EE311
Oligopoly (1)

Market Structures

Criteria for classifying Market Structures

- The number of sellers
- The number of buyers
- Entry conditions
- The degree of product differentiation

Types of Market Structures

	Number of Firms			
Degree of Product Differentiation	**Many**	**Few**	**One Dominant (one firm possess a large market share)**	**One**
Identical Products	Perfect Competition e.g. fresh-cut rose market	Oligopoly with homogeneous products e.g. electricity	Dominant firm e.g. internet book sales	Monopoly e.g. electricity in some countries
Differentiated Products	Monopolistic Competition e.g. local dry cleaning market	Oligopoly with differentiated products e.g. breakfast cereal market	----------	----------

Oligopoly

Assumptions

- Many Buyers and Few Sellers
- **Each firm faces downward-sloping demand** because each is a large producer compared to the total market size.
- There is no one dominant model of oligopoly. We will review several.

Cournot Model of Oligopoly (1838)

Assumptions

1) **Firms set outputs (quantities)**
2) Homogeneous Products
3) Simultaneous-move
4) Non-cooperative

Antoine Augustin Cournot
(1801-1877)

Definition: Firms act **simultaneously** if each firm makes its strategic decision at the same time, without prior observation of the other firm's decision.

Definition: Firms act **non-cooperatively** if they set strategy independently, without colluding with the other firm in any way.

Cournot Model of Oligopoly (1838)

In a Cournot duopoly model (i.e., two firms in the market),

1. Each firm "conjectures" the output produced by the other firm. i.e. Firm 1 conjectures that Firm 2 will produce Q2.

2. Based on its conjecture, each firm sets its quantity to maximize profit subject to the "residual demand".

Definition: The **residual demand** of Firm A is the market demand minus the amount of demand fulfilled by other firms in the market: $Q_A = Q_{MKT} - \sum Q_{non\text{-}A}$ where $\sum Q_{non\text{-}A}$ is the Q supplied by other firms.

For a duopoly, the residual demand of Firm 1 is $Q_1 = Q - Q_2$.

Residual Demand

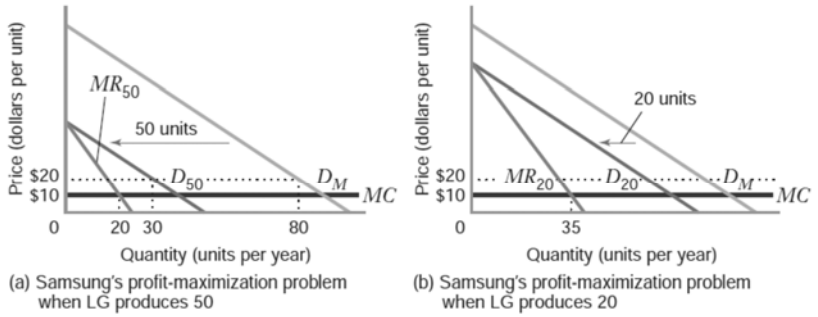


FIGURE 13.1 **Price Determination and Profit Maximization in the Cournot Model**
Panel (a) shows that when Samsung produces 30 units and LG produces 50, the market price will be $20. When LG produces 50 units, Samsung's residual demand curve is D_{50}, which is the market demand curve shifted leftward by 50 units. The residual demand curve traces out the quantity-price combinations that are available to Samsung when LG's output is 50 units. Facing this residual demand curve, Samsung maximizes its profits by producing 20 units, the point at which its marginal revenue, MR_{50}, equals its marginal cost, *MC*. This output is Samsung's best response when LG produces 50 units. Panel (b) shows that when LG produces 20 units, Samsung faces residual demand and marginal revenue curves D_{20} and MR_{20}, respectively, and maximizes profit by producing 35 units, where $MR_{20} = MC$.

Cournot Model of Oligopoly (1838)

3. However, each firm does not know the output that the other firm will set, so the only thing both Firms 1 and 2 can do is to form their **best response functions (BR).**

The BR of Firm 1 tells how much Firm 1 should produce at all possible levels of output of Firm 2, e.g. $Q_1^* = BR_1(Q_2)$.

4. The Cournot "NASH" Equilibrium is determined where
$$Q_1^* = BR_1(Q_2^*) \quad \text{AND} \quad Q_2^* = BR_2(Q_1^*)$$

i.e. Firm 1 is doing its BEST given what Firm 2 is doing, AND Firm 2 is doing its BEST given what Firm 1 is doing.

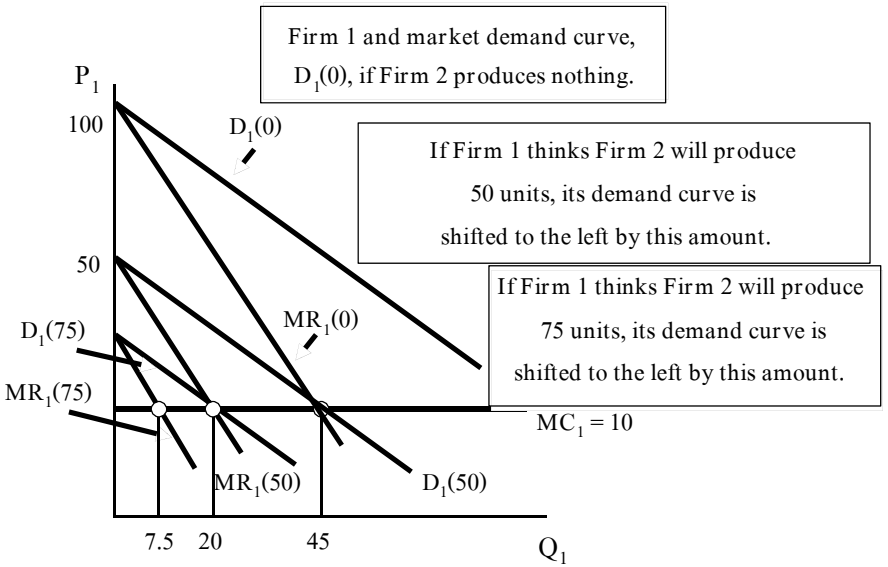
Cournot Model of Oligopoly: an Example

Cournot Model of Oligopoly: an Example

Firm 1's Output Decision

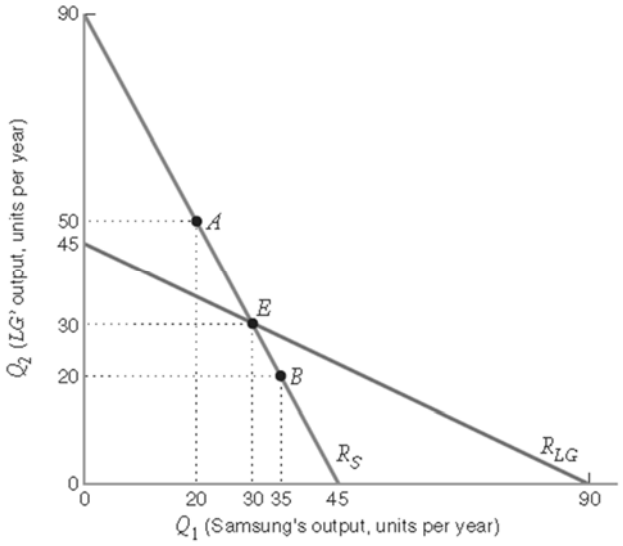
Q_2	$MR_1 = 100 - 2Q_1 - Q_2$	$Q^* = 45 - Q/2$
0	$100 - 2Q_1$	
50	$50 - 2Q_1$	
75	$25 - 2Q_1$	
90	$10 - 2Q_1$	

Firm 1's Output Decision

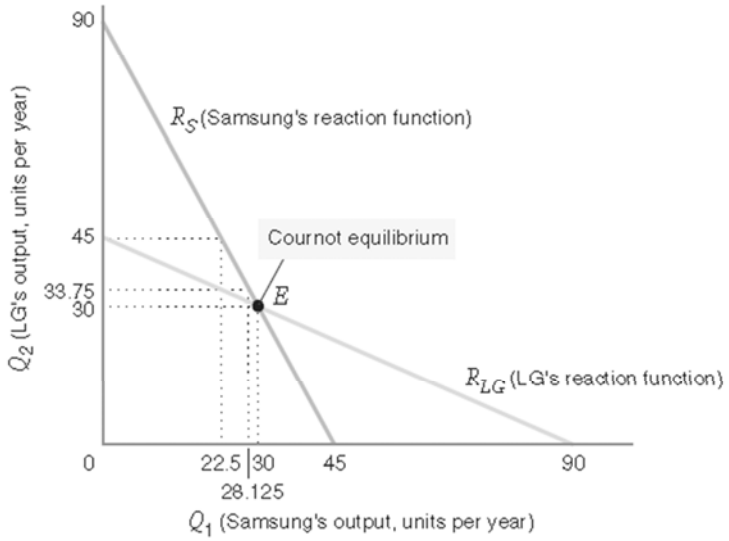


Best Response Curves and Cournot- Nash Equilibrium

Best Response Curves and Cournot- Nash Equilibrium



How Firms Achieve a Cournot-Nash Equilibrium



Learning-By-Doing #1

Suppose that the market has 2 identical firms.

The market demand is given by P = a – bQ.

The MC of each firm is given by MC = c.

Find Q* and P* of each firm.

$$q^* = \frac{a-c}{3b} = q_1^N = q_2^N$$

Learning-By-Doing #1

Learning-By-Doing #2

LEARNING-BY-DOING EXERCISE 13.2

Computing the Cournot Equilibrium for Two or More Firms with Linear Demand

Suppose that a market consists of N identical firms, that the market demand curve is $P = a - bQ$, and that each firm's marginal cost is c.

Problem

(a) What is the Cournot equilibrium quantity per firm?

(b) What are the equilibrium market quantity and price?

Learning-By-Doing #2

Learning-By-Doing #3

Suppose that the market has 2 asymmetric firms.

The market demand is given by P = a – bQ.

The MC of Firm 1 is $MC_1 = c_1$

The MC of Firm 2 is $MC_2 = c_2 > c_1$

Find Q* and P* of each firm.

$$q_1^* = \frac{a + c_2 - 2c_1}{3b} \quad ; \quad q_2^* = \frac{a - 2c_2 + c_1}{3b}$$

Learning-By-Doing #3

Cournot Oligopoly – Comparison

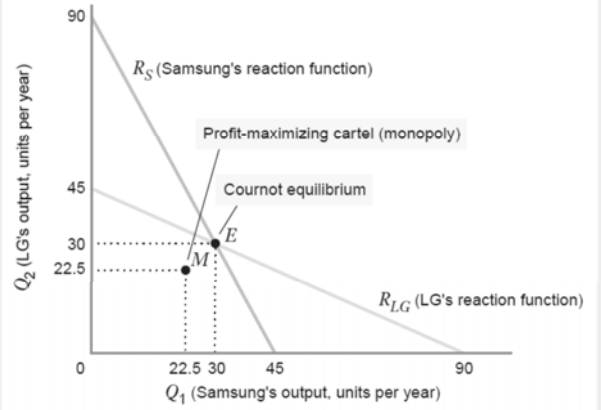


FIGURE 13.4 **Cournot Equilibrium versus Monopoly Equilibrium**
If Samsung and LG behave as a profit-maximizing cartel (monopoly) they will produce a total of 45 units. Splitting this equally gives each an output of 22.5. The cartel or monopoly equilibrium, point *M*, thus differs from the Cournot equilibrium, point *E*.

TABLE 13.4 Cournot Equilibrium for Various Numbers of Firms

Number of Firms	Price	Market Quantity	Per-Firm Profit	Total Profit
1 (monopoly)	$55.0	45.0	$2,025	$2,025
2	$40.0	60.0	$ 900	$1,800
3	$32.5	67.5	$ 506	$ 1,519
5	$25.0	75.0	$ 225	$ 1,125
10	$18.2	81.8	$ 67	$ 669
100	$10.9	89.1	<$ 1	$ 79
∞ (perfect competition)	$10.0	90.0	0	0

TABLE 13.5 Comparison of Equilibria **with P = a – bQ & MC = c**

Market Structure	Price	Market Quantity	Per-Firm Quantity
Monopoly	$\frac{1}{2}a + \frac{1}{2}c$	$\frac{1}{2}\left(\frac{a-c}{b}\right)$	$\frac{1}{2}\left(\frac{a-c}{b}\right)$
Cournot duopoly	$\frac{1}{3}a + \frac{2}{3}c$	$\frac{2}{3}\left(\frac{a-c}{b}\right)$	$\frac{1}{3}\left(\frac{a-c}{b}\right)$
N-firm Cournot oligopoly	$\frac{1}{N+1}a + \frac{N}{N+1}c$	$\frac{N}{N+1}\left(\frac{a-c}{b}\right)$	$\frac{1}{N+1}\left(\frac{a-c}{b}\right)$
Perfect competition	c	$\frac{a-c}{b}$	Virtually 0