

Micro, Modules 13, 14, 15, "Market power, cartels, oligopoly," practice problems

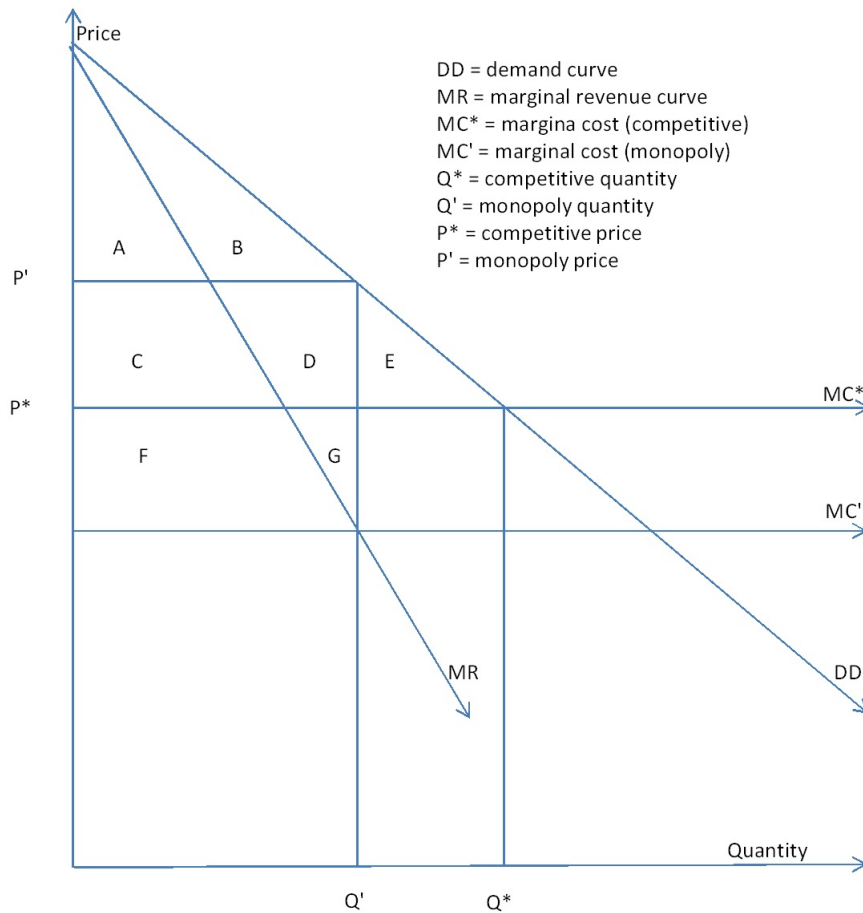
(The attached PDF file has better formatting.)

** Exercise 15.1: Costs savings with monopoly

The graphic below shows the effect on social welfare of a merger that reduces marginal costs.

- The vertical axis is price; the horizontal axis is quantity.
- The downward sloping line DD is the market demand curve.
- The downward sloping line MR is the marginal revenue curve, with twice the slope of the demand curve.
- P^* is the equilibrium price under perfect competition.
- P' is the equilibrium price under monopoly.
- Q^* is the equilibrium quantity under perfect competition.
- Q' is the equilibrium quantity under monopoly.
- MC^* is the marginal cost curve under perfect competition.
- MC' is the marginal cost curve under monopoly.

In the graphic, marginal costs are constant; constant marginal costs are not needed for this exercise.



- What is consumers' surplus under competition?
- What is producers' surplus under competition?
- What is consumers' surplus under monopoly?
- What is producers' surplus under monopoly?
- What is the difference in the social gain from trade between competition and monopoly?

Part A: Consumers' surplus under competition is $A + B + C + D + E$.

Part B: Producers' surplus under competition is zero, since the marginal cost curve is flat.

Part C: Consumers' surplus under monopoly is $A + B$.

Part D: Producers' surplus under monopoly is $C + D + F + G$.

Part E: The difference in social gain is $A + B + C + D + F + G - (A + B + C + D + E) = F + G - E$.

Question: is the difference in social gain positive or negative?

Answer: In industries with relatively high price elasticities of demand, where consumers can buy other products if the price is too high, monopoly has little effect. Monopoly is important where the price elasticity of demand is low. An example is pharmaceutical drugs: people with cancer will pay almost any price for a cancer drug which works. Pharmaceutical drugs have high costs: research and development, clinical trials, and approval by the FDA take about ten years. If five firms compete to produce a medication, each must spend the entire research and development costs. Society gains if the five firms merge into a monopoly and each pays one fifth the total research and development costs. The final market price for the medication is lower, since the costs are lower.

In other cases, marginal costs are low, and monopoly raises prices. For example, auto insurance is required by law, so the price elasticity of demand is low. Marginal costs don't differ much by size of the insurer. The loss costs are the same, underwriting costs are the same, and even distribution costs (agents' commissions) are not that much lower for large insurers. Society gains by having a large number of small insurers.

The world have only a few pharmaceutical drug makers and thousands of auto insurers. In these industries, actual markets are efficient. This is not always true, but it often occurs.

** Exercise 15.2: Oligopoly / Market power

Two identical firms sell the same product and compete as a Bertrand oligopoly.

- The market demand curve is $P = 40 - \frac{1}{2} Q$.
 - The marginal cost curve is $MC = 20$.
- A. What defines a Bertrand oligopoly?
 - B. What is the equilibrium price?
 - C. What is the equilibrium quantity?
 - D. What is consumers' surplus?
 - E. What is producers' surplus?
 - F. What is the net social gain from trade?

Part A: In a Bertrand oligopoly, firms take their competitors' prices as given.

Part B: The equilibrium price in a Bertrand oligopoly is the equilibrium price in competition.

- If a firm prices lower than the competitive price, it loses money.
- If a firm prices higher than the competitive price, its competitor prices slightly lower to take away its market share.

The competitive price is the marginal cost = \$20.

Question: What if both firms use the monopoly price? Both firms do better than with the competitive price, so the monopoly price is Pareto superior to the competitive price.

Answer: This is the same as the prisoner's dilemma, where both players do better with "not confess," but if either one fails to confess, the other choose "confess." Here too, if either firms sets the monopoly price, the other firm sets a lower price and obtains the whole market. Landsburg explains the prisoner's dilemma as a prelude to the oligopoly models.

Part C: If the price is the competitive price, the quantity is the competitive quantity, determined as $P = MC$:

$$40 - \frac{1}{2} Q = 20 \Rightarrow Q = 40.$$

The two firms are identical, so each firm produces $\frac{1}{2} \times 40 = 20$.

Part D: Consumers' surplus is the area below the demand curve from 0 to the quantity supplied:

$$\frac{1}{2} \times (\$40 - \$20) \times 40 = \$400$$

Part E: Producers' surplus is zero for constant marginal costs.

Part F: The social gain from trade is consumers' surplus + producers' surplus = $\$400 + \$0 = \$400$

** Exercise 15.3: Oligopoly / Market power

Two identical firms sell the same product and compete as a Cournot oligopoly.

- The market demand curve is $P = 40 - \frac{1}{2} Q$.
- The marginal cost curve is $MC = 20$.

- A. What defines a Cournot oligopoly?
- B. What is the marginal revenue curve?
- C. What is the equilibrium quantity?
- D. What is the equilibrium price?
- E. What is consumers' surplus?
- F. What is producers' surplus?
- G. What is the net social gain from trade?

Part A: In a Cournot oligopoly, firms take their competitors' quantities as given.

Part B: The total revenue curve (TR) is $P \times Q = 40 Q - \frac{1}{2} Q^2$.

The marginal revenue curve is $MR = \partial(TR)/\partial Q = \partial(40 Q - \frac{1}{2} Q^2)/\partial Q = 40 - Q$.

Part C: Suppose firm #1 produces quantity of q^* . Firm #2 faces a demand curve of $P = 40 - \frac{1}{2} (q + q^*)$, where q is its own quantity and q^* is the fixed quantity of Firm #1.

- The total revenue curve for Firm #2 is $TR = 40q - \frac{1}{2}q^2 - \frac{1}{2} \times q^* \times q$.
- The marginal revenue curve for Firm #2 is $MR = 40 - \frac{1}{2}q^* - q$.

Setting marginal revenue = marginal cost gives $40 - \frac{1}{2}q^* - q = 20$.

The two firms are identical, so in equilibrium, $q = q^*$. We solve $40 - \frac{1}{2}q - q = 20 \Rightarrow q = \frac{2}{3} \times 20$.

Question: Is this result general? In a Cournot oligopoly, does each firm produce two thirds what it would produce in competitive equilibrium?

Answer: This result applies if the marginal cost curve is flat and the Cournot oligopoly has two firms. If the marginal cost curve is flat and the Cournot oligopoly has N firms, each firm produces $N/(N+1)$ what it would produce in a competitive equilibrium.

Industry output is $\frac{2}{3}$ of competitive quantity, so each firm's output is $\frac{1}{2} \times \frac{2}{3} = \frac{1}{3}$ of the competitive quantity.

The equilibrium quantity under competition is $Q = 40$, so the equilibrium quantity for a Cournot oligopoly is $\frac{2}{3} \times 40 = 26.67$. Each firm produces 13.33.

Part D: The equilibrium price is read from the market demand curve:

$$P = 40 - \frac{1}{2} \times \frac{2}{3} \times 40 = \frac{2}{3} \times 40 = 26.67.$$

Part E: Consumers' surplus is the area below the demand curve from 0 to the quantity supplied:

$$\frac{1}{2} \times (\$40 - \$26.67) \times 26.67 = \$177.78$$

Part F: Producers' surplus is the area above the marginal cost curve from 0 to the quantity supplied:

$$(\$26.67 - \$20) \times 26.67 = \$177.78$$

Part G: The social gain from trade is consumers' surplus + producers' surplus = $\$177.78 + \$177.78 = \$355.56$.

Question: Is the net social gain from trade always less for a Cournot oligopoly than for a Bertrand oligopoly?

Answer: The social gain from trade depends on the quantity supplied. The competitive quantity gives the highest social gain from trade. Higher or lower quantity reduces the social gain from trade. So yes: the net social gain from trade always less for a Cournot oligopoly than for a Bertrand oligopoly.

**** Exercise 15.4: Oligopoly / Market power**

Two identical firms sell the same product and compete as a Bertrand oligopoly.

- The market demand curve is $P = 40 - \frac{1}{2} Q$.
- The marginal cost curve is $MC = 20$.

The two firms merge and reduce their operating costs. The marginal cost declines by a factor of Z , so the new marginal cost curve is $MC = 20 \times (1 - Z)$. The combined firm prices as a monopoly. Answer the questions below as functions of Z .

- What is the marginal revenue curve?
- What is the equilibrium quantity?
- What is the equilibrium price?
- What is consumers' surplus?
- What is producers' surplus?
- What is the net social gain from trade?
- If the net social gain from trade is the same as in the Bertrand scenario, what is Z ?

Part A: The total revenue curve (TR) is $P \times Q = 40 Q - \frac{1}{2} Q^2$.

The marginal revenue curve is $MR = \partial(TR)/\partial Q = \partial(40 Q - \frac{1}{2} Q^2)/\partial Q = 40 - Q$.

Part C: Set marginal revenue = marginal cost: $40 - Q = 20 \times (1 - Z) \Rightarrow Q = 20 + 20Z$.

Part D: The equilibrium price is read from the market demand curve:

$$P = 40 - \frac{1}{2} \times (20 + 20Z) = 30 - 10Z.$$

Part E: Consumers' surplus is the area below the demand curve from 0 to the quantity supplied:

$$\frac{1}{2} \times (\$40 - (30 - 10Z)) \times (20 + 20Z) = (\$10 + 10Z) \times (10 + 10Z) = \$100 + \$200Z + \$100Z^2$$

Part E: Producers' surplus above the marginal cost curve from 0 to the quantity supplied:

$$(\$30 - 10Z - (\$20 - 20Z)) \times (20 + 20Z) = (\$10 + 10Z) \times (20 + 20Z) = \$200 + \$400Z + \$200Z^2$$

Part F: The social gain from trade is consumers' surplus + producers' surplus

$$\$100 + \$200Z + \$100Z^2 + \$200 + \$400Z + \$200Z^2 = \$300 + \$600Z + \$300Z^2$$

Part G: In the Bertrand oligopoly, the net social gain from trade is \$400. Solve

$$\$400 = \$300 + \$600Z + \$300Z^2 \Rightarrow 3Z^2 + 6Z - 1 = 0 \Rightarrow$$

$$Z = \frac{-6 \pm \sqrt{(36 + 12)}}{6} = \frac{-6 \pm 6.92820}{6} = 0.15470. \text{ (Only the positive solution is relevant.)}$$

**** Exercise 15.5: Oligopoly**

The *Price Theory* textbook discusses two models of oligopoly: Cournot and Bertrand.

- A. What is the defining characteristic of the Cournot oligopoly model?
- B. What is the defining characteristic of the Bertrand oligopoly model?
- C. Under which model is the equilibrium quantity higher?
- D. Under which model is the equilibrium price higher?
- E. Under which model is consumers' surplus higher?
- F. Under which model is producers' surplus higher?
- G. Under which model is the net social gain higher?

Part A: In the Cournot oligopoly model, each firm takes its competitor's quantity as given.

Part B: In the Bertrand oligopoly model, each firm takes its competitor's price as given.

Part C: The equilibrium quantity is higher in the Bertrand oligopoly model.

- Bertrand oligopoly: equilibrium quantity = competitive quantity.
- Cournot oligopoly: equilibrium quantity = $\frac{2}{3} \times$ competitive quantity.

Part D: The equilibrium price is higher in the Cournot oligopoly model.

- The market demand curve is downward sloping.
- A lower equilibrium quantity means a higher equilibrium price.

Part E: Consumers' surplus is higher in a Bertrand oligopoly model.

A higher equilibrium price and lower quantity in a Cournot oligopoly means less consumers' surplus.

Part E: Producers' surplus is higher in a Cournot oligopoly model.

If producers' surplus were lower, firms would raise quantity and lower price.

Part F: Net social gain is higher in a Bertrand oligopoly model.

Net social gain is maximized at the competitive quantity, as in the Bertrand oligopoly model.

** Exercise 15.6: Predatory pricing and buy-outs

- Insurer ABC is a large nationwide firm with 85% of the personal auto market in State W.
 - Its surplus is ten times its annual premium in State W.
 - Insurers X, Y, and Z are small mono-state insurers; each has 5% of the personal auto market in State W.
 - Each insurer's surplus is 40% of the annual premium in State W.
 - Entry to the market is easy (barriers to entry are small).
 - Personal auto coverage is required by law for all drivers.
- A. Is the price elasticity of demand high or low?
- B. Why might ABC temporarily reduce prices below cost?
- C. Why might predatory pricing be a poor strategy?
- D. Why might ABC purchase insurers X, Y, and Z?
- E. Why might this purchase be a poor strategy?
- F. If entry into the market is expensive, would predatory pricing / buy-outs be more or less likely?

Part A: Personal auto coverage is required by law for all drivers. Regardless of the price (as long as it is not too high), most drivers buy coverage. Price elasticity of demand is low.

Most people buy cars and pay whatever is needed for insurance. If the car costs \$50,000, gas and repairs cost \$5,000 a year, and the car lasts 10 years, the cost of driving is \$10,000 a year. The insurance policy costs another \$1,000 a year. A 10% change in the cost of insurance coverage is a change of 1% in the total cost of driving. This makes the price elasticity of demand for insurance very inelastic.

Part B: With inelastic price elasticity of demand, ABC can make large monopoly profits if it controls the entire market. It can easily withstand temporary losses in the state, since its total surplus is ten times its premium in the state. Insurers X, Y, and Z can not withstand losses, since each insurer's surplus is low relative to its premium in the state. These insurers may exit the industry if prices are too low.

Part C: If other insurers realize that predatory pricing below cost is temporary, they may shut down for a year. Insurers have few fixed costs, so the losses from shutting down temporarily are small. Some insurers may also arrange for a loan (through a holding company or a subsidiary).

Even if predatory pricing succeeds in driving insurers from the market, barriers to entry are small. As soon as ABC raises prices, new insurers will enter the market.

Part D: Instead of predatory pricing, ABC might buy insurers X, Y, and Z. Once it has the entire market, it can raise prices to monopoly levels.

Part E: Buy-outs can be expensive, since the acquiring firm generally pays a premium above market prices. If other insurers realize that ABC will buy out its competitors in the state, they will form subsidiaries in the state and sell them at premiums to ABC.

Part F: If entry into the market is expensive (barriers to entry are high), ABC is less worried about new firms entering. It is more likely to buy out existing firms or reduce prices below cost for a year or two.

Question: Do barriers to entry affect predatory pricing and buy-outs in this fashion?

Answer: Yes they do. In industries with low barriers to entry (service firms, insurance, high-tech firms like cell phones and other gadgets), buy-outs are not common. In industries with high barriers to entry (automobiles, oil, pharmaceutical drugs), firms buy each other to create monopolies. For example, suppose two firms have patented cancer medications. If a single firm has the entire market, it can charge extremely high prices, since the price elasticity of demand for cancer medication is inelastic. People with cancer will pay \$100 a year or \$10,000 a year for medication; the cost of the medication won't much affect their purchase, since they will die with no medication. If their insurance pays for the medication, they will pay \$100,000 a year. A third firm will not enter the market, since the time lag for research and development, clinical studies, and approval by the Food and Drug Administration is about ten years. The two existing firms will not compete. One will buy out the other and charge monopoly prices.