

ECO 650: Firms' Strategies and Markets

Course 1: Multiproduct firms' pricing strategies

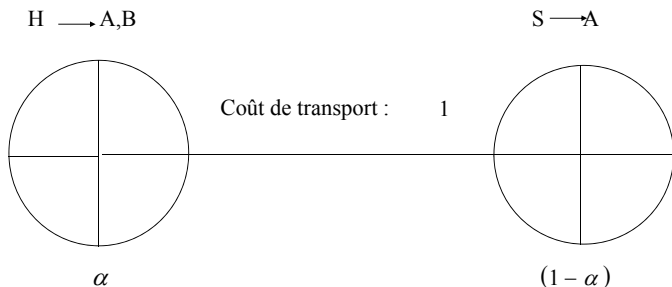
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Exercise 1

- ▶ Two stores H (Hypermarket) and S (Supermarket)
- ▶ H sells A and B – S sells A
- ▶ $\alpha \in [0, \frac{1}{2}]$ consumers are located at H and $1 - \alpha$ in S.
- ▶ Transportation cost among the stores is normalized to 1.
- ▶ $u_A = 1$; u_B uniformly distributed over $[0, 1]$ around each store.
- ▶ $b \in [0, 1]$ is the unit cost for B. No cost for A.



1. Which consumers may travel from one store to the other?
2. We note $p^H = p_A^H + p_B^H$ the sum of prices for the two goods at store H ; p^S the price of B at store S .
Determine the demand at each store.
3. Determine the two candidates Nash equilibria in pure strategy.
4. Assume $b \rightarrow 0$ and $\alpha = \frac{1}{9}$; show that the loss-leading equilibrium is the unique Nash equilibrium in pure strategy.
5. How do you explain the emergence of this loss-leading equilibrium?

Solution–Exercise 1

1. No consumer in H will travel to S as $u_B < 1$. In contrast, when $1 + u_B - p^H - 1 > 1 - p^S$ (i.e. $u_B > 1 + p^H - p^S$) consumers located in S may choose to travel to H to buy the two goods A and B instead of A alone.
2.
 - ▶ If $p^H < p^S$, some consumers travel from S to H to buy the two goods and $D_A^H = \alpha + (1 - \alpha)(p^S - p^H)$ whereas $D_B^H = \alpha(1 - p_B^H) + (1 - \alpha)(p^S - p^H)$. Demand for A at S is $D^S = (1 - \alpha)(1 + p^H - p^S)$.
 - ▶ If $p^H > p^S$, $D_A^H = \alpha$ whereas $D_B^H = \alpha(1 - p_B^H)$ and $D^S = 1 - \alpha$.
3.
 - ▶ If $p^H < p^S$, the profit of H can be written as:

$$\Pi^H = (p^H - b)[\alpha + (1 - \alpha)(p^S - p^H)] - \alpha p_B^H (p_B^H - b)$$

$$\Pi^S = (1 - \alpha)p^S(1 + p^H - p^S)$$

Maximizing Π^H with respect to p^H and p_B^H , and Π^S with respect to p^S , we obtain the first loss-leading equilibrium candidate:

$$p^{H*} = \frac{1 + \alpha}{3(1 - \alpha)} + \frac{2b}{3}, p_B^{H*} = \frac{b}{2}, p^{S*} = \frac{2 - \alpha}{3(1 - \alpha)} + \frac{b}{3}$$

3. ▶ If $p^H > p^S$, the profit of H and S can be respectively written as:

$$\Pi^H = p_A^H \alpha + \alpha(1 - p_B^H)(p_B^H - b), \quad \Pi^S = (1 - \alpha)p^S$$

Maximizing Π^H with respect to p_A^H and p_B^H , and Π^S with respect to p^S , we obtain the second local monopoly equilibrium candidate:

$$\hat{p}_A^H = 1, \hat{p}_B^H = \frac{1+b}{2}, \hat{p}^S = 1$$

4. The equilibrium profit in the loss-leading case is:

$$\Pi^{H*} = \frac{(1 + \alpha - b(1 - \alpha))^2}{9(1 - \alpha)} + \frac{b^2 \alpha}{4}, \quad \Pi^{S*} = \frac{(2 - \alpha)^2}{9(1 - \alpha)} + \frac{b^2(1 - \alpha)}{9}$$

In the local monopoly case:

$$\hat{\Pi}^H = \alpha + \frac{(1 - b)\alpha}{4}, \quad \hat{\Pi}^S = 1 - \alpha$$

Assume $b \rightarrow 0$, when $\alpha = \frac{1}{9}$: H has no incentive to deviate unilaterally from the loss leading strategy by raising its price to the local monopoly level as $\Pi^{H*} = 2 \cdot (\frac{5}{9})^2 > \hat{\Pi}^H = \frac{5}{9} \cdot \frac{1}{4}$. Conversely when $\alpha = \frac{1}{3}$, the deviation becomes profitable. Again, S cannot unilaterally deviate by raising her price as it would remain in the competition situation.

5. The logic under the result here is complementarity.

- ▶ A complementarity between the two independent products arises through the transportation cost.
- ▶ H has an incentive to sell B below cost because this is the product which has an elastic demand, and therefore lowering this price below cost can attract consumers from S .
- ▶ If instead $\alpha = \frac{1}{3}$ there is a local monopoly equilibrium. H has no incentive to compete to attract consumers from S .