Microeconomics, Module 11: "Monopoly" (Chapter 10)

Homework Assignment

(The attached PDF file has better formatting.)

We examine the effects of natural monopoly on output, prices, consumers' surplus, producers' surplus, and the dead weight loss. This example also shows the social benefits of open source code for software products, which is an example of natural monopoly.

The demand curve for Supercomputers is $P = 40 - \frac{1}{2} Q$. Research and development is done by programmers working independently (open source code), and the fixed costs for suppliers is zero. The marginal cost for producing supercomputers is fixed at MC = 20. (Prices are in millions of dollars.)

We presume first that the suppliers of supercomputers are in a competitive market. No supplier has an advantage over other suppliers, since all firms have marginal cost of $20 million. If a firm charges more than $20 million, some other firm produces a supercomputer for a lower price and takes away its market share.

A. What is the supply curve? (The supply curve is the marginal cost curve in a competitive industry. We have four supply curves: industry long-run, industry short run, firm long-run, and firm short run. We use the industry short run supply curve with the market demand curve to determine the short run equilibrium price, and we use the firm's long-run supply curve to determine the long-run price and the number of firms in the industry. We cover this in the modules on competitive pricing. For this example, the supply curve is the same for the industry and the firm, and it is the same in the short run as the long-run.)
B. What is the equilibrium price? (The marginal cost is fixed at $20 million, and fixed costs are zero. If a firm charges more than $20 million, some other firm takes away its business; if a firm charges less than $20 million, it loses money. We can solve this mathematically by equating the supply and demand curves. The supply curve is horizontal at P = 20, so the intersection occurs at P = 20.)
C. What is the equilibrium quantity? (Marginal cost of 20 equals marginal revenue at the optimum profitability. In a competitive market, marginal revenue equals price, so the marginal revenue curve is the demand curve. Equate P = 20 with $P = 40 - \frac{1}{2} Q$ to solve for Q.)
D. What is producers' surplus? (In a competitive industry with a flat supply curve, why is producers' surplus equal to zero? By definition, producers' surplus is the area between price and marginal cost from zero to the quantity supplied. Since price equals marginal cost, the area is the quantity times zero.)
E. What is consumers' surplus? (This is a triangle with vertices at 0,20; 0,40; and 40,20. This triangle is the area below the demand curve, above the price, and out to the quantity supplied.)

Question: This industry could be competitive with 40 firms making one supercompter apiece, or 1 firm making 40 supercomputers. Why do we assume it is competitive?

Answer: The number of firms does not determine if the industry is competitive. Even if this industry has only 1 firm, it is competitive, since the fixed costs are zero and the marginal cost curve is flat. If the 1 firm charges more than the competitive price, another firm enters and takes away its market share. Our assumptions may not be realistic, but given the assumptions, the industry is competitive.

Question: If producers' surplus is zero, who do the firms produce?

Answer: Producers' surplus includes a reasonable profit as part of the costs. The firms earn their opportunity cost of capital, which is what firms expect to earn in a competitive market. These are the accounting profits expected by shareholders. Everyone is happy: consumers get the lowest possible prices, employees are paid, and shareholders earn a competitive return on their capital.

In practice, building supercomputers has high fixed costs. Once the fixed costs are spent, the marginal costs do not rise with each supercomputer supplied, so the industry is a natural monopoly and competition does not work. Assume fixed costs are $100 million.

The producers' surplus remains zero, since the supply curve is flat. Fixed costs are more than zero, so all firms lose money. The only way for firms to produce is to combine into a monopoly. They will produce supercomputers, though not as many as the competitive firms. But as Landsburg notes, we can't compare the monopoly with a competitive industry when the marginal cost curve is flat and the firms have large fixed costs, since the competitive industry is not possible.

F. In a monopolistic industry, what is the total revenue curve? {Total revenue is P × Q, or Q × (40 – ½ Q).}
G. What is the marginal revenue curve? {Marginal revenue is the partial derivative of total revenue with respect to quantity, or $\partial(40Q - \frac{1}{2}Q^2)/\partial Q$.}
H. What is the quantity produced by a monopoly? {With a *flat* marginal cost curve and a *linear* demand curve, the monopoly quantity is one half the competitive quantity. We see this by equating marginal revenue with marginal cost, which is MC = 20.}
I. What is the price charged by the monopoly? {For the equilibrium price, we use the *demand* curve, *not* the marginal cost curve. The demand curve is 40 – ½ Q.}
J. What is consumers' surplus? {The vertices of the triangle are now 0,30; 0,40, 20,30. The consumers' surplus is smaller, since the price is higher and the quantity is lower.}
K. What is producers' surplus? {This is a *rectangle*, with vertices 0,20; 0,30; 20,20; 20,30. The producers' surplus is not the profit, since we must subtract the fixed costs.}
L. What is the dead weight loss? {This is a triangle, with vertices 20,20; 20,30; 40,20.}

Question: Why is this a dead weight loss? We just said that it is not possible for the firms to operate in a competitive market.

Answer: The dead weight loss compares the actual social welfare with the social welfare that would be achieved if firms produced the optimal quantity. The optimal quantity is the one which maximizes social welfare, even though this equilibrium can not be achieved in a competitive market.