ECO 650: Firms' Strategies and Markets

Vertical Relationships and Bargaining(II)

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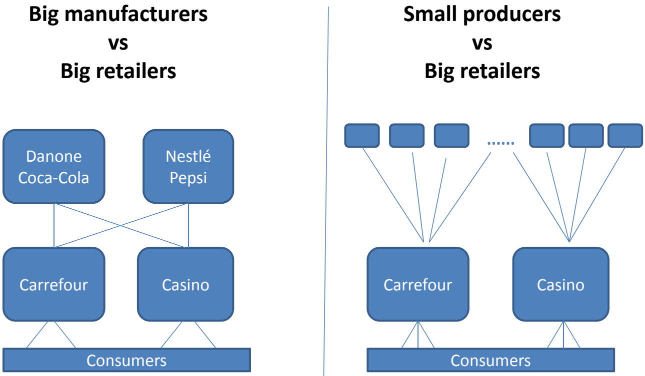
10/11/2021

Buying power of retailers

A retailer is an intermediary: he buys products to suppliers and resells them to consumers.

The high concentration on the retail market ⇒ buying power towards suppliers: heterogenous balance of power!!



*Famous national brands
*High concentration among manufacturers

*Small manufacturers
*Farmers (fruits and vegetables,meat,...)

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  - Private labels (since 70s): products sold under retailer's own brand

Consequences of Buyer Power: Potential Harms and Benefits

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- Benefits: A monopolist may prefer dealing with several retailers, and thus favor competition, to obtain higher profits.

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- "Bargaining theory with Applications", Muthoo (2004).

The Nash program (1950,1953)

- A bargaining problem with two players
- A vector $x = (x_1, x_2) \in \mathbb{R}^2$; x_i is the allocation of player i.
- A threat point $\underline{x} = (\underline{x}_1, \underline{x}_2) \in \mathbb{R}^2$;
- Players utility function $U_i(x)$.
- F is the set of feasible allocations; $F \bigcap \{(x_1, x_2) \in \mathbb{R}^2 : x_1 \geq \underline{x}_1, x_2 \geq \underline{x}_2\}$ is nonempty and bounded.

Theorem

The Nash Bargaining Solution x^* satisfies:

$$x^* \in \underset{x \in F}{argmax}(U_1(x_1) - U_1(\underline{x}_1))(U_2(x_2) - U_2(\underline{x}_2))$$

Five axioms

- Strong Pareto Optimality: the solution has to be realizable and Pareto optimal.
- Individual rationality: No player can have less than his outside option, otherwise he will not accept the "agreement".
- Invariance by an affine transformation: The result does not depend on the representation of (Von Neumann Morgenstern) utility functions.
- Independence of Irrelevant Alternatives: Eliminating alternatives that would not have been chosen, without changing the outside option, will not change the solution.
- Symmetry: Symmetric players receive symmetric payoffs.

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Split-The-Difference-Rule

- Let V denote the cake to be shared such that $x_1 = V - x_2$,
- $U_i(x_i) = x_i$ (Risk neutral); $(\alpha, 1-\alpha)$ the bargaining powers.

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The Nash bargaining solution (x_1^N, x_2^N) is:

$$x_1^N = \underline{x}_1 + \alpha(V - \underline{x}_1 - \underline{x}_2)$$

$$x_2^N = \underline{x}_2 + (1-\alpha)(V - \underline{x}_1 - \underline{x}_2)$$

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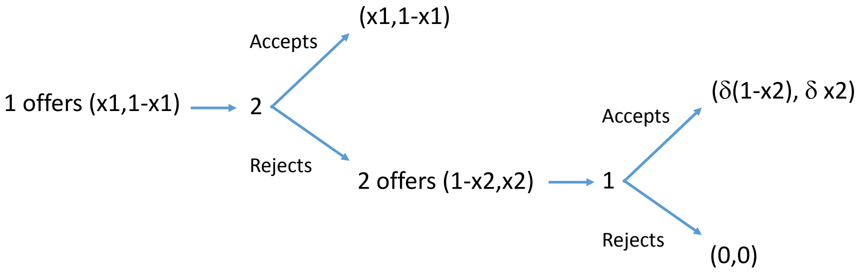
- Finite number T of periods.
- There is a discount factor δ by period.

The Rubinstein (1982) game for $T = 2$



Resolution of the Rubinstein game

- Assume $T = 2$; in the second period, there is an equilibrium where 1 accepts any nonnegative offer by 2; 2 thus offers $(0, 1)$ (or $(\varepsilon, 1 - \varepsilon)$ to select equilibria); in period 1, 1 offers $(1 - \delta, \delta)$ and 2 accepts.

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- Assume $T = 3$; in the third period, 1 makes the last offer and 2 accepts any nonnegative offer; 1 thus offers $(1, 0)$; in period 2, 2 offers $(\delta, 1-\delta)$ and 1 accepts; in period 1, 1 offers $(1-\delta(1-\delta), \delta(1-\delta))$ and 2 accepts.

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- By iteration, there is an equilibrium where 1 offers in the first period $(x_1 = 1 - \delta + ... + (-1)^{T-1}\delta^{T-1}, 1 - x_1)$.

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- Impatience is the driving force that leads to an agreement, and it increases the power of the first player:
  - When the two players are infinitely patient, their situations become symmetric: when $T \to +\infty$ and $\delta = 1$, the sharing of the pie is $(\frac{1}{2}, \frac{1}{2})$;
  - When the two players are infinitely impatient, player 1 gets the whole pie: when $T \to +\infty$ and $\delta = 0$, the sharing of the pie is $(1, 0)$.

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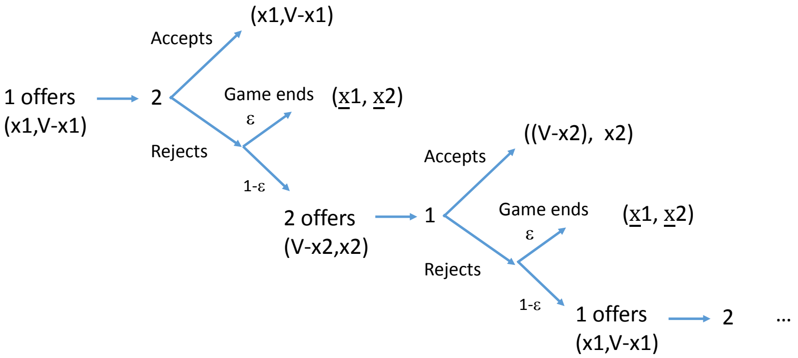
- Players alternate making the same offers 1 offers $(x_1, V - x_1)$ and 2 offers $(V - x_2, x_2)$;
- Infinite horizon; each time an offer is rejected, there is an exogenous risk of breakdown (end of the game) with a probability ε (no discounting).

Binmore-Rubinstein-Wolinsky (1986) game



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Binmore-Rubinstein-Wolinsky (1986): results

- Any subgame perfect equilibrium involves player i indifferent between accepting or rejecting the offer of player j.

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- If both firms have the same bargaining power ($\epsilon \to 0, \alpha = 1/2$), in equilibrium, equal sharing of the surplus:
$(\underline{x}_1 + \frac{V-\underline{x}_1-\underline{x}_2}{2}; \underline{x}_2 + \frac{V-\underline{x}_1-\underline{x}_2}{2})$.
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This is the symmetric Nash bargaining solution.
- If $\epsilon \to 1$, the player that plays first has all the power and the other player gets its disagreement payoff.

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- Bargaining power in a vertical chain with downstream competition : creating a buying group

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  - λ is the degree of specificity of the investment for B with a complete specificity when $\lambda = 0$ and no specificity when $\lambda = 1$.

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- Irrespective of the buyer, an agreement between S and a buyer brings a value V.
- Formally we have a sequential stage game :
  1. An upstream seller S chooses its investment level I. Once the investment is realized, it is sunk.
  2. S bargains with B, following a Nash bargaining, over a contract T.

Bargaining stage

Maximize the Nash bargaining product:

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$$\Pi_S = V - (\frac{C(I) + C(\lambda I)}{2}) - I$$

decreases with the specificity of the investment.

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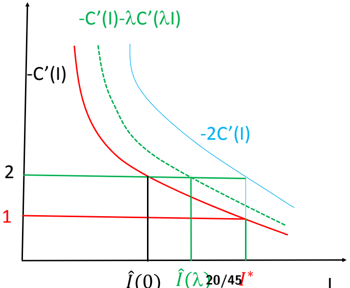
The FOC of an integrated firm is:

$$-C'(I) = 1$$



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- Here specificity of investment by the producer is a source of buyer power!
- Vertical integration is a solution to hold-up.

Exercise 1: Bargaining power within a chain of monopolies

Assumptions:

- A manufacturer produces a good at a unit cost c.
- A retailer faces a demand $D(p) = 1 - p$.
- The game:
    1. The manufacturer and the retailer bargain over a two-part tariff contract (w, F);
    2. The retailer sets a final price p to consumers.

Questions:

1. Given the contract (w, F), determine the optimal price set by the retailer in stage 2. Determine the stage-2 equilibrium profits of firms $\pi_U(w) + F$ and $\pi_D(w) - F$.

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- The FOC is: $1 - 2p + w = 0 \Rightarrow p = \frac{1+w}{2}$;
- Profits are $\pi_U(w) = (w - c)(\frac{1-w}{2})$ and $\pi_D(w) = (\frac{1-w}{2})^2$.

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- FOCS are:

$$\begin{aligned} -(\pi_U(w) + F) + (\pi_D(w) - F) &= 0 \qquad (1) \\ \frac{\partial \pi_U(w)}{\partial w}(\pi_D(w) - F) + \frac{\partial \pi_D(w)}{\partial w}(\pi_U(w) + F) &= 0 \qquad (2) \end{aligned}$$

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- w is set to maximize joint profits $w^* = c$: Efficiency!

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- Using (2), we have : $F^* = \frac{\pi_D(c)-\pi_U(c)}{2} = \frac{(1-c)^2}{8}$.
- In equilibrium both firms obtain a profit $\frac{(1-c)^2}{8}$.

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- D can also offer the two products and in that case the integrated profit is Π^{HL}.
- Products are imperfect substitutes : $\Pi^H < \Pi^{HL} < \Pi^H + \Pi^L$.
- D can either open two slots or restrict its capacity to one single slot.

Research issue

Does D have an incentive to restrict its capacity to one slot?

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D has no incentive to restrict its capacity to one slot. He always offer the two goods and this is strictly profitable for two reasons:

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Comparing these offers for D:

$$\pi_D^H + \bar{S}_H = \Pi^H > \pi_D^L + \bar{S}_L = \Pi^L \Rightarrow H \texttt{ wins.}$$

In equilibrium H offers $S_H^* = \max\{\Pi^L - \pi_D^H, 0\} = \Pi^L - \alpha\Pi^H$ such that D is just indifferent between the two options. $S_H^* > 0$ only when $\alpha < \alpha^s = \frac{\Pi^L}{\Pi^H}$ and in that case the profit of D amounts to $\pi_D^H + \Pi^L - \pi_D^H = \Pi^L$.

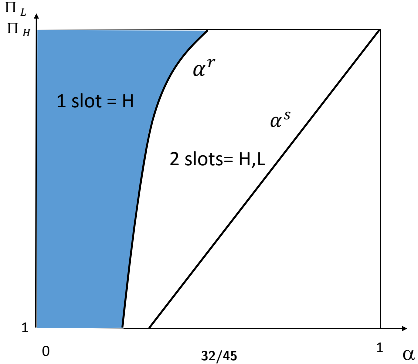
Capacity restriction

With slotting fees, D may have incentive to restrict its capacity to one slot when $\alpha < \alpha^r = \frac{\Pi^{HL} - \Pi^H}{2\Pi^{HL} - \Pi^H - \Pi^L} \in [0, 1]$. BOUTON

- By creating a competition for slots among suppliers D may obtain a larger share of a smaller pie.

$\Pi_{HL} = 4$

$\Pi_H = 3$



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Profitability of a buying group?

A buying group consists in bargaining together and then compete on the downstream market.

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  - We obtain the Cournot equilibrium quantities $q_i^C(w_i, w_j) = \frac{1+w_j-2w_i}{3}$ for $i = 1, 2$.

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Bargaining stage

The asymmetric Nash product is:

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In equilibrium wholesale unit prices are $w_i = w_j = \frac{\alpha}{2}$. Thus equilibrium profits are $\pi_i^C = \frac{(8-7\alpha)^2}{36(4-3\alpha)^2}$ and $\pi_U^C = \frac{\alpha(8-7\alpha)}{6(4-3\alpha)^2}$.

With buying group

The bargaining succeeds either with both firms or none. The bargaining stage is thus rewritten as follows:

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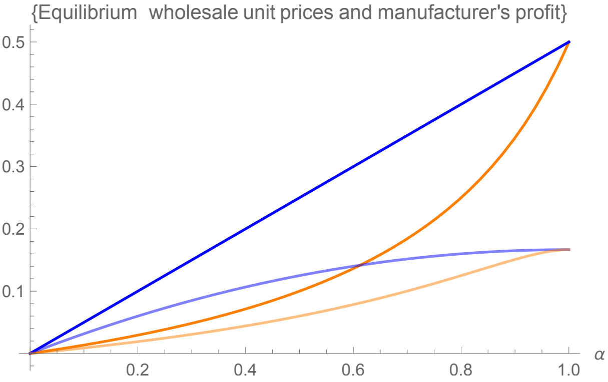
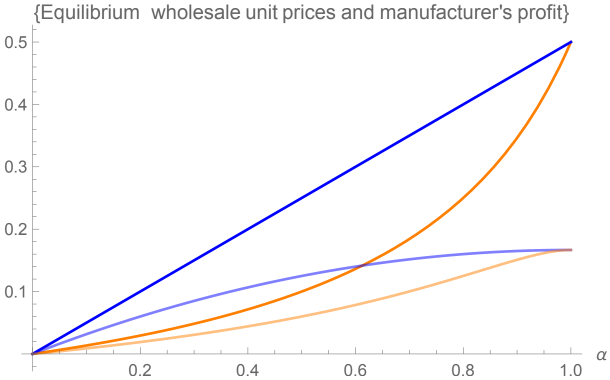
Comparing (4) with (3) it is immediate that the equilibrium w decreases with the buying group. In equilibrium we find that wholesale unit prices are $w_i = w_j = \frac{\alpha}{2(4-3\alpha)}$. Thus equilibrium profits are $\pi_i^C = \frac{(2-\alpha)^2}{36}$ and $\pi_U^C = \frac{\alpha(2-\alpha)}{6}$.



Legend: Blue - No Buying Group; Orange- Buying Group. Bold: Wholesale prices.



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Forming a Buying group enhances retailer's buyer power.

They obtain lower input prices and capture a larger share of profit to the detriment of the manufacturer.

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- Use $P(Q) = 1 - Q$ and $C(Q) = \frac{Q^2}{2}$ for numerical application.
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$$F_1 - C(q_1 + q_2) + C(q_2) = P(q_1)q_1 - F_1$$

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  - Numerical application : $q_1^* = q_2^* = \frac{1}{4}$, $F_1^* = F_2^* = \frac{9}{64}$, $\Pi_U^* = \frac{5}{32}$, $\Pi_1^* = \Pi_2^* = \frac{3}{64}$.

2. D_1 and D_2 merge and the new entity bargain with U over a new contract (q, F). Determine the new equilibrium profits.

- Nash bargaining with the merged entity
  - $U - D_1$ maximizes the Nash product: $\max_{q_1,q_2,F}[\Pi_U][\Pi_M]$ with $\Pi_M = P(q_1)q_1 + P(q_2)q_2 - F$
  - FOCS are:

$$F - C(q_1 + q_2) = P(q_1)q_1 + P(q_2)q_2 - F$$

    and

$$C'(q_1 + q_2) = P'(q_1)q_1 + P(q_1)$$

    The second condition is unchanged which implies that quantity sold is the same.
  - Numerical application : $q_1^M = q_2^M = \frac{1}{4}$, $F = \frac{1}{4}$, $\Pi_U^M = \frac{1}{8}$, $\Pi_1^M = \Pi_2^M = \frac{1}{16} = \frac{4}{64} > \frac{3}{64}$.

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- The merge unit bargain for the whole quantity, that is both the marginal quantity and the infra marginal quantity (less costly).

BOUTON

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- The relative outside options are key to determine the sharing of profits within the channel.
  - Restricting the shelf capacity may be a way for a retailer to enhance competition among manufacturers and obtain a larger share of a smaller pie.
  - Forming a buying group may be a way for retailers to obtain lower input prices from manufacturer (Caution: linear wholesale unit prices or convex production cost!)

References

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- The profit of D when he offers two products HL:

$$\pi_D^{HL} = (2\alpha - 1)\Pi^{HL} + (1-\alpha)(\Pi^H + \Pi^L)$$

- The profit of D when he sells H only is:
  - $\pi_D^H = \pi^L$ if $\alpha < \alpha^s = \frac{\Pi^L}{\Pi^H}$
  - $\pi_D^H = \alpha\pi^H$ if $\alpha > \alpha^s$
- Assume that $\alpha < \alpha^s$, comparing the two profits, we have:
  - $\pi_D^{HL} < \Pi^L \Rightarrow \alpha < \alpha^r = \frac{\Pi^{HL} - \Pi^H}{2\Pi^{HL} - \Pi^H - \Pi^L}$
  - We also check that $\alpha^r < \alpha^s$ (True, using $\Pi^{HL} < \Pi^H + \Pi^L$).
- Assume that $\alpha > \alpha^s$, comparing the two profits, we have:
  - $\pi_D^{HL} > \pi_D^H$

back

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