Industrial Organization

Resit Exam Fall 2023 – Solution Topics

1. <u>True.</u>

Requiring all firms to immediately publicize price changes enhances market transparency, allowing competing firms to closely monitor each other without having to resort to direct communication. This heightened transparency minimizes the detection lag, thereby reducing deviation payoffs and facilitating collusion.
TL; DR: When firms' price changes are almost immediately noted by their competitors, deviating from a tacit collusive agreement becomes less attractive, as competitors swiftly discover (and punish) any such deviations.

2. <u>True.</u>

When consumers refrain from searching for bargains or actively seeking the lowest prices, it can be considered as if each firm operates with its own set of consumers, essentially having its own demand. In this setting, firms possess the ability to maximize profits by tailoring prices according to their individual demand, essentially operating as a monopoly and charging the corresponding monopoly price.

In other words, the absence of price comparison behavior enables firms to set prices that optimize their profits, capitalizing on the consumer tendency to not actively seek bargains. This underscores how firms can leverage consumer behavior to their advantage in setting prices that maximize their profits.

3.[1]

(i)

Firms will collude as long as the present value of profits under collusion is higher than the present value of profits under deviation. In this case, that happens when each firm's discount factor is higher than ½:

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

(ii)

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

$$\frac{\pi^M}{2} + \delta^2\frac{\pi^M}{2} + \delta^4\frac{\pi^M}{2} + \cdots > \pi^M$$

[1]You needed to show all the relevant intermediate steps in parts **(i)** and **(ii)** (if you did not follow the suggested procedure in the latter), not just jump from the initial inequation to the conclusion!

Define $y = \delta^2$:

$$\frac{\pi^M}{2} + y\frac{\pi^M}{2} + y^2\frac{\pi^M}{2} + \cdots > \pi^M$$

Notice that the expression above is nearly identical to the initial inequation in part **(i)**. Therefore:

$$y > \frac{1}{2} \Leftrightarrow \delta^2 > \frac{1}{2} \Leftrightarrow \delta > \frac{1}{\sqrt{2}}$$

(iii)

In odd years, B will be the only *farturas* stall at the fair. Therefore, it will charge the monopoly price, P^M.

(iv)

Given that $\delta < \frac{1}{\sqrt{2}}$, tacit collusion is not possible under this arrangement. Therefore, the agreement will collapse, and firms will compete *à la* Bertrand in even years. *Farturas* will be sold for a price equal to both firms' marginal cost, *c*.

(v)

Yes. Since $\delta > \frac{1}{2}$, firms could collude before firm A announced its decision to quit the market in odd years. Therefore, *farturas* were sold for P^M every period.

Now, since tacit collusion falls apart in even years, consumers will only have to pay c per *fartura* whenever both firms are present at the fair. Therefore, in even years, Consumer Surplus will be higher than before.

(vi)

No. Even though the number of stalls at the fair is now lower in odd years, the fact is that had no practical impact on *farturas*' price and quantity traded (as discussed in part **(iii)**). However, firm A's decision led to the collapse of the tacit collusive agreement, thereby *increasing* competition in even years (as shown in part **(iv)**).

4.

(i)

Firm A's profit-maximization problem:

$$\max_{q_A} P(q_A + q_B + q_C)q_A - 4q_A$$

$$FOC: \frac{d\pi_A}{dq_A} = 0 \Leftrightarrow 10 - 2q_A - q_B - q_C - 4 = 0 \Leftrightarrow q_A^* = 3 - \frac{q_B + q_c}{2}$$

$$By\ symmetry\ q_A^* = q_B^* = q_C^* \rightarrow \boldsymbol{q_A^* = q_B^* = q_C^* = \frac{3}{2}}$$

$$Q = 4{,}5 \wedge P = 5{,}5 \wedge \boldsymbol{\pi_A^* = \pi_B^* = \pi_C^* = (5{,}5 - 4) \times 1{,}5 = 2{,}25}$$

(ii)

Firm M's profit-maximization problem:

$$\max_{q_M} P(q_M + q_C)q_M - cq_M$$

$$FOC: \frac{d\pi_M}{dq_M} = 0 \Leftrightarrow 10 - 2q_M - q_C - c = 0 \Leftrightarrow q_M^* = \frac{10-c}{2} - \frac{q_C}{2}$$

Firm C's profit-maximization problem:

$$\max_{q_C} P(q_M + q_C)q_C - 4q_C$$

$$FOC: \frac{d\pi_C}{dq_C} = 0 \Leftrightarrow 10 - 2q_C - q_M - 4 = 0 \Leftrightarrow q_C^* = 3 - \frac{q_M}{2}$$

$$\begin{cases} q_M^* = \frac{10-c}{2} - \frac{q_c}{2} \\ q_C^* = 3 - \frac{q_M}{2} \end{cases} \Leftrightarrow \begin{cases} \boldsymbol{q_M^* = \frac{14-2c}{3}} \\ \boldsymbol{q_C^* = \frac{2+c}{3}} \end{cases} \rightarrow \begin{cases} Q = q_M^* + q_C^* = \frac{16-c}{3} \\ P = 10 - Q = \frac{14+c}{3} \end{cases} \rightarrow \begin{cases} \boldsymbol{\pi_M^* = \left(\frac{14-2c}{3}\right)^2} \\ \boldsymbol{\pi_C^* = \left(\frac{2+c}{3}\right)^2} \end{cases}$$

(iii)

If $c = 4 \rightarrow \pi_M^*(c = 4) = \left(\frac{14-4\times2}{3}\right)^2 = 4.$

Before the transaction, $\pi_A + \pi_B = 2{,}25 + 2{,}25 = 4{,}5 > 4.$

The merger did not prove to be profitable for the merged entity, as evidenced by the decrease in its profits following the transaction.

(iv)

A merger triggers two effects on the profits of the merged entity: a **price effect** and a **quantity effect**.

Subsequent to the merger, the market equilibrium price experienced an increase to $P = \frac{14+4}{3} = 6$. This rise in the market equilibrium price contributes *positively* to the profits of the merged entity. Conversely, as the marginal cost of the merged entity remained constant post-transaction, the merged entity is expected to produce fewer units of output than before: $q_M^* = \frac{14-2\times4}{3} = 2 < 1{,}5 + 1{,}5$. This reduction in output exerts a *negative* impact on the profits of the merged entity.

In general, the total effect on the profits of the merged entity post-transaction is ambiguous and depends on the magnitude of these two effects. In the present case, with $c = 4$, the quantity effect surpasses the price effect, rendering the merger unprofitable for the merged entity.

(v)

If $c = 1 \rightarrow \pi_M^*(c = 1) = \left(\frac{14-1\times2}{3}\right)^2 = 16.$

Before the transaction, $\pi_A + \pi_B = 2{,}25 + 2{,}25 = 4{,}5 < 16.$

The merger proved to be profitable for the merged entity, as evidenced by the increase in its profits following the transaction.

In this case, when $c = 1$, the market equilibrium price decreases to $P = \frac{14+1}{3} = 5$ which contributes *negatively* to the profits of the merged entity. On the other hand, the merged entity will now produce $q_M^* = \frac{14-2\times 1}{3} = 4 > 1{,}5 + 1{,}5$. This increase in output exerts a *positive* impact on the profits of the merged entity.

Overall, when $c = 1$, the positive quantity effect surpasses the negative price effect, rendering the merger profitable for the merged entity.

(vi)

The merger is welfare enhancing if the market equilibrium price falls below the initial value of 5,5.

$$\frac{14+c}{3} < 5{,}5 \leftrightarrow 14 + c < 16{,}5 \leftrightarrow \boldsymbol{c < 2{,}5}$$

The merger is welfare enhancing as long as $\boldsymbol{c < 2{,}5}$.

(vii)

When a given merger is followed by a reduction in the marginal cost of the merged entity, it induces two distinct effects. Firstly, the merger, by eliminating one firm from the market, relaxes competition among the firms, resulting in a higher market equilibrium price. Simultaneously, a decrease in the marginal cost of the merged entity serves as an incentive for the merged entity to increase production, leading to a subsequent decline in the market equilibrium price.

The impact of the merger on welfare hinges on the value of the marginal cost (c). When c is high, the merger decreases total welfare, as the first effect outweighs the second. Conversely, the merger proves welfare-enhancing when c is sufficiently low, as the second effect prevails against the first one.

(Alternatively, one could recognize that the market equilibrium price, denoted as $P = \frac{14+c}{3}$, is a positive function of c. Consequently, as c increases, the market equilibrium price also increases, leading to a decrease in welfare, and vice versa. This relationship highlights the impact of changes in the marginal cost (c) on the market equilibrium price and, subsequently, on total welfare.)

(viii)

Prior to the merger, firm C's profits were 2.25. Subsequent to the merger, firm C's profits are represented by the expression $\left(\frac{2+c}{3}\right)^2$.

$$\pi_C^* = \left(\frac{2+c}{3}\right)^2 \rightarrow \left(\frac{2+c}{3}\right)^2 < 2{,}25 \leftrightarrow \frac{2+c}{3} < 1{,}5 \leftrightarrow 2 + c < 4{,}5 \leftrightarrow \boldsymbol{c < 2{,}5}$$

If c is less than 2.5, the merger will lead to a reduction in firm C's profits. This outcome is attributed to the merger causing a decline in the market equilibrium price thus leading to a decrease in firm C’s profits.