Industrial Organization

Collusion (II)

Week 11

Consider an **oligopoly** with **N symmetric firms**. Firm 1 is considering whether to collude or deviate in period t = 0. Assume that Firms 2, 3, ..., N will stick to the collusive agreement in that period.

If firms would compete à la Bertrand after Firms 2, 3, ..., N notice that Firm 1 deviated, Firm 1 will collude if:

$$\frac{\pi^M}{N} + \delta \frac{\pi^M}{N} + \delta^2 \frac{\pi^M}{N} + \dots > \pi^M + 0 + 0 + \dots$$

If firms would compete à la Cournot after Firms 2, 3, ..., N notice that Firm 1 deviated, Firm 1 will collude if:

$$\frac{\pi^{M}}{N} + \delta \frac{\pi^{M}}{N} + \delta^{2} \frac{\pi^{M}}{N} + \dots > \pi_{1}^{Deviation} + \delta \pi^{Cournot} + \delta^{2} \pi^{Cournot}$$
where $\pi_{1}^{Deviation} = \pi_{1} \left(q_{1} = BR_{1} \left(q_{2} = \dots = q_{N} = \frac{Q^{M}}{N} \right) \right)$



 $+ \cdots$



Consider an **oligopoly** with **N symmetric firms**. Firm 1 is considering whether to collude or deviate in period t = 0. Assume that Firms 2, 3, ..., N will stick to the collusive agreement in that period.

• If firms would **compete à la Bertrand** after Firms 2, 3, ..., N notice that Firm 1 deviated, **Firm 1 will collude if:**

$$\frac{\pi^M}{N} + \delta \frac{\pi^M}{N} + \delta^2 \frac{\pi^M}{N} + \dots > \pi^M + 0 + 0 + \dots \rightarrow \delta > 1 - \frac{1}{N}$$

What if Firms 2, 3, ..., N only find out after period t = 1 that Firm 1 deviated? (Detection lag)

$$\frac{\pi^{M}}{N} + \delta \frac{\pi^{M}}{N} + \delta^{2} \frac{\pi^{M}}{N} + \dots > \pi^{M} + \delta \pi^{M} + 0 + \dots \rightarrow \delta > \left(1 - \frac{1}{N}\right)^{\frac{1}{2}}$$

define a new variable (e.g., $v = \delta^{2}$).

Sometimes, it may be useful to *def*



1



WHEN COLLUDING, FIRMS WILL WEIGHT THE LONG RUN BENEFITS OF COLLUDING AGAINST THE SHORT RUN BENEFITS OF **DEVIATING!**

A firm will choose to collude as long as... (assuming a market with 2 firms)

 $\pi^{Collusion} > \pi^{Deviation}$

$$\frac{\pi^{M}}{2} + \delta \frac{\pi^{M}}{2} + \delta^{2} \frac{\pi^{M}}{2} + \cdots > \pi_{1}^{Deviation} + \delta \pi^{Non-co}$$

IF THE LONG RUN BENEFITS OF COLLUDING INCREASE/DECREASE, THEN COLLUSION IS MORE/LESS LIKELY. IF THE SHORT RUN BENEFITS OF DEVIATING INCREASE/DESCRASE, THEN COLLUSION IS LESS/MORE LIKELY.



 \leftrightarrow

ooperative equilibrium $+ \delta^2 \pi^{Non-cooperative}$ equilibrium $+ \cdots$

WHEN COLLUDING, FIRMS WILL WEIGHT THE <mark>LONG RUN BENEFITS OF COLLUDING</mark> AGAINST THE <mark>SHORT RUN BENEFITS OF DEVIATING!</mark>

A firm will choose to collude as long as... (assuming a market with 2 firms)

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True or False





"When two firms have different marginal costs, they will be unable to tacitly collude."



(*) These exercises are not in the exercise book



"Firms may tacitly collude and yet their price might not differ that much from the price they would

Collusion

EXERCISE (*)

3)

A small town organizes an annual fair every year. The fair's organizers reserve space for **two food stalls**. **One of them is always awarded to the local bakery**, *The Lovely Donut*, **whereas the other is awarded to another (non-local) bakery**, *Sweet Delights*. They both sell the same type of food, so much that the public sees them as perfect substitutes. The demand for food at each year's fair is the following: q = 10 - p. **The two bakeries compete in prices**, **which they set simultaneously and independently when the fair begins**. **The fair has been taking place for many decades and is expected to continue forever!** [Denote the discount rate by δ .] (i) Are the two bakeries able to tacitly collude on prices? If so, for which values of the discount factor will they be able to do so? Quantify.

(*) These exercises are not in the exercise book



Collusion

EXERCISE (*)

3)

- and the other in even years.
- easier or harder for the bakeries to tacitly collude under this new arrangement? Quantify and explain intuitively.
- relented and began allotting three slots for food stalls every year.
- (iv) Which regime is more favorable to the fair's visitors? Explain.
- (*) These exercises are not in the exercise book



A third (non-local) bakery, Au Bon Pain, has also applied to the fair. It too produces the same type of food as the two other bakeries. As a result, the organizers have decided that the two non-local bakeries will alternate, with one being awarded a space in odd years

(ii) Are the three bakeries able to tacitly collude on prices? If so, for which values of the discount factor will they be able to do so? Is it

Faced with insistent requests by the two non-local bakeries that both be allowed to participate every year in the fair, the fair organizers

(iii) Are the three bakeries able to tacitly collude on prices? If so, for which values of the discount factor will they be able to do so? Is it easier or harder for the bakeries to tacitly collude under this new arrangement (compared to the initial one)? Quantify and explain intuitively.



Collusion

EXERCISE (*)



Two firms, A and B, supply a market for a homogeneous good whose yearly demand is given by q = 10 - p. Both produce it at a **constant marginal and average cost of 2**. They **choose prices simultaneously and independently**, which they announce at the beginning of every year. **They expect to serve this market forever**. Denote the discount factor by δ as usual.

(i) Will these firms be able to tacitly collude? **What condition should the discount factor obey for this to be possible?** Quantify and explain.

(ii) What is the optimal tacit collusion price from the point of view of both firms? What will each firm's profit be? Quantify and explain.

(*) These exercises are not in the exercise book



Collusion

EXERCISE (*)

4

Firm B's factory has suffered a fire on new year's eve. As a result, its marginal and average cost is now 4, a fact that is common knowledge, and thus also known by firm A.
(iii) Will these firms still be able to tacitly collude around the optimal tacit collusion price? What will each firm's profit be?

As a consequence of the fire, **besides its higher marginal and average cost**, **4**, **firm B is also unable to produce more than one unit of output** per year, **a fact that is <u>not</u> common knowledge**, **and thus unknown to A**. (iv) Should firm B **(credibly) announce** its capacity constraint? If so, what will each firm's profit be? Compute and explain.

(*) These exercises are not in the exercise book



Recommended readings

CABRAL, LUIS MB. INTRODUCTION TO INDUSTRIAL ORGANIZATION. MIT PRESS, 2017.

✓ Chapter 8: Collusion





