Industrial Organization

Midterm Fall 2022 – Solution Topics

1. False.

In monopolistic competition, the assumption of free entry and exit implies that long-run profits are equal to zero, even if product quality were to increase.[1] However, in the short-run, an increase in the quality of a differentiated product – leading to an increase in the individual or specific demand for that product – may lead to higher profits, provided that the associated cost is not too large.

2. True.

If the quantity supplied by the competitive fringe is only positive for a very high price (relative to the Dominant Firm's marginal cost), then the fringe supply curve will be "very high up" in the price-quantity space (i.e., the competitive fringe is "very inefficient").

Therefore, it is possible that the Dominant Firm's optimal choice of quantity will be such that the resulting market price is below the fringe supply curve – meaning that the quantity supplied by the fringe will be 0.[2] In that particular case, the presence of the fringe "is almost useless from a social welfare viewpoint," as it does not contribute to a reduction of the deadweight loss.

3.

(i) The franchisee is a monopolist:

$$\max_{\{Q\}} \pi^M = (10 - Q)Q - (2 + c)\,Q$$

$$FOC: \frac{d\pi^M}{dQ} = 0 \Leftrightarrow 10 - 2\mathrm{Q} - 2 - \mathrm{c} = 0 \Leftrightarrow \mathbf{Q^M} = \mathbf{4} - \frac{\mathbf{c}}{\mathbf{2}}$$

(ii) The franchisor's optimal choice of c (the "rent" received per burger sold by the franchisee) can be obtained from the following maximization problem:[3]

$$\max_{\{c\}} \pi^F = cQ = c\left(4 - \frac{c}{2}\right)$$

[1] You did not need to mention long-run profits in order to get full points.
[2] For a numerical example, see exercise 4.1.1. in the IO Exercise Book (in particular, the case for which $c = 20$).
[3] You could include a Fixed Cost (to maintain the brand) in the franchisor's problem, but that was not required.

$$FOC: \frac{d\pi^F}{dc} = 0 \Leftrightarrow 4 - \text{c} = 0 \Leftrightarrow \mathbf{c = 4}$$

(iii)

Franchisee's profit: $\pi^M = \left(10 - 4 + \frac{4}{2}\right)\left(4 - \frac{4}{2}\right) - (2 + 4)\left(4 - \frac{4}{2}\right) = 4$

Franchisor's profit: $\pi^F = 4\left(4 - \frac{4}{2}\right) = 8$

Consumers' surplus: $CS = \frac{2(10-8)}{2} = 2$

(iv) The franchisee is a monopolist:

$$\max_{\{Q\}} \pi^M = (10 - Q)Q - 2Q$$

$$FOC: \frac{d\pi^M}{dQ} = 0 \Leftrightarrow 10 - 2\text{Q} - 2 = 0 \Leftrightarrow \mathbf{Q^M = 4}$$

(v) The franchisor will seek to extract the franchisee's entire producer surplus as a fixed fee, F. Therefore, he should charge $F = (6 - 2) * 4 = 16$ to "rent" the brand.

(vi)

Franchisee's profit: $\pi^M = (6 - 2) * 4 - 16 = 0$

Franchisor's profit: $\pi^F = 16$

Consumers' surplus: $CS = \frac{4(10-6)}{2} = 8$

(vii) The new scheme is socially better than the old one.

Total Surplus with per-unit-of-output fee, c: $4 + 8 + 2 = 14$

Total Surplus with fixed fee, F: $16 + 8 = 24$

4.

(i) Firm 1's profit-maximization problem:

$$\max_{\{P_1\}} \pi_1 = P_1(10 - P_1 + P_2) - 6(10 - P_1 + P_2)$$

$$FOC: \frac{d\pi_1}{dP_1} = 0 \Leftrightarrow 10 - 2\text{P}_1 + \text{P}_2 + 6 = 0 \Leftrightarrow \boldsymbol{P_1 = 8 + \frac{P_2}{2}}$$

Firm 2's demand is symmetric to Firm 1's. Besides, Firm 2's cost structure (in particular, the marginal cost) is equal to Firm 1's. Therefore, in equilibrium, $\boldsymbol{P_1 = P_2}$ (symmetry).

$$\begin{cases} P_1 = 8 + \dfrac{P_2}{2} \\ P_1 = P_2 \end{cases} \Leftrightarrow \begin{cases} \dfrac{P_1}{2} = 8 \\ - \end{cases} \Leftrightarrow \begin{cases} \boldsymbol{P_1 = 16} \\ \boldsymbol{P_2 = 16} \end{cases}$$

$$q_1 = 10 - 16 + 16 = 10; q_2 = 10$$

$$\boldsymbol{\pi_1 = (16 - 6) * 10 = 100; \pi_2 = 100}$$

(ii) Firm 1's new profit-maximization problem:

$$\max_{\{P_1\}} \pi_1 = P_1(10 - P_1 + P_2) - \mathbf{2}(10 - P_1 + P_2)$$

$$FOC: \frac{d\pi_1}{dP_1} = 0 \Leftrightarrow 10 - 2\mathrm{P}_1 + \mathrm{P}_2 + \mathbf{2} = 0 \Leftrightarrow \boldsymbol{P_1 = 6 + \frac{P_2}{2}}$$

In equilibrium:

$$\begin{cases} P_1 = 6 + \dfrac{P_2}{2} \\ P_2 = 8 + \dfrac{P_1}{2} \end{cases} \Leftrightarrow \begin{cases} P_1 = 6 + \dfrac{8 + \frac{P_1}{2}}{2} \\ - \end{cases} \Leftrightarrow \begin{cases} P_1 = 10 + \dfrac{P_1}{4} \\ - \end{cases} \Leftrightarrow \begin{cases} \boldsymbol{P_1 = \dfrac{40}{3}} \\ \boldsymbol{P_2 = \dfrac{44}{3}} \end{cases}$$

$$q_1 = 10 - \frac{40}{3} + \frac{44}{3} = \frac{34}{3}; q_2 = 10 - \frac{44}{3} + \frac{40}{3} = \frac{26}{3}$$

$$\boldsymbol{\pi_1 = \left(\frac{40}{3} - 2\right) * \frac{34}{3} = 128.(4); \pi_2 = \left(\frac{44}{3} - 6\right) * \frac{26}{3} = 75.(1)}$$

(iii) The total effect of the R&D project on P_1 is the change from $P_1 = 16$ **(i)** to $P_1 = \frac{40}{3}$ **(ii)**.

In order to separate the two effects, you need to calculate a hypothetical equilibrium corresponding to the "intermediate scenario" in which Firm 2 is unaware of Firm 1's project: in that case, $\boldsymbol{P_2 = 16}$ (Firm 2's information and cost structure are exactly the same as in part **(i)**, so its optimal choice will be the same).

In equilibrium:

$$\begin{cases} P_1 = 6 + \dfrac{P_2}{2} \\ P_2 = 16 \end{cases} \Leftrightarrow \begin{cases} \boldsymbol{P_1} = 6 + \dfrac{16}{2} = \mathbf{14} \\ - \end{cases}$$

$$q_1 = 10 - 14 + 16 = 12$$

Therefore, with respect to P_1:

- The direct effect of the R&D project is the change from $P_1^{(i)} = 16$ to $\boldsymbol{P_1^{(iii)} = 14}$ (this corresponds to a scenario in which c_1 declines but Firm 2's choice is kept constant).
- The strategic effect of the R&D project is the change from $\boldsymbol{P_1^{(iii)} = 14}$ to $P_1^{(ii)} = \frac{40}{3}$

(iv)

$$\boldsymbol{\pi_1^{(iii)}} = (\mathbf{14-2}) * \mathbf{12} = \mathbf{144}$$

- The direct effect of the R&D project with respect to Firm 1's profits is the increase from $\pi_1^{(i)} = 100$ to $\boldsymbol{\pi_1^{(iii)}} = \mathbf{144}$
- The strategic effect of the R&D project with respect to Firm 1's profits is the decrease from $\boldsymbol{\pi_1^{(iii)}} = \mathbf{144}$ to $\pi_1^{(ii)} = 128. (4)$