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Competition Policy - Spring 2005

Monopolization practices I

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Summary

- Some definitions
- Efficiency reasons for tying
- Tying as a price discrimination device: Bundling
- Requirements tying
- Exclusionary tying
- Strategic behavior in network industries

Some definitions *(1/2)*

- **Tie-in sales (tying)**: Whenever a good is offered under the condition that another good is bought with it.

- **Bundling (or package tie-in)**: Different goods are sold together in fixed proportions (e.g., shoes and laces, cars and tyres, laptop and OS software and so on.)

- **Mixed-bundling**: When the consumer is also given the choice to buy the goods separately.

- **Requirements tying**: Whenever two goods are sold together in variable proportions (e.g., copy machine and toner, cell phone and subscription and so on.)

Efficiency reasons for tying

- *Consumers save on assembling costs and transaction costs:* If they buy the bundle (e.g., shoes and laces, different car parts) rather than separate goods
- *Scale economies due to division of labour:* Else, each of us should learn how to assemble a car.
- *Solving problems of asymmetric information:* And guaranteeing highest quality, by ensuring that different components work well together (but quality problems might also be solved in other ways, e.g. with quality control, minimum quality standards, certifications.)

Tying as a price discrimination device: Bundling *(1/3)*

- Bundling might be used to extract more surplus from consumers (especially when preferences for different goods are negatively correlated.)

- Example: See Table next page.

- A monopolist obtains higher profits by bundling two products than selling them separately to the two consumers.

- Ambiguous effects on welfare (same as with price discrimination.)

Tying as a price discrimination device: Bundling *(2/3)*

- By selling A, B separately, firm earns 4(2)+5(2)=18.

- By bundling them, it makes 12+12=24.

	1's willingness to pay	2's willingness to pay
Good A	7	4
Good B	5	8
Goods A and B	12	12

Requirements tying *(1/9)*

- Requirements tying might act as a metering device.

- If a product can be used with different intensities, a firm would like to charge more to consumers with higher intensity of use (i.e., with higher valuation.)

- By keeping low price of basic product (e.g. copy machine, cellular handset) and high price of complementary products (toner cartridges, calls), firm charges according to intensity of use.

- Welfare higher, if under tying more consumers buy.

- Welfare lower, if all consumers buy absent tying or with it (same effects as with price discrimination.)

A model of requirements tying

A consumer is type $i = h, l$ and buys one unit of good A and q units of B.

$$U_i = q - \frac{q^2}{2v_i}$$

Proportion of type l (lower intensity) is λ. Good A is monopolized by firm 1 and market B has several suppliers (including 1.) Constant marginal cost $c_A, c_B < 1$. No fixed cost.

No tying (all buy)

Suppose a consumer buys. Then his demand is: $q_i = v_i(1 - p_B)$.

He will buy if $U_i - p_A - p_B q_i \geq 0$, that is, if $v_i(1 - p_B)^2/2 - p_A \geq 0$.

Competition implies $p_B = c_B$

If firm 1 prices so that all consumers buy:

$$p_A^{NT} = \frac{v_l(1 - c_B)^2}{2}$$

In this case l consumers have no surplus and h consumers have $CS_h^{NT} = (v_h - v_l)(1 - c_B)^2/2$.

Producer surplus is $\pi^{NT} = v_l(1 - c_B)^2/2 - c_A$. Welfare is then:

$$W^{NT} = \frac{((1 - \lambda)v_h + \lambda v_l)(1 - c_B)^2}{2} - c_A.$$

No tying (Only high types buy)

If firm 1 prices so that only h consumers buy:

$$p_A^{NTh} = \frac{v_h(1-c_B)^2}{2}$$

In this case all consumers have no surplus $CS^{NTh} = 0$.

Producer surplus is $\pi^{NTh} = (1-\lambda)\left(v_h(1-c_B)^2/2 - c_A\right) = W^{NTh}$. This strategy is profitable if $\pi^{NTh} \geq \pi^{NT}$, which is true if:

$$\lambda \leq \frac{(v_h - v_l)(1-c_B)^2}{v_h(1-c_B)^2 - 2c_A}$$

Tying

If firm 1 requires consumers who want good A also to buy good B from it (and can enforce it.)

$$\pi = (p_B - c_B)[\lambda v_l(1 - p_B) + (1 - \lambda)v_h(1 - p_B)] + p_A - c_A.$$

Which implies

$$p_B^T = \frac{(1 - \lambda)(v_h - v_l) + c_B[\lambda v_l + (1 - \lambda)v_h]}{2v_h - v_l - 2\lambda(v_h - v_l)} > c_B$$

Price of A is chosen so that $v_i(1 - p_B^T)^2/2 - p_A \geq 0$, thus:

$$p_A^T = \frac{(1 - c_B)^2 v_l[\lambda v_l + (1 - \lambda)v_h]^2}{2[2v_h - v_l - 2\lambda(v_h - v_l)]^2}$$

The price p_A^T acts like the fixed part of a two-part tariff, and allows to screen between types.

$$\pi^T = \frac{(1-c_B)^2[\lambda v_l + (1-\lambda)v_h]^2}{2[2v_h - v_l - 2\lambda(v_h - v_l)]} - c_A.$$

Consumers of type l have no surplus and:

$$CS_h^T = \frac{(1-c_B)^2(v_h - v_l)[\lambda v_l + (1-\lambda)v_h]^2}{2[2v_h - v_l - 2\lambda(v_h - v_l)]^2}$$

Thus:

$$W^T = \frac{(1-c_B)^2[\lambda v_l + (1-\lambda)v_h]^2[1 + (1-\lambda)(v_h - v_l)]}{2[2v_h - v_l - 2\lambda(v_h - v_l)]^2} - c_A$$

Comparisons of equilibria

1. First assume that it is optimal to serve all under no tying. Then:

$$\pi^T - \pi^{NT} = \frac{(1-c_B)^2(v_h - v_l)^2}{2[2v_h - v_l - 2\lambda(v_h - v_l)]} > 0.$$

$$W^{NT} - W^T = \frac{(1-c_B)^2(1-\lambda)(v_h - v_h)^2[(1+\lambda-2\lambda^2)v_h + 2\lambda^2 v_l]}{2[2v_h - v_l - 2\lambda(v_h - v_l)]^2} > 0.$$

Consumers do not buy any more at marginal cost good B.

2. Now assume that it is optimal to serve only the h types under no tying.

   Simple to see as under no tying consumer surplus is zero and now positive. Profits have to be higher or else it would not be done.

3. To check that tying will indeed be profitable consider $c_A = c_B = 0$, $v_h = 2$, $v_l = 1$. Without tying firm 1 will serve only h if $\lambda < 1/2$. Then $\pi^T - \pi^{NTh} > 0$ if $\lambda > 1 - \sqrt{3}/3$.

Exclusionary tying *(1/15)*

- Whinston, 1990: tying as a commitment to compete aggressively, thus forcing a rival out of the market.

- Two independent products, A and B. Firm 1 monopolist on A, firms 1 and 2 both sell good B.

- If 1 commits to bundle A and B, it will price more aggressively, because it knows that every consumer who buys B will not buy A, on which firm 1 has a high margin (A is a monopoly)

- Fierce competition decrease both firms profits: knowing it, rival exits if cannot cover fixed costs.

A model of exclusionary tying with differentiated goods

- Consumers uniformly distributed in $[0,1]$ consume one unit (at most) of A, valued at $v > c_A$ and one of B, valued at $U_{Bi} = w - t_i|x - x_{Bi}| - p_{Bi}$, where $w > \max(c_{B1}, c_{B2})$ and $x_{B1} = 0, x_{B2} = 1$.

- Firm 1first decides whether to bundle A and B_1 (irreversibly.) Then both firms decide whether to enter market B (and if so, pay F.) Then pricing ($\tilde{p}$ for the bundle if there is one, otherwise p_A, p_{B1} and p_{B2}.)

Independent Pricing (no tying)

A consumer will buy $B1$ rather than $B2$ if $U_{B1} > U_{B2}$ or $w - t_1 x - p_{B1} \geq w - t_2(1-x) - p_{B2}$.

Both firms sell at equilibrium if:

$$
\begin{aligned}
(A1) \quad 0 &< v - c_A < t_2 + 2t_1 + c_{B1} - c_{B2} \\
(A2) \quad v - c_A &> -2t_2 - t_1 + c_{B1} - c_{B2}
\end{aligned}
$$

$$
x_{12}(p_{B1}, p_{B2}) \equiv \frac{t_2 + p_{B2} - p_{B1}}{t_2 + t_1}.
$$

$$q_{B1} = x_{12}(p_{B1}, p_{B2}), q_{B2} = 1 - x_{12}(p_{B1}, p_{B2}).$$

$$\pi_{B1} = (p_{B1} - c_{B1})\frac{t_2 + p_{B2} - p_{B1}}{t_2 + t_1}; \pi_{B2} = (p_{B2} - c_{B2})\frac{t_1 + p_{B1} - p_{B2}}{t_2 + t_1}$$

$$R_{B1} : p_{B1} = \frac{t_2 + c_{B1} + p_{B2}}{2}; R_{B2} : p_{B1} = 2p_{B2} - c_{B2} - t_1$$

Thus

$$p^*_{Bi} = \frac{t_i + 2t_j + c_{Bj} + 2c_{Bi}}{3}; \pi^*_{Bi} = \frac{\left(t_i + 2t_j + c_{Bj} + 2c_{Bi}\right)^2}{9(t_i + t_j)}$$

Tying

A consumer will buy $A/B1$ at price $\tilde{p}$ rather than $B2$ if $\tilde{U} > U_{B2}$ or $v + w - t_1 x - \tilde{p} \geq w - t_2(1 - x) - p_{B2}$.

$$\tilde{x}_{12}(\tilde{p}, p_{B2}) \equiv \frac{t_2 + p_{B2} + v - \tilde{p}}{t_2 + t_1}.$$

$\tilde{q}_{B1} = \tilde{x}_{12}(\tilde{p}, p_{B2}), q_{B2} = 1 - \tilde{x}_{12}(\tilde{p}, p_{B2})$.

$$\tilde{\pi} = (\tilde{p} - c_A - c_{B1})\frac{v + t_2 + p_{B2} - \tilde{p}}{t_2 + t_1}; \pi_{B2} = (p_{B2} - c_{B2})\frac{v + t_1 + \tilde{p} - p_{B2}}{t_2 + t_1}$$

$$R_1 : \tilde{p} = \frac{v + c_A + t_2 + c_{B1} + p_{B2}}{2}; R_2 : \tilde{p} = 2p_{B2} - c_{B2} + v - t_1$$

Thus

$$\tilde{p}^* = \frac{t_1 + 2t_2 + c_{B2} + 2c_{B1} + v + 2c_A}{3}; \tilde{p}^*_{B2} = \frac{t_2 + 2t_1 + c_{B1} + 2c_{B2} - v + c_A}{3}$$

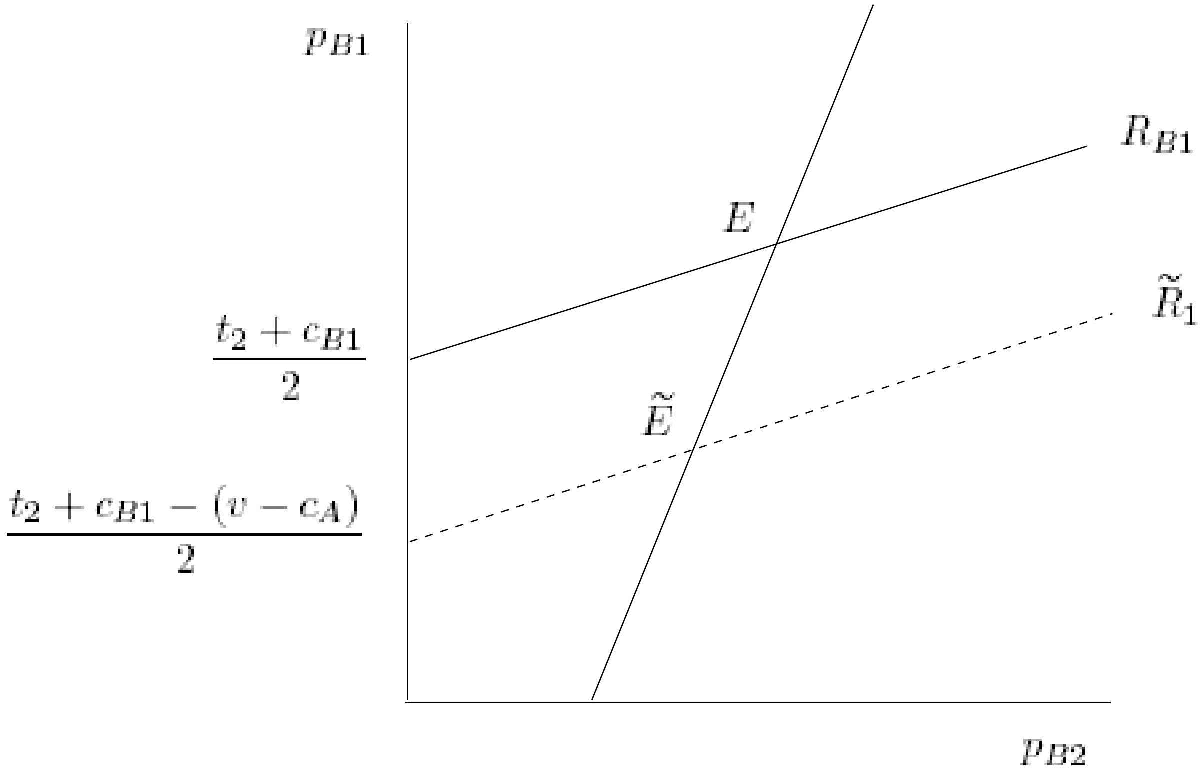
$$\widetilde{\pi}_1^* = \frac{(t_1 + 2t_2 + c_{B2} - c_{B1} + v - c_A)^2}{9(t_1 + t_2)}; \widetilde{\pi}_{B2}^* = \frac{(t_2 + 2t_1 + c_{B1} - c_{B2} - v + c_A)^2}{9(t_1 + t_2)}$$

$$\widetilde{\pi}_1^* < \pi_1^* \text{ iff } v - c_A < 5t_2 + 7t_1 + 2c_{B1} - 2c_{B2}$$

This is compatible with $(A2)$ as long as $7t_2 + 8t_1 + c_{B1} - c_{B2}$ which is true by $(A1)$.

Intuition Let $\widetilde{p} = v + \widetilde{p}_{B1}$

$$\widetilde{R}_1 : \widetilde{p}_{B1} = \frac{t_2 + c_{B1} + p_{B2} - (v - c_A)}{2}; R_2 : \widetilde{p}_{B1} = 2p_{B2} - c_{B2} - t_1$$



Entry

Entry for 2 without tying but no entry with tying if: $\pi^*_{B2} \geq F > \tilde{\pi}^*_{B2}$.

Bundling decision

Not necessarily true that 2 will be excluded: monopoly bundling profits π^m must be bigger than duopoly under no bundling π^*_1.

To find π^m note that a consumer buys the bundle rather than nothing if $U_m > 0$ or $v + w - t_1 x - \tilde{p}_m \geq 0$. $x_m = (v + w - \tilde{p}_m)/t_1$. Two cases depending on $x_m \geq 1$ or $x_m < 1$.

$$q_m = \begin{cases} 1, \text{ if } \tilde{p}_m \leq v + w - t_1 \\ \frac{v+w-\tilde{p}_m}{t_1}, \text{ if } \tilde{p}_m > v + w - t_1 \end{cases}$$

$$\pi_m = \begin{cases} \tilde{p}_m - c_A - c_{B1}, & \text{if } \tilde{p}_m \leq v + w - t_1 \\ (\tilde{p}_m - c_A - c_{B1}) \frac{v+w-\tilde{p}_m}{t_1}, & \text{if } \tilde{p}_m > v + w - t_1 \end{cases}$$

Optimal interior price is $\tilde{p}_m = (v + w + c_A + c_{B1})/2$ and it applies only if $v + w < c_A + c_{B1} + 2t_1$ (otherwise $\tilde{p}_m \leq v + w - t_1$.)

$$\pi_m^* = \begin{cases} v + w - t_1 - c_A - c_{B1}, & \text{if } v + w \geq c_A + c_{B1} + 2t_1 \\ \frac{(\ v+w-c_A-c_{B1})^2}{4t_1}, & \text{if } v + w < c_A + c_{B1} + 2t_1 \end{cases}$$

Suppose $c_A = c_{B1} = c_{B2} = t_2 = 0$ and $v + w < 2t_1$

$$\pi_m^* - \pi_1^* = \frac{(v + w)^2}{4t_1} - \frac{t_1}{9} - v.$$

So for high enough t_1 bundling will not be chosen.

Exclusionary tying *(10/15)*

Suppose $c_A = c_{B1} = c_{B2} = t_2 = 0$ but $v + w \geq 2t_1$

$$\pi_m^* - \pi_1^* = -t_1 - \frac{t_1}{9} + w.$$

So for low t_1 or high w exclusion is profitable.

Exclusion leads to higher profits in B but some consumers stop buying from A so monopoly may not be profitable.

Exclusionary tying *(11/15)*

Welfare

- Under exclusion, consumers have less variety and prices increase, but fixed costs are avoided.

- Overall lower consumer welfare and likely lower total welfare.

Exclusionary tying with complementary goods

- When products are *complementary*, exclusionary bundling is less likely to be profitable, since it reduces sales of the tied good.

- *Example*: as above, but A and B are complements in fixed proportions, and A is necessary product

- In this example, by bundling A and B firm 1 would *trivially* exclude firm 2. But, would it be profitable?

- The following shows that by bundling firm 1 would have (weakly) lower profits.

A model with complementary goods

Let $\widetilde{p}_m$ optimal price of monopoly bundle, as before.
If no bundle, suppose: $p_A = \widetilde{p}_m - c_B$; $p_B = c_B$. Two cases:

1. Firm 2 not active: this pricing does as well as bundling ($p_A + p_B = \widetilde{p}_m$.)

2. Firm 2 active if 1 does not bundle. Two effects from firm 2:

   (a) Some consumers would switch to firm 2, but firm 1's profits are the same (same number of sales from A, and no lost profits on $B1$, since $p_B = c_B$.)

   (b) Some consumers previously not buying now buy $B2$: firm 1's profits rise, as demand for A increases.

Summary and practice

Possible efficiency effects from tying.

Ambiguous welfare effects (even absent efficiency effects) if tying as price discrimination device.

Two-part test for tying practices:

1. If firm is not dominant, tying should be allowed.

2. If firm is dominant, then full investigation:

   (a) Negatives: possible anti-competitive effects (less likely when products are complementary, and when bundling is reversible.)

   (b) Positives: Efficiency reasons for tying (also, risk of tampering with product design and innovations!)

Strategic behavior in network industries *(1/10)*

- Network industries are fertile grounds for anti-competitive behaviour: externalities due to a strong customer base make life difficult for entrants.

- Network inter-operability main problem. By denying access to its customer base (i.e., by denying inter-operability) an incumbent might prevent entry of a competing network product.

- Denying inter-operability is not optimal if access to two compatible networks has so strong externalities that many new consumers are attracted (better share a large market than be monopolist of a small one).

Compatibility

- Why not to force incumbents to grant compatibility (i.e., access to competing networks)?

- Under incompatible products, very fierce competition (and low prices) at early industry stages: imposing compatibility deprives successful firm of its reward (competition *for* the market, not *in* the market.)

- However, a *more interventionist* policy makes sense when the incumbent enjoys strong position due to *previous legal monopoly.*

Other comments

- *Exclusionary* behaviour *less likely* to occur when *complementary products* are at issue (same arguments as for *tying*.)
  - Suppose incumbent firm 1 has monopoly of product A and duopolist of product B. By making A incompatible to B2, 1 would exclude firm 2, but this is likely to reduce its profits (some people who would buy A with B2 would stop doing so.)
- Predatory pricing, exclusive contracts, and false announcements might also persuade consumers not to switch to entrants.

A model of interoperability in networks (Crémer, Rey, Tirole 2000)

- Two firms. One has a installed base $\beta_1 > 0$ and another firm has $\beta_2 = 0$.

- Consumers uniformly distributed in $[0, 1]$. A consumer in $T \in [0, 1]$ attaches a net benefit to the network:

$$S_i = T + s_i - p_i, \text{ where } s_i = v[\beta_i + q_i + \theta(\beta_j + q_j)].$$

- $v < 1/2$ is the importance of externalities, and θ is the quality of interoperability.

- For both firms to get customers we must have: $p_1 - s_1 = p_2 - s_2 = \widehat{p}$.

- The consumer indifferent between joining or not has: $S_i = T + s_i - p_i = T - \widehat{p} = 0$, so a consumer will buy if $T \geq \widehat{p}$, thus

$$q_1 + q_2 = 1 - \widehat{p}$$

- Thus $p_i = \widehat{p} + s_i$ and $p_i = 1 - q_i - q_j + s_i$ and

$$p_i = 1 + v[\beta_i + \theta\beta_j] - (1 - v)q_i - (1 - v\theta)q_j.$$

Equilibrium with product market competition

- $\pi_i = \Big(p_i(q_i, q_j) - c\Big)\, q_i.$

$$R_1 : q_1 = \frac{1 - c + v\beta_1 - (1 - v\theta)q_2}{2(1-v)};\ R_2 : q_1 = \frac{1 - c + v\theta\beta_1 - 2(1-v)q_2}{1 - v\theta}$$

- $$q_i^* = \frac{1}{2}\left(\frac{2(1-c) + v(1+\theta)(\beta_i + \beta_j)}{2(1-v) + (1 - v\theta)} + \frac{(1-\theta)v(\beta_i - \beta_j)}{2(1-v) - (1-v\theta)}\right)$$

- Note that this is "Fulfilled expectations Cournot equilibrium" and

$$q_1^* - q_2^* = \frac{(1-\theta)v\beta_1}{2(1-v) - (1-v\theta)} > 0 \text{ if } \theta < 1$$

Equilibrium with tipping to the firm with installed base

- $q_2 = 0$

- $\pi_1^m = (1 + v\beta_1 - (1-v)q_1 - c)\, q_1$ and optimal quantity is

$$q_1^m = \frac{1 - c + v\beta_1}{2(1-v)}.$$

- This is an equilibrium provided $p_2(q_1^m, 0) \leq c$, or

$$1 + v\theta\beta_1 - (1 - v\theta)\frac{1 - c + v\beta_1}{2(1-v)} - c \leq 0.$$

- For $\theta = 0$ this is equivalent to (and compatible with $v < 1/2$):

$$v \geq \frac{1 - c}{2(1-c) + \beta_1}$$

Equilibrium with tipping to the entrant

- $q_1 = 0$, $\pi_2^m = (1 + v\theta\beta_1 - (1-v)q_2 - c)\, q_2$ and optimal quantity is
$$q_2^m = \frac{1 - c + v\theta\beta_1}{2(1-v)}.$$

- This is an equilibrium provided $p_1(0, q_2^m) \leq c$, or
$$1 + v\beta_1 - (1 - v\theta)\frac{1 - c + v\theta\beta_1}{2(1-v)} - c \leq 0.$$

- This is easier if θ is small. For $\theta = 0$ this is equivalent to:
$$c \geq 1 + \frac{2\beta_1 v(1-v)}{1-2v}$$
which never happens since $q_2^m \geq 0$ requires $c < 1$ (entrant tipping can happen with more than two firms.)

Interoperability as a choice

Let $\theta = \min(\theta_1^*, \theta_2^*)$. The optimal choice depends on the equilibrium

For tipping equilibria $\theta = 0$ is best for firm 1.

For interior equilibria note $\pi_i^* = (1 - v)\,(q_i^*)^2$.

Assume $\theta = 0$ or $\theta = 1$ only (wlog by Crémer and Tirole), and $c = 0$

$$q_1^*(\theta = 1) - q_1^*(\theta = 0) = \frac{v(1 - 2v - \beta_1(3 - 4v + 2v^2))}{3(1 - v)(3 - 8v + 4v^2)} > 0,$$

which holds if $\beta_1 < (1 - 2v)/(3 - 4v + 2v^2)$

$$q_2^*(\theta = 1) - q_2^*(\theta = 0) = \frac{v(1 - 2v - \beta_1(6 - 11v + 2v^2))}{3(1 - v)(3 - 2v)(1 - 2v)} > 0$$

In general inter-operability eliminates incumbents' advantage, but increases demand of new customers.

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