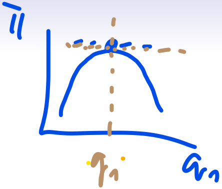
Static and dynamic games, preventing the entry and predation

Industrial organization – lecture 2

Cournot model

Pepall et al. (2014, pp. 222–228)

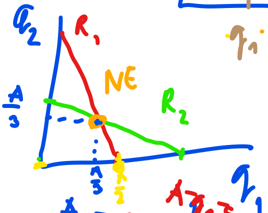


2 firms with

- the same marginal cost $c_1 = c_2 = c$
- zero fixed cost $F_1 = F_2 = 0$

Inverse demand function: $p = A - (q_1 + q_2)$

What is the Cournot equilibrium?
What is the profit?



$\Pi_1 = p \cdot q_1 - c \cdot q_1$

$\Pi_1 = (A - q_1 - q_2) \cdot q_1 - c \cdot q_1$

$\Pi_1 = Aq_1 - q_1^2 - q_1 q_2 - cq_1$

$\Pi_1' = A - 2q_1 - q_2 - c = 0$

$R_1: \quad q_1 = \frac{A - q_2 - c}{2}$

$R_2: \quad q_2 = \frac{A - q_1 - c}{2}$

$q_1 = \frac{A - c - \frac{A - q_1 - c}{2}}{2} = \frac{A + q_1 - c}{4}$

$\frac{3}{4} q_1 = \frac{A - c}{4}$

$q_1 = \frac{A - c}{3} \quad q_2 = \frac{A - c}{3}$

$\Pi = (p - c) \cdot q_1 = \left(A - \frac{A-c}{3} - \frac{A-c}{3} - c\right) \cdot \frac{A-c}{3}$

$= \left(\frac{A}{3} - \frac{c}{3}\right) \cdot \frac{A-c}{3} = \frac{(A-c)^2}{9}$

Stackelberg model

Pepall et al. (2014, pp. 265–268)

2 firms:

- firm 1 is the leader
- firm 2 is the follower

Both firms have

- the same marginal cost $c_1 = c_2 = c$
- zero fixed cost $F_1 = F_2 = 0$

Inverse demand function: $p = A - (q_1 + q_2)$

What is the Stackelberg equilibrium?
What is the profit?
What is the reason for the dominance of the leader?

leader knows: $q_2 = \frac{A - q_1 - c}{2}$

$\Pi_1 = p \cdot q_1 - c \cdot q_1$

$\Pi_1 = (A - q_1 - q_2) \cdot q_1 - c \cdot q_1$

$\Pi_1 = \left(A - q_1 - \frac{A - q_1 - c}{2}\right) \cdot q_1 - c \cdot q_1$

$\Pi_1 = Aq_1 - q_1^2 - \frac{A}{2}q_1 + \frac{q_1^2}{2} + \frac{c}{2}q_1 - cq_1$

$\Pi_1 = \frac{Aq_1}{2} - \frac{q_1^2}{2} - \frac{c}{2} \cdot q_1$

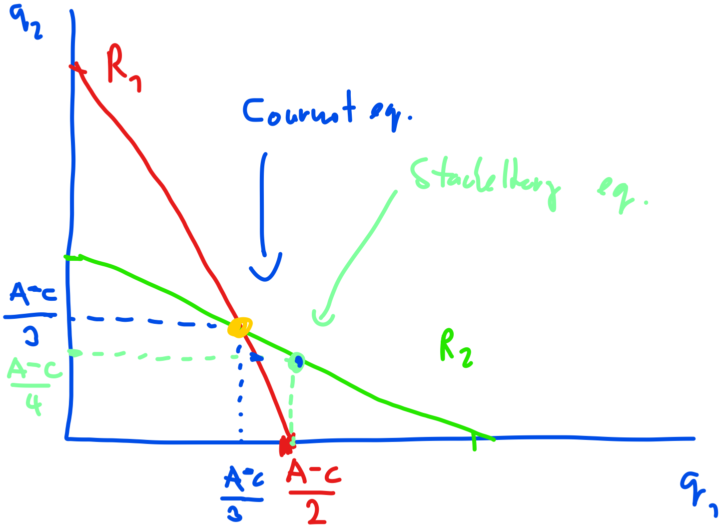
$\Pi_1' = \frac{A}{2} - q_1 - \frac{c}{2} = 0$

$q_1 = \frac{A - c}{2}$

$q_2 = \frac{A - c - \frac{A-c}{2}}{2}$

$\Pi_1 = (p - c) \cdot q_1 = \left(A - \frac{A-c}{2} - \frac{A-c}{4} - c\right) \cdot \frac{A-c}{2} = \left(\frac{A}{4} - \frac{c}{4}\right) \cdot \frac{A-c}{2} = \frac{(A-c)^2}{8}$

Stackelberg model – graph

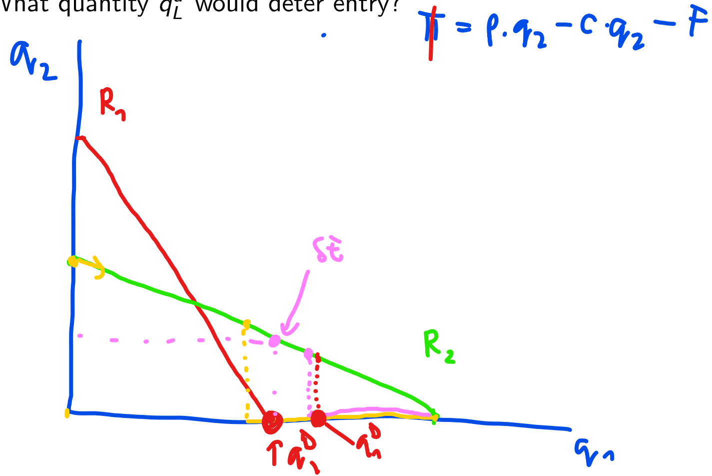


Limit output and limit price models

Pepall et al. (2014, pp. 289–291)

Stackelberg + the follower has one-time sunk entry costs F.

What quantity q_L^d would deter entry?



Limit output and limit price models

Pepall et al. (2014, pp. 289–291)

When does the leader choose the quantity q_L^d?

Capacity expansion as a credible entry-deterring commitment

Pepall et al. (2014, pp. 291–299)

Dixit, A. (1980). The role of investment in entry-deterrence. *The economic journal*, 90(357), 95–106.

A dynamic two-stage game between two firms:

1. The incumbent chooses the capacity level $\overline{K_1}$ at a cost $r\overline{K_1}$.
2. Cournot game:

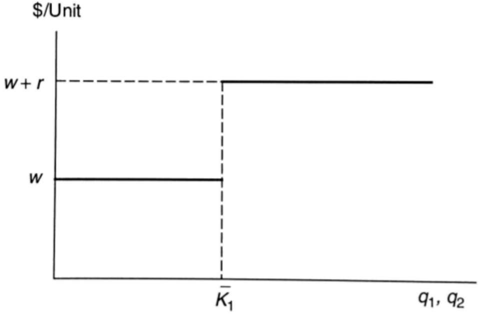
   The incumbent's costs are

$$c_1(q_1) = \begin{cases} wq_1 + r\overline{K_1} + F_1 & \text{for } q_1 \leq \overline{K_1} \\ (w+r)q_1 + F_1 & \text{for } q_1 > \overline{K_1} \end{cases}$$

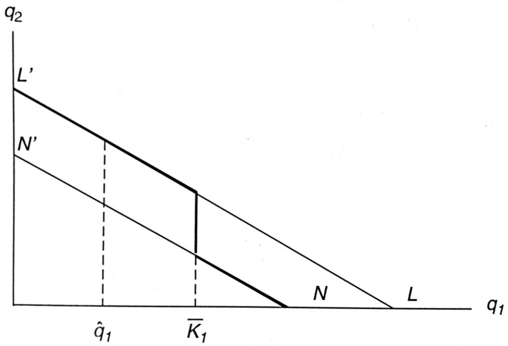
   The entrant's costs are

$$c_2(q_2) = (w+r)q_2 + F_2$$

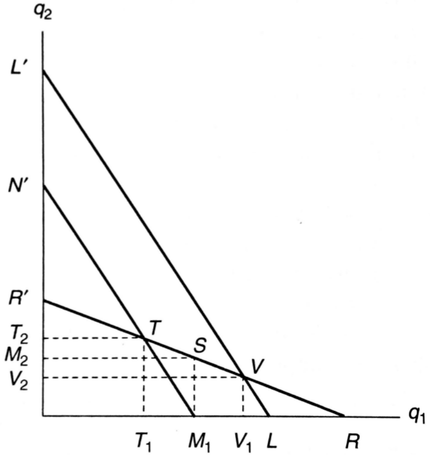
The effect of previously acquired capacity



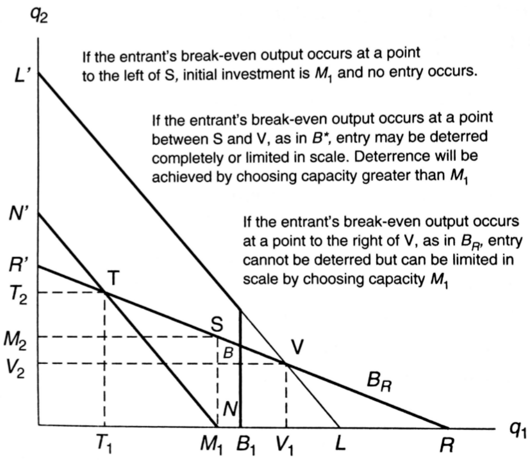
The incumbent's best response in stage 2



The rational bounds on the incumbent's choice of $\overline{K_1}$



Possible locations of the entrant's break-even point



Evidence on predatory capacity expansion

Pepall et al. (2014, pp. 304–309)

- Alcoa case – increased capacity 8x between 1912 and 1934
- Weiman and Levin (1994) – preemptive investment in SBT
- Safeway in Edmonton in 1960s and 1970s
- DuPont production of titanium dioxide
- Excess capacity expansion in Texas hotels