

Review Session Handout #9

Chapter 11: Monopoly and Market Power

Introduction to Microeconomics: Markets, Strategy, and Real-World Cases

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Exercise R9.1. A monopolist faces a straight-line demand curve on which the price starts at \$24 and falls by \$2 for each extra unit sold (the first unit sells for \$22, the second for \$20, and so on). Its marginal cost is constant at \$4, and it has no fixed cost.

Part (a). Find the profit-maximizing quantity and price.

The monopolist produces where marginal revenue equals marginal cost. On a straight-line demand curve, the marginal revenue line starts at the same price, \$24, but is twice as steep, so it falls by \$4 for each extra unit. It reaches the \$4 marginal cost at 5 units, since $\$24 - 5 \times \$4 = \$4$. The demand curve shows that buyers will pay $\$24 - 5 \times \$2 = \$14$ for each of 5 units. The following table confirms the choice.

Quantity	Price	Total revenue	Marginal revenue
4	\$16	\$64	\$10
5	\$14	\$70	\$6
6	\$12	\$72	\$2

The fifth unit adds \$6 to revenue, more than its \$4 marginal cost, so it is worth selling; the sixth adds only \$2, less than its marginal cost, so it is not. The monopolist sells 5 units at \$14 each.

Part (b). Compute the monopolist's profit.

Revenue is $5 \times \$14 = \$70$ and total cost is $5 \times \$4 = \$20$, so profit is $\$70 - \$20 = \$50$. Equivalently, the monopolist earns $\$14 - \$4 = \$10$ on each of 5 units.

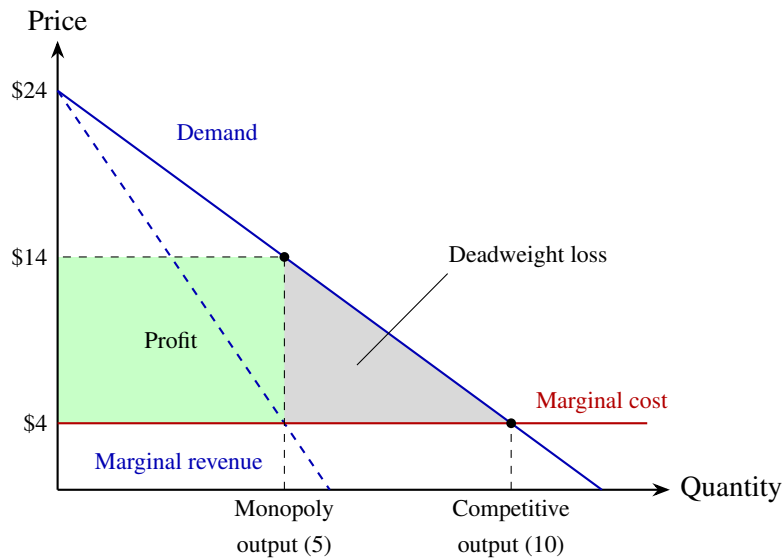
Part (c). What output and price would prevail under perfect competition with the same cost?

Under perfect competition, the price equals marginal cost, \$4. The price falls from \$24 to \$4, a drop of \$20, after $\frac{\$20}{\$2} = 10$ units, so a competitive industry sells 10 units at \$4 each.

Part (d). Compute the deadweight loss from monopoly. Illustrate your answers in a diagram showing demand, marginal revenue, marginal cost, the monopoly output and price, the competitive output and price, and the deadweight loss.

The deadweight loss is the triangle between the demand curve and the marginal cost line, from the monopoly output (5 units) to the competitive output (10 units). Its base is 5 units and its height is $\$14 - \$4 = \$10$, so

$$\text{deadweight loss} = \frac{1}{2} \times 5 \times \$10 = \$25.$$



Remark. The monopolist cuts output from 10 to 5 units and raises the price from \$4 to \$14. Consumer surplus falls from $\frac{1}{2} \times 10 \times \$20 = \$100$ under competition to $\frac{1}{2} \times 5 \times \$10 = \$25$ under monopoly. Of the \$75 drop, \$50 is the profit the monopolist captures (a transfer from consumers to the firm), and the remaining \$25 is the deadweight loss: surplus from units that buyers value above their \$4 cost but that are never produced.

Exercise R9.2. A pharmaceutical company holds a patent on a drug. On a straight-line demand curve, the price buyers will pay starts at \$100 per dose and falls by \$1 for each extra thousand doses sold. Marginal cost is \$20 per dose, and there is no fixed cost.

Part (a). Find the monopoly price, quantity, and profit.

Marginal revenue starts at \$100 and falls twice as fast as the price, by \$2 for each extra thousand doses. It reaches the \$20 marginal cost at 40 thousand doses, since $100 - 40 \times 2 = 20$. The price at that quantity is $100 - 40 \times 1 = \$60$ per dose. Profit is

$$(\$60 - \$20) \times 40,000 = \$1,600,000.$$

Part (b). Compute consumer surplus under monopoly.

Consumer surplus is the triangle above the price and below the demand curve, with base 40,000 doses and height $100 - \$60 = \$40$:

$$\frac{1}{2} \times 40,000 \times \$40 = \$800,000.$$

Part (c). If the patent expires and the market becomes competitive, find the new price and quantity.

The price falls to marginal cost, \$20 per dose. The price drops \$80 from its starting value of \$100, so buyers purchase 80 thousand doses.

Part (d). Compute the gain in consumer surplus from competition.

Under competition, consumer surplus is

$$\frac{1}{2} \times 80,000 \times (\$100 - \$20) = \frac{1}{2} \times 80,000 \times \$80 = \$3,200,000.$$

The gain in consumer surplus is $\$3,200,000 - \$800,000 = \$2,400,000$.

Part (e). Compute the change in total surplus (consumer surplus plus producer surplus). Relate your answer to the arguments for and against patents.

With no fixed cost, producer surplus equals profit.

- Monopoly: total surplus is $\$800,000 + \$1,600,000 = \$2,400,000$.
- Competition: total surplus is $\$3,200,000 + \$0 = \$3,200,000$, since price equals marginal cost and producer surplus is zero.

Total surplus rises by $\$3,200,000 - \$2,400,000 = \$800,000$. This is the deadweight loss of the monopoly, the triangle between demand and marginal cost from 40 to 80 thousand doses:

$$\frac{1}{2} \times 40,000 \times (\$60 - \$20) = \$800,000.$$

Remark. Patents create a trade-off. While the patent lasts, the monopoly price causes a deadweight loss of \$800,000 and transfers \$1,600,000 of surplus from patients to the firm as profit. The argument for patents is that the prospect of this profit pays for the costly research that produces new drugs (Section 11.4.3). The argument against is the deadweight loss: patients who value the drug above its \$20 cost are priced out. Governments grant patents for a limited time, accepting this loss while the patent lasts in exchange for the new products it encourages.

Exercise R9.3. Two monopolists sell unrelated products, and each has a constant marginal cost of \$6 and no fixed cost.

- Firm A runs the only movie theater in a small town. On its straight-line demand curve, the ticket price starts at \$30 and falls by \$1 for each extra hundred tickets sold per week.
- Firm B holds the patent on the ink cartridge for a popular printer. On its straight-line demand curve, the cartridge price starts at \$42 and falls by \$3 for each extra hundred cartridges sold per week.

Part (a). Find each firm's monopoly price and quantity.

For each firm, marginal revenue starts at the same price as demand and falls twice as fast.

- Firm A: marginal revenue falls by \$2 per hundred tickets and reaches the \$6 marginal cost at 12 hundred tickets, since $\$30 - 12 \times \$2 = \$6$. The price is $\$30 - 12 \times \$1 = \$18$. Firm A sells 1,200 tickets per week at \$18.
- Firm B: marginal revenue falls by \$6 per hundred cartridges and reaches \$6 at 6 hundred cartridges, since $\$42 - 6 \times \$6 = \$6$. The price is $\$42 - 6 \times \$3 = \$24$. Firm B sells 600 cartridges per week at \$24.

Part (b). Compute each firm's markup, the price minus marginal cost.

Firm A's markup is $\$18 - \$6 = \$12$, and Firm B's markup is $\$24 - \$6 = \$18$. Firm B charges the higher markup.

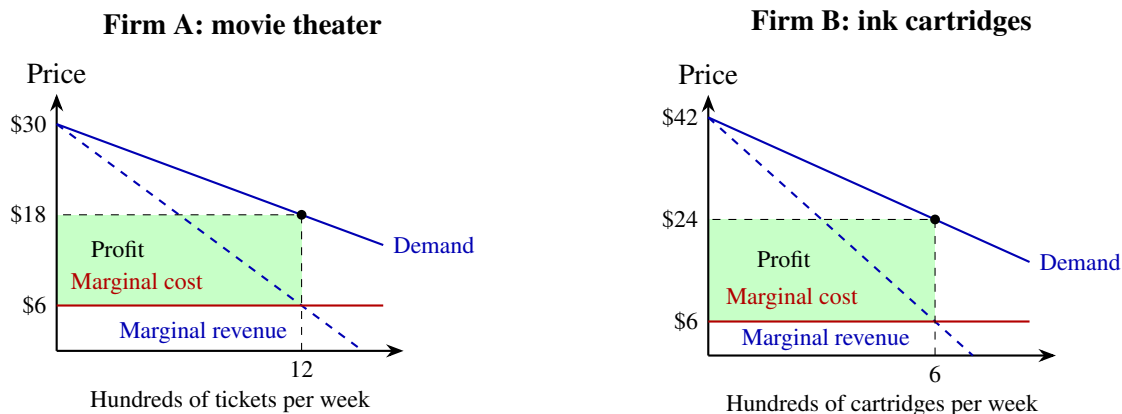
Part (c). Compute each firm's Lerner index, the gap between price and marginal cost expressed as a share of the price.

Firm A's Lerner index is $\frac{\$12}{\$18} = \frac{2}{3} \approx 0.67$, and Firm B's is $\frac{\$18}{\$24} = 0.75$. Markup is two-thirds of Firm A's price and three-quarters of Firm B's price.

Part (d). Compute the price elasticity of demand at each firm's monopoly price, using a 1 percent increase in the price. Explain why the firm facing the less elastic demand charges the higher markup. Illustrate both firms in side-by-side diagrams.

- Firm A: a 1 percent increase in the price, from \$18 to \$18.18, cuts the quantity by 0.18 hundred tickets, from 1,200 to 1,182 tickets. This is a fall of $\frac{18}{1,200} = 1.5$ percent, so the elasticity at \$18 is 1.5.
- Firm B: a 1 percent increase in the price, from \$24 to \$24.24, cuts the quantity by $\frac{\$0.24}{\$3} = 0.08$ hundred cartridges, from 600 to 592 cartridges. This is a fall of $\frac{8}{600} \approx 1.33$ percent, so the elasticity at \$24 is about 1.33.

Demand for cartridges is less elastic at the chosen price (about 1.33 against 1.5). A profit-maximizing firm sets its price so that the Lerner index equals 1 divided by the price elasticity of demand: $\frac{1}{1.5} \approx 0.67$ for Firm A and $\frac{1}{1.33} \approx 0.75$ for Firm B, matching part (c). When buyers cut back little as the price rises, a high markup costs the firm few sales, so Firm B sustains the larger markup. The following figure shows both firms, with each profit shaded.



Remark. At the chosen prices, demand for Firm B's cartridges is less elastic than demand for Firm A's tickets (1.33 against 1.5), so Firm B sustains the larger markup, as Section 11.4.2 predicts. A plausible reason is that owners of the printer have no other cartridge that fits, while moviegoers can stream a film at home instead.