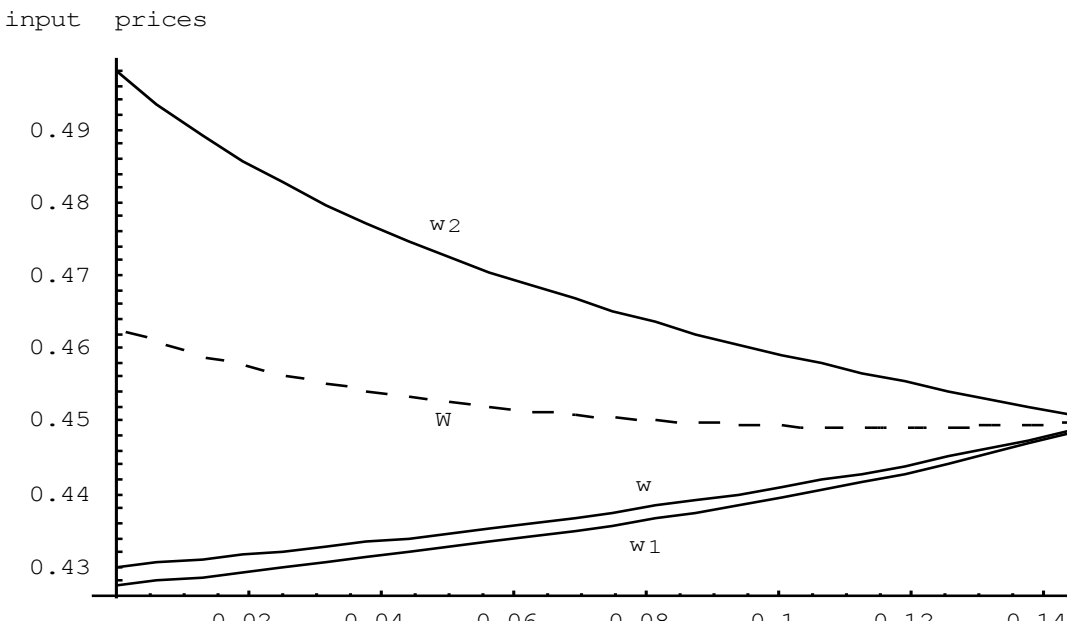
- **Our model**
  - Under PD, the more efficient (and larger) firm obtains again a lower input price.
  - PD amplifies market share differences.
  - If firm i becomes more efficient, the shift in market share is amplified both by a reduction in w_i and by an increase in w_j (**"waterbed effect"**).
- UP reduces input price for less efficient firm, but increases input price for more efficient firm.
  - Intuition: As w_j decreases, participation constraint for firm i becomes again slack.
  - Implication: Shifts market share to the less efficient firm j, both as w_j decreases and as w_i increases.

Downstream Competition: Short Run (cont.)

For linear demand (and small F) uniform price is smaller than "average" PD price

➔ Implies increase in total output and thus consumer surplus.

Example for $k_1 \leq k_2 = 0.15$ (W = average PD price, w = uniform price)



Downstream Competition: Long Run

- PD vs. uniform pricing: Incentives for the ex-post more efficient firm are now *strictly* higher under PD as
  - reduction in c_i increases w_j under PD,
  - while it lowers joint price w.
- Incentives for ex-post less efficient firm are additionally reduced as lower c_j *increases* uniform price w.
- If firms initially symmetric, *ex-post* less efficient firm invests less.
- Linear demand and quadratic investment costs: For all examples we studied, uniform pricing raises long-run marginal costs for *both* firms.

Conclusion

- Non-discriminatory pricing rules often advocated by small firms.
  - Standard (unconstrained) case generates opposite.
  - Our analysis:
    - → Uniform pricing indeed benefits smaller firms.
    - → Under competition, also eliminates “waterbed” effect.
    - → PD amplifies, not dampens, differences in market share.
- Long-run analysis: Uniform pricing may stifle investment incentives.
- Under uniform pricing firms always ex-post different:
  - Ex-post less efficient firm sits on rival’s shoulders.
  - Instead of “leveling the playing field”, uniform pricing may create differences endogenously.

Buyer power and the waterbed effect

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Motivation

- "Waterbed Effect": *If (non cost-related) price reductions to one set of buyers lead to higher prices for other buyers.*
- Logically consistent or accounting illusion?
- If logically consistent, then:
  - When strong, when weak?
  - Consumer harm?

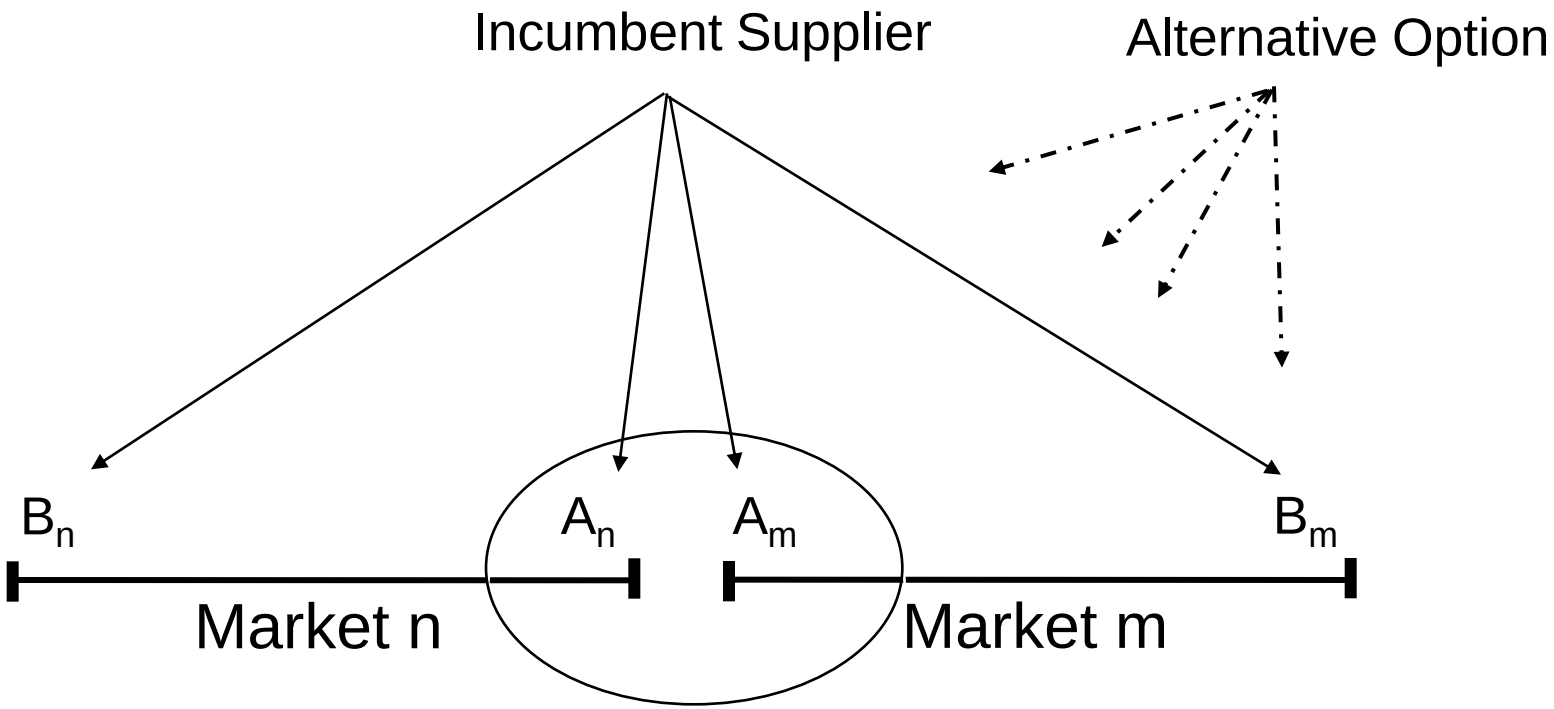
The Basic Model

- Markets and firms:
  - n = 1,…, N symmetric markets. Each with two firms, A_n and B_n.
  - For now symmetric own marginal costs c.
  - Linear wholesale pricing of supplier: $w(A_n)$, $w(B_n)$.
  - Supplier's own marginal costs k.
- Game: Supplier makes TOL offer.
- Outside option for buyers:
  - Switch at fixed costs F. Procure elsewhere with costs k + c.

The model (cont.)

- Price competition. Strategic complements.
- Standard assumptions on derived profit function π:
  - $\pi_1 < 0$, $\pi_{11} > 0$.
  - $\pi_{12} < 0$.
- Working example: Hotelling competition.

Illustration (Hotelling)



Analysis with symmetric firms

- Participation constraints:
  1. $\pi(c+w(A_n), c+w(B_n)) \geq \pi(c+k, c+w(B_n)) - F$
  2. $\pi(c+w(B_n), c+w(A_n)) \geq \pi(c+k, c+w(A_n)) - F$

- Symmetric wholesale price for independent firms (w_I) up in F.

- Hotelling:

$$w(A_n) = w(B_n) = w_I = k + 3t\sqrt{1 + 2F/t} - 1$$

Introducing Multiples

- One large buyer controls $n_L \geq 2$ firms.

- Three different equilibrium wholesale prices:
  - Large buyer w_L.
  - Competing small firms w_S.
  - Other independent firms w_I.

- The **waterbed effect**:
  - $w_L < w_I$ and $w_S > w_I$. However, different intuition!
  - Difference $w_S - w_L > 0$ is strictly increasing in F.

Retail Prices and Consumer Surplus

- Retail price of small firms affected by:
  - Waterbed effect: Up.
  - Increased competition (strategic complements): Down.
- Formally:

$$\frac{dp_S}{dw_L} = \frac{\partial p_S}{\partial w_L} + \frac{\partial p_S}{\partial w_S}\frac{\partial w_S}{\partial w_L}.$$

- **Result:** *If the large buyer's discount is relatively small, i.e., if F is small, then all retail prices go down.*
  - First, "strategic complement" effect independent of F.
  - Second, waterbed effect goes to zero for low F.

Results for the Hotelling Model

- **Result 1:** *The waterbed effect dominates if*

$$y_S < \frac{1}{3t}(w_S - k)$$

- Here:
  - y_S is the market share of a small firm.
  - This is thus more likely to hold if F is large, i.e., if the price differential is already large.

Results (cont.)

- Consumer surplus: Marginal change w.r.t. discount w_L equal to marginal change in average price.

- **Result:** *Consumer surplus down if large buyer gets additional discount (implied by further growth) whenever*

$$2y_S \frac{2-y_S}{1+y_S} < \frac{1}{3t}(y_S - k)$$

- While stricter than previous condition, again more likely if small buyers already more “squeezed”.

Extensions

- "Organic Growth"
  - The waterbed effect arises as well if:
    - →Each buyer only controls one firm.
    - →But size differences are due to different own marginal costs.
    - →Growth = Increase in efficiency.
  - Only difference: Welfare analysis.

- Endogenous acquisition (Hotelling)
  - Larger buyers have a higher willingness to acquire additional firms.
    - →Can lever larger discount into new market.
    - →Further input price differential dampens competition. (In contrast, to case where firms become more symmetric.)

Summary

- Results:
  - Formal foundation for the waterbed, even with constant upstream market structure.
  - Potential for consumer harm, even without downstream exit.
  - Waterbed effect stronger and consumer harm more likely if smaller firms are already substantially disadvantaged.

- Caveats and next steps:
  - Reconsider “full” bargaining case.
  - Alternative models/sources of buyer power.

Merci!

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