Industrial Organization

Resit Exam Spring 2023 – Solution Topics

1. True.

In a market with N firms, the decision for firms to establish a collusive agreement depends on the following condition:[1]

$$\frac{\pi^M}{N} + \frac{\pi^M}{N}\delta + \frac{\pi^M}{N}\delta^2 + \cdots > \pi^M \leftrightarrow \delta > 1 - \frac{1}{N}$$

This result shows that as the number of firms (N) in the market increases, the minimum value of delta required to attain a collusive agreement increases as well. Consequently, as N grows larger, the likelihood of collusion decreases.

Based on this reasoning, the statement holds true. In the case of the widebody aircraft market, there are fewer firms compared to the narrowbody aircraft market. Therefore, anticompetitively high prices are less likely to occur in the latter market. However, it is important to note that the possibility of attaining a collusive agreement still exists in a market with more firms if each firm's delta value is sufficiently high. Hence, while less likely, collusion cannot be entirely ruled out.

2. True.

Profits are positive in a symmetric Cournot duopoly in which firms do not face fixed costs, in spite of product homogeneity. Therefore, product heterogeneity is not a *necessary* condition for positive profits. Moreover, in Monopolistic Competition, long-run profits are equal to zero, even though goods are differentiated. Hence, product heterogeneity is not a *sufficient* condition for positive profits.

Short-run profits may be positive in a Monopolistic Competition framework, in spite of product heterogeneity. Therefore, product homogeneity is not a *necessary* condition for positive profits. Finally, in a symmetric Bertrand duopoly, profits are equal to zero even though goods are homogeneous. Thus, product heterogeneity is not a *sufficient* condition for positive profits.

[1]For simplicity, without loss of generality, here we assume that if firms collude, they will do it around the optimal collusive price, i.e., the monopoly price.

3.

(i)

Since firms compete in prices and have the same marginal cost, the Bertrand Paradox emerges as the only conceivable equilibrium.

Bertrand Paradox: $P = MC_A = MC_B = 2 \rightarrow Q(P = 2) = 8 \rightarrow q_A = q_B = 4 \rightarrow \pi_A = \pi_B = 0$.

(ii)

As previously mentioned, in the presence of both firms in this market, neither of them will generate any profit.

If firm A chooses to initiate a lawsuit against firm B, firm B faces two possible courses of action:

- Not defend: In this scenario, firm B would opt not to defend itself. Consequently, firm B would exit the market, experiencing a profit of 0, the same as in the previous scenario.
- Defend: Alternatively, firm B may choose to defend itself. However, this choice entails the payment of legal expenses, specifically lawyer fees amounting to f. Regardless of the lawsuit's outcome, if firm B decides to defend itself, its profit would be $-f$.

Given these two alternatives, when confronted with a lawsuit from firm A, firm B will opt not to defend itself.

(iii)

As explained earlier, if firm A initiates a lawsuit against firm B, firm B will choose not to defend itself, leading to its exit from the market and granting firm A a monopoly position.

As a monopolist, firm A's profit can be calculated by solving the following maximization problem:

$$\max_Q \pi_A = P(Q).Q - TC(Q) - f = (10 - Q).Q - 2Q - f$$

$$\frac{d\pi_A}{d_Q} = 0 \leftrightarrow 10 - 2Q - 2 = 0 \leftrightarrow Q^M = 4 \rightarrow P^M = 6 \rightarrow \pi_A = 16 - f$$

Firm A would decide to file a lawsuit against firm B if the profits from doing so outweigh the profits of refraining from the lawsuit, meaning:

$$\pi_A^{ii} > \pi_A^{i} \leftrightarrow 16 - f > 0 \leftrightarrow f < 16.$$

Hence, firm A will file a lawsuit against firm B as long as f is less than 16.

(iv)

Each firm has two available strategies: file or not file. This game can be represented in the following payoff matrix:

A/B	File	Not File
File	$(8-2f, 8-2f)$	$(16-f, 0)$
Not File	$(0, 16-f)$	$(0,0)$

The solution of this game depends on the magnitude of f, the legal expenses:

- If $0 < f < 4 \rightarrow$ In this case, both firms will choose to file a lawsuit. NE: (File, File).
- If $4 < f < 16 \rightarrow$ In this range, only one firm will choose to file a lawsuit while the other firm refrains from filling. NE: (File, Not File) and (Not File, File).
- If $f > 16 \rightarrow$ When legal expenses exceed 16, neither firm will file a lawsuit. NE: (Not File, Not File).

Therefore, depending on the magnitude of f, the legal expenses, the game's solution leads to different outcomes: both firms filing a lawsuit, one firm filing while the other does not, or neither firm filing a lawsuit.

(v)

In the initial scenario, when only firm A had the ability to file a lawsuit, firm A would choose to initiate a lawsuit against firm B if the legal expenses, f, were less than 16. In this situation, firm B would not defend itself, resulting in firm A becoming the sole firm in the market. As a monopolist, firm A would set the price at the monopoly level, i.e., $P = P^M = 6$.
However, if the legal expenses exceed 16 ($f > 16$), firm A would decide not to file a lawsuit against firm B. In this case, both firms would charge a price equal to their marginal cost, which is $P = MC_A = MC_B = 2$.
Therefore, in the initial scenario, depending on the magnitude of the legal expenses, either firm A would become a monopolist charging a higher price or both firms would compete by setting a price equal to their marginal cost.

Magnitude of f	***Outcome***	***Market Price***
$f < 16$	Firm A files a lawsuit against firm B and firm B leaves the market	$P = P^M = 6$
$f > 16$	Firm A decides not to file a lawsuit against firm B	$P = MC_A = MC_B = 2$

On the other hand, if firm B also has the ability to file a lawsuit, the dynamics of the situation change:

Magnitude of f	***Outcome***	***Market Price***
$0 < f < 4$	Both firms will choose to file a lawsuit. In this case, the losing firm will leave the market and the other one becomes a monopolist	$P = P^M = 6$
$4 < f < 16$	Only one firm chooses to file a lawsuit while the other firm refrains from doing so, leaving the market. As a result, the firm that filed the lawsuit will become a monopolist	$P = P^M = 6$
$f > 16$	Neither firm will file a lawsuit. In this case, the equilibrium computed in (i) prevails	$P = MC_A = MC_B = 2$

Overall, in both situations, if $f > 16$ the equilibrium price in the market is $P = 2$ while if $f < 16$ the equilibrium price is $P = P^M = 6$.
Therefore, consumers in the market are not directly affected by firm B's ability to file a lawsuit.

4.[2]

(i) Firms will collude as long as the present value of profits under collusion is higher than the present value of profits under deviation:

$$\frac{\pi^M}{2} + \delta\frac{\pi^M}{2} + \delta^2\frac{\pi^M}{2} + \cdots \geq \pi^M \Leftrightarrow \cdots \Leftrightarrow \delta \geq \frac{1}{2}$$

The optimal collusive price is determined by the consumer valuation, which is set at 10. When firms collude around this optimal price, each firm sells to 5 consumers, resulting in a profit of $\pi_i = (10 - 2) \times 5 = 40$.

[2]You needed to show all the relevant intermediate steps in parts **(i)** and **(ii)**, not just jump from the initial inequality to the conclusion!

(ii)

As before, firms will collude as long as the present value of profits under collusion is higher than the present value of profits under deviation:

$$\frac{\pi^M}{2} + \delta^2 \frac{\pi^M}{2} + \delta^4 \frac{\pi^M}{2} + \cdots \geq \pi^M \Leftrightarrow \frac{\frac{\pi^M}{2}}{1-\delta^2} \geq \pi^M \Leftrightarrow \cdots \Leftrightarrow \delta \geq \frac{\sqrt{2}}{2}$$

The minimum discount factor required for collusion to be preferred over deviation has increased $\left(\frac{1}{2} < \frac{\sqrt{2}}{2}\right)$. This implies that sustaining a collusive agreement has become relatively harder (there is a smaller interval of possible values of δ that would enable collusion).

In summary, this technological evolution <u>hinders</u> tacit collusion.

(iii)

The optimal collusive price is still determined by the valuation of each consumer, i.e., 20.

(iv)

In order to find out whether firms benefited or not from the technological evolution, we must compare the present value of profits under collusion in both scenarios. Notice that, with the technological change and ensuing increase in consumer valuation, collusive payoffs have doubled to 80 per period. Firms benefit if:

$$\frac{80}{1-\delta^2} > \frac{40}{1-\delta} \Leftrightarrow \frac{80}{(1-\delta)(1+\delta)} > \frac{40}{1-\delta} \Leftrightarrow \frac{80}{1+\delta} > 40 \Leftrightarrow 80 > 40(1+\delta) \Leftrightarrow \delta < 1$$

Therefore, for any value of $\delta < 1$, the firms are better off with the new fertilizer technology (they would be indifferent if $\delta = 1$).