Chapter 10 THEORY OF PRICE UNDER PURE MONOPOLY

10.1 INTRODUCTION

"Perfect competition" provides the economist with a very useful analytical model, even though the exacting conditions of the model never obtain in the real world. The same statement almost applies to the model of pure monopoly, to which we now turn. The conditions of the model are exacting; and it is difficult, if not impossible, to pinpoint a pure monopolist in real-world markets. On the other hand, many markets closely approximate monopoly organization, and monopoly analysis often explains observed business behavior quite well.

10.1.a—Definition

A pure monopoly is said to exist if there is one, and only one, seller in a well-defined market. Thus from the sales or revenue side pure monopoly and perfect competition are polar opposites. The perfectly competitive firm has so many "rivals" in the market that competition becomes impersonal and rivalry, or "competition" in the popular sense, does not exist at all. Rivalry does not exist in the case of pure monopoly either, for the simple reason that there are no rivals. There is no "competition" in the popular sense; and there is no competition in the technical economic sense either.

Yet this may overstate the case somewhat, for two types of *indirect competition* and one source of *potential competition* tend to moderate the price-output policies of pure or near-pure monopolies. The first source of indirect competition is the general struggle for the consumer's dollar. *All* commodities compete for a place in the consumer's budget—the products of monopolists as well as the products of perfectly competitive firms. Unless a monopolist can secure a market for his product, his monopoly position is worthless. For example, the files of the U.S. Patent Office would reveal many patents (and therefore output

monopoly) for inventions that were never produced or were produced for only a short period of time. Monopoly does not guarantee success; it only guarantees that the monopolist can make the most of whatever demand conditions exist.

A second source of indirect competition lies in the existence of substitute goods. Needless to say, there are no *perfect* substitutes for a monopoly product; otherwise a monopoly would not exist. However, imperfect substitutes exist; and the true market power of a monopolist depends upon the extent to which other commodities may be used as substitutes in consumption. For example, whale-oil lamps and gaslights, candles and Coleman Lanterns are very poor substitutes for electricity in residential and commercial lighting. Therefore, electricity for lighting purposes closely approximates pure monopoly. On the other hand, there are quite good substitutes for electrical heating. Fuel oil and natural gas are strong competitors in the residential heating market; coal-fired steam heat, in addition to oil and gas, competes in the commercial market. As a consequence, the "monopoly" position of electrical power companies is very weak in these markets.

As has been said, the presence of indirect competition tends to moderate the price-output policies of monopolists. The threat of potential competition does so as well. Various reasons explain the establishment of a monopoly position (see 10.1.b). An entrepreneur can sometimes maintain his monopoly position, however, only if he does not exploit it fully. In many cases potential competitors will be attracted into the market if profit prospects are bright. This is particularly true when the price-output policy of the existing monopolist is such that potential competitors feel they can readily capture a substantial portion of the market. While this situation is especially applicable to local or regional markets served by only one firm, it applies in broader situations as well. Whenever entry is possible, the position of an existing monopoly is perilous. To protect it the monopolist must serve his market well; otherwise new entrants will be attracted and the monopoly broken.

To summarize:

Definition: a pure monopoly exists when there is only one producer in a market. There are no direct competitors or rivals in either the popular or technical sense. However, the policies of a monopolist may be constrained by the indirect competition of all commodities for the consumer's dollar and of reasonably adequate substitute goods, and by the threat of potential competition if market entry is possible.

10.1.b—Bases of Monopoly

Since the business of businessmen is profit, one might wonder why a monopoly ever arises. Many different factors may lead to the establishment of a monopoly or near monopoly. For example, on a local level the personal characteristics of the owner-monopolist may bring all the trade to his door. Other seemingly trivial reasons may explain monopoly; but monopolies so established are destined for a short life. Permanent monopoly must rest on firmer ground.

One of the most important bases for monopoly is in the control of raw-material supplies. Suppose input x is required to produce output y. If one person has exclusive control over or ownership of x, he can easily establish a monopoly over y by refusing to sell x to any potential competitors. An interesting example of input-control monopoly can be taken from the economic history of the United States. Bauxite is a necessary ingredient in the production of aluminum. For many years the Aluminum Company of America (Alcoa) owned almost every source of bauxite in the United States. The control of resource supply, coupled with certain patent rights, provided Alcoa with an absolute monopoly in aluminum. Indeed, it was only after World War II that the federal courts effectively broke Alcoa's monopoly of the aluminum market.

The discussion of Alcoa brings to light another important source of monopoly. The patent laws of the United States make it possible for a person to apply for and obtain the exclusive right to produce a certain commodity or to produce a commodity by means of a specified process. The patent is applicable for seventeen years, but it is subject to renewal after that time. Obviously, such exclusive rights can easily lead to monopoly. Alcoa is an example of a monopoly based upon both resource control and patent rights. E. I. Du Pont de Nemours & Co. has enjoyed patent monopolies over many commodities, cellophane being perhaps the most notable. At one time the Eastman Kodak Company enjoyed a similar position (by lease from a German company); more recently the Minnesota Mining and Manufacturing Company ("Three M") has enjoyed patent monopoly or near monopoly with products such as their Scotch Tape and Thermofax Copier.

Despite these notable examples, patent monopoly may not be quite what it seems in many instances. A patent gives one the exclusive right to produce a particular, meticulously specified commodity or to use a particular, meticulously specified process to produce a commodity others can produce. But a patent does not preclude the development of closely related substitute goods or closely allied production processes.

International Business Machines has the exclusive right to produce IBM machines; but many other millisecond digital computers are available and there is keen competition in the computer market. The same is true of production processes. Thus while patents may sometimes establish pure monopolies, at other times they are merely permits to enter highly—but not perfectly—competitive markets.

A third source of monopoly lies in the cost of establishing an efficient production plant, especially in relation to the size of the market. The situation we are now discussing is frequently called "natural" monopoly. It comes into existence when the minimum average cost of production occurs at a rate of output sufficient, almost sufficient, or more than sufficient to supply the entire market at a price covering full cost. This situation, in turn, typically occurs when the fixed cost of production (investment in plant and equipment) is very large relative to the variable cost of production.

Suppose a situation such as this exists but two firms are in the market. If the market is split between the two, each must necessarily produce at a relatively high average cost. Each has an incentive to lower price and increase output because average cost will also decline. But if both act in this fashion, price will surely fall more rapidly than average cost. Economic warfare ensues, and the ultimate result is likely to be the emergence of only one firm in a monopoly position.[1] The term "natural" monopoly simply designates that the "natural" result of market forces is the development of a monopoly organization.

Examples of natural monopoly are not hard to come by. Virtually all public utilities are natural monopolies and vice versa. Municipal water works, electrical power companies, sewage disposal systems, telephone companies, and many transportation services are examples of natural monopolies on both local and national levels.

The final source of monopoly to be discussed here is the market franchise. Use of a market franchise is frequently associated with natural monopolies and public utilities, but it need not be. A market franchise is actually a contract entered into by some governmental body (for instance, a city government) and a business concern. The governmental unit gives a business firm the exclusive right to market a good or service within its jurisdiction. The business firm, in turn, agrees to permit the governmental unit to control certain aspects of its market conduct. For example, the governmental unit may limit, or attempt to limit, the firm to a "fair return on fair market value of assets." In other

[1] For the classical treatment of this situation, see F. Zeuthen, *Problems of Monopoly and Economic Warfare* (London: Routledge, 1930).

cases the governmental unit may establish the price and permit the firm to earn whatever it can at that price. There are many other ways in which the governmental unit can exercise control over the firm. The essential feature, however, is that a governmental unit establishes the firm as a monopoly in return for various types of control over the price and output policies of the business.[2]

10.2 DEMAND UNDER MONOPOLY

The most important objective of Part I was to show that market demand curves are negatively sloped (except for the truly insignificant case of Giffen's paradox). Now, since a monopoly constitutes a one-firm market, the market demand curve *is* the monopoly demand curve. As

TABLE 10.2.1

DEMAND AND MARGINAL REVENUE UNDER MONOPOLY

Quantity	*Price*	*Total Revenue*	*Marginal Revenue*
5	$2.00	$10.00	—
13	1.10	14.30	$0.54
23	.85	19.55	.52
38	.69	25.92	.42
50	.615	30.75	.35
60	.55	33.00	.23
68	.50	34.00	.13
75	.45	33.75	−.03
81	.40	32.40	−.23
86	.35	30.10	−.46

explained in section 5.4, when demand is negatively sloped average and marginal revenue are different, and for marginal profit calculations the latter is the relevant concept.[3]

Consider an hypothetical situation given by the data in Table 10.2.1. Market demand is indicated by the first two columns and is plotted graphically in Figure 10.2.1. Total revenue, the product of price and quantity, is given in column three and depicted graphically in Figure 10.2.1. (*Note:* the right-hand ordinate refers to total revenue while the customary left-hand ordinate refers to price and marginal revenue.) Finally, marginal revenue is shown in column four.

As you will recall, marginal revenue is the addition to total

[2] For a more detailed discussion of the bases of monopoly, see George J. Stigler, *The Theory of Price* (New York: Macmillan & Co., 1949), pp. 197–217.

[3] The remainder of this section is a brief review of section 5.4. Students thoroughly familiar with the content of section 5.4 may proceed immediately to section 10.3.

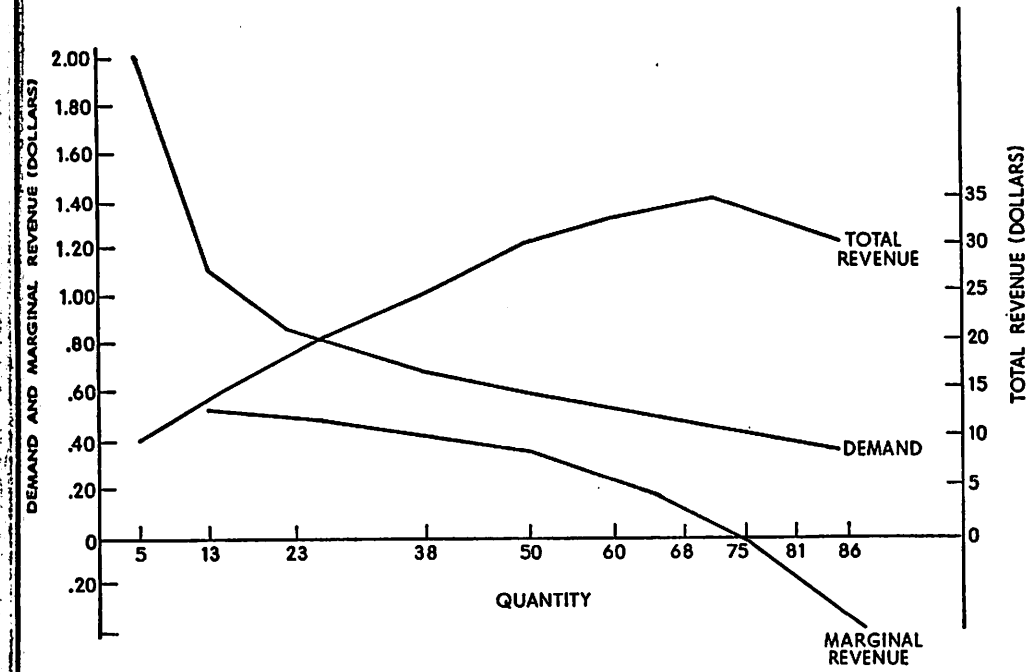

FIGURE 10.2.1

DEMAND AND REVENUE UNDER MONOPOLY

revenue attributable to the addition of one unit to output (or sales). In this example, quantity does not increase by single units. Thus marginal revenue must be calculated as the *average* marginal revenue over the corresponding quantity range. Thus[4]

[4] For continuous cases, the demand function in inverse form may be written

$$p = f(q), \quad f'(q) < 0, \tag{10.2.1}$$

where p and q denote price and quantity respectively.
Thus total revenue is

$$pq = qf(q) \tag{10.2.2}$$

and marginal revenue is

$$MR = \frac{d(pq)}{dq} = f(q) + qf'(q). \tag{10.2.3}$$

As you will recall from section 5.4, price elasticity of demand is

$$\eta = -\frac{dq}{dp}\frac{p}{q} = -\frac{1}{f'(q)}\frac{p}{q} = -\frac{p}{qf'(q)}. \tag{10.2.4}$$

Now, factor $p = f(q)$ from the right-hand side of expression (10.2.3), obtaining

$$MR = p\left(1 + \frac{qf'(q)}{p}\right). \tag{10.2.5}$$

$$MR = \frac{\Delta TR}{\Delta Q} = \text{(for example)}\ \frac{\$14.30 - \$10.00}{13 - 5} = \$0.54 \cdot$$

The corresponding plot is shown in Figure 10.2.1.

The highly discrete case in Figure 10.2.1 is generalized by Figure 10.2.2, which is an exact reproduction of Figure 5.4.2. The important

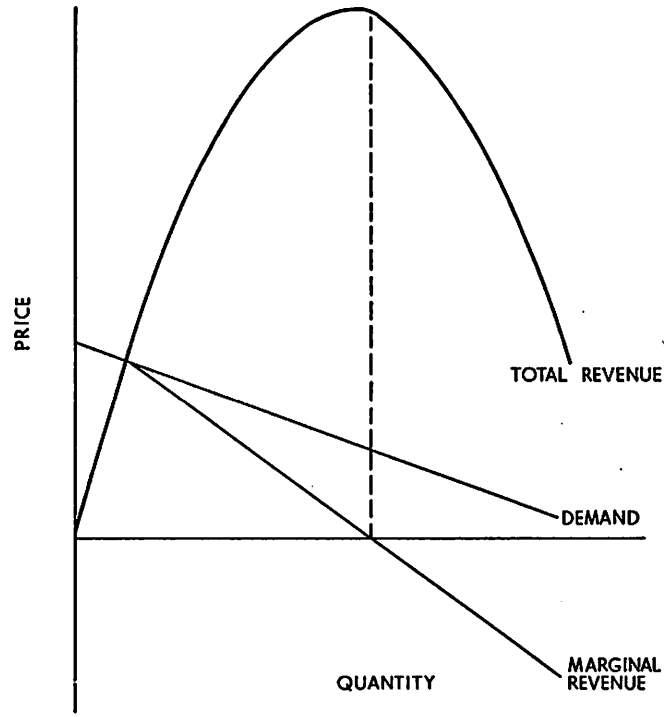

FIGURE 10.2.2

RELATIONSHIPS AMONG DEMAND, TOTAL REVENUE, AND MARGINAL REVENUE

relationships, already discussed, are immediately apparent from the figure.

Relationships: when demand is negatively sloped marginal revenue is negatively sloped as well. Furthermore, marginal revenue is less than price at all relevant points. The difference between marginal revenue and price depends upon the price elasticity of demand, as shown by the formula: MR equals $p(1 - 1/\eta)$.

Total revenue at first increases, reaches a maximum, and declines thereafter. The maximum point on the total revenue curve is attained at precisely that rate of output and sales (quantity) for which marginal revenue is zero.

Thus from expression (10.2.4),

$$(10.2.6) \qquad MR = p\left(1 - \frac{1}{\eta}\right).$$

10.3 COST AND SUPPLY UNDER MONOPOLY

The short-run cost conditions confronting a monopolist may be, for all practical purposes, identical to those faced by a perfectly competitive firm. In particular, an entrepreneur who is a monopolist in the commodity market may indeed be a perfect (buying) competitor in the market for productive inputs. This would tend to be true if the monopolist required only unspecialized inputs, such as unskilled labor. In this event, the analysis of Chapter 8 would apply straightforwardly to cost under monopoly. In many instances, however, the monopolist requires certain *specialized* inputs for which there is no broad general market. There are only a few buyers of the specialized input (in the limit, only one). Thus the commodity-market monopolist may be a monopolist or near monopolist in various input markets as well.[5]

10.3.a—Cost with Monopoly in the Input Market

The analysis in Part I was based on the assumption that each consumer is a perfect competitor in the *buying* market. That is, each consumer is such a small purchaser, relative to the entire market, that he may buy any quantity he wishes without affecting market price. The same type of assumption was used in Chapter 8: each producer employs such a small quantity of each input, relative to the entire market for that input, that he may employ any amount he desires without affecting input price. But if a producer is a monopolist or near monopolist in an input market, the price of that input will depend in part upon the purchases of the producer in question.

This is a simple matter of demand and supply analysis. If the commodity-market monopolist is a monopolist in the input market his individual input demand curve is the *market* input demand curve as well. Given a (positively sloped) input supply curve, input price is determined and is, among other things, a function of input demand.

To get at this another way, consider Table 10.3.1 and the associated Figure 10.3.1. We assume only one variable input is required in the production process, represented by columns one and two. The remaining columns contain cost data. Total fixed cost is \$10, given in

[5] In this case the monopolist is called a monopsonist or an oligopsonist, respectively. The use of this terminology is deferred until Chapter 14, where the present case is analyzed more intensively.

column three. Under present assumptions, the commodity monopolist is a monopolist in the input market as well. He thus faces a rising supply curve for the input. Columns one and four give the supply of input curve, which is shown graphically in Figure 10.3.1. Given the supply of input curve, total variable cost (column five) is obtained by multiplying the number of units of the variable input used by the supply price of that number of units.

Column six introduces a new concept. When a producer is a perfect competitor in the input market he can purchase any quantity of

TABLE 10.3.1

COST UNDER MONOPOLY IN THE INPUT MARKET

Units of Variable Input	*Total Product*	*Fixed Cost*	*Price of Variable Input*	*Total Variable Cost*	*Marginal Cost of Input*	*Total Cost*	*Average Variable Cost*	*Average Total Cost*	*Marginal Cost*
0	0	$10	$2.00	0	—	$10.00	—	—	—
1	5	10	2.25	$ 2.25	—	12.25	$0.45	$2.45	$0.45
2	13	10	2.50	5.00	$2.75	15.00	.39	1.15	.34
3	23	10	2.75	8.25	3.25	18.25	.36	.80	.33
4	38	10	3.00	12.00	3.75	22.00	.32	.58	.25
5	50	10	3.25	16.25	4.25	26.25	.33	.53	.35
6	60	10	3.50	21.00	4.75	31.00	.35	.52	.48
7	68	10	3.75	26.25	5.25	36.25	.39	.53	.66
8	75	10	4.00	32.00	5.75	42.00	.43	.56	.82
9	81	10	4.25	38.25	6.25	48.25	.47	.60	1.04
10	86	10	4.50	45.00	6.75	55.00	.52	.64	1.35

the input he desires without affecting market price. Thus the price of the input is equal to the marginal cost of the input, just as price of output equals marginal revenue in a perfectly competitive selling market. Implicit in the above statement is the following:

Definition: the marginal cost of a variable input is the addition to total variable cost attributable to the addition of one unit of the variable input to the production process.

The marginal cost of the variable input is computed in the same manner as any other "marginal" quantity: the difference in total variable cost is divided by the difference in the number of units of variable input. Thus the first entry in column six is

$$\frac{\$5.00 - \$2.25}{2 - 1} = \$2.75 \cdot$$

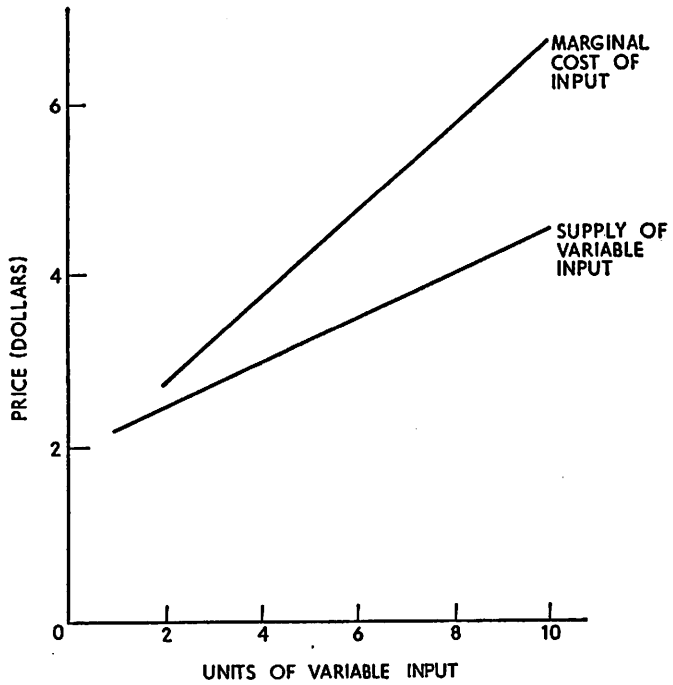

FIGURE 10.3.1

SUPPLY AND MARGINAL COST OF VARIABLE INPUT

Marginal cost of input is shown graphically in Figure 10.3.1. Using this figure, provide a nonmathematical, but logical, answer to the following:

Exercise: given a positively sloped supply of variable input curve, prove that the marginal cost of the variable input curve lies above, and rises more rapidly than, the associated linear supply curve. Also, compare and contrast the relationships between demand–marginal revenue and supply of input–marginal cost of input.[6]

[6] A mathematical answer is:
The supply of input curve in inverse form is given by

$$p = g(q), \quad g'(q) > 0, \tag{10.3.1}$$

where p and q represent price and quantity supplied of the variable input, respectively. The condition $g'(q) > 0$ implies that the supply curve is positively sloped. Total variable cost is

$$TVC = pq = qg(q), \tag{10.3.2}$$

so marginal cost of input is

$$\frac{d[qg(q)]}{dq} = g(q) + qg'(q) \cdot \tag{10.3.3}$$

In light of expression (10.3.1,) $g(q) + qg'(q) > g(q)$. Hence the marginal cost of input curve must lie above the supply of input curve. Further, from expression (10.3.1) the slope

The last four columns of Table 10.3.1 follow by the calculations developed in Chapter 8. Two important elements are to be gleaned from this analysis. First, a rising supply price of a variable input causes an input-market monopolist to be confronted with a higher and also rising marginal cost of input curve. The significance of this relationship will become quite clear in Chapter 14.

Second, the rising supply price of the variable input causes the cost curves to rise more rapidly than if the supply price of input were constant. Thus, for example, marginal cost of output rises not only because of diminishing marginal physical productivity of the input but also became the price of the input rises as its use expands.

10.3.b—A Word on Monopoly Supply

Short-run monopoly supply is discussed in some detail in subsection 10.4.d. However, since cost conditions have been introduced a word of caution is in order. The marginal cost (of output) curve is *not* the monopolist's supply curve. In fact, as you will see below, "supply" generally has much less meaning in monopoly than in perfect competition.

10.4 SHORT-RUN EQUILIBRIUM UNDER MONOPOLY

The analysis of perfect competition was based upon two important assumptions: each entrepreneur attempts (or acts as though he attempts) to maximize profit; and the firm operates in an environment

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of the supply curve is $g'(q)$, while from expression (10.3.3) the slope of the marginal cost curve is $2g'(q) + qg''(q)$. For linear curves, $g''(q) = 0$; so the marginal cost curve has a steeper slope than the supply curve. If the supply curve is concave from above, $g''(q) > 0$, and the conclusion holds *a fortiori*. However, if the supply curve is positively sloped but concave from below, $g''(q) < 0$. In this case the marginal cost curve lies above the supply curve but approaches it asymptotically as q increases without bound.

Next, the elasticity of supply is the relative responsiveness of quantity supplied to a change in supply price. In the present notation, this may be written

$$(10.3.4) \qquad \theta = \frac{p}{q}\frac{dq}{dp} = \frac{p}{q}\frac{1}{\frac{dp}{dq}} = \frac{p}{q}\frac{1}{g'(q)}.$$

Equation (10.3.3) may be written

$$(10.3.5) \qquad MC = p\left(1 + \frac{q}{p}g'(q)\right),$$

since $p = g(q)$. Substituting expression (10.3.4) in expression (10.3.5), one obtains

$$(10.3.6) \qquad MC = p\left(1 + \frac{1}{\theta}\right).$$

The analogy with demand-marginal revenue is obtained from this last expression.

not subject to outside control. Monopoly analysis rests upon the same two assumptions; accordingly, the results must be modified when applied to franchise monopoly or to monopolies subject to some other form of government regulation and control.

10.4.a—Total Revenue–Total Cost Approach

The monopolist, just as the perfect competitor, attains maximum profit by producing and selling at that rate of output for which the positive difference between total revenue and total cost is greatest. (Or, he minimizes loss when the negative difference is least.) To illustrate the total revenue-total cost approach, the hypothetical revenue and cost

TABLE 10.4.1

PROFIT MAXIMIZATION BY THE TOTAL REVENUE-TOTAL COST APPROACH

Output and Sales	*Price*	*Total Revenue*	*Total Cost*	*Profit*
5	$2.00	$10.00	$12.25	$- 2.25
13	1.10	14.30	15.00	- .70
23	.85	19.55	18.25	+ 1.30
38	.69	25.92	22.00	+ 3.92
50	.615	30.75	26.25	+ 4.50
60	.55	33.00	31.00	+ 2.00
68	.50	34.00	36.25	- 2.25
75	.45	33.75	42.00	- 8.25
81	.40	32.40	48.25	-15.85
86	.35	30.10	55.00	-25.10

data from Tables 10.2.1 and 10.3.1 are reproduced in Table 10.4.1. These data are illustrated graphically in Figure 10.4.1.

The table and graph are almost self-explanatory. One should note that maximum profit ($4.50) is attained at fifty units of output and sales. By reference to Table 10.3.1, this rate of output is less than that associated with minimum unit cost. Similarly, it is less than the maximum revenue output; and it is also less than the rate of output (somewhat greater than sixty) for which price equals marginal cost. The latter condition is the "rule" for profit maximization under perfect competition. But it does not hold for monopoly, as the *marginal* approach makes clear.

10.4.b—Marginal Revenue–Marginal Cost Approach

Since all underlying concepts have been introduced, this section begins with a continuation of the example previously used. Table

10.4.2 provides the relevant data, shown graphically in Figure 10.4.2.

Under monopoly (or any nonperfectly competitive situation) maximum profit is attained at that rate of output and sales for which marginal cost equals marginal revenue. The hypothetical data in Table 10.4.2 clearly illustrate this proposition. For a proof, however, the continuous case represented by Figure 10.4.3 is used.

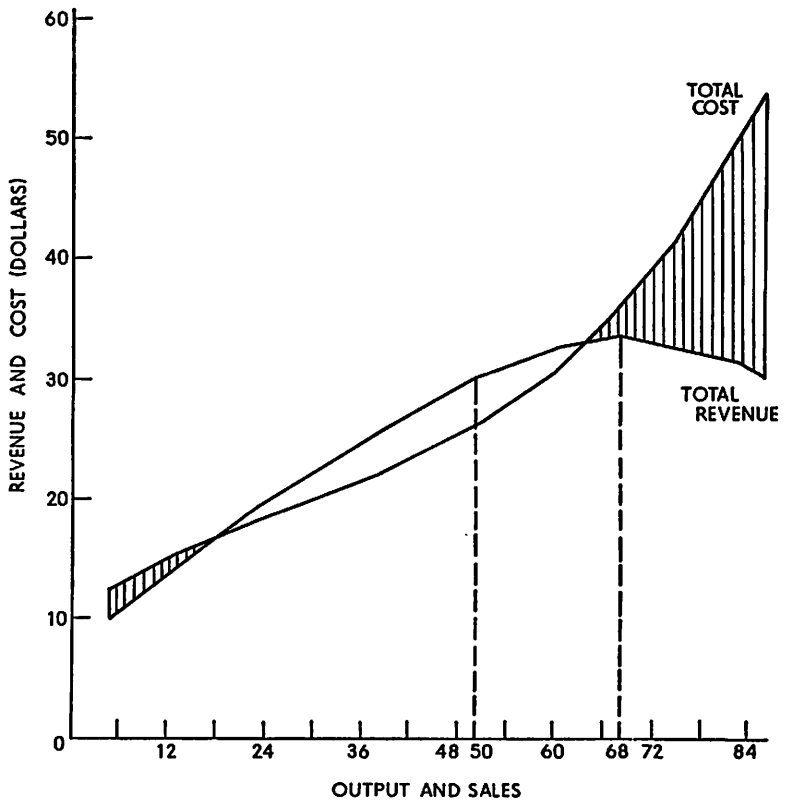

FIGURE 10.4.1

PROFIT MAXIMIZATION BY THE TOTAL REVENUE–TOTAL COST APPROACH

Marginal cost and marginal revenue are given by curves of customary shape, intersecting at point E. We wish to prove that producing output $O\bar{q}$ associated with this intersection leads to maximum profit or minimum loss. The method of attack is "proof by contradiction." Suppose $O\bar{q}$ were not the profit-maximizing output. First, assume it is less than $O\bar{q}$—say, Oq_1. At that point marginal cost is OA and marginal revenue is $OB > OA$. Hence adding a unit to output and sales will increase total revenue by more than it increases total cost.

TABLE 10.4.2

MARGINAL REVENUE–MARGINAL COST APPROACH TO PROFIT MAXIMIZATION

Output and Sales	*Price*	*Total Revenue*	*Total Cost*	*Marginal Revenue*	*Marginal Cost*	*Profit*
5	$2.00	$10.00	$12.25	—	$0.45	$− 2.25
13	1.10	14.30	15.00	$0.54	.34	− .70
23	.85	19.55	18.25	.52	.33	+ 1.30
38	.69	25.92	22.00	.42	.25	+ 3.92
50	.615	30.75	26.25	.35	.35	+ 4.50
60	.55	33.00	31.00	.23	.48	+ 2.00
68	.50	34.00	36.25	.13	.66	− 2.25
75	.45	33.75	42.00	−.03	.82	− 8.25
81	.40	32.40	48.25	−.23	1.04	−15.85
86	.35	30.10	55.00	−.46	1.35	−25.10

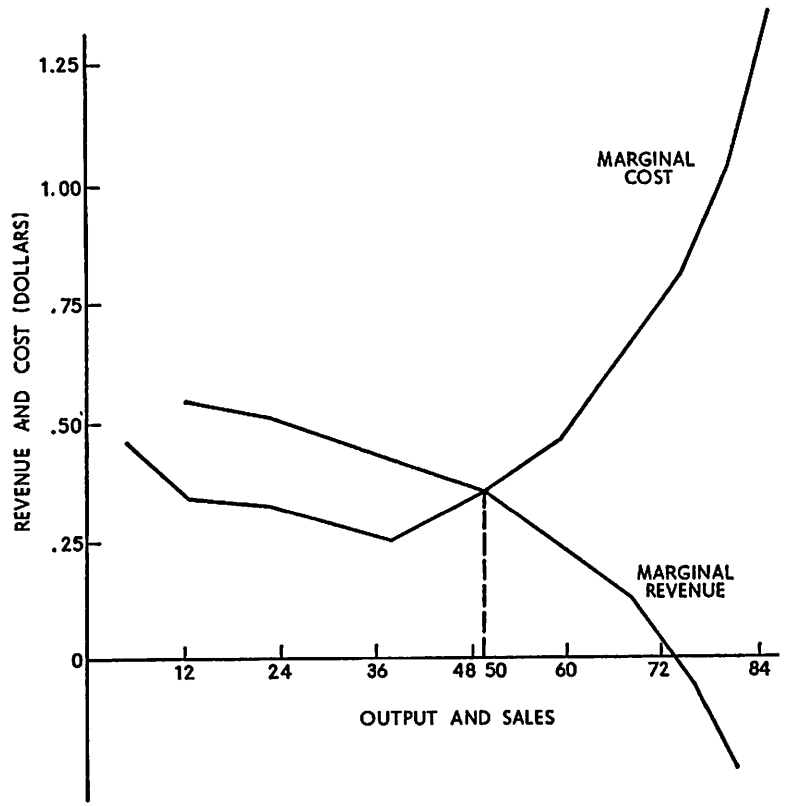

FIGURE 10.4.2

PROFIT MAXIMIZATION BY THE MARGINAL REVENUE–MARGINAL COST APPROACH

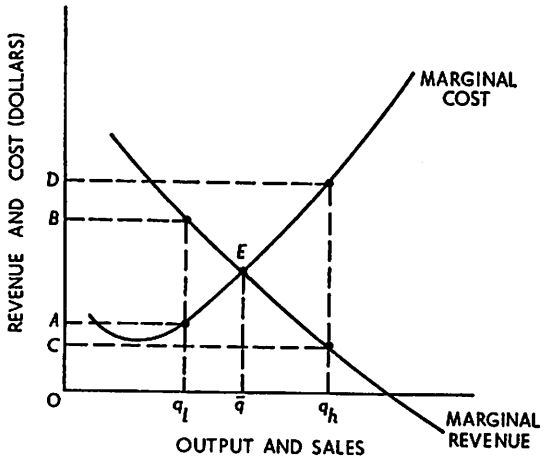

FIGURE 10.4.3

PROOF OF $MC = MR$ THEOREM FOR PROFIT MAXIMIZATION

Therefore profit can be expanded, or loss reduced, by expanding output from the rate Oq_l. And this statement must hold for *any* output less than $O\bar{q}$ since $MR > MC$ over the entire range from O to $O\bar{q}$.

Next, suppose the profit-maximizing output were greater than $O\bar{q}$ —say, Oq_h. At this point marginal revenue is OC and marginal cost is $OD > OC$. At this rate of output an additional unit of output and sales adds more to total cost than to total revenue. Profit, accordingly, is diminished or loss augmented. Further, this must hold for *any* output greater than $O\bar{q}$ because $MC > MR$ over that entire range of output.

Since the profit-maximizing output can neither exceed nor be less than $O\bar{q}$, the following proposition is established:[7]

[7] Let the monopolist's demand function in inverse form be $p = f(q)$ and let his cost be $C = C(q)$. Thus profit (π) is

$$(10.4.1) \qquad \pi = qf(q) - C(q).$$

The first-order condition for profit maximization requires that the first derivative of expression (10.4.1) equal zero, or

$$(10.4.2) \qquad d\pi/dq = f(q) + qf'(q) - C'(q) = 0.$$

Marginal revenue is $d[qf(q)]/dq = f(q) + qf'(q)$. Similarly, marginal cost is $dC/dq = C'(q)$. Hence expression (10.4.2) gives the profit-maximization rule stated in the text.

For a true local maximum, the second derivative of expression (10.4.1) must be less than zero. That is, the second-order condition requires that

$$(10.4.3) \qquad d^2\pi/dq^2 = 2f'(q) + qf''(q) - C''(q) < 0.$$

The first two terms give the slope of the marginal revenue curve while $C''(q)$ is the slope of the marginal cost curve. The second-order condition requires that the slope of the marginal revenue curve be less than the slope of the marginal cost curve (with respect to the quantity axis). Given a negatively sloped marginal revenue curve the condition is obviously satisfied when marginal cost is positively sloped. However, monopoly differs from perfect competition in that the marginal cost curve may be negatively sloped at the profit-maximizing point provided its slope is less steep (absolute value of slope is less) than that of marginal revenue.

Note: while very rare, certain segments of commodity demand curves may give rise to positively sloped marginal revenue curves. The student may verify, for example, that the demand curve $q = (1 - p)^2 + 1$ gives rise to a positively sloped marginal revenue curve over the interval $0 < p < 1$.

Proposition: a monopolist, or any other producer, will maximize profit or minimize loss by producing and marketing that output for which marginal cost equals marginal revenue. Whether a profit or loss is made depends upon the relation between price and average total cost.

10.4.c—Short-Run Equilibrium

Using the proposition just established, the position of short-run equilibrium under monopoly is easily described. Figure 10.4.4 is a graphical representation. The revenue side is given by the demand and marginal revenue curves, D and MR respectively. Costs are depicted by

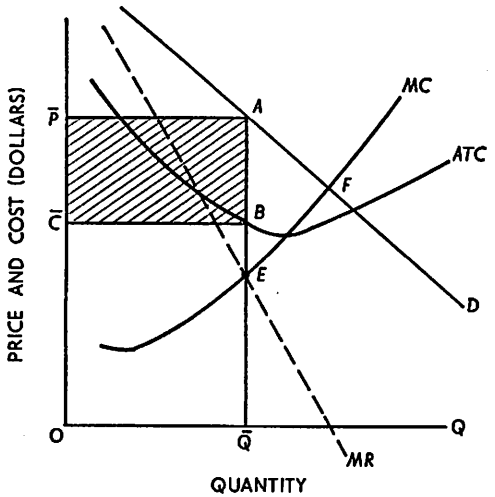

FIGURE 10.4.4

SHORT-RUN EQUILIBRIUM UNDER MONOPOLY

the average total cost and marginal cost curves, ATC and MC respectively.

The profit-maximization "rule" states that short-run equilibrium occurs at point E where marginal cost equals marginal revenue. The associated price and output are $O\bar{P}$ and $O\bar{Q}$. At the rate of output $O\bar{Q}$, average total or unit cost is $O\bar{C}$ $(= \bar{Q}B)$. Profit per unit is $O\bar{P} - O\bar{C} = \bar{P}\bar{C}$. Thus short-run monopoly profit is $\bar{P}\bar{C} \times O\bar{Q} = \bar{P}AB\bar{C}$. It is thus represented by the area of the shaded rectangle in Figure 10.4.4.

In the example of Figure 10.4.4, the monopolist earns a pure profit in the short run, just as a perfect competitor may. If demand is sufficiently low relative to cost he may also incur a loss, just as a perfect competitor may. In the short run the primary difference between monopoly and perfect competition lies in the slope of the demand curve. Either may earn a pure economic profit; either may incur a loss. Other comparisons are difficult. If it happened that Figure 10.4.4 also exactly represented a perfect competitor with horizontal demand curve intersecting *MC* at point *F*, one could say that price would be lower and the output greater under perfect competition than under monopoly.

This type of comparison is very risky, however, because it involves all sorts of assumptions concerning the behavior of cost as plant size expands or contracts. In particular, one must assume that *MC* somehow represents competitive supply. But as we have already seen, the competitive supply curve usually cannot be taken as the sum of individual marginal cost or supply curves. As a consequence, short-run comparisons are fraught with danger. About the best that can be said is that a monopolist is more likely to earn a pure profit in the short run because he can effectively exercise some market control.

10.4.d—Monopoly Supply in the Short Run

It has been indicated previously that "monopoly supply" has considerably less meaning than "competitive supply." The analysis of this section will make the reasons clear.

Suppose the market demand curve for a monopolist is fixed and gives rise to the marginal revenue curve constructed in Figure 10.4.5. Given the marginal cost curve *MC*, equilibrium output is $O\bar{Q}$, corresponding to the intersection of *MC* and *MR*. Further, suppose the demand curve is such as to establish the equilibrium market price $O\bar{P}$. One can definitely say that point *S* is one point on the monopoly supply curve. But that is about all that can be said. The monopoly supply curve is certainly not $\bar{Q}S$, because the monopolist would produce and market $O\bar{Q}$ units only at the price $O\bar{P}$. One might regard $\bar{P}S$ as the monopoly supply curve because the monopolist would supply any amount up to $O\bar{Q}$ units at the price $O\bar{P}$. However, this is also fictitious because the level $O\bar{P}$ is established prior to the line $\bar{P}S$ by the *MC* equals *MR* rule. For stationary demand and cost conditions, monopoly supply is best regarded as the single point *S*.

If demand shifts while the cost curves remain unchanged one can construct a monopoly supply curve. But note that it does not have the meaning of a competitive supply curve, which is based entirely on

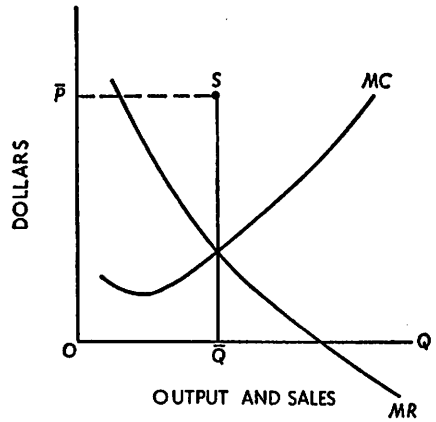

FIGURE 10.4.5
SHORT-RUN MONOPOLY SUPPLY WITH FIXED DEMAND

prevailing cost conditions. In perfect competition one can define a unique "supply price" for each quantity: *q* units will be supplied for $\$x$ per unit (or more). In monopoly, supply price is not unique. A given quantity would be supplied at different prices, depending upon market demand and marginal revenue.

This point will become clearer after a discussion of Figure 10.4.6. In panel a there is one stationary marginal cost curve *MC*. Suppose

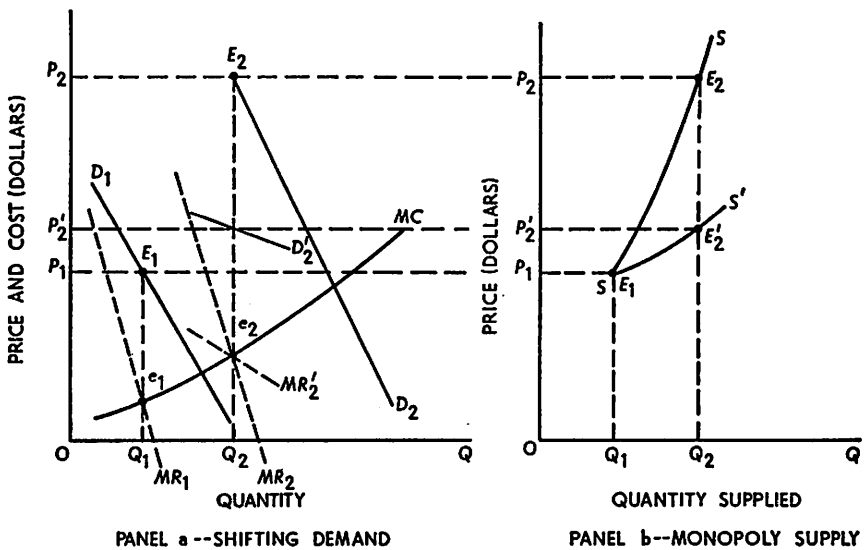

FIGURE 10.4.6
MONOPOLY SUPPLY WITH SHIFTING DEMAND

demand is D_1, with the associated marginal revenue curve MR_1. Equilibrium is attained at point e_1, with output OQ_1 at price OP_1. This price-output pair is plotted in panel b as the point E_1. Next, suppose demand shifts to D_2 with marginal revenue MR_2. Equilibrium now shifts to e_2 with output OQ_2 and price OP_2. The latter price-output pair is plotted in panel b as point E_2. Connecting all points such as E_1 and E_2 generated by a particular pattern of demand shifts, one obtains the curve labeled *SS* in panel b.

SS may be regarded as a monopoly supply curve for the *particular set of demand shifts.* But if demand had shifted differently there would have been a different set of supply prices and a correspondingly different supply curve. For example, if demand had shifted to D_2' instead of D_2, quantity supplied would nonetheless be OQ_2, because MR_2' intersects *MC* at that rate of output. Price, however, would be $OP_2' < OP_2$; and the associated point on panel b would be E_2'. The supply curve based on this set of demand shifts would be *SS'*, which is significantly different from *SS*.

In summary:

Relationships: for stationary demand and cost conditions short-run monopoly supply is best regarded as a single point in the *P-Q* plane. If demand shifts while cost conditions remain stationary a monopoly supply curve can be constructed. But the curve depends upon the precise set of demand shifts. In neither case does monopoly supply have the clear and exact meaning of competitive supply; and the concept of supply price is entirely meaningless in monopoly.

10.4.e—Multiplant Monopoly in the Short Run

The discussion so far has implicitly assumed that a monopolist owns and produces by means of only one plant. This, however, is not necessarily the case. The monopolist may operate more than one plant, and cost conditions may differ from one plant to another. An hypothetical two-plant example is given in Table 10.4.3 and illustrated graphically in Figure 10.4.7.

The first three columns of Table 10.4.3 provide the revenue data, while the last three contain the relevant cost data. The marginal costs of plants one and two are shown in columns four and five, and they are plotted in panel a, Figure 10.4.7. Similarly, demand and marginal revenue are plotted in panel b. The final column, "monopoly marginal cost," is derived from the marginal cost curves of the individual plant.

If output is expanded from zero to one, the one unit should clearly

TABLE 10.4.3

PROFIT MAXIMIZATION IN A MULTIPLANT MONOPOLY

Output and Sales	*Price*	*Marginal Revenue*	*Marginal Cost Plant #1*	*Marginal Cost Plant #2*	*Monopoly MC*
1	$5.00	$—	$1.92	$2.04	$1.92
2	4.50	4.00	2.00	2.14	2.00
3	4.10	3.30	2.08	2.24	2.04
4	3.80	2.90	2.16	2.34	2.08
5	3.55	2.55	2.24	2.44	2.14
6	3.35	2.35	2.32	2.54	2.16
7	3.20	2.30	2.40	2.64	2.24
8	3.08	2.24	2.48	2.74	2.24
9	2.98	2.18	2.56	2.84	2.32
10	2.89	2.08	2.64	2.94	2.34

be produced in plant one, whose marginal cost is \$1.92 (<\$2.04 in plant two). Hence marginal cost for the multiplant monopoly is \$1.92. If output is to be two units, both should be produced in plant one because its marginal cost for the second unit (\$2) is less than the

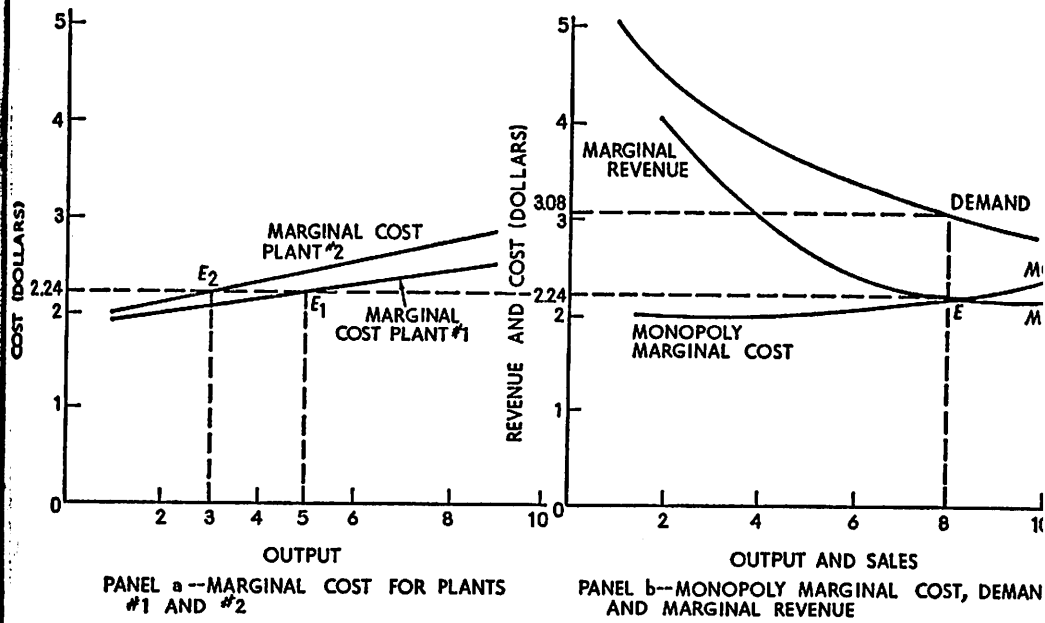

FIGURE 10.4.7

SHORT-RUN PROFIT MAXIMIZATION FOR A MULTIPLANT MONOPOLY

marginal cost of producing one unit in plant two. Hence monopoly marginal cost for two units is \$2. If three units of output are to be produced, however, plant two should enter production because its marginal cost for the first unit (\$2.04) is less than the marginal cost of the third unit in plant one. By producing two units in plant one and one unit in plant two, the multiplant monopoly has a marginal cost of \$2.04 for the third unit. Column six, "monopoly marginal cost," is derived by continuing this line of reasoning for each successive unit of output.

Monopoly marginal cost is plotted in panel b, Figure 10.4.7. It intersects marginal revenue at point *E*, corresponding to eight units of output and market price of \$3.08. By the *MC* equals *MR* rule, this price-output combination is the one for which monopoly profit is a maximum. The problem faced by the monopolist is the allocation of production between plants one and two.

First, observe that $MC = MR = \$2.24$ at the equilibrium point. A horizontal dashed line at the \$2.24 level has been extended from panel b to panel a. The line intersects the plant marginal cost curves at E_1 and E_2, the points at which $MC_1 = MC_2 = MC = MR$. The associated outputs are five units for plant one and three units for plant two; their combined quantity is precisely eight units, the profit-maximizing output. Thus the monopolist allocates production to his plants by equalizing plant marginal cost with the common value of monopoly marginal cost and marginal revenue at the equilibrium output.

Generalizing, we obtain the following:

Proposition: a multiplant monopolist maximizes profit by producing that output for which monopoly marginal cost equals marginal revenue. Optimal allocation of production among the various plants requires each plant produce that rate of output for which the plant marginal cost is equal to the common value of monopoly marginal cost and marginal revenue at the monopoly equilibrium output.

10.5 LONG-RUN EQUILIBRIUM UNDER MONOPOLY

A monopoly exists if, and only if, there is only one firm in the market. Among other things this statement implies that *entrance* into the market is not possible. Thus whether or not a monopolist earns a pure profit in the short run, no other producer can enter the market in the hopes of sharing whatever pure profit exists. Therefore, pure

economic profit is not eliminated in the long run, as it is in the case of perfect competition.[8]

10.5.a—Long-Run Equilibrium in a Single-plant Monopoly

Long-run equilibrium adjustment in a single-plant monopoly must take one of two possible courses. First, if the monopolist incurs a short-run loss, and if there is no plant size that will result in pure profit (or at least, no loss), the monopolist goes out of business. Second, if he earns a short-run profit with his original plant, he must determine whether a

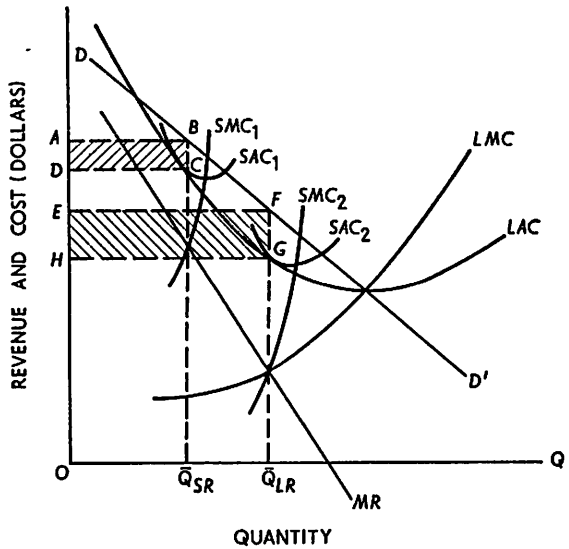

FIGURE 10.5.1

LONG-RUN EQUILIBRIUM FOR A SINGLE-PLANT MONOPOLIST

plant of different size (and thus a different price and output) will enable him to earn a larger profit.

The first situation requires no comment. The second is illustrated by Figure 10.5.1. *DD'* and *MR* show the market demand and marginal revenue confronting a monopolist. *LAC* is his long-run envelope cost

[8] Certain economists prefer to say that in the long run pure profit does not exist irrespective of the type of market organization (whether perfectly competitive, monopolistic, etc.). They contend that the monopoly position or the monopoly-causing "ingredient" should be capitalized, thereby increasing total cost by the amount of the pure profit that would otherwise exist (in the absence of capitalization). This is a perfectly defensible argument; however, the interpretation used in the text is retained to facilitate comparisons among long-run equilibria under various types of market organization. If the no-profit approach is preferred by the student, he should compare long-run equilibria in terms of differential returns to the same inputs.

curve (see Chapter 8), and *LMC* is the associated long-run marginal cost curve. Suppose in the initial period the monopolist builds the plant exemplified by the SAC_1 and SMC_1 curves. Equality of short-run marginal cost with marginal revenue leads to the sale of $O\overline{Q}_{SR}$ units at the price *OA*. At this rate of output unit cost is $OD = \overline{Q}_{SR}C$; short-run monopoly profit is represented by the area of the shaded rectangle *ABCD*.

Since a pure economic profit can be reaped, the monopolist would not consider discontinuing production. However he would search for a more profitable long-run organization. To this end, long-run marginal cost becomes the relevant consideration. By an argument analogous to the one used in subsection 10.4.b to establish the *MC* equals *MR* rule, the profit-maximum maximorum is attained when long-run marginal cost equals marginal revenue. The associated rate of output is $O\overline{Q}_{LR}$, and price is *OE*.

By reference to *LAC*, the plant capable of producing $O\overline{Q}_{LR}$ units per period at the least unit cost is the one represented by SAC_2 and SMC_2. Unit cost, accordingly, is *OH*, and long-run maximum monopoly profit is given by the area of the shaded rectangle *EFGH*. This profit is obviously (visually) greater than the profit obtainable from the original plant.

Generalizing, we have the following:

Proposition: a monopolist maximizes profit in the long run by producing and marketing that rate of output for which long-run marginal cost equals marginal revenue. The optimal plant is the one whose short-run average total cost curve is tangent to the long-run average cost curve at the point corresponding to long-run equilibrium output. At this point short-run marginal cost equals marginal revenue.

The organization described by the proposition above is the best the monopolist can attain; and he *can* attain it because in the long run his plant size is variable and the market is effectively closed to entry.

10.5.b—Comparison with Perfect Competition

The long-run equilibrium positions of a monopolist and a perfect competitor are somewhat more comparable than their short-run equilibria. The comparison is based upon the graphical illustrations of long-run equilibrium in Figures 9.6.3 and 10.5.1.

First, under perfect competition production occurs at the point of minimum long- and short-run average cost. While the monopolist utilizes the plant capable of producing his long-run equilibrium output at the least unit cost, this plant is not the one associated with absolute

minimum unit cost (for any output).[9] Thus in a sense to be described more fully in Chapter 16, society's limited resources are used relatively more efficiently in perfectly competitive markets than in monopoly markets.[10]

Second, the output of a perfectly competitive firm is *relatively* greater and its price *relatively* lower than the output and price of a monopolist. But notice that the adverb "relatively" is necessary in the statement.

Finally, the perfect competitor produces at the point where marginal cost and price are equal. For the monopolist, price exceeds marginal cost by a substantial amount. Under certain conditions,[11] demand represents the marginal *social* valuation of a commodity by the members of the society. Similarly, long-run marginal cost usually represents the marginal *social* cost of production. Under monopoly, the marginal *value* of a commodity to the society exceeds the marginal cost of its production to society. The society as a whole would therefore benefit by having more of its resources used in producing the commodity in question. The profit-maximizing monopolist will not do so, however, for producing at the point where price equals marginal cost would eliminate all, or almost all, his profit. Accordingly, social welfare tends to be promoted more by competitive than by monopolistic market organization.

10.5.c—Long-Run Equilibrium in a Multiplant Monopoly

In the long run a multiplant monopolist adjusts the number of plants to attain long-run equilibrium. The process is illustrated in Figure 10.5.2.

The adjustment of each individual plant is shown in panel a. Irrespective of original plant size, in the long run the monopolist can construct *each* plant of such size that short-run average cost coincides with long-run average cost at the minimum point on the latter curve. In other words, he can construct each plant of size *SAC* so as to produce

[9] Of course, the demand curve *could* be such that marginal revenue intersects long-run marginal cost at the point where the latter intersects the long-run average cost curve. In this instance the single-plant monopolist would produce at minimum long-run unit cost. Such a case would indeed be rare, and the slightest change in demand would upset it.

[10] This statement is concerned with relative economic efficiency and ignores the fact that cost comparisons between monopoly and perfect competition are generally impossible. Comparison is possible if the industry in question is truly a constant-cost industry, for minimum long-run average cost is attained at the same level irrespective of the scale of operation. On the other hand, comparisons are not valid for long-run decreasing- or increasing-cost industries.

[11] The exceptions are noted in Chapter 16.

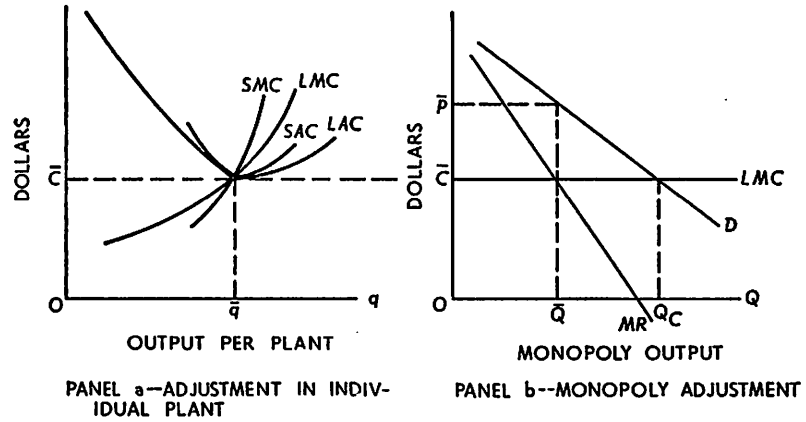

FIGURE 10.5.2

LONG-RUN EQUILIBRIUM FOR A MULTIPLANT MONOPOLIST

$O\bar{q}$ units of output at the irreducible minimum unit cost $O\bar{C}$. From this point he can expand output, not by producing more units per plant at a higher unit cost but by building more plants each of which produces $O\bar{q}$ units at $O\bar{C}$ per unit.

Thus the long-run marginal cost curve of a multiplant monopolist is a horizontal line at the height $O\bar{C}$. To reemphasize, he can produce any aggregate output by having the correct number of plants operate at the rate $O\bar{q}$ per period of time. Thus his long-run marginal cost is constant at the minimum level of unit cost. The curve is shown in panel b by the line labeled *LMC*. The revenue conditions for the monopolist are also shown in panel b by *D* and *MR*.

Invoking the *LMC* equals *MR* rule, long-run profit-maximizing equilibrium is attained with an output of $O\bar{Q}$ units per period and a price of $O\bar{P}$. The number of plants n_m the monopolist constructs and utilizes is $n_m = O\bar{Q}/O\bar{q}$.

10.5.d—Comparison with Perfect Competition

In the long run both perfectly competitive firms and multiplant monopolists operate their plants at minimum long- and short-run unit cost. In this respect they are alike. Their differences will become clear by considering an hypothetical case.

Suppose each firm in a perfectly competitive industry is represented by panel a, Figure 10.5.2. Then long-run industry equilibrium would occur at OQ_c in panel b, where demand equals long-run marginal cost. The associated market price is $O\bar{C}$, and the equilibrium number of firms n_c is $n_c = OQ_c/O\bar{q}$.

Next, suppose all firms are bought by the same individual and that he creates an effective monopoly. As shown before, the monopolist will produce $O\bar{Q}$ units and sell them at $O\bar{P}$ each. He would require only $n_m < n_c$ plants; he would accordingly scrap the superfluous plants (in number, $n_c - n_m$). Thus while either organization would be characterized by minimum-cost production, in comparison with the perfectly competitive industry, the multiplant monopolist would sell fewer units, charge a higher price, and operate fewer plants. In this case, as in the case of a single-plant monopoly, social welfare tends to be promoted to a greater extent by competition than by monopoly.

10.6 SPECIAL TOPICS IN MONOPOLY THEORY

Sections 10.1 through 10.5 comprise the theory of pricing under general monopoly. In this concluding section two special types of monopoly organization are discussed.

10.6.a—Price Discrimination

Certain commodities are purchased by two or more distinct types of buyers. For example, commercial and residential purchasers of electric power can usually be sharply divided on the basis of demand elasticity. Similarly, tourists and traveling salesmen constitute two different types of markets for motel accommodations. If a monopolist possesses a market divisible in this manner, and if he can effectively separate it, he may practice *discriminatory pricing* to augment his monopoly profit.

Price discrimination occurs when different prices are charged for the same commodity in different markets. The analysis of discriminatory pricing is a straightforward application of the *MR* equals *MC* rule; but in a sense it is diametrically opposite from the application of the rule to multiplant monopoly. In the latter, plant marginal cost curves are aggregated to obtain the monopoly marginal cost which is equated to marginal revenue. In price discrimination, submarket marginal revenue curves are aggregated to obtain the monopoly marginal revenue to which marginal cost is equated.

For simplicity, consider the case in which a general market can be separated into two distinct submarkets. Panel a, Figure 10.6.1, shows demand (D_1D_1', D_2D_2') and marginal revenue (MR_1, MR_2) for submarkets one and two respectively. Aggregating the demand and marginal revenue curves horizontally yields the market demand and marginal revenue curves shown in panel b. The allocation of sales

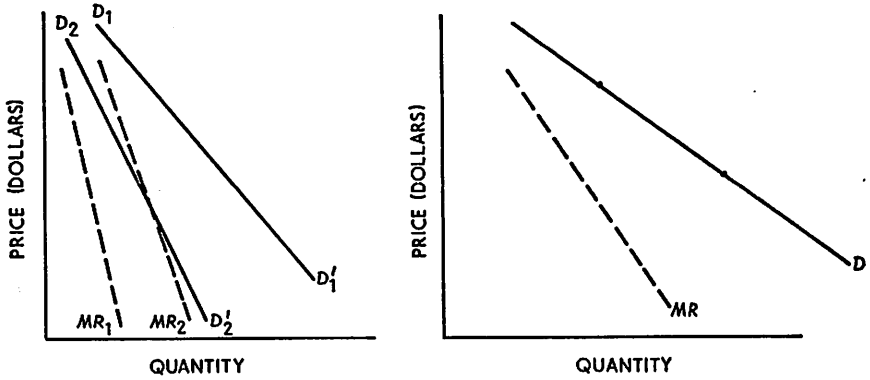

FIGURE 10.6.1

MARKET CONDITIONS LEADING TO PRICE DISCRIMINATION

between the two markets is the basic problem encountered by the price-discriminating monopolist.

Suppose, for the moment, the monopolist has somehow correctly allocated the sale of q units. Next, suppose he decides to expand output and sales to q plus one units. In which market should the additional unit be sold? The answer should be obvious: the additional unit should be sold so as to increase total revenue by the greatest possible amount. This will occur, of course, if the unit is sold in the market with the higher marginal revenue corresponding to the prior allocation of the q units.

Generalizing, the total output to be sold should be allocated between the two markets in such a way that marginal revenue is the same in both markets. If marginal revenue were higher in market one than in market two, for example, the monopolist could augment his profit by shifting some units from market two to market one. Maximum profit is obtained only when marginal revenue is the same in both markets.

This argument establishes the basis of allocating a given volume of sales between two markets. It also permits an easy explanation of the fundamental market condition required for profitable and meaningful price discrimination. Recall that marginal revenue may be expressed in the following way:

$$MR = p\left(1 - \frac{1}{\eta}\right),$$

where p is price and η is the elasticity of demand. As just shown, MR

must be the same in each market. If η were also the same in each market, p would necessarily be the same. In this case the two submarkets are indistinguishable since all revenue-connected magnitudes are the same. Consequently, profitable price discrimination requires that the elasticity of demand differ between the two markets.

As has been said, the first problem confronting a price-discriminating monopolist is the allocation of a given level of sales between his markets. The second problem is determining the optimal level of sales and, therefore, the level of price in each of the submarkets. For this calculation cost data are required.

In Figure 10.6.2, AC and MC represent the (aggregate) unit and marginal cost of producing the monopolized output. D_1D_1' and D_2D_2'

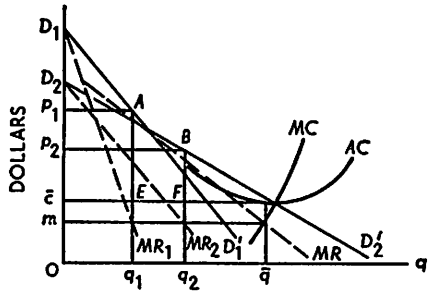

FIGURE 10.6.2

PROFIT MAXIMIZATION UNDER PRICE DISCRIMINATION

are the submarket demand curves; MR_1 and MR_2 are the corresponding marginal revenue curves. Aggregating the two marginal revenue curves, just as we previously aggregated plant marginal costs, the monopoly marginal revenue curve MR is obtained. Next, invoking the MC equals MR rule, the profit-maximizing output is $O\bar{q}$ units. The marginal revenue (equals marginal cost) associated with this output is Om.

The market allocation rule, previously determined, requires that marginal revenue be the same in each submarket. Thus, Oq_1 units are sold in market one and Oq_2 units in market two (Oq_1 plus Oq_2 equals $O\bar{q}$). Furthermore, given the submarket demand curves, the price in each submarket is determined. A price of Op_1 per unit is charged in market one, and Op_2 per unit is charged in market two.

At any given output it is visually apparent that demand is more elastic in market two than in market one. Using this information in conjunction with the results above brings out an interesting, albeit

rather obvious, point: the more elastic the submarket demand the lower the equilibrium price in that submarket.[12] Among other things, this principle accounts for the price differential favoring commercial, as against residential, users of electrical power.

Summarizing these results:

Proposition: if the aggregate market for a monopolist's product can be divided into submarkets with different price elasticities the monopolist can profitably practice price discrimination. Total output is determined by equating marginal cost with aggregate monopoly marginal revenue. The output is allocated among the submarkets so as to equate marginal revenue in each submarket with aggregate marginal revenue at the *MR* equals *MC* point. Finally, price in each submarket is determined directly from the submarket demand curve, given the submarket allocation of sales.

10.6.b—Bilateral Monopoly

The final special topic, bilateral monopoly, is analyzed chiefly to explain the meaning of *indeterminate* in economics. Our general conclusion is that price and quantity is *indeterminate* in cases of bilateral monopoly. This does not mean the market collapses or that the parties fail to reach a definite agreement on price and quantity. Rather it means the information the economist has is not sufficient to determine the precise market solution. The solution, in other words, is based not only upon conditions of demand and cost, with which the economist can deal, but also upon bargaining skills and other personal characteristics anterior to the realm of economic analysis.

A bilateral monopoly is said to exist when one producer has an output monopoly and there is only one buyer for the product (a purchase monopoly). Thus a bilateral monopoly would exist if there

[12] This proposition is easily proved. First, recall that marginal revenue may always be written as

$$(10.6.1) \qquad MR = p\left(1 - \frac{1}{\eta}\right).$$

Next, since marginal revenue must be equal in both markets, we have

$$(10.6.2) \qquad MR_1 = MR_2,$$

where subscripts denote the market. Using expression (10.6.1) in expression (10.6.2), we obtain

$$(10.6.3) \qquad p_1\left(1 - \frac{1}{\eta_1}\right) = p_2\left(1 - \frac{1}{\eta_2}\right).$$

Let market one be characterized by the higher price elasticity of demand. Hence, $\eta_1 > \eta_2$, and thus $\left(1 - \frac{1}{\eta_1}\right) > \left(1 - \frac{1}{\eta_2}\right)$. Using the latter inequality in expression (10.6.3), equality between the left- and right-hand sides requires $p_2 > p_1$.

were only one copper-mining firm and one brass manufacturer in the world. This example is somewhat fanciful; however, the situation is sometimes approximated quite closely in the real world. A "one-mill" town with an effective labor union, while not exactly a bilateral monopoly situation, is very close to being one.

Bilateral monopoly is analyzed by means of Figure 10.6.3. *D* is the demand curve of the single buyer in the market; hence *D* and *MR* are the demand and marginal revenue curves confronting the monopolistic seller. Similarly, *MC* is the marginal cost curve of the single producer.

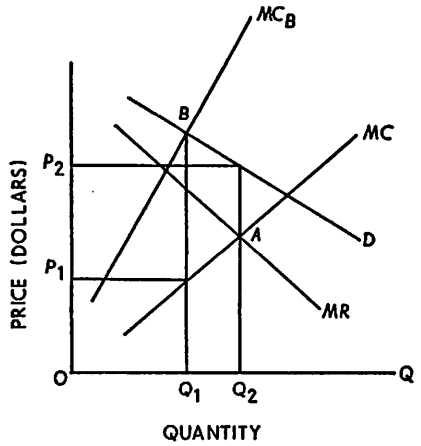

FIGURE 10.6.3
BILATERAL MONOPOLY

MC and *MR* intersect at point *A;* hence the output monopolist wishes to sell OQ_2 units at a price of OP_2 per unit. If he could do so, his profit from operation would be maximized.

If the output monopolist could force the single buyer to behave as though he were a buyer in a large and impersonal market, he could do so. But in this situation the single buyer realizes his potential power as a buying monopolist. In the limit, if the single buyer could control the market completely he could make the output monopolist behave as if he were a perfect competitor. Then *MC* would be the supply curve as well as the marginal cost curve. If it were, the curve marginal to *MC*, labeled MC_B, would be the *marginal cost of buying* an additional unit.[13]

Optimally, the single buyer would like to equate his marginal

[13] With necessary verbal changes to allow for the difference between buying products and hiring inputs, MC_B in Figure 10.6.3 is entirely analogous to the marginal cost of input curve in Figure 10.3.1.

valuation of the product (given by his demand curve) with the marginal cost of purchasing. He would strive to attain point B with the purchase of OQ_1 units at a price of OP_1 (determined by the MC equals potential supply curve) per unit. If a large number of producers were in the market, or if he could get the monopolist to act as if he were a perfect competitor, he could do so.

However, the single buyer can no more induce the output monopolist to act like a perfectly competitive producer than the single seller can induce the purchase monopolist to act like a perfectly competitive buyer. Each realizes the situation that exists and tries to do his best. The economist cannot determine the solution. He can say the "best" the output monopolist can do is to sell OQ_2 units at OP_2 unit. Similarly, the "best" the purchase monopolist can do is to buy OQ_1 units at OP_1 per unit. Neither extreme is likely to materialize. Output will lie somewhere between OQ_1 and OQ_2 and price somewhere between OP_1 and OP_2. The precise result is determined by factors beyond the purview of economic analysis.

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Chapter 11 THEORY OF PRICING UNDER MONOPOLISTIC COMPETITION

11.1 INTRODUCTION

Chapters 9 and 10 dealt with the "pure" and "extreme" cases of perfect competition and monopoly. The two models are pure in that the analytical results are completely independent of personal influences, especially entrepreneurial expectations and speculation concerning the behavior of rivals. Indeed, there are no *rivals* in either perfect competition or monopoly. They are "extremes" from the standpoint of numbers and profit. In perfect competition the number of firms in an industry is indefinitely large, while at the opposite end of the "numbers" spectrum, monopoly is a one-firm industry. Similarly, zero economic profit per firm is the central characteristic of long-run equilibrium in perfect competition. In contrast, monopolization of a market guarantees the single firm a greater long-run pure profit than it could earn under any other organization of the market (that is, than if there were one or more rival firms in the market).

11.1.a—Historical Perspective

With the exception of a few "naive" duopoly theories, discussed in Chapter 12, the theories of perfect competition and monopoly constituted "classical" microeconomic theory from Marshall to Knight. In point of fact, the theory of perfect competition was not perfectly developed until the publication of Knight's *Risk, Uncertainty, and Profit.*[1] Stigler even argued that Knight's meticulous discussion of perfect competition, clearly pointing out the austere nature of the rigorously defined concept, caused a widespread reaction against the use of perfect competition as a model of economic behavior.[2] This is probably true; but whatever the cause, in the late 1920's and early 1930's there was definitely a reaction against the use both of perfect

[1] London School Reprints of Scarce Works, No. 16, 1933.

[2] George J. Stigler, "Perfect Competition, Historically Contemplated," *Journal of Political Economy,* LXV (1957), pp. 1–17.