

## Monopoly

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### I. Sources of monopoly power

Monopoly differs from perfect competition in two key aspects:

- 1 firm vs. numerous firms
- barriers to entry/exit vs. free entry/exit

As long as both are true, firm has ability to charge  $P > ATC$ .

Question for class: what are some examples of industries dominated by a single firm?

Common themes likely to emerge:

- control over scarce inputs
- economies of scale
- patents
- government grants of exclusive privilege

### II. Economic analysis

#### A. Output and pricing decisions

Consider a profit-maximizing firm which has a demand curve equal to the demand curve for the product. The firm's goal is to select  $Q$  to maximize

$$\Pi = P(Q)Q - C(Q)$$

This function reaches its maximum when its derivative with respect to  $Q$  equals zero:

$$d\Pi/dQ = P(Q) + (dP/dQ)Q - dC/dQ = 0$$

$$P(Q) + (dP/dQ)Q = dC/dQ$$

Let's examine each of these terms in detail. When  $Q$  increases by 1 unit, two things happen on the revenue side: (1) the firm gains extra revenue by selling the extra  $Q$  at

price  $P$  and (2) the price has to fall a bit to sell the extra  $Q$ , so the monopolist loses revenue from the price cut. These actions correspond to the two terms on the left side of the equation.

For instance suppose RDU DSL could increase output by 1 thousand households, given a base of 10 thousand households, by cutting price from \$45 to \$43/month. Total revenue would go from \$450 thousand to \$473 thousand, an increase of \$23 thousand. Here is the linkage to the  $P(Q)$  term: RDU DSL would gain \$43 thousand/month revenue from the new households. Here is the linkage to the  $(dP/dQ)Q$  term: RDU DSL would lose \$20 thousand/month ( $= -2 \cdot 10$ ) from its base customers. The result is a net gain of \$23 thousand. We will use the term *marginal revenue* to refer to the change in a firm's revenue resulting from a change in output.

The right side of the equation is an expression we have seen before: marginal cost. So we can rewrite the previous equation this way:

$$\boxed{MR = MC}$$

This guideline is used by the monopolist to set output. It is used in the same way a competitive firm uses the  $P = MC$  rule. The monopolist will always follow a strategy that increases output (e.g., expanding into Lizard Lick), when  $MR > MC$ . It also will sell off or close capacity when MC of operating that capacity is greater than MR generated by that capacity.

Pricing decision: Rewrite  $P(Q) + (dP/dQ)Q = dC/dQ$  as

$$P + (dP/dQ)Q = MC$$

Multiply and divide the second term on the left side by  $P$  (which means multiplying it by 1):

$$P + P(dP/dQ)(Q/P) = MC$$

Recall that  $(dQ/dP)/(P/Q) = \text{elasticity of demand} = E_d$ , so we now have

$$P + P(1/E_d) = P(1 + (1/E_d)) = MC$$

$$\boxed{P = MC/(1 + (1/E_d))}$$

This rule tells us the relationship between  $P$  and  $MC$ :

- 1) The first thing to notice is that the denominator on the right side is always less than one (because  $E_d < 0$ ).  $P > MC$  always!
- 2) The second thing to notice is that  $E_d < -1$  for a monopolist. Remember the linkage between TR and elasticity in the first week of the course;  $MR > 0$  means that  $E_d < -1$ . The denominator becomes zero if  $E_d = -1$  and negative for  $E_d > -1$ . The monopolist is always producing on the elastic segment of its demand curve.
- 3) The markup of  $P$  over  $MC$  is inversely related to the absolute value of  $E_d$ . If  $E_d = -2$ , then  $P = 2 \cdot MC$ , whereas if  $E_d = -5$ , then  $P = 1.25 \cdot MC$ . In other words, the more elastic the demand, the smaller the markup. Which should make sense – more substitutes should mean less monopoly power!

Example using linear demand curves:

$$\begin{aligned}P &= a - bQ \\TR &= Q(a-bQ) = aQ - bQ^2 \\MR &= dTR/dQ = a - 2bQ\end{aligned}$$

MR curve has same vertical intercept as demand curve; slope is twice as large. (See Figure 10.1)

More specific example on MR:

$$\begin{aligned}P &= 100 - 20Q \\TR &= Q(100-20Q) = 100Q - 20Q^2 \\MR &= 100 - 40Q\end{aligned}$$

Example with MC:

Let  $P = 80 - 2Q$  and  $TC = 100 + 2Q^2$  what are  $P$ ,  $Q$ , profits for a monopolist?

Step 1: Calculate MR

$$MR = 80 - 4Q$$

Step 2: Calculate MC

$$MC = 4Q$$

Step 3: Solve for Q

$$\begin{aligned}MR &= MC \\80 - 4Q &= 4Q \\10 &= Q\end{aligned}$$

Step 4: Solve for P

$$P = 80 - 2Q = 60$$

Step 5: Calculate profits

$$\Pi = TR - TC = 600 - 300 = 300$$

A sample problem on monopoly (#4, p. 378) – Firm has demand curve  $P = 120 - 0.02Q$  and cost function  $C = 60Q + 25,000$ , where  $Q$  = weekly production and  $P$  = cents per unit. Part (a) asks for production, price, and profit. Answer is  $Q = 1500$ ,  $P = 90$ , Profit = 20000.

Graphically, focus on Figure 10.3, bottom panel. There are three things to look for:

- 1) Set output where  $MR = MC$
- 2) Set  $P$  off demand curve at this output level
- 3) Profits equal difference between  $P$  and  $AC$  times output (yellow rectangle)

B. Comparison to perfect competition:

Monopoly	Perfect competition
$P > MC$	$P = MC$
Q inefficient (too low)	Q efficient
$\Pi > 0$	$\Pi = 0$

C. Social cost

Once again we have an inefficient situation, because the value of the last unit of output produced by a monopolist is greater than the cost of the resources that went into producing it. We measure this loss to society by looking at producer and consumer surplus to calculate deadweight loss (Figure 10.10). In perfect competition output would be  $Q_c$  (at the point where  $P=MC$ ), whereas in monopoly output will be  $Q_m$  (at the point where  $MR=MC$ ). The loss in consumer surplus is rectangles A+B. Part of this loss (A) is a transfer to producers and is not lost to society. There also is a loss of producer surplus of C, which represents extra output the monopolist could sell at a price that would more than cover the cost of production. The net effect is a *deadweight loss* of B+C. This represents the lost value of output  $Q_c - Q_m$ , net of resource costs. This is lost, no matter what kind of government policy is put in place to regulate, tax or redistribute the profits of the monopolist!

All of the above is based on a static analysis. Monopolists expend considerable resources to obtain and maintain their protected position. Catch the lunch scene on K Street in Washington DC sometime! Or, better yet, read the financial reports for any political campaign. You always wondered why telecom deregulation is slow and confusing – do you think this is just a coincidence? (Sorry, off the soapbox for now.)

If you consider the incentives for cost-saving innovation, a different picture emerges. A competitive firm has little incentive to innovate because any cost savings will be copied quickly by other firms.  $\Pi = 0$  before and after the innovation, so the only gain to the competitive firm is in the short interval between when the innovation is launched and when it gets copied by everyone.

On the other hand a monopolist stands to capture all of the gains from innovation. By lowering MC, the monopolist stands to generate a larger price markup ( $P - AC$ ) over a larger base of output. The interesting twist here is that this is a win-win situation for all involved – the monopolist gets higher profits and customers get more output at a lower price!

Finally, remember that new products are a threat to any monopoly. Think of the great WordPerfect and Lotus 1-2-3 monopolies 15 years ago; IBM's monopoly of mainframes 25 years ago. Close and better substitutes are a much bigger threat to a monopolist than the Justice Dept., which provides further incentives for innovation.

### III. Regulation

#### A. Antitrust

Section 10.7 of text lays out basics on antitrust law. Basic intent was to protect customers and small businesses from predatory behavior of big business. As you might expect, it has not always worked out that way. Highlights are

1. Sherman Act (1890): Section 1 bans price fixing (both directly and implicitly); Section 2 bans monopolization, which means business practices designed to obtain or maintain a monopoly position.
2. Clayton Act (1914): forbids practices that were thought to lead to the creation of monopoly positions. These include price discrimination, predatory pricing, mergers of firms in the same industry that would reduce competition, and tying arrangements (e.g., if you buy this card reading machine from us, you also must buy the cards).
3. Federal Trade Commission Act (1914): created FTC, which regulates a wide range of business practices, such as advertising and vertical relationships. Section 5 outlaws "unfair methods of competition," which can be interpreted broadly.

Enforcement is through Antitrust Division of Justice Dept, FTC, and private suits. We will apply these concepts next week when we discuss the Microsoft case.

Economic goals: increase number of competitors, reduce entry barriers, and make demand more elastic. Factors in evaluating whether this system is working or not:

- Gains to consumers from smaller P/MC ratio
- versus
- Costs of litigation, enforcement, defense
  - State of competition in global marketplace
  - Possible loss of efficiency if firms lose economies of scale, scope

As you might expect, champions of the current system claim gains are large and costs small; critics, the reverse!

#### B. Price

Another way to reduce the deadweight loss would be to take steps to directly regulate price and thereby stimulate output. Price regulation is widely practiced in utilities, telecommunication and medicine today; used to be widely applied to transportation, agriculture, and petroleum. Obviously not all of these are/were monopolies; sometimes price regulation has a momentum all its own!

If the Justice Dept ends up prevailing over Microsoft, then government experts (or bureaucrats, pick the term you like best) could tell Bill Gates how much to charge for Windows XP. Figure 10.11 shows the economic impact. The ideal would be to set P at level where D crosses MC ( $P_2 = P_c$ ), this would yield the competitive outcome. But the odds of this happening are not especially high, so Gates has to make his output decisions like a competitive firm, comparing P and MC. If  $P = P_1$ , then Gates increases output as long as  $P > MC$ . Once  $P_1$  hits the demand curve, Gates has to cut price to sell extra units, so the original MR curve becomes relevant to decision making once again. Here MR is so low that production beyond  $Q_1$  is unthinkable. Government can set price too low (see  $P_3$ ) and create an inefficiency almost as bad as an unregulated monopolist.

More interesting case is *natural monopoly*, where MC, AC are still declining when they cross D curve. See Figure 10.12. Left to its own devices, natural monopoly will set

output at  $Q_m$  where  $MR=MC$ . If government sets price at point where  $P=MC$  here, the firm will be stuck at  $Q_c$  and will lose money. Possible solutions:

- 1) Set  $P$  where  $AC = D$  at  $P_r$  so that firm does not lose \$. This is roughly the situation for CP&L and other electrical utilities before deregulation
- 2) Two-part tariff, where  $P = P_c$  to get efficient output level and then everyone pays access charge to cover difference between  $P$  and  $AC$ . This is widely applied in telecom.

#### C. Nationalization

Widely practiced throughout the world. Rare in US except for USPS. Issues: what decision rule to set output, price (probably not profit maximization); ample evidence that the rule is to create the maximum number of government jobs. Obvious implications for costs!

#### IV. Domination by a few firms

More common than monopoly is a situation where a few firms dominate an industry. . Classic case is big 3 automakers in 1950s and 1960s. To analyze these situations, we need to understand what determines the degree of competition and price markup. Big difference is that now when you change price/output, firm runs risk of losing business to other firms in same industry – in contrast to monopoly where such close substitutes were not available. Each firm's demand curve will be much more elastic than the industry demand curve. (Figure 10.7)

Degree of monopoly power depends on:

- Elasticity of market demand: easier to fix prices in oil than most other commodities
- Number of firms: more potential competitors mean greater odds that cartel will fall apart AND each firm less able to raise prices and make it stick
- Interaction among firms: sometimes aggressive, sometimes laid back – will study this more later