UN1105 Principles of Economics

Recitation 6: Monopoly, and Oligopoly & Game Theory

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Fall 2020

Outline

- Review of Concepts
  - Monopoly
  - Oligopoly & Game Theory
- Analytical Questions
  - Q1: K&W Problem 13.03
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- Short-answer Questions
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Review of Concepts: Monopoly (i)

- Definitions:
  - Monopolist: a firm that is the only producer of a good with no close substitutes.
  - An industry controlled by a monopolist is known as a monopoly.
- How/why do monopolies arise?
- Monopolist's profit-maximizing quantity and price:
  - $\Delta\Pi(Q+1) = \Pi(Q+1) - \Pi(Q) = MR(Q+1) - MC(Q+1)$
  - Thus, chooses Q^* s.t. $MR(Q^*) = MC(Q^*)$.
  - Given Q^*, optimal price is given by $P^D(Q^*)$ on the demand curve.
    - Note, a P.C. firm also produces such that $MR(Q^*) = MC(Q^*)$, but because each firm is a price-taker, $MR(Q^*) = P$.
    - Not so for a monopolist, as they face a downward-sloping demand curve, thus the *price effect* implies $MR(Q^*) < P(Q^*)$.
- Compare outcomes to that under P.C.
  - Lower output, higher price.
  - Given $P(Q^*) > MC(Q^*)$, production level is socially inefficient.
- Public policy
  - How can policy makers address the inefficiency?
- Price discrimination
  - DFN: charging different prices to different consumers for *the same product*.
  - Examples and Implications.

Review of Concepts: Monopoly (ii)

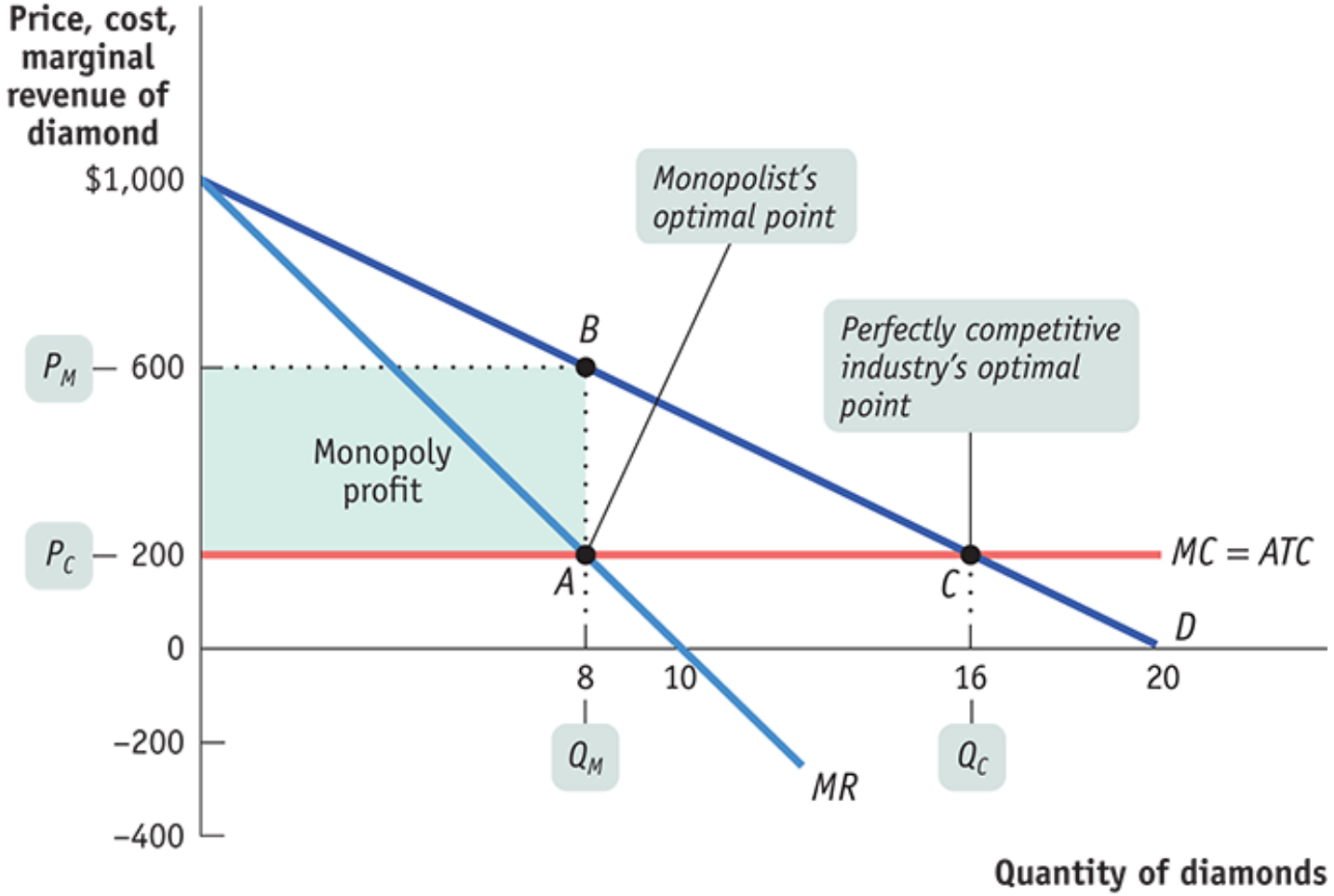
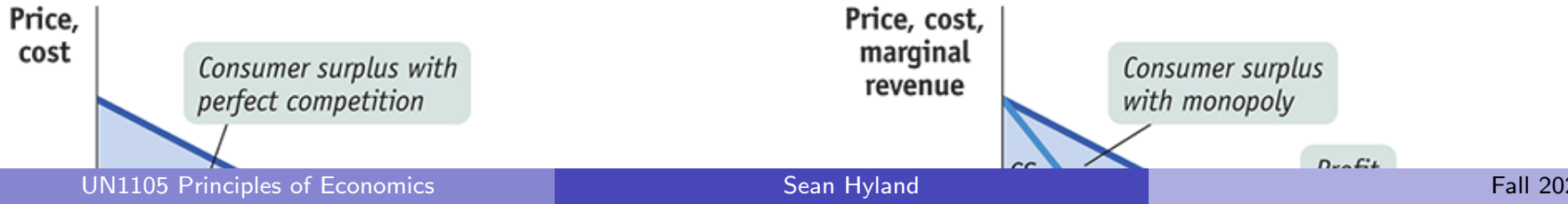


FIGURE 13-6

Krugman/Wells, *Microeconomics*, 5e, © 2018 Worth Publishers

(a) Total Surplus with Perfect Competition

(b) Total Surplus with Monopoly



Review of Concepts: Oligopoly & Game Theory (i)

- Definitions
  - An oligopoly is a market that is dominated by a small number of firms.
  - Each oligopolist has some market power (ability to influence the price).
  - (We allow for both homogeneous and heterogeneous goods.)
- Comparison to other market structures.
  - Note that PC firms face an exogenous price, whilst monopolists have no competitors.
  - To analyze this market structure we must consider the strategic interactions between firms.
  - This helps us to understand the effect of *competition*.
- Game Theory
  - A game consists of players, strategies, and payoffs.
- Prisoner's Dilemma
- Concepts
  - Dominant strategy: a strategy that is a player's best action *regardless of the action taken by the other player.*
  - Nash equilibrium: the result when each player in a game chooses the action that maximizes his or her payoff *given the actions of other players*.
- Extensions
  - Tacit collusion, repeated games, product differentiation.

Review of Concepts: Oligopoly & Game Theory (ii)

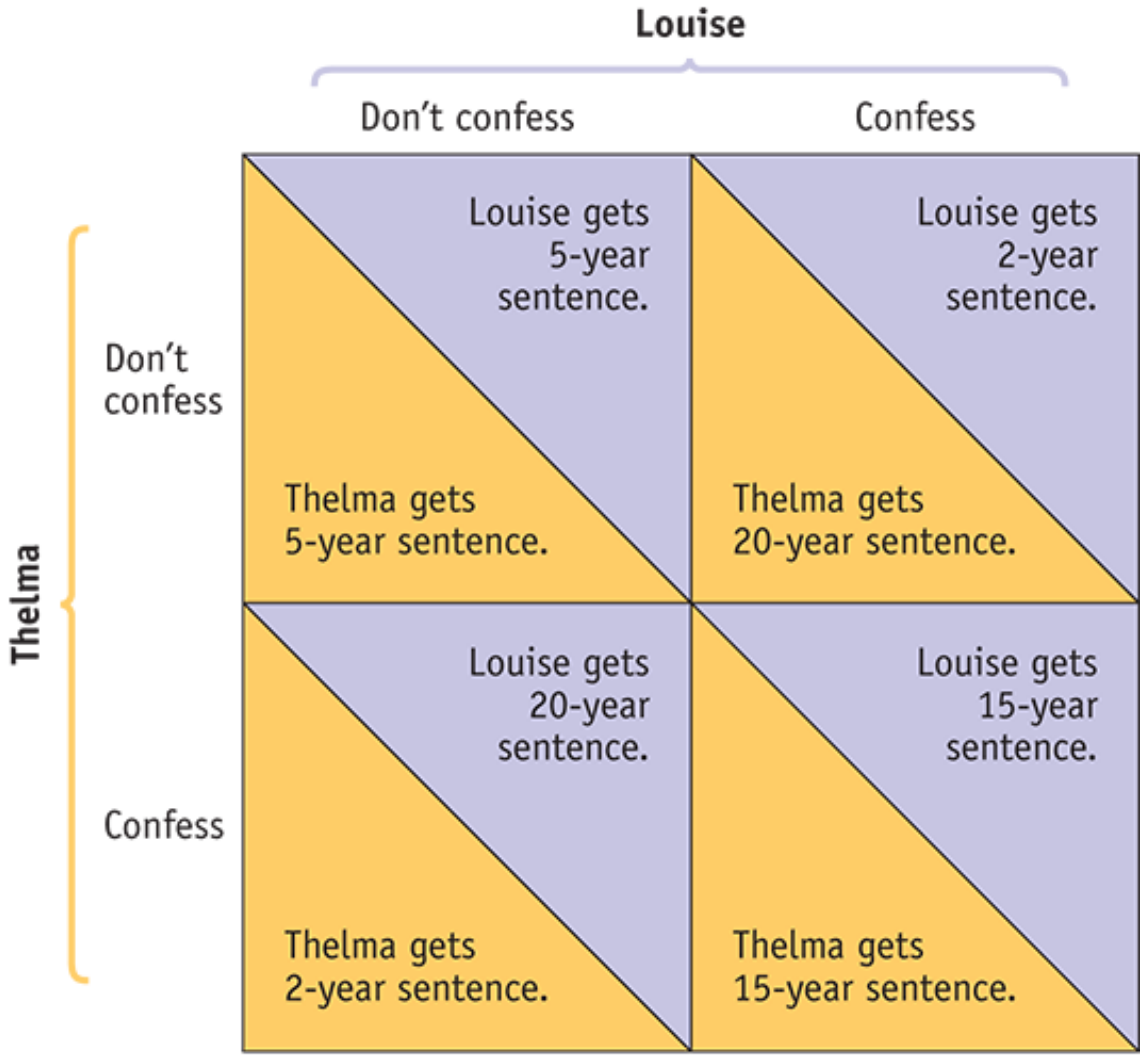


FIGURE 14-3
Krugman/Wells, *Microeconomics*, 5e, © 2018 Worth Publishers

Analytical Questions, Q1: K&W Problem 13.03

The Baxter brothers have just made a documentary movie about their basketball team, which they are thinking about making available for download on the internet, and they can act as a single-price monopolist if they choose to. Each time the movie is downloaded, their internet service provider charges them a fee of $4. The Baxter brothers are arguing about which price to charge customers per download. The accompanying table shows the demand schedule for their film.

Table 1: Baxter Family's Demand and Revenue Schedule

Price per Download ($)	Quantity of Downloads Demanded	Total Revenue ($s)	Marginal Revenue ($s)	Total Cost ($s)	Total Profit ($s)
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			8		
8	1	8		4	4
			5		
6	3	18		12	6
			2		
4	6	24		24	0
			-1		
2	10	20		40	-20
			-4		
0	15	0		60	-60

Analytical Questions, Q1: K&W Problem 13.03

(a) Calculate the total revenue and the marginal revenue per download.
- $R(Q) = P(Q) \times Q$, note for monopolist price is a function of quantity.
- $MR = \frac{\Delta R(Q)}{\Delta Q}$

(b) Bob is proud of the film and wants as many people as possible to download it. Which price would he choose? How many downloads would be sold?
Bob would charge \$0. At that price, there would be 15 downloads, the greatest quantity demanded.

(c) Bill wants as much total revenue as possible. Which price would he choose? How many downloads would be sold?
Bill would charge \$4. At that price, total revenue is greatest (\$24). At that price, there would be 6 downloads.

(d) Ben wants to maximize profit. Which price would he choose? How many downloads would be sold?
Ben would charge \$6. At that price, there would be 3 downloads. For any more downloads, marginal revenue would be below marginal cost, and so further downloads would lose the Baxters' money.

(e) Brad wants to charge the efficient price. Which price would he choose? How many downloads would be sold?
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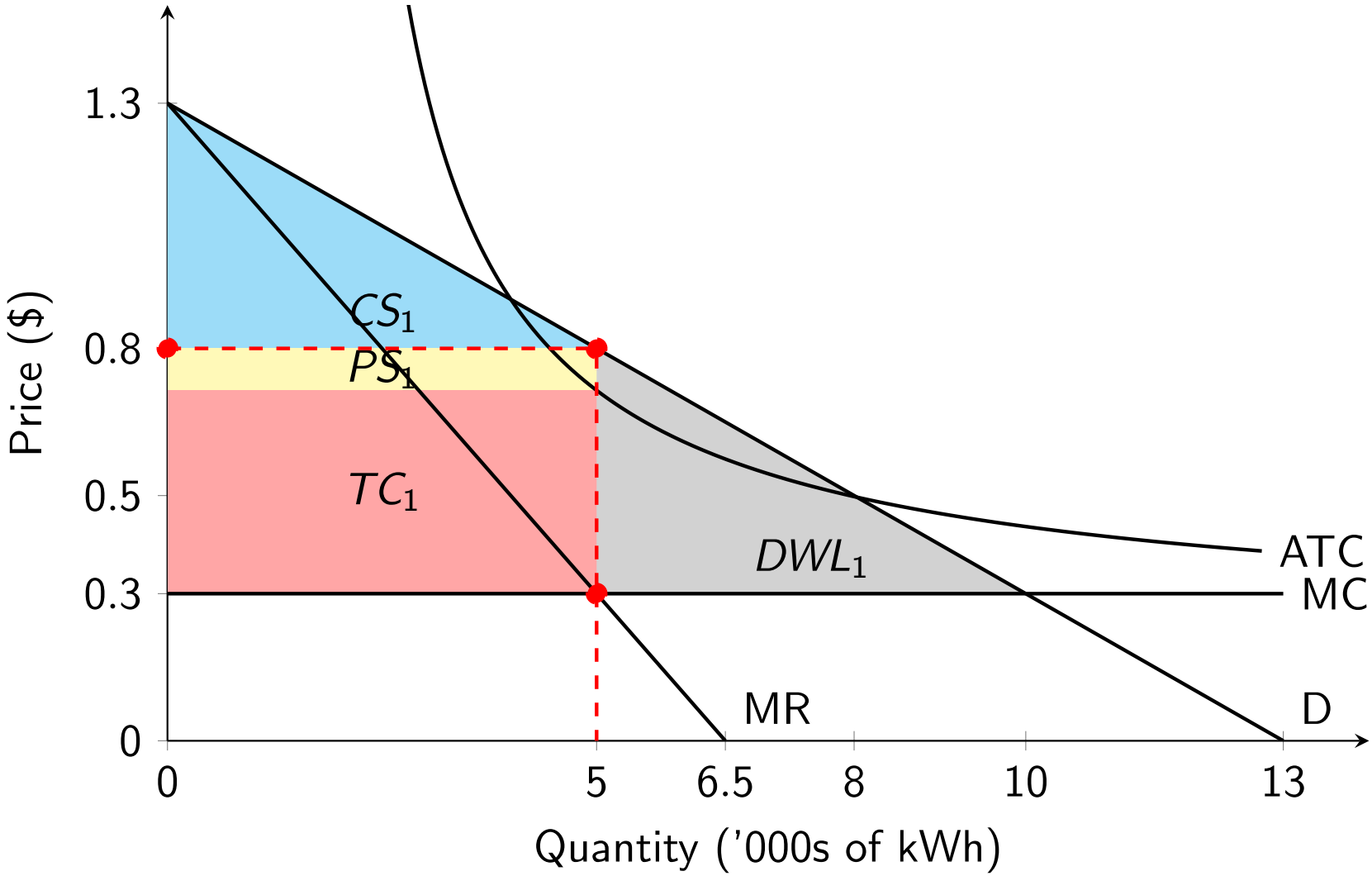
Analytical Questions, Q2: K&W Problem 13.09

The following diagram illustrates your local electricity company's natural monopoly. It shows the demand curve for kilowatt-hours (kWh) of electricity, the company's MR curve, its MC curve, and its ATC curve.

1. If the government does not regulate this monopolist, which price will it charge? Illustrate the inefficiency this creates by shading the deadweight loss from monopoly.
   - Output: $MR(Q) = MC(Q)$ at $Q = 5$.
   - Price, from demand curve: $P^D(Q = 5) = 0.8$.
2. If the government imposes a price ceiling equal to the marginal cost, \$0.30, will the monopolist make profits or lose money? Shade the area of profit (or loss) for the monopolist. If the government does impose this price ceiling, do you think the firm will continue to produce in the long run?
   - $Q^D(P = 0.3) = 10$.
   - However, $ATC(10) > 0.3$, thus the monopolist will incur a loss and in the LR will exit the market.
3. If the government imposes a price ceiling of \$0.50, will the monopolist make a profit, lose money, or break even?
   - $Q^D(P = 0.5) = 8$.
   - Note, $ATC(8) = 0.5$, thus the price equals the monopolist's ATC and so the firm will make zero profit.

Analytical Questions, Q2: K&W Problem 13.09

Figure 1: Price and Quantity under a Natural Monopoly (1)



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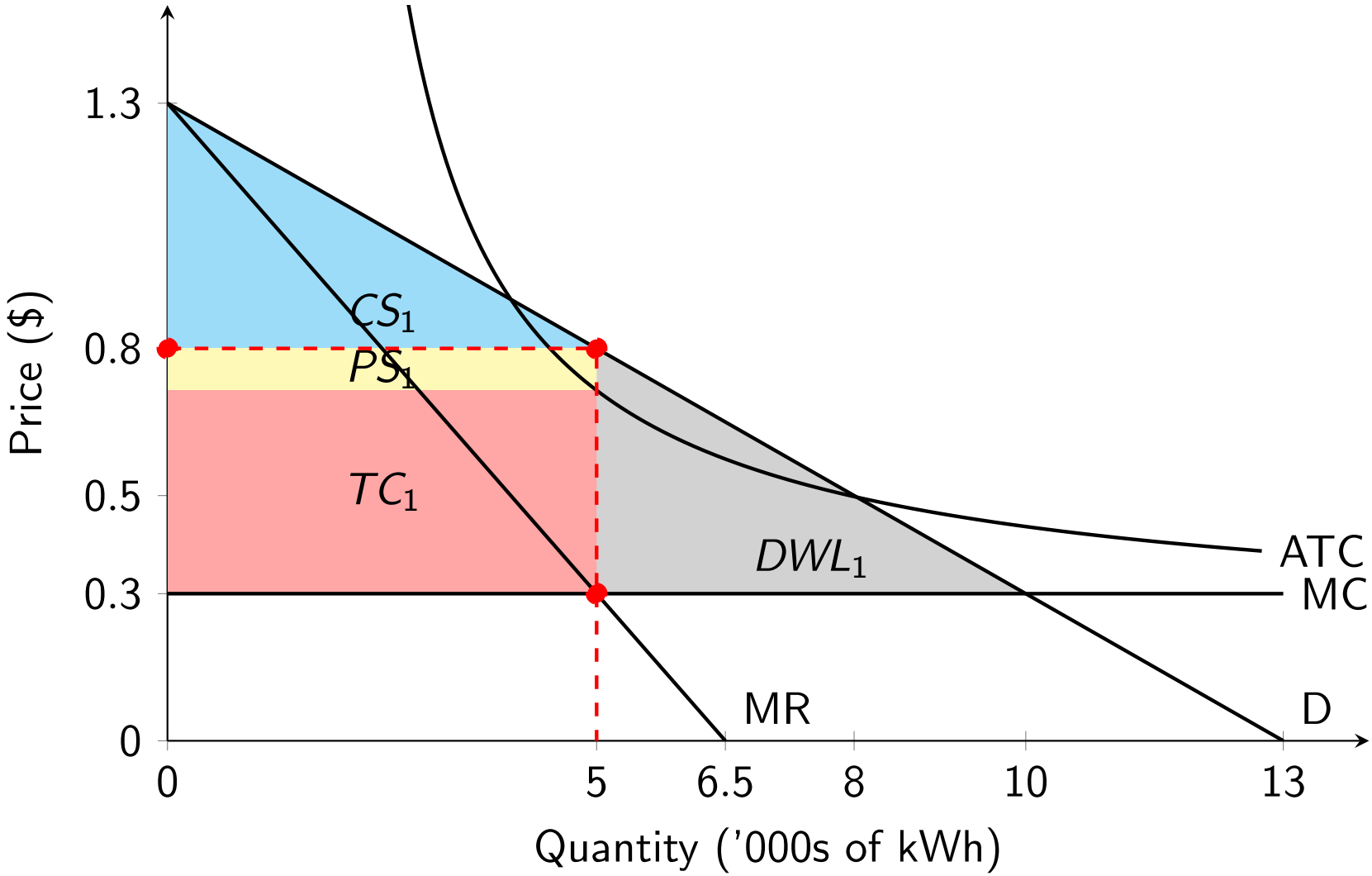

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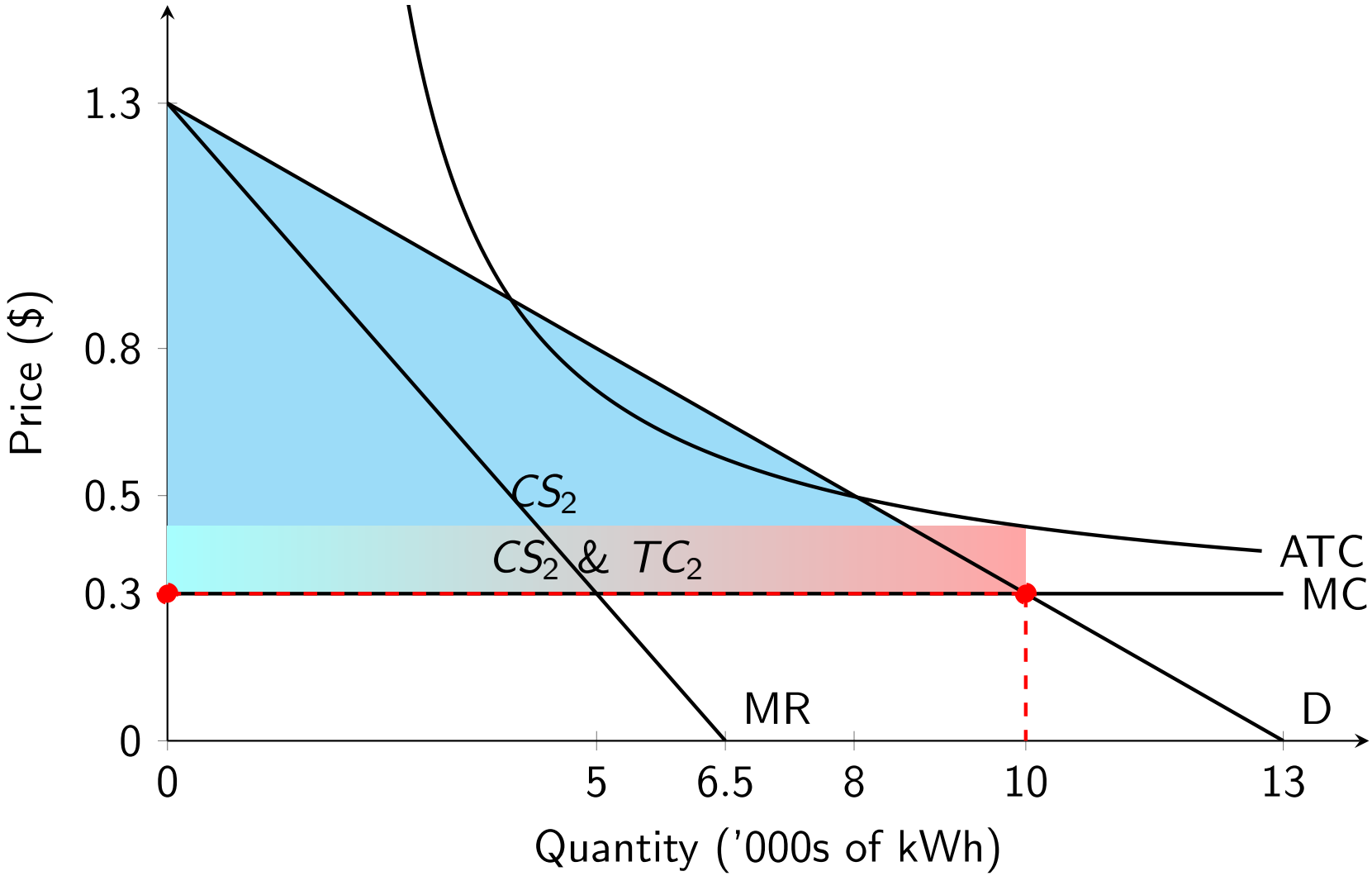
Analytical Questions, Q2: K&W Problem 13.09

Figure 2: Price and Quantity under a Natural Monopoly (2)



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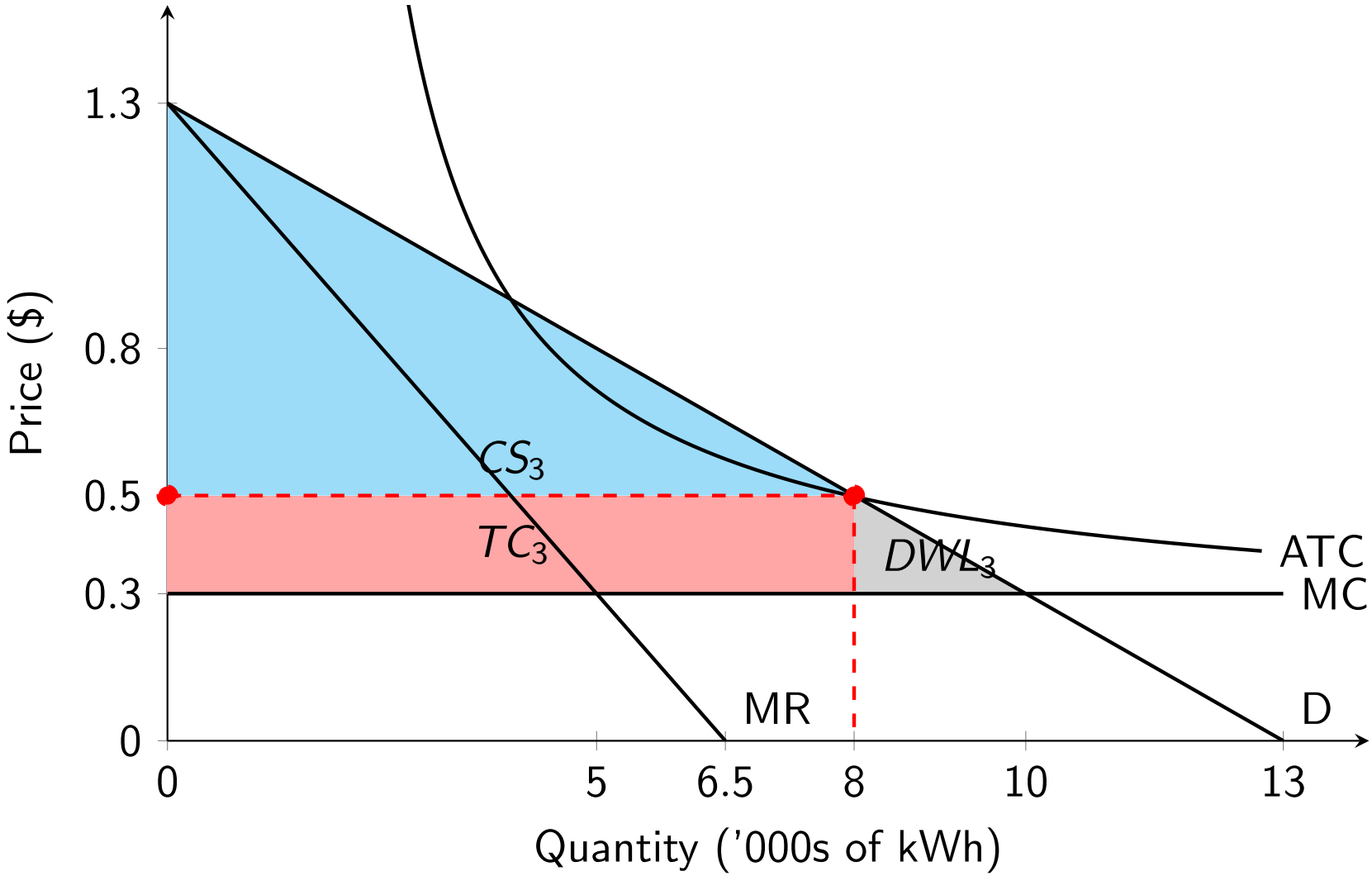
Analytical Questions, Q2: K&W Problem 13.09

Figure 3: Price and Quantity under a Natural Monopoly (3)



Analytical Questions, Q3: K&W Problem 14.04

In France, the market for bottled water is controlled by two large firms, Perrier and Evian. Each firm has a fixed cost of €1 million and a constant marginal cost of €2 per liter of bottled water (€1 = 1 euro). The following table gives the market demand schedule for bottled water in France.

Price of Btld. Water (€ per L)	Quantity Demanded (Millions of L)	Total Revenue (€, Millions)	Marginal Revenue (€, Millions)
10	0	0	
			9
9	1	9	
			7
8	2	16	
			5
7	3	21	
			3
6	4	24	2
			1
5	5	25	
			-1
4	6	24	
			-3
3	7	21	
			-5
2	8	16	
			-7
1	9	9	

Analytical Questions, Q3: K&W Problem 14.04

(a) Suppose the two firms form a cartel and act as a monopolist. Calculate marginal revenue for the cartel. What will the monopoly price and output be? Assuming the firms divide the output evenly, how much will each produce and what will each firm's profits be?

- The cartel maximizes profit by producing such that $MR = MC$ (here €2).
- Thus they produce a quantity of 4 million liters, and sell them at €6 per liter.
- If the firms divide production equally, each produces 2 million liters and has revenue of €12 million.
- Since the fixed cost is €1 million and each liter's marginal cost is €2, each firm has profit of €7 million ($= (6-2) \times 2 - 1$).

(b) Now suppose Perrier decides to increase production by 1 million liters. Evian doesn't change its production. What will the new market price and output be? What is Perrier's profit? What is Evian's profit?

- Total production is now 5 million liters (3 from Perrier, 2 from Evian).
- According to the demand schedule, this would reduce the price per liter to €5.
- Perrier's profit increases to €8 million ($= (5-2) \times 3 - 1$), because there is a positive quantity effect, whilst they share the negative price effect.
- Meanwhile, Evian's profit falls to €5 ($= (5-2) \times 2 - 1$), as they experience is a pure price effect.

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Analytical Questions, Q3: K&W Problem 14.04

(c) What if Perrier increases production by 3 million liters? Evian doesn't change its production. What would Perrier's output and profits be relative to those in part b?

- Total production is now 7 million liters (5 from Perrier, 2 from Evian).
- According to the demand schedule, this would reduce the price per liter to €3.
- Perrier's profit falls to €4 million ($= (3-2) \times 5 - 1$).
- This implies that although Perrier has an incentive to increase production somewhat, it does not have an incentive to increase production dramatically.
- Meanwhile, Evian's profit falls further to €1 ($= (3-2) \times 2 - 1$).

(d) What do your results tell you about the likelihood of cheating on such agreements?

- Since each firm can significantly increase its profit by moderately increasing production, the likelihood of cheating is high.

Analytical Questions, Q4: K&W Problem 14.05

To preserve the North Atlantic fish stocks, it is decided that only two fishing fleets, one from the United States and the other from the European Union, can fish in those waters. Suppose that the fisheries agreement breaks down, so that the fleets behave noncooperatively. Assume that the United States and the European Union each can send out either one or two fleets. The more fleets in the area, the more fish they catch in total but the lower the catch of each fleet. The accompanying matrix shows the profit (in dollars) per week earned by the two sides.

Table 2: U.S. and E.U. Fisheries Payoff Matrix

		European Union			
		1 fleet		2 fleets	
United States	1 fleet		10		12
		10		4	
	2 fleet		4		7.5
		12		7.5	

Analytical Questions, Q4: K&W Problem 14.05

(a) What is the non-cooperative Nash equilibrium? Will each side choose to send out one or two fleets?

- If the European Union has only one fleet, the United States will have a higher profit if it sends out two fleets ($12,000 rather than $10,000).
- If the European Union sends out two fleets, the United States will have a higher profit if it also sends out two fleets ($7,500 rather than $4,000).
- The same reasoning will persuade the European Union that its best strategy is also to send out two fleets whether the United States sends out one or two.
- Both parties will send out two fleets, each earning only $7,500 each instead of the $10,000 they would each have earned if they had each limited themselves to one fleet.

Analytical Questions, Q4: K&W Problem 14.05

To preserve the North Atlantic fish stocks, it is decided that only two fishing fleets, one from the United States and the other from the European Union, can fish in those waters. Suppose that the fisheries agreement breaks down, so that the fleets behave noncooperatively. Assume that the United States and the European Union each can send out either one or two fleets. The more fleets in the area, the more fish they catch in total but the lower the catch of each fleet. The accompanying matrix shows the profit (in dollars) per week earned by the two sides.

Table 2: U.S. and E.U. Fisheries Payoff Matrix

		European Union: 1 fleet	European Union: 2 fleets
United States: 1 fleet		10	12
		10	4
United States: 2 fleet		4	7.5
		12	7.5

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Short-answer Questions, Q5: K&W Problem 13.XX

It is often said that the monopolist will never set the price in the inelastic range of the demand curve. Why?

- If the firm is operating in the inelastic portion of the demand curve a decrease in price will increase quantity demanded, but by proportionally less. Thus total revenue falls whilst total costs rise, which decreases profit.
- An increase in price, meanwhile, will increase total revenue and decrease total cost, which increases profit.
- So if a monopolist is in the inelastic range of the demand curve, they can definitely increase profit by decreasing quantity and increasing price since total revenue will rise (by the definition of inelastic demand) and total cost will fall (since less units are being made).
- For this reason, a monopolist (at least an unregulated one) will never set the price in the lower half, or inelastic range, of the demand curve.

Short-answer Questions, Q6: K&W Problem 14.09

Over the last 40 years the Organization of Petroleum Exporting Countries OPEC) has had varied success in forming and maintaining its cartel agreements. Explain how the following factors may contribute to the difficulty of forming and/or maintaining its price and output agreements.

(a) New oil fields are discovered and increased drilling is undertaken in the Gulf of Mexico and the North Sea by nonmembers of OPEC.
With the discovery of new oil by nonmembers of OPEC, there is increased competition. This will lead to a fall in market price and make the cartel agreement harder to maintain.

(b) Crude oil is a product that is differentiated by sulfur content: it costs less to refine low-sulfur crude oil into gasoline. Different OPEC countries possess oil reserves of different sulfur content.
The OPEC countries sell a differentiated and complex product. This complicates the decision about what prices to set for what types of oil and makes enforcement of a cartel agreement more difficult. Much of the conflict within OPEC rests on the price differential that is set between high- and low-quality oils.

(c) Cars powered by hydrogen are developed.
The development of a hydrogen-powered car would make it more difficult to form or maintain an agreement. Remember that a cartel essentially acts like