Market Power

Economics II: Microeconomics

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Microeconomics

- Consumers:
  - People.
  - Households.
- Firms:
  - Monopoly.
  - `Oligopoly` $\longleftarrow$ `Now`
  - Perfect Competition.
- Equilibrium:
  - Holds.
  - Does not hold.

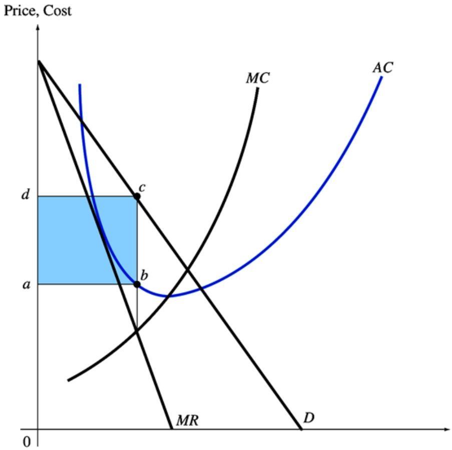
- Inverse Demand function:

$$p = D(q)$$

  - e.g. linear:

$$p = A - bq$$

- Optimal production
  - $\max \pi$.
  - $MR = MC$.
- Can it sustain perpetually?



Definition

Oligopoly is a market characterised with more than one producer where their individual decision on production has a non-negligible effect on the price of the good.

Definition

Duopoly is a version of Oligopoly with only two producers.

- Simultaneously choosing the quantity to produce.

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- Acknowledging the existence of the other producer.

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- Acknowledging the existence of the other producer.
- In equilibrium neither firm has incentive to change its output decision (Nash equilibrium).

- Demand:
  $p = A - b(q_1 + q_2)$

Problem

Given firm 2's decision firm 1 should choose an output level that maximises its profit subject to the market demand.

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  invariable $\bar{q}_2$

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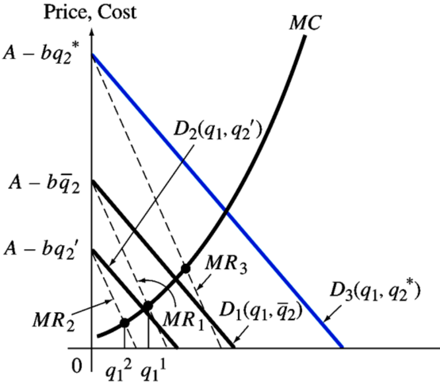
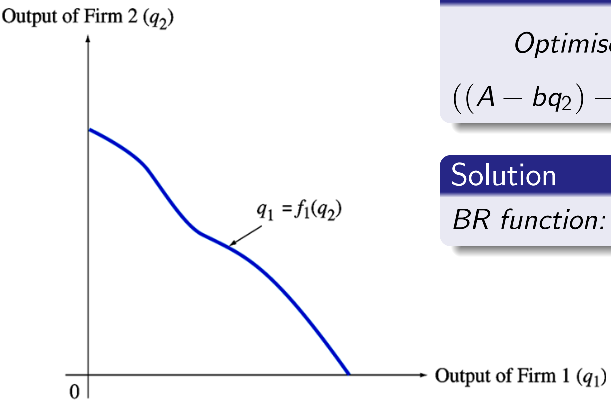


Reaction (Best Response) Function



Problem

$$Optimise: \ \max \pi_1 =$$
$$((A - bq_2) - bq_1) \cdot q_1 - C(q_1)$$

Solution

BR function: $q_1 = f_1(q_2)$

$$\pi_1 = p(q_1 + q_2) \cdot q_1 - C(q_1)$$

$$a_i, b_i, c_i, d_i \sim \pi_1(\bar{q}_2)$$

Normal Form

x a_1	x b_1	x c_1	x d_1
x a_2	x b_2	x c_2	x d_2
x a_3	x b_3	x c_3	x d_3
x a_4	x b_4	x c_4	x d_4

$\pi_1 = p(q_1 + q_2) \cdot q_1 - C(q_1)$
$a_i, b_i, c_i, d_i \sim \pi_1(\bar{q}_{2,i})$

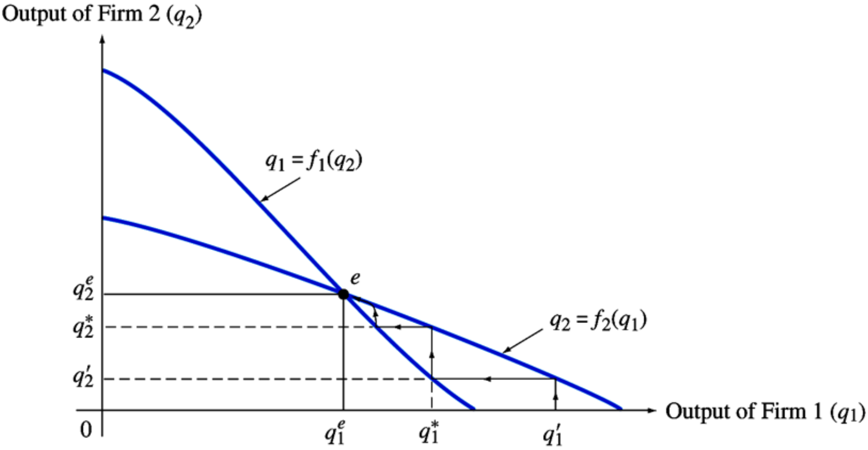
a_1, x	$\pi_1^*(q_{2,1})$, x	c_1, x	d_1, x
$\pi_1^*(q_{2,2})$, x	b_2, x	c_2, x	d_2, x
a_3, x	b_3, x	c_3, x	$\pi_1^*(q_{2,3})$, x
a_4, x	b_4, x	$\pi_1^*(q_{2,4})$, x	d_4, x

$\pi_1^*(q_{2,i}) = \max\{a_i, b_i, c_i, d_i\}$

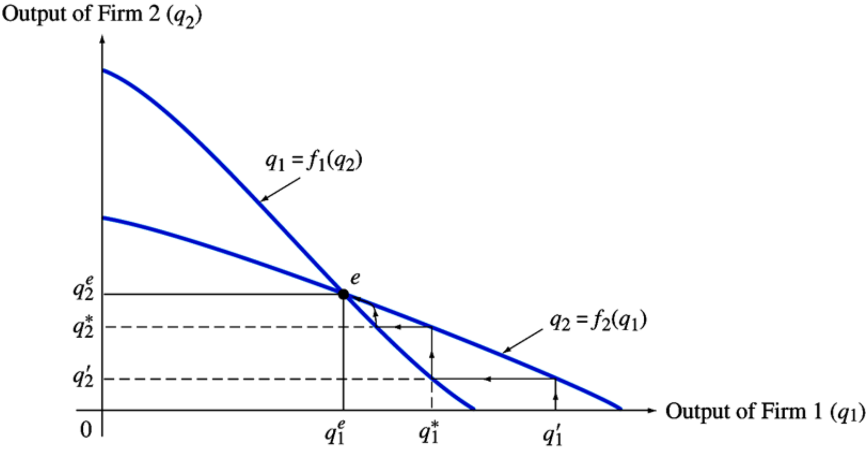
$$\pi_1 = p(q_1 + q_2) \cdot q_1 - C(q_1)$$
$$\pi_2 = p(q_1 + q_2) \cdot q_2 - C(q_2)$$

(v, x)	$(\pi_1^*(q_{2,1}), x)$	$(v, \pi_2^*(q_{1,3}))$	(v, x)
$(\pi_1^*(q_{2,2}), x)$	$(v, \pi_2^*(q_{1,2}))$	(v, x)	(v, x)
(v, x)	(v, x)	(v, x)	$(\pi_1^*(q_{2,3}), \pi_2^*(q_{1,4}))$
$(v, \pi_2^*(q_{1,1}))$	(v, x)	$(\pi_1^*(q_{2,4}), x)$	(v, x)

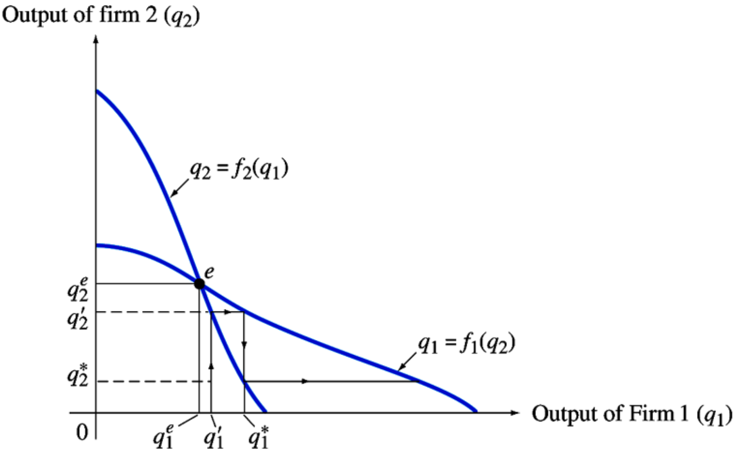
$$\pi_1^*(q_{2,i}) = \max\{\pi_1(q_{2,i})\}$$
$$\pi_2^*(q_{1,i}) = \max\{\pi_2(q_{1,i})\}$$



- Convergence of the Cournot equilibrium



- Convergence of the Cournot equilibrium
- Does it always converge?



Output of firm 2 (q_2)
$q_2 = f_2(q_1)$
e
q_2^e
q_2'
q_2^*
$q_1 = f_1(q_2)$
0
q_1^e
q_1'
q_1^*
Output of Firm 1 (q_1)

Firms Treat the Rivals as Equals.

Oligopoly

The Big Assumption of Cournot Model: Firms treat the rivals as equals.

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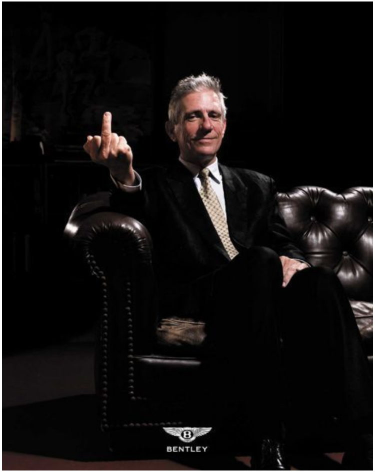
What is Next?

Oligopoly

Do firms treat the rivals as equals?



Definition

Stackelberg leader decides on the production quantity acknowledging the existence of the second producer in the market.

Definition

Stackelberg follower decides on the production quantity after observing what the leader firm has done.

Definition

Cournot Model is a simultaneous-move quantity-setting oligopoly (duopoly) game.

Definition

Stackelberg Model is a sequential-move quantity-setting oligopoly (duopoly) game.

Example (Cournot)

Problem (Firm 1)

$\max \pi_1 =$
$(A - b(q_1 + q_2)) \cdot q_1 - C(q_1)$
solution: $q_1 = f_1(q_2)$

Problem (Firm 2)

$\max \pi_2 =$
$(A - b(q_1 + q_2)) \cdot q_2 - C(q_2)$
solution: $q_2 = f_2(q_1)$

Demand: $p = A - bQ$

Example (Stackelberg)

Problem (Firm 2: Follower)

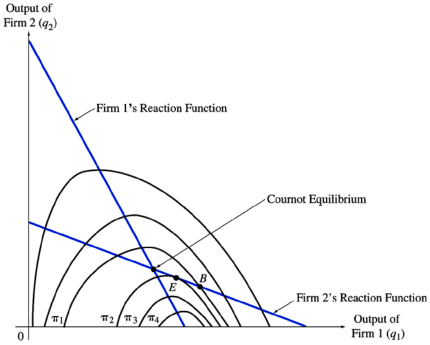
$\max \pi_2 =$
$(A - b(q_1^* + q_2)) \cdot q_2 - C(q_2)$
solution: $q_2 = f_2(q_1^*)$

Problem (Firm 1: Leader)

$\max \pi_1 =$

$(A - b(q_1 + f(q_1))) \cdot q_1 - C(q_1)$

solution: q_1^*



- *First-mover advantage*

Example (Stackelberg)

Problem (Firm 2: Follower)

$\max \pi_2 =$
$(A - b(q_1^* + q_2)) \cdot q_2 - C(q_2)$
solution: $q_2 = f_2(q_1^*)$

Problem (Firm 1: Leader)

$\max \pi_1 =$

$(A - b(q_1 + f(q_1))) \cdot q_1 - C(q_1)$

solution: q_1^*

Demand: $p = A - bQ$

QUESTIONS AND COMMENTS!

Definition

Bertrand model of price competition for oligopolies is a simultaneous-move price-setting market-sharing game.

The producer on the market faces the following demand function:

$$D_i\left(p_i, p_j\right) = \begin{cases} D\left(p_i\right) & \text{if } \; p_i < p_j \\ \frac{1}{2} D\left(p_i\right) & \text{if } \; p_i = p_j \\ 0 & \text{if } \; p_i > p_j \end{cases}$$

Definition

Bertrand (Nash) equilibrium is a pair of prices that , once set, are such that neither firm has any incentive to change its price given the price of its opponent.

Lemma

In case of Bertrand equilibrium the prices are equal to the marginal cost.

Proof.

If $p_j > c$, $p_i = p_j - \varepsilon > c$ *will capture all the market.* □

Fact

In order to make extra-normal (half monopoly level) profit, the producers may collude on price.

Example

	Honour Agreement		Cheat	
Honour Agreement	£1000	£1000	£ 200	£1200
Cheat	£1200	£ 200	£ 500	£ 500

- Simultaneous game
- Sequential game

Problem

Assume Bertrand price-competition while neither of the firms can satisfy the market demand alone (they are capacity-constrained)

Fact

Game defined by the Edgeworth model does not have an equilibrium: Prices cycle endlessly and never settle at any particular level. Industry will go through periods when prices fall ("price wars") and periods when prices rise (if prices reach marginal cost, they always move back to a higher level).

Thank you!

- Consumers:
  - People.
  - Households.
- Firms:
  - `Market Power` $\longleftarrow$ `Now`
  - Monopoly.
  - Oligopoly
  - Perfect Competition
  - Internal organisation
- Equilibrium:
  - Holds.
  - Does not hold.

Firm's problem

Revision

Optimal production

- $\max \pi$
  - $\pi = R - C$
  - $MR = MC$

Firm's problem
Revision

- Revenue:

$$R = p(Q) \cdot q$$

- Marginal revenue:

$$\begin{aligned}
MR &= \frac{\partial p}{\partial Q} q + \frac{\partial q}{\partial q} p \\
MR &= p\left(1 + \frac{\partial p}{\partial Q}\frac{Q}{p}\frac{q}{Q}\right) \\
MR &= p\left(1 - \frac{s}{|\varepsilon|}\right) \\
p &= MR \div \left(1 - \frac{s}{|\varepsilon|}\right)
\end{aligned}$$

- Pricing:

$$\boxed{p = MC \div \left(1 - \frac{s}{|\varepsilon|}\right)}$$

Markup Pricing:

$$p = \frac{MC}{1 - \frac{s}{|\varepsilon|}}$$

- Monopoly:

$$s = 1 : p = \frac{MC}{1 - \frac{1}{|\varepsilon|}}$$

- Oligopoly (Cournot):

$$s = q/Q : p = \frac{MC}{1 - \frac{s}{|\varepsilon|}}$$

- Competition:

$$s = 0 : p = MC$$

Definition

Lerner Index,

$$Ł = \frac{p - MC}{p},$$

is a measure of market power: the firm's ability to raise price above marginal cost.

Lemma

Lerner Index:

- *Monopoly:* $Ł = \frac{1}{|\varepsilon|}$
- *Oligopoly:* $Ł = \frac{s}{|\varepsilon|}$
- *Competitive firm:* $Ł = 0$

Definition

An industry consisting of many firms, each if which has an insubstantial share if the market, constitutes a **perfectly competitive market**.

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    - Perfect factor mobility

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- Characteristics:
  - The firms are price-takers
  - No barriers for entry
  - Homogeneous product
  - Perfect factor mobility
  - Perfect information

Lemma (Output Rule 1)

Produce when the price is above the average variable cost: $p > AVC$

Proof.

Follows from the shutdown condition:

$$-FC > pq - VC - FC$$

$\square$

Lemma (Output rule 2)

Produce at a level where the price is equal to the marginal cost: $p = MC$

Proof.

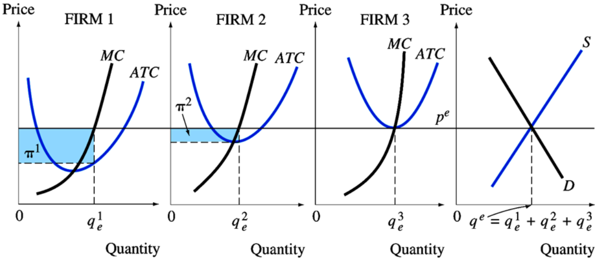
Follows from the zero marginal profit condition:

$$\pi' = 0$$

$\square$

Competitive firm

Short-Run Equilibrium for a Competitve Industry



Definition

A price-quantity combination constitutes a short-run equilibrium for a competitive market if it is such that:

1. no individual firm wishes to change the amount of own supply
2. no individual consumer wishes to change the amount demanded
3. the excess demand is zero in the market.

Fact

In the short-run equilibrium some firms may make (extra-normal, non-zero) profit due to short-run constraints.

Fact

In the long-run due to free entry and exit:

1. *firm leaves the market if LR profit is negative,* $\pi < 0$
2. *firm enters the market if LR profit is positive,* $\pi > 0$

Fact

All firms in the market operating at minimum LR average cost.