CHAPTER 11
PRICING WITH MARKET POWER

REVIEW QUESTIONS

1. Suppose a firm can practice perfect, first-degree price discrimination. What is the lowest price it will charge, and what will its total output be?

When the firm is able to practice perfect first-degree price discrimination, each unit is sold at the reservation price of each consumer, assuming each consumer purchases one unit. Because each unit is sold at the consumer's reservation price, marginal revenue is simply the price of the last unit. We know that firms maximize profits by producing an output such that marginal revenue is equal to marginal cost. For the perfect price discriminator, that point is where the marginal cost curve intersects the demand curve. Increasing output beyond that point would imply that \( MR < MC \), and the firm would lose money on each unit sold. For lower quantities, \( MR > MC \), and the firm should increase its output.

2. How does a car salesperson practice price discrimination? How does the ability to discriminate correctly affect his or her earnings?

The relevant range of the demand curve facing the car salesperson is bounded above by the manufacturer's suggested retail price plus the dealer's markup and bounded below by the dealer's price plus administrative and inventory overhead. By sizing up the customer, the salesperson determines the customer's reservation price. Through a process of bargaining, a sales price is determined. If the salesperson has misjudged the reservation price of the customer, either the sale is lost because the customer's reservation price is lower than the salesperson's guess or profit is lost because the customer's reservation price is higher than the salesperson's guess. Thus, the salesperson's commission is positively correlated to his or her ability to determine the reservation price of each customer.

3. Electric utilities often practice second-degree price discrimination. Why might this improve consumer welfare?

Consumer surplus is higher under block pricing than under monopoly pricing because more output is produced. For example, assume there are two prices \( P_1 \) and \( P_2 \), with \( P_1 \) greater than \( P_2 \). Customers with reservation prices above \( P_1 \) pay \( P_1 \), capturing surplus equal to the area bounded by the demand curve and \( P_1 \). This also would occur with monopoly pricing. Under block pricing, customers with reservation prices between \( P_1 \) and \( P_2 \) capture surplus equal to the area bounded by the demand curve, the difference between \( P_1 \) and \( P_2 \), and the difference between \( Q_1 \) and \( Q_2 \). This quantity is greater than the surplus captured under monopoly, hence block pricing, under these assumptions, improves consumer welfare.
4. Give some examples of third-degree price discrimination. Can third-degree price discrimination be effective if the different groups of consumers have different levels of demand but the same price elasticities?

To engage in third-degree price discrimination, the producer must separate customers into distinct markets (sorting) and prevent the reselling of the product from customers in one market to customers in another market (arbitrage). While examples in this chapter stress the techniques for separating customers, there are also techniques for preventing resale. For example, airlines restrict the use of their tickets by printing the name of the passenger on the ticket. Other examples include dividing markets by age and gender, e.g., charging different prices for movie tickets to different age groups. If customers in the separate markets have the same price elasticities, then from equation 11.2 we know that the prices are the same in all markets. While the producer can effectively separate the markets, there is little profit incentive to do so.

5. Show why optimal, third-degree price discrimination requires that marginal revenue for each group of consumers equals marginal cost. Use this condition to explain how a firm should change its prices and total output if the demand curve for one group of consumers shifted outward, so that marginal revenue for that group increased.

We know that firms maximize profits by choosing output so marginal revenue is equal to marginal cost. If $MR$ for one market is greater than $MC$, then the firm should increase sales to maximize profit, thus lowering the price on the last unit and raising the cost of producing the last unit. Similarly, if $MR$ for one market is less than $MC$, the firm should decrease sales to maximize profit, thereby raising the price on the last unit and lowering the cost of producing the last unit. By equating $MR$ and $MC$ in each market, marginal revenue is equal in all markets.

If the quantity demanded increased, the marginal revenue at each price would also increase. If $MR = MC$ before the demand shift, $MR$ would be greater than $MC$ after the demand shift. To lower $MR$ and raise $MC$, the producer should increase sales to this market by lowering price, thus increasing output. This increase in output would increase $MC$ of the last unit sold. To maximize profit, the producer must increase the $MR$ on units sold in other markets, i.e., increase price in these other markets. The firm shifts sales to the market experiencing the increase in demand and away from other markets.
6. When pricing automobiles, American car companies typically charge a much higher percentage markup over cost for “luxury option” items (such as leather trim, etc.) than for the car itself or for more “basic” options such as power steering and automatic transmission. Explain why.

This can be explained as an instance of third-degree price discrimination. In order to use the model of third-degree price discrimination presented in the text, we need to assume that the costs of producing car options is a function of the total number of options produced and the production of each type of options affects costs in the same way. For simplicity, we can assume that there are two types of option packages, “luxury” and “basic,” and that these two types of packages are purchased by two different types of consumers. In this case, the relationship across product types \( MR_1 = MR_2 \) must hold, which implies that:

\[
P_1/P_2 = (1+1/E_2) / (1+1/E_1)
\]

where 1 and 2 denote the luxury and basic products types. This means that the higher price is charged for the package with the lower elasticity of demand. Thus the pricing of automobiles can be explained if the “luxury” options are purchased by consumers with low elasticities of demand relative to consumers of more “basic” packages.

7. How is peak-load pricing a form of price discrimination? Can it make consumers better off? Give an example.

Price discrimination involves separating customers into distinct markets. There are several ways of segmenting markets: by customer characteristics, by geography, and by time. In peak-load pricing, sellers charge different prices to customers at different times. When there is a higher quantity demanded at each price, a higher price is charged. Peak-load pricing can increase total consumer surplus by charging a lower price to customers with elasticities greater than the average elasticity of the market as a whole. Most telephone companies charge a different price during normal business hours, evening hours, and night and weekend hours. Callers with more elastic demand wait until the period when the charge is closest to their reservation price.

8. How can a firm determine an optimal two-part tariff if it has two customers with different demand curves? (Assume that it knows the demand curves.)

If all customers had the same demand curve, the firm would set a price equal to marginal cost and a fee equal to consumer surplus. When consumers have different demand curves and, therefore, different levels of consumer surplus, the firm is faced with the following problem. If it sets the user fee equal to the larger consumer surplus, the firm will earn profits only from the consumers with the larger consumer surplus because the second group of consumers will not purchase any of the good. On the other hand, if the firm sets the fee equal to the smaller consumer surplus, the firm will earn revenues from both types of consumers.

9. Why is the pricing of a Gillette safety razor a form of a two-part tariff? Must Gillette be a monopoly producer of its blades as well as its razors? Suppose you were advising Gillette on how to determine the two parts of the tariff. What procedure would you suggest?

By selling the razor and the blades separately, the pricing of a Gillette safety razor can be thought of as a two-part tariff, where the entry fee is the cost of the razor and the usage fee is the cost of the blades. Gillette does not need to be a monopoly producer of its blades. In the simplest case where all consumers have identical demand curves, Gillette should set the blade price to marginal cost, and the razor cost to total consumer surplus for each consumer. Since blade price is set to marginal cost it does not matter if Gillette has a monopoly or not. The determination of the two parts of the tariff becomes more complicated the greater the variety of consumers with different demands, and there is no simple formula to calculate the optimal two-part tariff. The key point to consider is that as the entry fee becomes smaller, the number of entrants will rise,
and the profit from the entry fee will fall. Arriving at the optimal two part tariff might involve some amount of iteration over different entry and usage fees.

10. In the town of Woodland, California there are many dentists but only one eye doctor. Are senior citizens more likely to be offered discount prices for dental exams or for eye exams? Why.

The dental market is competitive, whereas the eye doctor is a local monopolist. Only firms with market power can practice price discrimination, which implies senior citizens are more likely to be offered discount prices from the eye doctor. Each dentist is already charging a price equal to marginal cost so they are not able to offer a discount.

11. Why did MGM bundle Gone with the Wind and Getting Gertie's Garter? What characteristic of demands is needed for bundling to increase profits?

Loews bundled its film Gone with the Wind and Getting Gertie's Garter to maximize revenues. Because Loews could not price discriminate by charging a different price to each customer according to the customer's price elasticity, it chose to bundle the two films and charge theaters for showing both films. The price would have been the combined reservation prices of the last theater that Loews wanted to attract. Of course, this tactic would only maximize revenues if demands for the two films were negatively correlated, as discussed in the chapter.

12. How does mixed bundling differ from pure bundling? Under what conditions is mixed bundling preferable to pure bundling? Why do many restaurants practice mixed bundling (by offering complete dinners as well as an à la carte menu) instead of pure bundling?

Pure bundling involves selling products only as a package. Mixed bundling allows the consumer to purchase the products either separately or together. Mixed bundling yields higher profits than pure bundling when demands for the individual products do not have a strong negative correlation, marginal costs are high, or both. Restaurants can maximize profits with mixed bundling by offering both à la carte and full dinners by charging higher prices for individual items to capture the consumers’ willingness to pay and lower prices for full dinners to induce customers with lower reservation prices to purchase more dinners.

13. How does tying differ from bundling? Why might a firm want to practice tying?

Tying involves the sale of two or more goods or services that must be used as complements. Bundling can involve complements or substitutes. Tying allows the firm to monitor customer demand and more effectively determine profit-maximizing prices for the tied products. For example, a microcomputer firm might sell its computer, the tying product, with minimum memory and a unique architecture, then sell extra memory, the tied product, above marginal cost.

14. Why is it incorrect to advertise up to the point that the last dollar of advertising expenditures generates another dollar of sales? What is the correct rule for the marginal advertising dollar?

If the firm increases advertising expenditures to the point that the last dollar of advertising generates another dollar of sales, it will not be maximizing profits, because the firm is ignoring additional advertising costs. The correct rule is to advertise so that the marginal revenue of an additional dollar of advertising equals the additional dollars spent on advertising plus the marginal production cost of the increased sales.

15. How can a firm check that its advertising-to-sales ratio is not too high or too low? What information does it need?

The firm can check whether its advertising-to-sales ratio is profit maximizing by comparing it with the negative of the ratio of the advertising elasticity of demand to the price elasticity of demand. The firm must know both the advertising elasticity of demand and the price elasticity of demand.
1. Price discrimination requires the ability to sort customers and the ability to prevent arbitrage. Explain how the following can function as price discrimination schemes and discuss both sorting and arbitrage:

   a. **Requiring airline travelers to spend at least one Saturday night away from home to qualify for a low fare.**

      The requirement of staying over Saturday night separates business travelers, who prefer to return for the weekend, from tourists, who travel on the weekend. Arbitrage is not possible when the ticket specifies the name of the traveler.

   b. **Insisting on delivering cement to buyers and basing prices on buyers’ locations.**

      By basing prices on the buyer's location, customers are sorted by geography. Prices may then include transportation charges. These costs vary from customer to customer. The customer pays for these transportation charges whether delivery is received at the buyer's location or at the cement plant. Since cement is heavy and bulky, transportation charges may be large. This pricing strategy leads to “based-point-price systems,” where all cement producers use the same base point and calculate transportation charges from this base point. Individual customers are then quoted the same price. For example, in *FTC v. Cement Institute*, 333 U.S. 683 [1948], the Court found that sealed bids by eleven companies for a 6,000-barrel government order in 1936 all quoted $3.286854 per barrel.

   c. **Selling food processors along with coupons that can be sent to the manufacturer to obtain a $10 rebate.**

      Rebate coupons with food processors separate consumers into two groups: (1) customers who are less price sensitive, i.e., those who have a lower elasticity of demand and do not request the rebate; and (2) customers who are more price sensitive, i.e., those who have a higher demand elasticity and do request the rebate. The latter group could buy the food processors, send in the rebate coupons, and resell the processors at a price just below the retail price without the rebate. To prevent this type of arbitrage, sellers could limit the number of rebates per household.

   d. **Offering temporary price cuts on bathroom tissue.**

      A temporary price cut on bathroom tissue is a form of intertemporal price discrimination. During the price cut, price-sensitive consumers buy greater quantities of tissue than they would otherwise. Non-price-sensitive consumers buy the same amount of tissue that they would buy without the price cut. Arbitrage is possible, but the profits on reselling bathroom tissue probably cannot compensate for the cost of storage, transportation, and resale.

   e. **Charging high-income patients more than low-income patients for plastic surgery.**

      The plastic surgeon might not be able to separate high-income patients from low-income patients, but he or she can guess. One strategy is to quote a high price initially, observe the patient’s reaction, and then negotiate the final price. Many medical insurance policies do not cover elective plastic surgery. Since plastic surgery cannot be transferred from low-income patients to high-income patients, arbitrage does not present a problem.
2. If the demand for drive-in movies is more elastic for couples than for single individuals, it will be optimal for theaters to charge one admission fee for the driver of the car and an extra fee for passengers. True or False? Explain.

True. Approach this question as a two-part tariff problem where the entry fee is a charge for the car plus the driver and the usage fee is a charge for each additional passenger other than the driver. Assume that the marginal cost of showing the movie is zero, i.e., all costs are fixed and do not vary with the number of cars. The theater should set its entry fee to capture the consumer surplus of the driver, a single viewer, and should charge a positive price for each passenger.

3. In Example 11.1, we saw how producers of processed foods and related consumer goods use coupons as a means of price discrimination. Although coupons are widely used in the United States, that is not the case in other countries. In Germany, coupons are illegal.

a. Does prohibiting the use of coupons in Germany make German consumers better off or worse off?

In general, we cannot tell whether consumers will be better off or worse off. Total consumer surplus can increase or decrease with price discrimination, depending on the number of different prices charged and the distribution of consumer demand. Note, for example, that the use of coupons can increase the market size and therefore increase the total surplus of the market. Depending on the relative demand curves of the consumer groups and the producer’s marginal cost curve, the increase in total surplus can be big enough to increase both producer surplus and consumer surplus. Consider the simple example depicted in Figure 11.3.a.

![Figure 11.3.a](image)

In this case there are two consumer groups with two different demand curves. Assuming marginal cost is zero, without price discrimination, consumer group 2 is left out of the market and thus has no consumer surplus. With price discrimination, consumer 2 is included in the market and collects some consumer surplus. At the same time, consumer 1 pays the same price under discrimination in this example, and therefore enjoys the same consumer surplus. The use of coupons (price discrimination) thus increases total consumer surplus in this example. Furthermore, although the net change in consumer surplus is ambiguous in general, there is a
transfer of consumer surplus from price-insensitive to price-sensitive consumers. Thus, price-sensitive consumers will benefit from coupons, even though on net consumers as a whole can be worse off.

b. **Does prohibiting the use of coupons make German producers better off or worse off?**

Prohibiting the use of coupons will make the German producers worse off, or at least not better off. If firms can successfully price discriminate (i.e. they can prevent resale, there are barriers to entry, etc.), price discrimination can never make a firm worse off.

4. Suppose that BMW can produce any quantity of cars at a constant marginal cost equal to $20,000 and a fixed cost of $10 billion. You are asked to advise the CEO as to what prices and quantities BMW should set for sales in Europe and in the U.S. The demand for BMWs in each market is given by:

\[ Q_E = 4,000,000 - 100P_E \quad \text{and} \quad Q_U = 1,000,000 - 20P_U \]

where the subscript \( E \) denotes Europe and the subscript \( U \) denotes the United States. Assume that BMW can restrict U.S. sales to authorized BMW dealers only.

a. **What quantity of BMWs should the firm sell in each market, and what will the price be in each market? What will the total profit be?**

With separate markets, BMW chooses the appropriate levels of \( Q_E \) and \( Q_U \) to maximize profits, where profits are:

\[ \pi = TR - TC = (Q_E P_E + Q_U P_U) - \left\{ (Q_E + Q_U) 20,000 + 10,000,000,000 \right\} \]

Solve for \( P_E \) and \( P_U \) using the demand equations, and substitute the expressions into the profit equation:

\[ \pi = Q_E \left( 40,000 - \frac{Q_E}{100} \right) + Q_U \left( 50,000 - \frac{Q_U}{20} \right) - \left\{ (Q_E + Q_U) 20,000 + 10,000,000,000 \right\} \]

Differentiating and setting each derivative to zero to determine the profit-maximizing quantities:

\[ \frac{\partial \pi}{\partial Q_E} = 40,000 - \frac{Q_E}{50} - 20,000 = 0, \text{ or } Q_E = 1,000,000 \text{ cars} \]

and

\[ \frac{\partial \pi}{\partial Q_U} = 50,000 - \frac{Q_U}{10} - 20,000 = 0, \text{ or } Q_U = 300,000 \text{ cars} \]

Substituting \( Q_E \) and \( Q_U \) into their respective demand equations, we may determine the price of cars in each market:

\[ 1,000,000 = 4,000,000 - 100P_E, \text{ or } P_E = \$30,000 \quad \text{and} \quad 300,000 = 1,000,000 - 20P_U, \text{ or } P_U = \$35,000. \]

Substituting the values for \( Q_E, Q_U, P_E, \) and \( P_U \) into the profit equation, we have

\[ \pi = \{(1,000,000)(\$30,000) + (300,000)(\$35,000)\} \cdot \{(1,300,000)(20,000)\} + 10,000,000,000, \text{ or } \]

\[ \pi = \$4.5 \text{ billion}. \]

b. **If BMW were forced to charge the same price in each market, what would be the quantity sold in each market, the equilibrium price, and the company’s profit?**

If BMW charged the same price in both markets, we substitute \( Q = Q_E + Q_U \) into the demand equation and write the new demand curve as

\[ Q = 5,000,000 - 120P, \text{ or in inverse for as } P = \frac{5,000,000}{120} - \frac{Q}{120}. \]
Since the marginal revenue curve has twice the slope of the demand curve:

\[ MR = \frac{5,000,000}{120} - \frac{Q}{60}. \]

To find the profit-maximizing quantity, set marginal revenue equal to marginal cost:

\[ \frac{5,000,000}{120} - \frac{Q}{60} = 20,000, \text{ or } Q^* = 1,300,000. \]

Substituting \( Q^* \) into the demand equation to determine price:

\[ P = \frac{5,000,000}{120} - \left( \frac{1,300,000}{120} \right) = $30,833.33. \]

Substituting into the demand equations for the European and American markets to find the quantity sold

\[ Q_e = 4,000,000 \cdot (100)(30,833.3), \text{ or } Q_e = 916,667 \text{ and } \]
\[ Q_U = 1,000,000 \cdot (20)(30,833.3), \text{ or } Q_U = 383,333. \]

Substituting the values for \( Q_e, Q_U, \) and \( P \) into the profit equation, we find

\[ \pi = (1,300,000 \cdot $30,833.33) - (1,300,000(20,000)) + 10,000,000,000, \text{ or } \]
\[ \pi = $4,083,333,330. \]

5. A monopolist is deciding how to allocate output between two geographically separated markets (East Coast and Midwest). Demand and marginal revenue for the two markets are:

\[ P_1 = 15 - Q_1 \quad \text{MR}_1 = 15 - 2Q_1 \]
\[ P_2 = 25 - 2Q_2 \quad \text{MR}_2 = 25 - 4Q_2. \]

The monopolist’s total cost is \( C = 5 + 3(Q_1 + Q_2). \) What are price, output, profits, marginal revenues, and deadweight loss (i) if the monopolist can price discriminate?  (ii) if the law prohibits charging different prices in the two regions?

With price discrimination, the monopolist chooses quantities in each market such that the marginal revenue in each market is equal to marginal cost. The marginal cost is equal to 3 (the slope of the total cost curve).

In the first market

\[ 15 - 2Q_1 = 3, \text{ or } Q_1 = 6. \]

In the second market

\[ 25 - 4Q_2 = 3, \text{ or } Q_2 = 5.5. \]

Substituting into the respective demand equations, we find the following prices for the two markets:

\[ P_1 = 15 \cdot 6 = $9 \quad \text{and} \]
\[ P_2 = 25 \cdot 2(5.5) = $14. \]

Noting that the total quantity produced is 11.5, then

\[ \pi = ((6)(9) + (5.5)(14)) \cdot (5 + (3)(11.5)) = $91.5. \]

The monopoly deadweight loss in general is equal to

\[ DWL = (0.5)(Q_C \cdot Q_M)(P_M \cdot P_C). \]

Here,

\[ DWL_1 = (0.5)(12 \cdot 6)(9 - 3) = $18 \quad \text{and} \]

\[ DWL_2 = (0.5)(12 \cdot 5.5)(14 - 3) = $340.5. \]
Therefore, the total deadweight loss is $48.25.

Without price discrimination, the monopolist must charge a single price for the entire market. To maximize profit, we find quantity such that marginal revenue is equal to marginal cost. Adding demand equations, we find that the total demand curve has a kink at \( Q = 5 \):

\[
P = \begin{cases} 
25 - 2Q, & \text{if } Q \leq 5 \\
18.33 - 0.67Q, & \text{if } Q > 5
\end{cases}
\]

This implies marginal revenue equations of

\[
MR = \begin{cases} 
25 - 4Q, & \text{if } Q \leq 5 \\
18.33 - 1.33Q, & \text{if } Q > 5
\end{cases}
\]

With marginal cost equal to 3, \( MR = 18.33 \cdot 1.33Q \) is relevant here because the marginal revenue curve “kinks” when \( P = $15 \). To determine the profit-maximizing quantity, equate marginal revenue and marginal cost:

\[18.33 \cdot 1.33Q = 3, \text{ or } Q = 11.5.\]

Substituting the profit-maximizing quantity into the demand equation to determine price:

\[P = 18.33 - (0.67)(11.5) = $10.6.\]

With this price, \( Q_1 = 4.3 \) and \( Q_2 = 7.2 \). (Note that at these quantities \( MR_1 = 6.3 \) and \( MR_2 = -3.7 \).)

Profit is

\[(11.5)(10.6) - (5 + (3)(11.5)) = $83.2.\]

Deadweight loss in the first market is

\[DWL_1 = (0.5)(10.6-3)(12-4.3) = $29.26.\]

Deadweight loss in the second market is

\[DWL_2 = (0.5)(10.6-3)(11-7.2) = $14.44.\]

Total deadweight loss is $43.7. Note it is always possible to observe slight rounding error. With price discrimination, profit is higher, deadweight loss is smaller, and total output is unchanged. This difference occurs because the quantities in each market change depending on whether the monopolist is engaging in price discrimination.

*6. Elizabeth Airlines (EA) flies only one route: Chicago-Honolulu. The demand for each flight on this route is \( Q = 500 - P \). Elizabeth’s cost of running each flight is $30,000 plus $100 per passenger.

a. What is the profit-maximizing price EA will charge? How many people will be on each flight? What is EA’s profit for each flight?

To find the profit-maximizing price, first find the demand curve in inverse form:

\[P = 500 - Q.\]

We know that the marginal revenue curve for a linear demand curve will have twice the slope, or

\[MR = 500 - 2Q.\]
The marginal cost of carrying one more passenger is $100, so $MC = 100$. Setting marginal revenue equal to marginal cost to determine the profit-maximizing quantity, we have:

$$500 \cdot 2Q = 100,$$

or $Q = 200$ people per flight.

Substituting $Q$ equals 200 into the demand equation to find the profit-maximizing price for each ticket,

$$P = 500 - 200,$$

or $P = $300.

Profit equals total revenue minus total costs,

$$\pi = (300)(200) - \{30,000 + (200)(100)\} = $10,000.$$

Therefore, profit is $10,000 per flight.

b. Elizabeth learns that the fixed costs per flight are in fact $41,000 instead of $30,000. Will she stay in this business long? Illustrate your answer using a graph of the demand curve that EA faces, EA’s average cost curve when fixed costs are $30,000, and EA’s average cost curve when fixed costs are $41,000.

An increase in fixed costs will not change the profit-maximizing price and quantity. If the fixed cost per flight is $41,000, EA will lose $1,000 on each flight. The revenue generated, $60,000, would now be less than total cost, $61,000. Elizabeth would shut down as soon as the fixed cost of $41,000 came due.

![Figure 11.6.b](image-url)

**Figure 11.6.b**

c. Wait! EA finds out that two different types of people fly to Honolulu. Type A is business people with a demand of $Q_A = 260 - 0.4P$. Type B is students whose total demand is $Q_B = 240 - 0.6P$. The students are easy to spot, so EA decides to charge them different prices. Graph each of these demand curves and their horizontal sum.

What price does EA charge the students? What price does EA charge other customers? How many of each type are on each flight?

Writing the demand curves in inverse form, we find the following for the two markets:

$$P_A = 650 - 2.5Q_A$$

and

$$P_B = 400 - 1.67Q_B.$$
Using the fact that the marginal revenue curves have twice the slope of a linear demand curve, we have:

\[ MR_A = 650 - 5Q_A \quad \text{and} \quad MR_B = 400 - 3.34Q_B. \]

To determine the profit-maximizing quantities, set marginal revenue equal to marginal cost in each market:

\[ 650 - 5Q_A = 100, \quad \text{or} \quad Q_A = 110 \quad \text{and} \quad 400 - 3.34Q_B = 100, \quad \text{or} \quad Q_B = 90. \]

Substitute the profit-maximizing quantities into the respective demand curve to determine the appropriate price in each sub-market:

\[ P_A = 650 - (2.5)(110) = $375 \quad \text{and} \quad P_B = 400 - (1.67)(90) = $250. \]

When she is able to distinguish the two groups, Elizabeth finds it profit-maximizing to charge a higher price to the Type A travelers, i.e., those who have a less elastic demand at any price.

\[ \pi = 63,750 - 61,000 = $2,750. \]
Chapter 11: Pricing with Market Power

Consumer surplus for Type A travelers is
\[(0.5)(650 - 375)(110) = 15,125.\]
Consumer surplus for Type B travelers is
\[(0.5)(400 - 250)(90) = 6,750\]
Total consumer surplus is $21,875.

e. Before EA started price discriminating, how much consumer surplus was the Type A demand getting from air travel to Honolulu? Type B? Why did total surplus decline with price discrimination, even though the total quantity sold was unchanged?

When price was $300, Type A travelers demanded 140 seats; consumer surplus was
\[(0.5)(650 - 300)(140) = 24,500.\]
Type B travelers demanded 60 seats at \(P = 300\); consumer surplus was
\[(0.5)(400 - 300)(60) = 3,000.\]
Consumer surplus was therefore $27,500, which is greater than consumer surplus of $21,875 with price discrimination. Although the total quantity is unchanged by price discrimination, price discrimination has allowed EA to extract consumer surplus from those passengers who value the travel most.

7. Many retail video stores offer two alternative plans for renting films:

- A two-part tariff: Pay an annual membership fee (e.g., $40) and then pay a small fee for the daily rental of each film (e.g., $2 per film per day).
- A straight rental fee: Pay no membership fee, but pay a higher daily rental fee (e.g., $4 per film per day).

What is the logic behind the two-part tariff in this case? Why offer the customer a choice of two plans rather than simply a two-part tariff?

By employing this strategy, the firm allows consumers to sort themselves into two groups, or markets (assuming that subscribers do not rent to non-subscribers): high-volume consumers who rent many movies per year (here, more than 20) and low-volume consumers who rent only a few movies per year (less than 20). If only a two-part tariff is offered, the firm has the problem of determining the profit-maximizing entry and rental fees with many different consumers. A high entry fee with a low rental fee discourages low-volume consumers from subscribing. A low entry fee with a high rental fee encourages membership, but discourages high-volume customers from renting. Instead of forcing customers to pay both an entry and rental fee, the firm effectively charges two different prices to two types of customers.

8. Sal’s satellite company broadcasts TV to subscribers in Los Angeles and New York. The demand functions for each of these two groups are
\[Q_{NY} = 60 - 0.25P_{NY}\]
\[Q_{LA} = 100 - 0.50P_{LA}\]
where \(Q\) is in thousands of subscriptions per year and \(P\) is the subscription price per year. The cost of providing \(Q\) units of service is given by
\[C = 1,000 + 40Q\]
where \(Q = Q_{NY} + Q_{LA}\).

a. What are the profit-maximizing prices and quantities for the New York and Los Angeles markets?

We know that a monopolist with two markets should pick quantities in each market so that the marginal revenues in both markets are equal to one another and equal to
Chapter 11: Pricing with Market Power

marginal cost. Marginal cost is $40 (the slope of the total cost curve). To determine marginal revenues in each market, we first solve for price as a function of quantity:

\[ P_{NY} = 240 - 4Q_{NY} \quad \text{and} \quad P_{LA} = 200 - 2Q_{LA}. \]

Since the marginal revenue curve has twice the slope of the demand curve, the marginal revenue curves for the respective markets are:

\[ MR_{NY} = 240 - 8Q_{NY} \quad \text{and} \quad MR_{LA} = 200 - 4Q_{LA}. \]

Set each marginal revenue equal to marginal cost, and determine the profit-maximizing quantity in each submarket:

\[ 40 = 240 - 8Q_{NY}, \text{ or } Q_{NY} = 25 \quad \text{and} \quad 40 = 200 - 4Q_{LA}, \text{ or } Q_{LA} = 40. \]

Determine the price in each submarket by substituting the profit-maximizing quantity into the respective demand equation:

\[ P_{NY} = 240 - (4)(25) = $140 \quad \text{and} \quad P_{LA} = 200 - (2)(40) = $120. \]

b. As a consequence of a new satellite that the Pentagon recently deployed, people in Los Angeles receive Sal's New York broadcasts, and people in New York receive Sal's Los Angeles broadcasts. As a result, anyone in New York or Los Angeles can receive Sal's broadcasts by subscribing in either city. Thus Sal can charge only a single price. What price should he charge, and what quantities will he sell in New York and Los Angeles?

Given this new satellite, Sal can no longer separate the two markets, so he now needs to consider the total demand function, which is the horizontal summation of the LA and NY demand functions. Above a price of 200 (the vertical intercept of the demand function for Los Angeles viewers), the total demand is just the New York demand function, whereas below a price of 200, we add the two demands:

\[ Q_T = 60 - 0.25P + 100 - 0.50P, \text{ or } Q_T = 160 - 0.75P. \]

Rewriting the demand function results in

\[ P = \frac{160}{0.75} - \frac{1}{0.75}Q. \]

Now total revenue = \( PQ = (213.3 - 1.3Q)Q \), or \( 213.3Q - 1.3Q^2 \), and therefore,

\[ MR = 213.3 - 2.6Q. \]

Setting marginal revenue equal to marginal cost to determine the profit-maximizing quantity:

\[ 213.3 - 2.6Q = 40, \text{ or } Q = 65. \]

Substitute the profit-maximizing quantity into the demand equation to determine price:

\[ 65 = 160 - 0.75P, \text{ or } P = $126.67. \]

Although a price of $126.67 is charged in both markets, different quantities are purchased in each market.

\[ Q_{NY} = 60 - 0.25(126.67) = 28.3 \quad \text{and} \quad Q_{LA} = 100 - 0.50(126.67) = 36.7. \]

Together, 65 units are purchased at a price of $126.67 each.
c. In which of the above situations, (a) or (b), is Sal better off? In terms of consumer surplus, which situation do people in New York prefer and which do people in Los Angeles prefer? Why?

Sal is better off in the situation with the highest profit. Under the market condition in 8a, profit is equal to:

\[ \pi = Q_{NY}P_{NY} + Q_{LA}P_{LA} - (1,000 + 40(Q_{NY} + Q_{LA})), \]

or

\[ \pi = (25)(140) + (40)(120) - (1,000 + 40(25 + 40)) = 4,700. \]

Under the market conditions in 8b, profit is equal to:

\[ \pi = Q_{T}P - (1,000 + 40Q_{T}), \]

or

\[ \pi = (126.67)(65) - (1,000 + (40)(65)) = 4633.33. \]

Therefore, Sal is better off when the two markets are separated.

Consumer surplus is the area under the demand curve above price. Under the market conditions in 8a, consumer surpluses in New York and Los Angeles are:

\[ CS_{NY} = (0.5)(240 - 140)(25) = \text{1250 and} \]

\[ CS_{LA} = (0.5)(200 - 120)(40) = \text{1600.} \]

Under the market conditions in 8b the respective consumer surpluses are:

\[ CS_{NY} = (0.5)(240 - 126.67)(28.3) = \text{1603.67 and} \]

\[ CS_{LA} = (0.5)(200 - 126.67)(36.7) = \text{1345.67.} \]

The New Yorkers prefer 8b because the equilibrium price is $126.67 instead of $140, thus giving them a higher consumer surplus. The customers in Los Angeles prefer 8a because the equilibrium price is $120 instead of $126.67.

*9. You are an executive for Super Computer, Inc. (SC), which rents out super computers. SC receives a fixed rental payment per time period in exchange for the right to unlimited computing at a rate of $P$ cents per second. SC has two types of potential customers of equal number—10 businesses and 10 academic institutions. Each business customer has the demand function \( Q = 10 - P \), where \( Q \) is in millions of seconds per month; each academic institution has the demand \( Q = 8 - P \). The marginal cost to SC of additional computing is 2 cents per second, regardless of the volume.

a. Suppose that you could separate business and academic customers. What rental fee and usage fee would you charge each group? What would be your profits?

For academic customers, consumer surplus at a price equal to marginal cost is

\[ (0.5)(8 - 2)(6) = 18 \text{ million cents per month or} \] $180,000 per month.

Therefore, charge $180,000 per month in rental fees and two cents per second in usage fees, i.e., the marginal cost. Each academic customer will yield a profit of $180,000 per month for total profits of $1,800,000 per month.

For business customers, consumer surplus is

\[ (0.5)(10 - 2)(8) = 32 \text{ million cents or} \] $320,000 per month.

Therefore, charge $320,000 per month in rental fees and two cents per second in usage fees. Each business customer will yield a profit of $320,000 per month for total profits of $3,200,000 per month.

Total profits will be $5 million per month minus any fixed costs.
**b. Suppose you were unable to keep the two types of customers separate and charged a zero rental fee. What usage fee maximizes your profits? What are your profits?**

Total demand for the two types of customers with ten customers per type is

\[ Q = 10(10 - P) + 10(8 - P) = 180 - 20P. \]

Solving for price as a function of quantity:

\[ P = 9 - \frac{Q}{20}, \text{ which implies } MR = 9 - \frac{Q}{10}. \]

To maximize profits, set marginal revenue equal to marginal cost,

\[ 9 - \frac{Q}{10} = 2, \text{ or } Q = 70. \]

At this quantity, the profit-maximizing price, or usage fee, is 5.5 cents per second.

\[ \pi = (5.5 - 2)(70) = 2.45 \text{ million cents per month}, \text{ or } $24,500. \]

**c. Suppose you set up one two-part tariff— that is, you set one rental and one usage fee that both business and academic customers pay. What usage and rental fees would you set? What would be your profits? Explain why price would not be equal to marginal cost.**

With a two-part tariff and no price discrimination, set the rental fee (RENT) to be equal to the consumer surplus of the academic institution (if the rental fee were set equal to that of business, academic institutions would not purchase any computer time):

\[ \text{RENT} = CS_A = (0.5)(8 - P^*)(8 - P^*) = (0.5)(8 - P^*)^2. \]

Total revenue and total costs are:

\[ TR = (20)(\text{RENT}) + (Q_A + Q_B)(P^*) \]
\[ TC = 2(Q_A + Q_B). \]

Substituting for quantities in the profit equation with total quantity in the demand equation:

\[ \pi = (20)(\text{RENT}) + (Q_A + Q_B)(P^*) - 2(Q_A + Q_B), \text{ or } \]
\[ \pi = (10)(8 - P^*)^2 + (P^* - 2)(180 - 20P^*). \]

Differentiating with respect to price and setting it equal to zero:

\[ \frac{d\pi}{dP} = -20P^* + 60 = 0. \]

Solving for price, \( P^* = 3 \) cent per second. At this price, the rental fee is

\[ (0.5)(8 - 3)^2 = 12.5 \text{ million cents or } $125,000 \text{ per month}. \]

At this price

\[ Q_A = (10)(8 - 3) = 50 \]
\[ Q_B = (10)(10 - 3) = 70. \]

The total quantity is 120 million seconds. Profits are rental fees plus usage fees minus total cost, i.e., \( (12.5)(20) \) plus \( (120)(3) \) minus 240, or 370 million cents, or $3.7 million per month. Price does not equal marginal cost, because SC can make greater profits by charging a rental fee and a higher-than-marginal-cost usage fee.
Chapter 11: Pricing with Market Power

10. As the owner of the only tennis club in an isolated wealthy community, you must decide on membership dues and fees for court time. There are two types of tennis players. “Serious” players have demand

\[ Q_1 = 10 - P \]

where \( Q_1 \) is court hours per week and \( P \) is the fee per hour for each individual player. There are also “occasional” players with demand

\[ Q_2 = 4 - (1/4)P. \]

Assume that there are 1,000 players of each type. Because you have plenty of courts, the marginal cost of court time is zero. You have fixed costs of $10,000 per week. Serious and occasional players look alike, so you must charge them the same prices.

a. Suppose that to maintain a “professional” atmosphere, you want to limit membership to serious players. How should you set the annual membership dues and court fees (assume 52 weeks per year) to maximize profits, keeping in mind the constraint that only serious players choose to join? What would profits be (per week)?

In order to limit membership to serious players, the club owner should charge an entry fee, \( T \), equal to the total consumer surplus of serious players. With individual demands of \( Q_1 = 10 - P \), individual consumer surplus is equal to:

\[(0.5)(10 - 0)(10 - 0) = $50, \text{ or} \]
\[(50)(52) = $2600 \text{ per year.} \]

An entry fee of $2600 maximizes profits by capturing all consumer surplus. The profit-maximizing court fee is set to zero, because marginal cost is equal to zero. The entry fee of $2600 is higher than the occasional players are willing to pay (higher than their consumer surplus at a court fee of zero); therefore, this strategy will limit membership to the serious player. Weekly profits would be

\[ \pi = (50)(1,000) - 10,000 = $40,000. \]

b. A friend tells you that you could make greater profits by encouraging both types of players to join. Is the friend right? What annual dues and court fees would maximize weekly profits? What would these profits be?

When there are two classes of customers, serious and occasional players, the club owner maximizes profits by charging court fees above marginal cost and by setting the entry fee (annual dues) equal to the remaining consumer surplus of the consumer with the lesser demand, in this case, the occasional player. The entry fee, \( T \), is equal to the consumer surplus remaining after the court fee is assessed:

\[ T = (Q_2 - 0)(16 - P)(1/2). \]

where \[ Q_2 = 4 - (1/4)P, \text{ or} \]
\[ T = (1/2)(4 - (1/4)P)(16 - P) = 32 - 4P + P^2/8. \]

Entry fees for all players would be

\[ 2000(32 - 4P + P^2/8). \]

Revenues from court fees equals

\[ P(Q_1 + Q_2) = P[1000(10 - P) + 1000(4 - P/4)] = 14,000P - 1250P^2. \]

Then total revenue = \( TR = 64,000 - 6000P - 1000P^2. \)

Marginal cost is zero and marginal revenue is given by the slope of the total revenue curve:
Chapter 11: Pricing with Market Power

\[ \Delta TR/\Delta P = 6000 - 2000P. \]

Equating marginal revenue and marginal cost implies a price of $3.00 per hour. Total revenue is equal to $73,000. Total cost is equal to fixed costs of $10,000. So profit is $63,000 per week, which is greater than the $40,000 when only serious players become members.

c. Suppose that over the years young, upwardly mobile professionals move to your community, all of whom are serious players. You believe there are now 3,000 serious players and 1,000 occasional players. Would it still be profitable to cater to the occasional player? What would be the profit-maximizing annual dues and court fees? What would profits be per week?

An entry fee of $50 per week would attract only serious players. With 3,000 serious players, total revenues would be $150,000 and profits would be $140,000 per week. With both serious and occasional players, we may follow the same procedure as in 10b. Entry fees would be equal to 4,000 times the consumer surplus of the occasional player:

\[ T = 4000(32 - 4P + P^2/8). \]

Court fees are

\[ P[3000(10 - P) + 1000(4 - P/4)] = 14,000P - 1250P^2. \]

Then TR =

\[ 128,000 + 18,000P - 2750P^2. \]

Marginal cost is zero, so setting

\[ \Delta TR/\Delta P = 18,000 - 2750P = 0 \]

implies a price of $6.55 per hour. Then total revenue is equal to $127,918 per week, which is less than the $150,000 per week with only serious players. The club owner should set annual dues at $2600, charge nothing for court time, and earn profits of $7.28 million per year.

11. Look again at Figure 11.12, which shows the reservation prices of three consumers for two goods. Assuming that the marginal production cost is zero for both goods, can the producer make the most money by selling the goods separately, by bundling, or by using “mixed” bundling (i.e., offering the goods separately or as a bundle)? What prices should be charged?

The following tables summarize the reservation prices of the three consumers and the profits from the three strategies as shown in Figure 11.12 in the text:

<table>
<thead>
<tr>
<th>Reservation Price</th>
<th>For 1</th>
<th>For 2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer A</td>
<td>$ 3.25</td>
<td>$ 6.00</td>
<td>$ 9.25</td>
</tr>
<tr>
<td>Consumer B</td>
<td>$ 8.25</td>
<td>$ 3.25</td>
<td>$11.50</td>
</tr>
<tr>
<td>Consumer C</td>
<td>$10.00</td>
<td>$10.00</td>
<td>$20.00</td>
</tr>
</tbody>
</table>
Chapter 11: Pricing with Market Power

<table>
<thead>
<tr>
<th></th>
<th>Price 1</th>
<th>Price 2</th>
<th>Bundled</th>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sell Separately</td>
<td>$8.25</td>
<td>$6.00</td>
<td>___</td>
<td>$28.50</td>
</tr>
<tr>
<td>Pure Bundling</td>
<td>___</td>
<td>___</td>
<td>$9.25</td>
<td>$27.75</td>
</tr>
<tr>
<td>Mixed Bundling</td>
<td>$10.00</td>
<td>$6.00</td>
<td>$11.50</td>
<td>$29.00</td>
</tr>
</tbody>
</table>

The profit-maximizing strategy is to use mixed bundling. When each item is sold separately, two of Product 1 are sold at $8.25, and two of Product 2 are sold at $6.00. In the pure bundling case, three bundles are purchased at a price of $9.25. The bundle price is determined by the lowest reservation price. With mixed bundling, one Product 2 is sold at $6.00 and two bundles at $11.50. Mixed bundling is often the ideal strategy when demands are only somewhat negatively correlated and/or when marginal production costs are significant.

12. Look again at Figure 11.17. Suppose that the marginal costs $c_1$ and $c_2$ were zero. Show that in this case, pure bundling and not mixed bundling, is the most profitable pricing strategy. What price should be charged for the bundle? What will the firm’s profit be?

Figure 11.17 in the text is reproduced as Figure 11.12 here. With marginal costs both equal to zero, the firm wants to sell as many units as possible to maximize profit. Here, revenue maximization is the same as profit maximization. The firm should set the bundle price at $100, since this is the sum of the reservation prices for all consumers. At this price all customers purchase the bundle, and the firm’s revenues are $400. This revenue is greater than setting $P_1 = P_2 = $89.95 and setting $P_B = $100 with the mixed bundling strategy. With mixed bundling, the firm sells one unit of Product 1, one unit of Product 2, and two bundles. Total revenue is $379.90, which is less than $400. Since marginal cost is zero, and demands are negatively correlated, pure bundling is the best strategy.

![Figure 11.12](image-url)
13. Some years ago, an article appeared in The New York Times about IBM’s pricing policy. The previous day IBM had announced major price cuts on most of its small and medium-sized computers. The article said:

“IBM probably has no choice but to cut prices periodically to get its customers to purchase more and lease less. If they succeed, this could make life more difficult for IBM’s major competitors. Outright purchases of computers are needed for ever larger IBM revenues and profits, says Morgan Stanley’s Ulric Weil in his new book, Information Systems in the ’80’s. Mr. Weil declares that IBM cannot revert to an emphasis on leasing.”

a. Provide a brief but clear argument in support of the claim that IBM should try “to get its customers to purchase more and lease less.”

If we assume there is no resale market, there are at least three arguments that could be made in support of the claim that IBM should try to “get its customers to purchase more and lease less.” First, when customers purchase computers, they are “locked into” the product. They do not have the option of not renewing the lease when it expires. Second, by getting customers to purchase a computer instead of leasing it, IBM leads customers to make a stronger economic decision for IBM and against its competitors. Thus, it would be easier for IBM to eliminate its competitors if all its customers purchased, rather than leased, computers. Third, computers have a high obsolescence rate. If IBM believes that this rate is higher than what their customers perceive it is, the lease charges would be higher than what the customers would be willing to pay and it would be more profitable to sell the computers instead.

b. Provide a brief but clear argument against this claim.

The primary argument for leasing computers to customers, instead of selling the computers, is that because IBM has monopoly power on computers, it might be able to charge a two-part tariff and therefore extract some of the consumer surplus and increase its profits. For example, IBM could charge a fixed leasing fee plus a charge per unit of computing time used. Such a scheme would not be possible if the computers were sold outright.

c. What factors determine whether leasing or selling is preferable for a company like IBM? Explain briefly.

There are at least three factors that could determine whether leasing or selling is preferable for IBM. The first factor is the amount of consumer surplus that IBM could extract if the computer were leased and a two-part tariff scheme were applied. The second factor is the relative discount rates on cash flows: if IBM has a higher discount rate than its customers, it might prefer to sell; if IBM has a lower discount rate than its customers, it might prefer to lease. A third factor is the vulnerability of IBM’s competitors. Selling computers would force customers to make more of a financial commitment to one company over the rest, while with a leasing arrangement the customers have more flexibility. Thus, if IBM feels it has the requisite market power, it should prefer to sell computers instead of lease them.

14. You are selling two goods, 1 and 2, to a market consisting of three consumers with reservation prices as follows:

<table>
<thead>
<tr>
<th>Consumer</th>
<th>For 1</th>
<th>For 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>B</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>C</td>
<td>100</td>
<td>20</td>
</tr>
</tbody>
</table>
The unit cost of each product is $30.

a. Compute the optimal prices and profits for (i) selling the goods separately, (ii) pure bundling, and (iii) mixed bundling.

The prices and profits for each strategy are

<table>
<thead>
<tr>
<th></th>
<th>Price 1</th>
<th>Price 2</th>
<th>Bundled Price</th>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sell Separately</td>
<td>$100.00</td>
<td>$100.00</td>
<td>—</td>
<td>$140.00</td>
</tr>
<tr>
<td>Pure Bundling</td>
<td>—</td>
<td>—</td>
<td>$120.00</td>
<td>$180.00</td>
</tr>
<tr>
<td>Mixed Bundling</td>
<td>$99.95</td>
<td>$99.95</td>
<td>$120.00</td>
<td>$199.90</td>
</tr>
</tbody>
</table>

You can try other prices to confirm that these are the best. For example, if you charge $60 for good 1 and $60 for good 2 then B and C will buy good 1 and A and B will buy good 2. Since marginal cost for each unit is $30, profit for each unit is $60-$30=$30 for a total of $120.

b. Which strategy would be most profitable? Why?

Mixed bundling is best because, for each good, marginal production cost ($30) exceeds the reservation price for one consumer. Consumer A has a reservation price of $100 for good 2 and only $20 for good 1. The firm responds by offering good 2 at a price just below Consumer A’s reservation price and by charging a price for the bundle, so that the difference between the bundle price and the price of good 2 is above Consumer A’s reservation price of good 1 ($20.05). Consumer C’s choice is symmetric to Consumer A’s choice. Consumer B chooses the bundle because the bundle’s price is equal to the reservation price and the separate prices for the goods are both above the reservation price for either good.

15. Your firm produces two products, the demands for which are independent. Both products are produced at zero marginal cost. You face four consumers (or groups of consumers) with the following reservation prices:

<table>
<thead>
<tr>
<th>Consumer</th>
<th>Good 1 ($)</th>
<th>Good 2 ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td>B</td>
<td>40</td>
<td>80</td>
</tr>
<tr>
<td>C</td>
<td>80</td>
<td>40</td>
</tr>
<tr>
<td>D</td>
<td>100</td>
<td>25</td>
</tr>
</tbody>
</table>

a. Consider three alternative pricing strategies: (i) selling the goods separately; (ii) pure bundling; (iii) mixed bundling. For each strategy, determine the optimal prices to be charged and the resulting profits. Which strategy would be best?

For each strategy, the optimal prices and profits are

<table>
<thead>
<tr>
<th></th>
<th>Price 1</th>
<th>Price 2</th>
<th>Bundled Price</th>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sell Separately</td>
<td>$80.00</td>
<td>$80.00</td>
<td>—</td>
<td>$320.00</td>
</tr>
<tr>
<td>Pure Bundling</td>
<td>—</td>
<td>—</td>
<td>$120.00</td>
<td>$480.00</td>
</tr>
<tr>
<td>Mixed Bundling</td>
<td>$94.95</td>
<td>$94.95</td>
<td>$120.00</td>
<td>$429.90</td>
</tr>
</tbody>
</table>

You can try other prices to verify that $80 for each good is optimal. For example if each good is $100 then only two units are sold and profit is $100. If one is $100 and
one is $80, then one is sold for $100 and two for $80 for a total of $260. Note that in the case of mixed bundling, the price of each good must be set at $94.95 and not $99.95 since the bundle is $5 cheaper than the sum of the reservation prices for consumers A and D. If the price of each good is set at $99.95 then neither consumer A nor D will buy the individual good because they only save five cents off of their reservation price, as opposed to $5 for the bundle. Also the difference between the bundle price and the unit price (120-94.95) is above the reservation price of the other good for each person. Pure bundling dominates mixed bundling, because with marginal costs of zero there is no reason to exclude purchases of both goods by all consumers.

b. **Now suppose that the production of each good entails a marginal cost of $30. How does this information change your answers to (a)? Why is the optimal strategy now different?**

With marginal cost of $30, the optimal prices and profits are:

<table>
<thead>
<tr>
<th></th>
<th>Price 1</th>
<th>Price 2</th>
<th>Bundled Price</th>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sell Separately</td>
<td>$80.00</td>
<td>$80.00</td>
<td>—</td>
<td>$200.00</td>
</tr>
<tr>
<td>Pure Bundling</td>
<td>—</td>
<td>—</td>
<td>$120.00</td>
<td>$240.00</td>
</tr>
<tr>
<td>Mixed Bundling</td>
<td>$94.95</td>
<td>$94.95</td>
<td>$120.00</td>
<td>$249.90</td>
</tr>
</tbody>
</table>

Mixed bundling is the best strategy. Since the marginal cost is above the reservation price of consumer’s A and D, the firm can benefit by using mixed bundling to encourage them to only buy the one good.
16. A cable TV company offers, in addition to its basic service, two products: a Sports Channel (Product 1) and a Movie Channel (Product 2). Subscribers to the basic service can subscribe to these additional services individually at the monthly prices $P_1$ and $P_2$, respectively, or they can buy the two as a bundle for the price $P_B$, where $P_B < P_1 + P_2$. (They can also forego the additional services and simply buy the basic service.) The company's marginal cost for these additional services is zero. Through market research, the cable company has estimated the reservation prices for these two services for a representative group of consumers in the company's service area. These reservation prices are plotted (as x's) in Figure 11.16, as are the prices $P_1$, $P_2$, and $P_B$ that the cable company is currently charging. The graph is divided into regions, I, II, III, and IV.

![Figure 11.16](image)

**a.** Which products, if any, will be purchased by the consumers in region I? In region II? In region III? In region IV? Explain briefly.

Product 1 = sports channel. Product 2 = movie channel.

<table>
<thead>
<tr>
<th>Region</th>
<th>Purchase</th>
<th>Reservation Prices</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>nothing</td>
<td>$r_1 &lt; P_1$, $r_2 &lt; P_2$, $r_1 + r_2 &lt; P_B$</td>
</tr>
<tr>
<td>II</td>
<td>sports channel</td>
<td>$r_1 &gt; P_1$, $r_2 &lt; P_B - P_1$</td>
</tr>
<tr>
<td>III</td>
<td>movie channel</td>
<td>$r_2 &gt; P_2$, $r_1 &lt; P_B - P_2$</td>
</tr>
<tr>
<td>IV</td>
<td>both channels</td>
<td>$r_1 &gt; P_B - P_2$, $r_2 &gt; P_B - P_1$, $r_1 + r_2 &gt; P_B$</td>
</tr>
</tbody>
</table>

To see why consumers in regions II and III do not buy the bundle, reason as follows: For region II, $r_1 > P_1$, so the consumer will buy product 1. If she bought the bundle, she would pay an additional $P_B - P_1$. Since her reservation price for product 2 is less than $P_B - P_1$, she will choose only to buy product 1. Similar reasoning applies to region III.
Consumers in region I purchase nothing because the sum of their reservation values are less than the bundling price and each reservation value is lower than the respective price.

In region IV the sum of the reservation values for the consumers are higher than the bundle price, so these consumers would rather purchase the bundle than nothing. To see why the consumers in this region cannot do better than purchase either of the products separately, reason as follows: since \( r_1 > P_B - P_2 \) the consumer is better off purchasing both products than just product 2, likewise since \( r_2 > P_B - P_1 \), the consumer is better off purchasing both products rather than just product 1.

b. **Note that the reservation prices for the Sports Channel and the Movie Channel, as drawn in the figure, are negatively correlated. Why would you, or would you not, expect consumers’ reservation prices for cable TV channels to be negatively correlated?**

Prices may be negatively correlated if people’s tastes differ in the following way: the more avidly a person likes sports, the less he or she will care for movies, and vice versa. Reservation prices would not be negatively correlated if people who were willing to pay a lot of money to watch sports were also willing to pay a lot of money to watch movies.

c. **The company’s vice president has said: “Because the marginal cost of providing an additional channel is zero, mixed bundling offers no advantage over pure bundling. Our profits would be just as high if we offered the Sports Channel and the Movie Channel together as a bundle, and only as a bundle.” Do you agree or disagree? Explain why.**

It depends. By offering only the bundled product, the company would lose customers below the bundle price in regions II and III. At the same time, those consumers above the bundling price line in these regions would only buy one service, rather than the bundled service. The net effect on revenues is indeterminate. The exact solution depends on the distribution of consumers in those regions.

d. **Suppose the cable company continues to use mixed bundling as a way of selling these two services. Based on the distribution of reservation prices shown in Figure 11.21, do you think the cable company should alter any of the prices it is now charging? If so, how?**

The cable company could raise \( P_B, P_1, \) and \( P_2 \) slightly without losing any customers. Alternatively, it could raise prices even past the point of losing customers as long as the additional revenue from the remaining customers made up for the revenue loss from the lost customers.

17. **Consider a firm with monopoly power that faces the demand curve**

\[ P = 100 - 3Q + 4A^{1/2} \]

and has the total cost function

\[ C = 4Q^2 + 10Q + A, \]

where \( A \) is the level of advertising expenditures, and \( P \) and \( Q \) are price and output.

a. **Find the values of \( A, Q, \) and \( P \) that maximize the firm’s profit.**

Profit (\( \pi \)) is equal to total revenue, \( TR \), minus total cost, \( TC \). Here,

\[
TR = PQ = (100 - 3Q + 4A^{1/2})Q = 100Q - 3Q^2 + 4QA^{1/2}
\]

and

\[
TC = 4Q^2 + 10Q + A.
\]
Therefore,
\[ \pi = 100Q \cdot 3Q^2 + 4QA^{1/2} - 4Q^2 - 10Q \cdot A, \] or
\[ \pi = 90Q - 7Q^2 + 4QA^{1/2} - A. \]
The firm wants to choose its level of output and advertising expenditures to maximize its profits:
\[ \text{Max } \pi = 90Q - 7Q^2 + 4QA^{1/2} - A. \]
The necessary conditions for an optimum are:
\[ \begin{align*}
(1) \quad \frac{\partial \pi}{\partial Q} &= 90 - 14Q + 4A^{1/2} = 0, \quad \text{and} \\
(2) \quad \frac{\partial \pi}{\partial A} &= 2QA^{1/2} - 1 = 0.
\end{align*} \]
From equation (2), we obtain
\[ A^{1/2} = 2Q. \]
Substituting this into equation (1), we obtain
\[ 90 - 14Q + 4(2Q) = 0, \text{ or } Q^* = 15. \]
Then,
\[ A^* = (4)(15^2) = 900, \]
which implies
\[ P^* = 100 - (3)(15) + (4)(900^{1/2}) = \$175. \]

b. **Calculate the Lerner index, **\( L = (P - MC)/P, \)** for this firm at its profit-maximizing levels of A, Q, and P.**

The degree of monopoly power is given by the formula \( \frac{P - MC}{P}. \) Marginal cost is \( 8Q + 10 \) (the derivative of total cost with respect to quantity). At the optimum, where \( Q = 15, MC = (8)(15) + 10 = 130. \) Therefore, the Lerner index is
\[ L = \frac{175 \cdot 130}{175} = 0.257. \]