Topic 11 Part 2

Oligopoly (Chapter 13)

Stackelberg Oligopoly – Assumptions

Assumptions

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

In Cournot Model, each firm sets output simultaneously.

In Stackelberg (duopoly) Model, **one firm sets output first, and then the other firm observes the first firm and sets output.**

Hence, we have the "leader" and "follower" in this model.

LEARNING-BY-DOING EXERCISE 14.3

An Entry Game

Avinash Dixit and Barry Nalebuff, authors of a delightful book on game theory, *Thinking Strategically*, have written, "It takes a clever carpenter to turn a tree into a table; a clever strategist knows how to turn a table into a tree."[18] In this exercise, we illustrate their point in the context of a simple entry game.

Suppose you own a firm that is considering entry into the digital camera business, where you will compete head to head with Kodak (which, let's say, currently has a monopoly). Kodak can react in one of two ways: It can start a price war or it can be accommodating. You can enter this business on a large scale or a small scale. Table 14.14 shows the payoffs you and Kodak are likely to get under the various scenarios that could unfold.

Problem Should you enter this business on a large scale or a small scale?

		Kodak	
		Accommodate	**Price War**
You	**Small**	4, 20	1, 16
	Large	8, 10	2, 12

Stackelberg Oligopoly – The Model

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

1. The follower (Firm 2) will set Q2 depending on how much the leader supplies output. The follower will form its best response function and set $Q_2^* = BR_2(Q_1)$

2. The leader (Firm 1) knows what the follower will do, so it will set Q1 to maximize its profit, taking into account the action of the follower, i.e. knowing that $Q_2^* = BR_2(Q_1)$.

Stackelberg Oligopoly – Example

For example, let

Inverse Demand: $P = 100 - Q$ where $Q = Q_1 + Q_2$

Marginal Cost: $MC = 10$

Firm 2 forms BR_2: Firm 2 sets Q_2 such that $MR_2 = MC$

$BR_2(Q_1)$: $Q_2 = 45 - (1/2)Q_1$

Firm 1 know this: Firm 1 sets Q_1 such that $MR_1 = MC$

$TR_1 = (100 - Q_1 - Q_2)Q_1 = (100 - Q_1 - 45 + (1/2)Q_1)Q_1$s

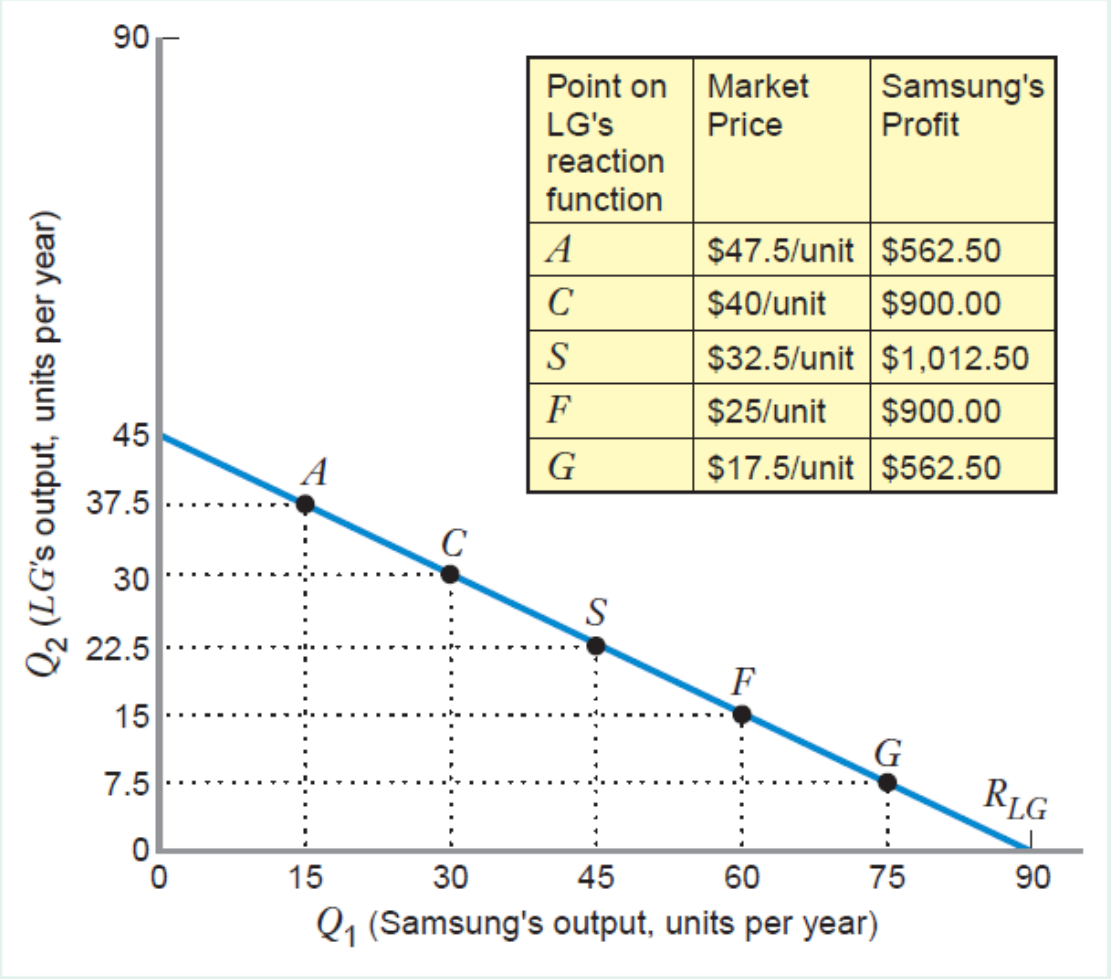
$= (55 - (1/2)Q_1)Q_1$

$MR_1 = 55 - Q_1$

Thus, $Q_1^* = 45$ $Q_2^* = 45 - (1/2)Q_1 = 22.5$

Stackelberg Oligopoly – The Model

Point C is the outcome in the Cournot model.
Point S is the outcome in the Stackelberg model.



Point on LG's reaction function	Market Price	Samsung's Profit
A	\$47.5/unit	\$562.50
C	\$40/unit	\$900.00
S	\$32.5/unit	\$1,012.50
F	\$25/unit	\$900.00
G	\$17.5/unit	\$562.50

FIGURE 13.6 The Stackelberg Model and the Follower's Profit Maximization
The line R_{LG} is LG's reaction function. The table in the upper right-hand corner shows the market price and Samsung's profits at various points along this reaction function. In the Stackelberg model, the leader (Samsung) chooses the point on the reaction function of the follower (LG) that makes the leader's profits as high as possible. This occurs at point *S*.

Stackelberg Oligopoly – The Model

Model	Q1	Q2	P(mkt)	π1	π2
Stackelberg	45	22.5	32.5	1012.5	506.25
Cournot	30	30	40	900	900
Cartel	22.5	22.5	55	1012.5	1012.5

We can see that in the Stackelberg Model, the leader has some advantage. We call this **"the first-mover advantage"**.

This is due to the leader able to control resources or the market.

Games like chess also have "the first-mover advantage".

Dominant Firm Markets

In some industries, a single company with a very large market share (**dominant firm**) competes against small firms (**fringe firms**).

The dominant firm sets the market price and splits the market demand with fringe firms.

Fringe firms supply identical products and act as perfect competitors. Since they are small firms, **they are price-takers**.

Fringe firms takes the market price as given and decide how much to supply. **In other words, their output will be determined by the fringe firms' supply curve.**

Dominant Firm Markets

The dominant firm's problem is to find P* that maximizes its profit.

However, it is important to note that

P* will determine how much fringe firms will supply. AND,

How much fringe firms will supply affect the dominant firm's residual demand (= Market Demand – Supply of Fringe Firms).

The dominant firm faces the following "trade-off":

If the dominant firm sets high P*, fringe firms will supply a lot. As a result, the dominant firms can sell less to the market.

Dominant Firm Markets

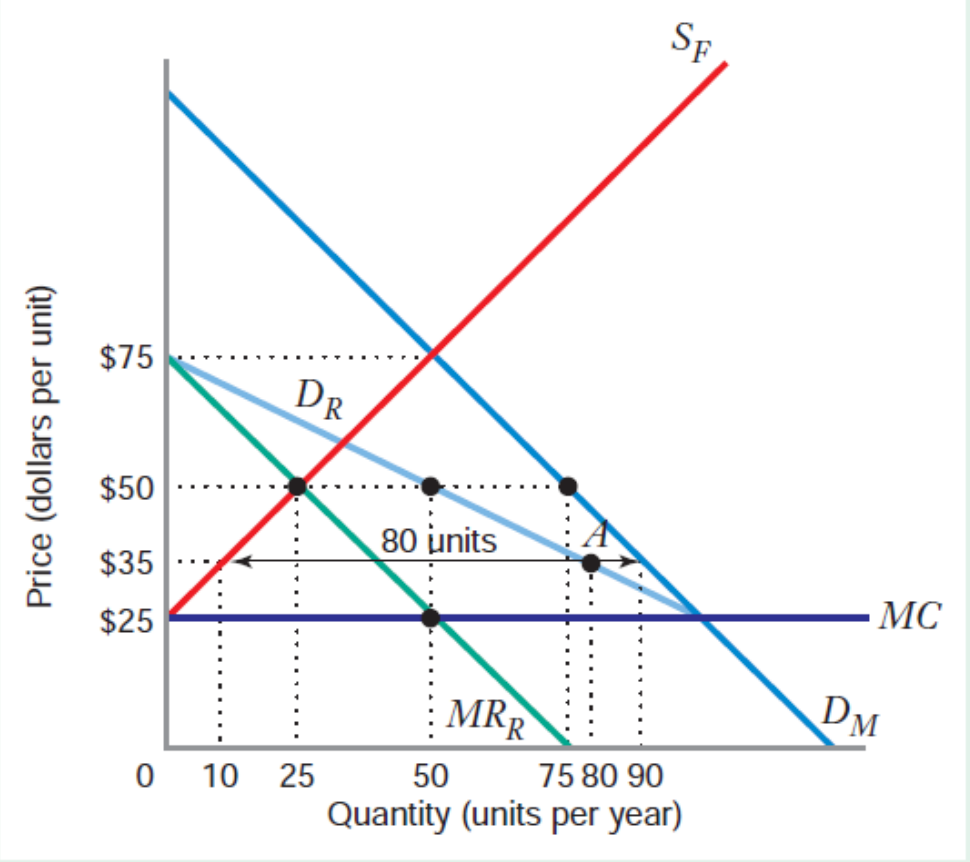


FIGURE 13.7 **Dominant Firm Market**
The dominant firm's residual demand curve D_R is the horizontal difference between the fringe's supply curve S_F and the market demand curve D_M. The dominant firm's profit-maximizing quantity is 50 units, and its profit-maximizing price is $50 per unit. At this price, the fringe supplies 25 units.

Dominant Firm Markets

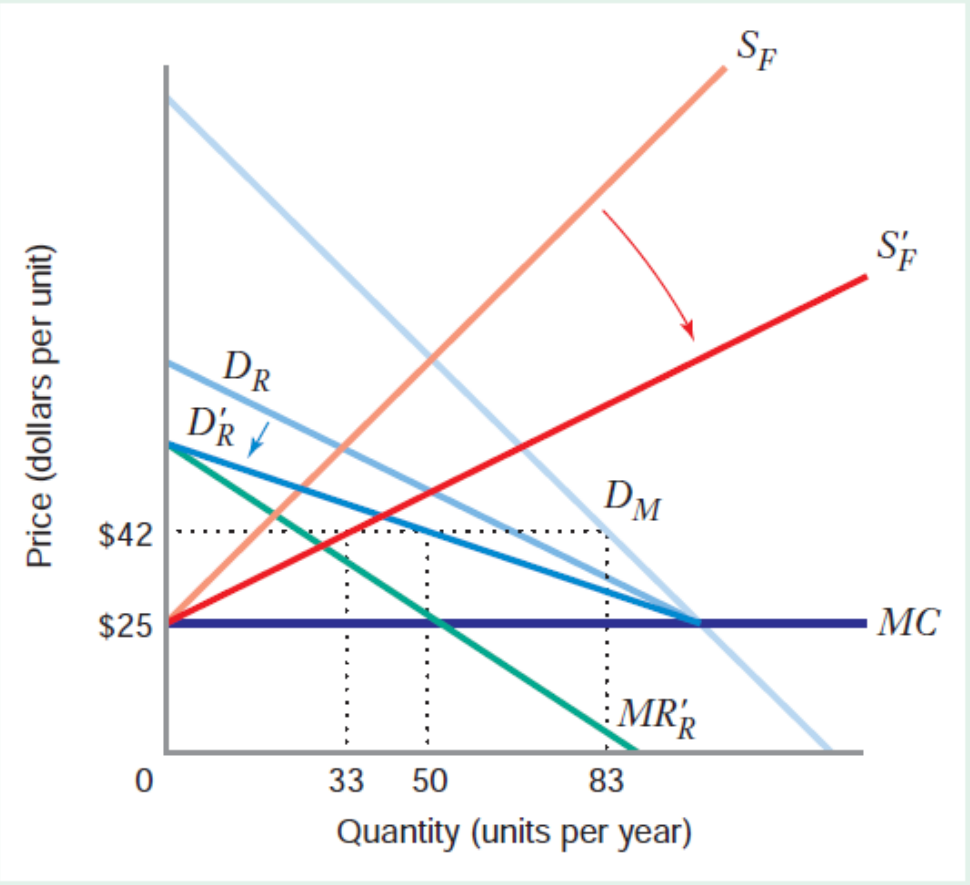


FIGURE 13.8 **Dominant Firm Market When the Size of the Competitive Fringe Grows**
When the size of the fringe grows, the fringe's supply curve rotates rightward to S'_F, causing the residual demand curve to rotate leftward to D'_R. The new profit-maximizing quantity for the dominant firm is 50 units, and the profit-maximizing price is $42. At this price, the fringe supplies 33 units of the total market demand of 83 units.

LEARNING-BY-DOING EXERCISE 13.3

Computing the Equilibrium in the Dominant Firm Model

Suppose that the market demand curve in a global mining industry is given by $Q^d = 110 - 10P$, where Q^d is measured in millions of units of product mined per year and P is measured in dollars per unit. The industry is dominated by a large firm with a constant marginal cost of \$5 per unit. There also exists a competitive fringe of 200 firms, each of whom has a marginal cost given by $MC = 5 + 100q$, where q is the output of a typical fringe firm.

Problem

(a) What is the equation of the supply curve for the competitive fringe?

(b) What is the equation of the dominant firm's residual demand curve?

(c) What is the profit-maximizing quantity of the dominant firm? What is the resulting market price? At this price, how much does the competitive fringe produce, and what is the fringe's market share (i.e., the fringe quantity divided by total industry quantity)? What is the dominant firm's market share?