You've no doubt noticed many places where you can receive price discounts if you show your student ID. Commonly discounted goods include movie admissions, clothing at the campus bookstore, gym memberships, train fare, and even computer equipment.

It's nice of these sellers to give you a price break while you're getting your education. School isn't cheap, and every little bit helps. The sellers' generosity must say something about the value that they put on everyone receiving a good education. Right?

Not really. The main motivation behind such student discounts isn't altruism. Instead, it is almost surely the sellers' attempt to extract more producer surplus from the market than they would otherwise. That's not to say you're worse off because they've offered these discounts; in fact, they make it more likely you will be able to consume goods that would otherwise be too expensive for you. But there's something in it for the sellers, too—these discounts increase their producer surplus and improve their bottom lines.
How, exactly, does offering student discounts raise a seller’s producer surplus? From our study of market power in Chapter 9, we know that when a firm can influence its own price, it makes a higher profit than a perfectly competitive (i.e., price-taking) company. The market power pricing rule we came up with, however, required the firm to charge the same price to all customers. In this chapter, we see that if a firm can charge different prices to different groups of customers (e.g., students and nonstudents), it can raise surplus and profit above those earned by a standard monopolist charging every customer the same price. There are many ways in which firms with market power can charge different prices for the same good. This chapter explores the most common of these strategies and looks at how they affect producers and consumers in the market.

10.1 The Basics of Pricing Strategy

A pricing strategy is a firm’s plan for setting the price of its product given the market conditions it faces and its desire to maximize profit. The pricing strategy for a perfectly competitive firm is that it charges the equilibrium market price for its product and earns no economic profit. The pricing strategy for firms with market power is more complex. A firm with market power that charges one price to all its customers sets the market price according to the quantity of output it chooses to produce to maximize its profit. (Remember that firms operating in markets with barriers to entry are able to earn economic profits even in the long run.) Some firms with market power, however, can charge different prices to different customers for the same product using a pricing strategy called price discrimination. If a firm with market power can price discriminate, it can earn greater economic profit than a single-price monopoly.

It is important to understand that price discrimination is not the same phenomenon as the existence of different prices for different goods. Price differences can occur across similar products even in a competitive market if the marginal costs of producing the products are different. For example, if the marginal cost of washing SUVs at the car wash is higher than that of washing Mini Coopers because SUVs are bigger, car washes might charge more to wash SUVs. Price discrimination is something different. It implies the use of market power to charge higher prices for the same product to those consumers who are willing to pay more for it. Price variations due to price discrimination do not reflect differences in marginal costs; they exist simply because the firm with market power has the ability to charge different prices for the same product.

There are several pricing strategies a company can use depending on its circumstances. These range from direct price discrimination to indirect price discrimination to bundling to two-part tariffs and beyond. The motivation for these strategies is straightforward: A company with market power charges a higher price for the units of output that provide consumers with greater consumer surplus. By adjusting the price, a firm extracts more producer surplus from each transaction.

10.2 Direct Price Discrimination I: Perfect/First-Degree Price Discrimination

10.3 Direct Price Discrimination II: Segmenting/Third-Degree Price Discrimination

10.4 Indirect/Second-Degree Price Discrimination

10.5 Bundling

10.6 Advanced Pricing Strategies

10.7 Conclusion
Requirement 2: The firm must prevent resale and arbitrage. To take advantage of advanced pricing strategies, a firm must be able to prevent its customers from reselling its product among themselves. Otherwise, the customers able to buy units at a low price could purchase a large number of units and resell them to other customers who would otherwise have had to buy the product from the firm at a higher price. The practice of taking advantage of price differences for a product by buying at a lower price and reselling at a higher price is called arbitrage.

The ability to engage in arbitrage makes all customers better off. The low-price customers make a profit on resale, and the high-price consumers can buy the product at a lower price than the firm would charge. The firm isn’t better off, though. It is effectively shut out from directly selling to any consumers except those who want to buy at the lowest price. Because it would then be selling at only one price, however, the firm would be back in the traditional situation for a firm with market power described in Chapter 9: It should produce the quantity at which marginal revenue equals marginal cost and charge the price at which buyers would consume that quantity (and therefore not worry about resellers).

If a firm meets these two requirements, it can attempt to implement more profitable pricing strategies. Figure 10.1 provides an overview of these strategies.

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**Figure 10.1  An Overview of Pricing Strategies**

A firm’s optimal pricing strategy is determined by characteristics of the firm, its product, and its consumers. In particular, a firm takes into account its degree of market power, whether the product can be resold, and its knowledge of its customers’ demand for the product.

- **Perfect competition** produces quantity at which $MR = P = MC$ (Chapter 8)
- **Monopoly** produces quantity ($Q^*$) at which $MR = MC$; sets price $P^*$ where $Q^* = D(P^*)$ (Chapter 9)
- **Advanced pricing strategies** (Section 10.6)
  - Block pricing
  - Two-part tariff
- **Indirect (second-degree) price discrimination** (Section 10.4)
  - Quantity discounts
  - Versioning
  - Coupons
- **Bundling** (Section 10.5)

---

**arbitrage**
The practice of reselling a product at a price higher than its original selling price.
Strategies for Customers with Different Demands  The first pricing strategies we look at involve price discrimination. For price discrimination to be an option, a firm needs to have different types of customers with different price sensitivities of demand. The exact kind of price discrimination the firm should use depends on the kind of information the firm has.

1. Can a firm identify its customers’ demands before they buy? If the firm has complete, detailed information about each customer’s own demand curve before she buys the product, it can practice perfect price discrimination and charge every customer a different price. If information about its customers is less detailed, a firm may be able to discriminate by customer group, as in third-degree price discrimination. The key to these kinds of price discrimination is that a firm must be able to directly identify different customers or groups of customers (as can a store that requires students to show IDs when making purchases) and charge different prices to each customer or group of customers.

2. Can a firm identify its customers’ differing demands only after they make a purchase? If a firm cannot identify different types of consumers before they make their purchases, it can try more indirect price discrimination, which involves offering different pricing packages and then identifying the customer’s type from the pricing package she chooses. These pricing packages can take the form of quantity discounts, different versions of the product at different prices, or (under the right conditions) bundling together different products.

Do a Firm’s Customers Have the Same Demand Curves? There is still another set of pricing strategies that a firm can use even if its consumers have the same demand curves. These strategies involve offering different unit prices to the same customer for different quantities purchased or charging lump-sum fees on top of per-unit prices.

We explore all these strategies in the remainder of this chapter. To help clarify a firm’s decision, each pricing strategy section has a When to Use It feature that explains what a firm needs to know about its market and customers to use a given pricing strategy most effectively. By using the best strategy, the firm can extract the most producer surplus from the market.

10.2 Direct Price Discrimination I: Perfect/First-Degree Price Discrimination

When to Use It  Perfect/First-Degree Price Discrimination

1. The firm has market power and can prevent resale.
2. The firm’s customers have different demand curves.
3. The firm has complete information about every customer and can identify each one’s demand before purchase.

Let’s start our study of pricing strategies by looking at a firm that has market power, can prevent resale, and knows that its consumers differ in their willingness to pay and therefore have different demand curves. To choose a price discrimination strategy that will allow the firm to reap the greatest benefits of these three characteristics, the firm must first ask itself whether it can directly identify what type of demand its customers have before they purchase the product, or whether it can determine this only after they buy the product. That is, do the buyers have some identifiable characteristic that allows the firm to observe their sensitivity to price and willingness to pay for the firm’s product? If they do, the company can directly identify its customers’ demands beforehand.
and increase its producer surplus by using direct price discrimination, that is, by charging different prices to different customers based on something that a firm can observe directly about its customers’ identities. If it can know its consumers’ demands only after they buy the product, then the firm has to use indirect price discrimination, which we discuss later in the chapter.

Let’s first consider the possibilities for a firm that has so much information about its customers before they buy that it knows each individual buyer’s demand curve and can charge each buyer a different price equal to the buyer’s willingness to pay. This type of direct price discrimination is known as perfect price discrimination or first-degree price discrimination.

Suppose a firm faces a market demand curve like the one labeled $D$ in Figure 10.2. Panel a shows the outcomes for a perfectly competitive firm and a monopolistic firm. We know from Chapter 8 that in a perfectly competitive market, the equilibrium price (which is the same as $MR$ in that case) equals marginal cost $MC$ and the firm produces quantity $Q_c$. Consumer surplus is the area under the demand curve and above the price, $A + B + C$. Because we assume that marginal cost is constant, there is no producer surplus.

In Chapter 9, we saw that a firm with market power facing demand curve $D$ and with no ability to prevent resale produces the quantity where its marginal cost equals its
direct price discrimination
A pricing strategy in which firms charge different prices to different customers based on observable characteristics of the customers.

perfect price discrimination (first-degree price discrimination)
A type of direct price discrimination in which a firm charges each customer exactly his willingness to pay.

Figure 10.2 Perfect (First-Degree) Price Discrimination

<table>
<thead>
<tr>
<th>(a) Perfect competition and monopoly</th>
<th>(b) Perfect price discrimination</th>
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<tbody>
<tr>
<td>Consumer surplus (competition)</td>
<td>Consumer surplus</td>
</tr>
<tr>
<td>$A + B + C$</td>
<td>$0$</td>
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<tr>
<td>Producer surplus (competition)</td>
<td>Producer surplus</td>
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<tr>
<td>$0$</td>
<td>$A + B + C$</td>
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<tr>
<td>Consumer surplus (market power)</td>
<td>Deadweight loss from market power</td>
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<tr>
<td>$A$</td>
<td>$0$</td>
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<tr>
<td>Producer surplus (market power)</td>
<td>Deadweight loss from market power</td>
</tr>
<tr>
<td>$B$</td>
<td>$0$</td>
</tr>
</tbody>
</table>

(a) A competitive market will set price equal to marginal cost, producing $Q_c$ and selling at a price of $P_c$. Consumers will receive a consumer surplus equal to $A + B + C$ and the firm will earn zero producer surplus. A single-price monopoly will sell quantity $Q_m$ at a price of $P_m$ and receive a producer surplus equal to $B$. Consumers will receive consumer surplus equal to $A$ and the deadweight loss from market power will be area $C$.

(b) If a firm with market power can identify each customer’s demand curve, then it will charge each customer her willingness to pay and capture the entire surplus, $A + B + C$. For example, the firm will charge a customer willing to pay $P_d$ exactly the price $P_d$ and a customer willing to pay $P_f$ the price $P_f$. The firm will sell up to the quantity $Q_c$, the perfectly competitive quantity where $P_c = MC$. There is no deadweight loss when a firm practices perfect price discrimination.
marginal revenue, $Q_m$, and sets the price $P_m$ for that quantity from its demand curve. It charges this single price to everyone in the market. This market power pricing has three outcomes relative to the competitive pricing: (1) There is now a producer surplus equal to the rectangle $B$ (far better from the firm’s perspective than the competitive outcome, no producer surplus); (2) there is now a deadweight loss equal to the triangle $C$, because quantity is below its competitive level; and (3) consumer surplus is reduced to area $A$.

If, however, the firm with market power can prevent resale and directly identify each and every customer’s demand curve (panel b), the outcome is very different. In this case, the firm can charge every customer her willingness to pay for every unit (or, to guarantee she’d take the deal, just a bit below this level). This is perfect price discrimination, and the benefit to the firm is tremendous. For any unit of output where a customer’s willingness to pay is greater than the firm’s marginal cost of producing it, the firm captures the whole amount of available surplus. So, for example, a customer accounting for the portion of the demand curve at $P_d$ pays that relatively high price, while another at $P_f$ pays that relatively low price. In these and all other cases, even though the prices are different, customers pay the most they are willing to pay, and the firm gets the entire surplus (the area below demand and above marginal cost).

After all such transactions, the firm will have sold a quantity of $Q_c$ to various consumers at different prices depending on each buyer’s willingness to pay. (Because the firm can prevent resale, customers aren’t able to buy the product from another customer for a lower price than the firm offers.) The producer surplus the firm earns as a result equals the entire surplus in the market ($A + B + C$). This is the maximum amount of surplus that can be made from the market because no consumer will pay more than his or her willingness to pay (that rules out the area above the demand curve) and the firm must pay its costs (that eliminates the area below the marginal cost curve). It’s good to be a firm that can perfectly price discriminate.

Another interesting feature of perfect price discrimination is that, unlike the single-price market power outcome, there is no deadweight loss! It is efficient: No potential surplus is lost from a reduction in the equilibrium quantity. The quantity sold ($Q_c$) is the same quantity that would be sold if the market were perfectly competitive. Who keeps the market surplus is very different in the two cases, however: Under perfect competition, the entire surplus goes to the consumers, while under perfect price discrimination, the entire surplus goes to the producer. Efficiency is not the same thing as fairness. (We will further discuss issues of market efficiency and distribution in Chapter 14.)

A firm with market power faces an inverse demand curve for its product of $P = 100 - 10Q$. Assume that the firm faces a marginal cost curve of $MC = 10 + 10Q$.

a. If the firm cannot price discriminate, what is the profit-maximizing level of output and price?

b. If the firm cannot price discriminate, what are the levels of consumer and producer surplus in the market, assuming the firm maximizes its profit? Calculate the deadweight loss from market power.

c. If the firm has the ability to practice perfect price discrimination, what is the firm’s output?

d. If the firm practices perfect price discrimination, what are the levels of consumer and producer surplus? What is the deadweight loss from market power?

Solution:

a. If the firm cannot price discriminate, it maximizes profit by producing where $MR = MC$. If the inverse demand function is $P = 100 - 10Q$, then the marginal revenue must be $MR = 100 - 20Q$. (Remember that, for any linear inverse demand function $P = a - bQ$, marginal revenue is $MR = a - 2bQ$.)
Setting $MR = MC$, we obtain
\[100 - 20Q = 10 + 10Q\]
\[90 = 30Q\]
\[Q = 3\]

To find the optimal price, we plug $Q = 3$ into the inverse demand equation:
\[P = 100 - 10Q\]
\[= 100 - 10(3)\]
\[= 100 - 30\]
\[= 70\]

The firm sells 3 units at a price of $70 each.

b. To find consumer and producer surplus, we need to start with a diagram showing the demand, marginal revenue, and marginal cost curves:

Consumer surplus is the area above price and below demand (area $A$). Producer surplus is the area above marginal cost but below the price (area $B + C$). (Note that we could just label these two areas as a large trapezoid, but it is easier to remember the formulas for the area of a rectangle and a triangle!) We can calculate the areas:

\[\text{Area } A = \frac{1}{2} \times 3 \times ($100 - $70)\]
\[= 0.5(3)($30)\]
\[= $45\]

Consumer surplus is $45.

\[\text{Area } B = \text{base } \times \text{height}\]
\[= \frac{1}{2} \times (4.5 - 3) \times ($70 - $40)\]
\[= 0.5(1.5)($30)\]
\[= $22.50\]

The deadweight loss from market power is $22.50.

c. If the firm practices perfect price discrimination, it will produce where $P = MC$. As we saw in part (b) above, this means that the firm will produce 4.5 units.

d. If the firm practices perfect price discrimination, consumer surplus will be zero because every consumer will be charged a price equal to his willingness to pay. Producer surplus will be the full area between the demand curve and the marginal cost curve (area $A + B + C + D$):

\[\text{Producer surplus } = \text{area } A + \text{area } B + \text{area } C + \text{area } D\]
\[= $45 + $90 + $45 + $22.50\]
\[= $202.50\]

There is no deadweight loss when the firm perfectly price discriminates. The competitive output level is achieved ($Q = 4.5$). Producers end up with the entire surplus available in the market.
Examples of Perfect Price Discrimination

Actual cases of died-in-the-wool perfect price discrimination are rare. What firm really knows every single customer’s willingness to pay for its product? There are instances, though, where sellers charge many, many different prices for the same product. Two classic examples are cars and college education.

When people walk into a car dealership, the salesperson sizes them up and eventually begins negotiating over price. While the dealer doesn’t have complete information about each customer’s willingness to pay, haggling differently with every customer is a lot like perfect price discrimination—the auto dealer is trying to simultaneously learn about the customer’s valuation of the car and arrive at a price as close as possible to that level. That’s why you should think twice when you go to buy a car and the salesman asks you, “How much are you looking to spend on a car?” That’s an invitation for you to give up your consumer surplus.

Likewise, families applying for college financial aid are required to submit complete information about their assets and income along with the student’s assets and income. From this information, the school has an almost perfect understanding of each student’s willingness to pay. This allows schools to produce an individually tailored financial aid plan. But that is another way of saying that they charge a different tuition price to each student, depending on how much they think the student can afford.

application

How Priceline Learned That You Can’t Price Discriminate without Market Power

Priceline is the online travel service known in part for originating the “name your own price” model of online sales. The initial idea was that people would go to Priceline’s site and enter what they were willing to pay for an airplane ticket—for example, $300 for a round-trip from Los Angeles to Boston on April 10th. Priceline would then see if there were any airlines willing to supply the ticket to Priceline for less than that. If so, Priceline would charge the customer’s credit card $300 and issue the ticket, earning the difference as profit.

The idea was that by asking each person what she was willing to pay, Priceline could engage in something like perfect price discrimination and therefore make a lot of money. We can think of its original business model in terms of Figure 10.3. Priceline figured that, with a marginal cost of tickets of $MC$ and travelers’ willingness to pay (demand curve) at $D$, it stood to earn producer surplus approximately equal to the area $A + B$. The stock market liked this model, too: Within three years of starting up its Web site, the company was valued at $13 billion, more than several of the major airlines combined.

There was a serious problem in Priceline’s approach, however. Priceline wanted to price discriminate, but it didn’t really have market power in the travel agency industry. There are thousands of offline travel agencies; several other major online travel firms like Orbitz, Travelocity, and Expedia; and airlines sell a lot of tickets directly from their own Web sites. We know from what we’ve just learned that a company can’t price-discriminate if it doesn’t have market power. Priceline learned this lesson the hard way.

Priceline’s problem was that, because travelers could also get fares at low prices directly from other travel sites, they wouldn’t offer their true willingness to pay from their demand curves. Instead, customers would only offer to buy tickets at a lower price than they could buy them elsewhere.

Priceline’s market demand curve was therefore not the consumer’s demand curve $D$, but rather a curve strictly below the market price of tickets at other sites. In the figure, the outside price occurs at $P_{out}$. So, the actual demand curve facing Priceline was not
D but $D_{act}$ instead. This kind of price discrimination doesn’t make large profits. It left Priceline with a surplus of only $B$, the small area below the actual demand curve and above marginal cost. Indeed, this demand curve left Priceline with less producer surplus than that earned by other travel sites (which were charging prices at or above $P_{out}$).

Realizing this, Priceline eventually deemphasized the “name your own price” business model and expanded into the conventionally priced online travel business. It has so far succeeded—its stock market valuation was back up to over $20 billion in 2011 after falling all the way to $225 million in 2000. It had a tough road back. The moral of the story is, as always: Remember your economics.

10.3 Direct Price Discrimination II: Segmenting/Third-Degree Price Discrimination

**When to Use It** Segmenting/Third-Degree Price Discrimination

1. The firm has market power and can prevent resale.
2. The firm’s customers have different demand curves.
3. The firm can directly identify specific groups of customers with different price sensitivities (but not the demand of every individual customer) before purchase.

Because it’s rare for a firm to have the kind of comprehensive information about customers that it needs to practice perfect price discrimination, a firm can’t generally capture all of the market surplus using price discrimination. But it can still earn more profit than a regular monopoly by using a pricing strategy called **segmenting** (or **third-degree price discrimination**), charging different prices to different groups (segments) of customers based on the identifiable attributes of those groups.¹

¹ While third-degree discrimination sounds like a variant of first-degree discrimination, the truth is that these names were somewhat arbitrarily coined by economist E. H. Chamberlin back in the 1930s.
For this kind of pricing strategy to work, the company must be able to directly identify groups of customers—students, for example—who have systematically different demands than other buyers. This group-level demand identification is typically much easier to determine than figuring out every individual customer’s willingness to pay.

Think about a company that sells a clothing line emblazoned with the logo of a local university. If the company knows that students typically don’t have a lot of money and tend to be bargain hunters while their parents or the faculty are less price-sensitive, the firm will want to charge students a lower price for clothing and parents or faculty a higher price. To do this, the company needs to be able to identify the groups directly. It must be able to tell before the sale which customers are students and which are parents or faculty, as well as prevent parents and faculty from pretending to be students to get the discount. One way the company can do this is to make showing a student ID a condition of the lower price.

As with all forms of price discrimination, however, the company must be able to prevent resale. They can’t sell school sweatshirts at a student discount just to have the students then turn around and sell them to visiting parents or faculty for less than the higher price these groups would be charged. As a practical matter, if such resales became a problem, the company could institute a quota that would limit the number of sweatshirts a student could buy. Limiting resale is critical to price discrimination.

**The Benefits of Segmenting: A Graphical Approach**

If a firm is able to engage in segmenting, how different should the prices be across the groups, and how much does the company stand to gain by price discriminating compared to the standard one-price monopoly strategy?

To answer these questions, let’s consider an example with two consumer groups, the market for entry into the prestigious Ironman 70.3 Cozumel Triathlon. This triathlon is a race that comprises a 1.2-mile swim, a 56-mile bike ride, and a 13.1-mile run. It may seem like a masochistic pursuit, but people pay serious money to enter this race.

There are two kinds of people who want to enter the Ironman Cozumel: people who live in and around Cozumel, and people who fly in from somewhere else. The two groups’ demand curves for entering the race are shown in Figure 10.4. Panel a shows the demand ($D_T$) for the participants traveling to Cozumel for the competition. The travelers mostly come from the United States; have high incomes and expensive triathlon equipment; and will have to pay for a plane ticket, a hotel room, food, and a rental car. They don’t care if the price of their registration for the race is a bit higher, because it’s a small share of the total cost to them. In other words, the demand curve for the traveling participants is fairly inelastic.

Panel b of the figure shows the local group’s demand curve, $D_L$. The local residents’ demand is more price-sensitive because they have many other activities they can pursue if the price of entering the race is too high. Thus, their demand curve is flatter and more elastic.

Preventing resale won’t be a problem for the firm organizing the race as long as it can tell which athletes are from out of town and which are not. This is easy because out-of-town athletes have to pay their entrance fees with some form of identification.
that gives their address, and they have to prove who they are when claiming their bib numbers on race day.

The fundamental economic idea of segmenting is simple. If a firm can directly identify groups that have different demands and charge different prices to each, it can essentially treat each group as a separate market. The firm then sets its profit-maximizing quantity for each one of these “markets” where \( MR = MC \) and sets the corresponding single-price profit-maximizing price according to each market’s demand curve.

Let’s see how the organizers of the Ironman Cozumel competition follow the segmenting strategy. The organizers have identified these two different demand curves and treat each as a separate market. From the demand curve of out-of-town entrants (travelers) \( D_T \), the organizers compute marginal revenue, labeled \( MR_T \) in panel a of Figure 10.4. Then from the point at which \( MR_T \) equals marginal cost \( MC \), the organizers determine the optimal quantity of entries to sell to out-of-towners \( Q_T = 600 \). At that quantity, the entry fee is \( P_T = $220 \). Producer surplus, \( PS_T \), will be relatively large.

(b) Local participants have a relatively elastic demand curve \( D_L \). A greater number of locals will register for the triathlon \( Q_L = 700 \) at a lower price \( P_L = $170/entry \). Producer surplus for locals, \( PS_L \), is relatively small.
That’s all there is to the strategy. As long as a seller can keep people from sneaking into the lower-price group or keep those in the lower-price group from reselling to the higher-price group, it can use segmenting to treat each group like a separate market and set the monopoly price for each market.

A firm following this pricing strategy will not earn as much producer surplus as one using perfect price discrimination (which would allow it to take the entire surplus from the market). However, it will earn more surplus than if it acted like a regular monopoly and charged the same price to everyone, because the strategy gives the firm some ability to charge a higher price to consumers with relatively inelastic demand and lower prices to consumers with relatively elastic demand.

Figure 10.5 shows the total Ironman Cozumel demand and marginal revenue that would face a monopolist forced to set only a single price. As in Chapter 5, we calculate the market demand as the horizontal sum of the participants’ demand curves—in this case, the sum of the traveling and local participants’ demands. This results in a kink in the market demand curve at $240, the demand choke price for local participants. At prices above $240, no locals purchase tickets, so the market demand curve is just the traveling racers’ demand curve.

A single-price monopolist race organizer sets the quantity of entries where its marginal cost equals marginal revenue, and charges the price corresponding to the total market demand curve. This quantity, 1,300 racers, is shown in Figure 10.5, and the corresponding price is $186.67 per entry. Notice how this price falls between the two prices ($170 and $225) that the organizers charge the segments when price-discriminating. Although it might not be obvious from looking at the figure, the producer surplus for the single-price monopolist is considerably smaller than the surplus the monopolist would earn by segmenting the market. (We see that this is indeed the case when we calculate the benefits from segmenting in the next section.)

The Benefits of Segmenting: A Mathematical Approach

To do the same analysis of segmenting using mathematics, we start with the two distinct demand curves for the Ironman Cozumel. The demand curve of the traveling participants is given by $Q_T = 1,700 - 5P_T$, and the locals’ demand curve is $Q_L = 2,400 - 10P_L$. 

\[ Q_T = 1,700 - 5P_T \]
\[ Q_L = 2,400 - 10P_L \]
Note that, in accordance with our story, the locals’ quantity demanded is more sensitive to price than the travelers’ quantity demanded: A $1 increase in the entry fee reduces the number of local entrants by 10, while it only decreases the number of traveling entrants by 5. We assume the marginal cost to the organizer of adding another triathlete to the race is a constant $100, no matter how many entrants there are.

The mathematical analysis of segmenting is done using the same steps as in the graphical analysis above. If the race organizers can identify the separate groups and prevent resale, they can compute the marginal revenue curves for each segment and solve for the monopoly prices separately for each group.

We can follow the methods discussed in Chapter 9 to find the marginal revenue curves from linear demand curves. First, we determine the inverse demand curves by rearranging the demand function to express price in terms of quantity demanded. Doing so gives us the following equations:

For travelers:
\[
Q_T = 1,700 - 5P_T
\]
\[
5P_T = 1,700 - Q_T
\]
\[
P_T = 340 - 0.2Q_T
\]

For locals:
\[
Q_L = 2,400 - 10P_L
\]
\[
10P_L = 2,400 - Q_L
\]
\[
P_L = 240 - 0.1Q_L
\]

Next, we know that the marginal revenue curve will look like the inverse demand curve, but the coefficient on quantity will be twice as large. The marginal revenue curves for the two segments are

For travelers:  
\[MR_T = 340 - 0.4Q_T\]

For locals:  
\[MR_L = 240 - 0.2Q_L\]

The organizers want to sell the quantities at which marginal cost ($100, the same for both groups of triathletes) equals its marginal revenue. Setting each marginal revenue equation above equal to marginal cost tells us the optimal number of entrants from each group:

For travelers:
\[
MR_T = MC \\
340 - 0.4Q_T = 100 \\
240 = 0.4Q_T \\
Q_T = 600
\]

For locals:
\[
MR_L = MC \\
240 - 0.2Q_L = 100 \\
140 = 0.2Q_L \\
Q_L = 700
\]

The last step is to find the entry fees that correspond to these quantities by plugging the quantities back into the inverse demand curve:

For travelers:
\[
P_T = 340 - 0.2Q_T \\
= 340 - 0.2(600) \\
= 340 - 120 \\
= $220
\]

For locals:
\[
P_L = 240 - 0.1Q_L \\
= 240 - 0.1(700) \\
= 240 - 70 \\
= $170
\]

Therefore, in a segmentation strategy, the race organizers sell 600 entries to out-of-towners for $220 each and 700 entries to locals at $170 each.

The total producer surplus the organizers earn is the difference between the price and the marginal cost for each segment times the number of entries sold to that segment. In Figure 10.4, those surpluses are rectangles $PS_T$ for the segment of nonlocal triathletes and $PS_L$ for the local triathletes. Using the results we computed above, we have

For travelers:
\[
PS_T = (220 - 100) \times 600 \\
= 120(600) \\
= $72,000
\]

For locals:
\[
PS_L = (170 - 100) \times 700 \\
= 70(700) \\
= $49,000
\]

for a combined producer surplus of $121,000 to the race organizer.
In our graphical analysis, we contended that the price-discriminating monopolist earns more producer surplus than the single-price monopolist. This makes intuitive sense, because a firm that segments the market can charge higher prices to more price-elastic customers and capture more of their consumer surplus. But how can we show this algebraically?

First, we can see that the marginal cost curve intersects demand at the part of the demand curve below the kink—the portion of the demand curve that is the sum of the local and nonlocal demand:

\[ Q = 1,700 - 5P + 2,400 - 10P = 4,100 - 15P \]

The inverse demand curve at this intersection is then \( P = \frac{4,100}{15} - \frac{Q}{15} \), and the marginal revenue curve has twice the slope, or \( MR = \frac{4,100}{15} - \frac{2Q}{15} \). We set \( MR \) equal to the marginal cost to solve for the optimal number of participants under the single-pricing strategy:

\[
\frac{4,100}{15} - \frac{2Q}{15} = 100 \\
4,100 - 2Q = 1,500 \\
Q = 1,300
\]

Note that 1,300 is exactly the sum of the local and traveling participants under the previous pricing system. Single-price monopolists and those who segment differ in the prices they set, but not always in the quantity they provide. That doesn’t mean the firm would be selling to the same group of individuals, however. The new price will be lower than the segmented price for travelers (inducing more to buy than in the segmented case) and higher than the segmented price for locals (excluding some locals from buying). Just what is the price in this instance? Plug the quantity into the inverse demand curve:

\[
P = \frac{4,100}{15} - \frac{1,300}{15} = \$186.67
\]

Thus, although locals face a slightly higher price, the travelers get a bargain relative to the segmented outcome.

To calculate the producer surplus, we find the area of the rectangle \( A \) in Figure 10.5:

\[
PS = (186.67 - 100) \times 1,300 \\
= 86.67(1,300) = \$112,671
\]

If the monopolist organizers segment the market for triathlon entries, they earn $121,000 in producer surplus; if they must charge a single price, they earn $112,671. Just by segmenting the market, the monopolist organizers can increase their producer surplus by $8,329, or about 7%.

**How Much Should Each Segment Be Charged?**

Because the standard market power pricing rule applies in each segment, it also means that the Lerner index, the basic markup formula we derived in Chapter 9, applies in each market. Recall that this formula relates the price elasticity of demand to the markup of price over marginal cost:

\[
\frac{(P - MC)}{P} = \frac{1}{E^D}
\]
If the firm sells the same good to both segments of the market, the marginal cost of producing for each segment is the same. In this case, the only reason to charge different prices to customers in different segments is because they have different demand elasticities. To see what the Lerner index implies for the ratio of the prices in the two segments (label them 1 and 2), first solve the Lerner index for price in each segment:

\[
\frac{P_1 - MC}{P_1} = -\frac{1}{E_1^D}
\]

\[
P_1 - MC = -\frac{1}{E_1^D} \times P_1
\]

\[
P_1 + \left( \frac{1}{E_1^D} \times P_1 \right) = MC
\]

\[
P_1 \left( 1 + \frac{1}{E_1^D} \right) = MC
\]

\[
P_1 \left( \frac{E_1^D}{E_1^D} + \frac{1}{E_1^D} \right) = MC
\]

\[
P_1 = \left( \frac{E_1^D}{1 + E_1^D} \right) \times MC
\]

Likewise,

\[
P_2 = \left( \frac{E_2^D}{1 + E_2^D} \right) \times MC
\]

Now, we can compute the ratio of these prices:

\[
\frac{P_1}{P_2} = \frac{[E_1^D/(1 + E_1^D)] \times MC}{[E_2^D/(1 + E_2^D)] \times MC}
\]

\[
= \frac{[E_1^D/(1 + E_1^D)]}{[E_2^D/(1 + E_2^D)]}
\]

As the demand in Segment 1 becomes less elastic relative to Segment 2 (i.e., \(E_1^D\) becomes smaller than \(E_2^D\) in absolute value), the ratio \(P_1/P_2\) will rise. That is, the greater the difference in price sensitivities between the segments, the greater should be the ratio in their prices.

Returning to our Ironman Cozumel example, suppose we know that the elasticity of demand for travelers is \(-1.83\) and the elasticity for locals is \(-2.43\). We can immediately determine what the ratio of prices should be by plugging these elasticities into the formula:

\[
\frac{P_1}{P_2} = \frac{-1.83}{-2.43 + 1} = \frac{-1.83}{-0.83} = \frac{2.2}{1.7} = 1.29
\]

In other words, the race organizer should set the price travelers face to be almost 1.3 times (i.e., 30% higher than) the price for locals. This is in fact the ratio between the $220 and $170 optimal entry fees we computed earlier.

\[2\] If you remember the calculation of elasticity from Chapter 2, you can verify these values.
Is it really price discrimination?

We mentioned this before, but it bears repeating: Always be careful about the distinction between price discrimination, when firms charge different prices for the same product, and price differences. It’s often surprisingly hard to tell them apart. Prices can differ across different customer groups if a firm with market power price discriminates, but prices can also differ across the groups if the marginal cost of supplying the groups differs, even in a perfectly competitive market.

For example, a bottle of Coca-Cola, which is basically just carbonated water plus syrup, is often less expensive than a bottle of carbonated water alone. Perhaps this price difference reflects price discrimination because the kinds of people who buy bottled water are less price-sensitive than the people who buy soda. But maybe the cost of bottling fancy carbonated water is greater than the cost of bottling soft drinks (a lot more people buy soda than carbonated water and there might be some economies of scale, for example). You can’t tell just from the prices. The only way to tell the difference between price discrimination and price differences due to costs in competitive markets (without actually being able to observe the firm’s marginal cost) is to find something that changes the price elasticity of demand without changing the cost. Price discrimination implies that a firm with market power sets its price based on the elasticity of demand and the marginal cost of producing. Price in a competitive market depends only on marginal cost. (This is related to the distinction we discussed in Chapter 9 about how firms with market power react differently than competitive firms to rotations in demand.)

10.2 figure it out

You manage a hair salon that has two locations: one in a large city in Ohio with several competing salons, and another in a small city in Pennsylvania with less competition. In Ohio, your customer’s price elasticity of demand is \( -3 \), while for your Pennsylvania customers it is \( -2 \). Assume that the marginal cost of producing a haircut is $30 regardless of location.

a. What are your salon’s optimal markups and prices in each location?

b. Why do they differ?

Solution:

a. The Lerner index provides us with a formula for seeing the relationship between pricing and the price elasticity of demand:

\[
\frac{(P - MC)}{P} = \frac{1}{E_D}
\]

Substituting for marginal cost (\( = $30 \)) and the price elasticity of demand for Ohio customers (\( = -3 \)), we get:

\[
\frac{(P - 30)}{P} = \frac{1}{-3}
\]

\[P = 3(P - 30)\]

\[2P = 90\]

\[P = 45\]

Repeating the same steps for Pennsylvania gives:

\[
\frac{(P - 30)}{P} = \frac{1}{-2}
\]

\[P = 2(P - 30)\]

\[P = 60\]

Customers in Ohio will be charged a price of $45 per haircut, while those in Pennsylvania will be charged a price of $60 per haircut.

b. Because demand is relatively more elastic in Ohio than in Pennsylvania (the absolute value of the price elasticity of demand is greater), customers in Ohio are more price-sensitive. Therefore, they will be charged a lower price.
Ways to Directly Segment Customers

There are many ways firms directly identify customer segments for the purposes of price discrimination. Here are some of the most common ones.

**By Customer Characteristics** Firms sometimes price according to customer characteristics such as age (e.g., senior citizen discounts at the movies or child discounts at a hotel), gender, or whether the customer is a student or local resident. The basic idea remains to identify the more price-sensitive customers and charge them less. Firms need to be careful when pricing based on consumer characteristics in certain countries because in some cases this may be prohibited by laws against discrimination based on age, gender, race, physical disabilities, and so on.

Segmenting can even be based on the user’s species. Doctors and veterinarians sometimes use the same medicines. Drug makers recognize that Grandma’s willingness to pay for the arthritis medication Lodine probably well exceeds someone’s willingness to purchase Lodine for her arthritic dog Rover (and not only because Grandma’s savings are larger than Rover’s collection of buried rawhides). This difference in willingness to pay probably explains why a congressional investigation found that the price of Lodine for humans was almost three times higher than for dogs. Indeed, it determined that manufacturers priced almost every comparable medication significantly higher for people than for animals.3

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**freakonomics**

**Victoria’s Not-So-Secret Price Discrimination**

Sometimes price discrimination can end up being costly not just to consumers, but also to producers. In 1996 Denise Katzman of New York City sued Victoria’s Secret for gender discrimination and asked for millions of dollars in damages. In alleging gender discrimination, Katzman didn’t object to the catalog’s pages of scantily clad women. Rather, she pointed to the promotional coupon on the catalog’s back page.

The problem? While Ms. Katzman’s catalog offered her $10 off an order of $75, an almost identical catalog for a male friend offered $25 off the same amount. Was her catalog out of date? Nope. The folks at Victoria’s Secret were just engaging in a little “naked” price discrimination.

Although the company kept its reasons for the different promotions a secret, we can speculate on why it might employ such price discrimination using our economics reasoning. We know that price discrimination occurs when a company uses its market power to charge higher prices to people who are willing to pay more. In this case, Victoria’s Secret recognized that its practice of sending out catalogs gave it the opportunity to segment its customers and advertise different prices to different types of customers. Women might be willing to purchase $75 of fancy underwear for a price of $65, but men are probably not as willing to shell out that kind of money for underwear for their wives or girlfriends. They might only pay $50 for the same order. Because most people don’t end up reading through their friends’ catalogs, this form of price discrimination could easily go undetected.

Ms. Katzman never did collect her millions in damages, however. Neither did fellow New Yorker Roy Den Hollander who in 2007 brought suit against bars that sponsor Ladies’ Nights, which Hollander termed “invidious.” He lost his suit, and bars everywhere continue to advertise gender-based price discrimination with weekly Ladies’ Nights.

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3 [http://lobby.la.psu.edu/010_Insuring_the_Uninsured/Congressional_Statements/House/H_Thurman_0031600.htm](http://lobby.la.psu.edu/010_Insuring_the_Uninsured/Congressional_Statements/House/H_Thurman_0031600.htm)
Customer characteristics can also apply to firms or other corporate organizations in business-to-business transactions. Academic journals, for example, know that individuals are much more price sensitive to subscription prices than libraries, so the publishers charge significantly more for institutional subscriptions than for individual ones. Elsevier, for example, one of the largest publishers of academic journals, charges individuals $112 for a year’s subscription to the International Journal of Industrial Organization (don’t all rush to order it at once), but the publisher charges libraries $1,720 for the same subscription.

**By Past Purchase Behavior** Consumers reveal a lot about their willingness to pay when they buy other products, and many sellers use that information to segment customers. In industries like auto insurance or direct-broadcast satellite TV, where people don’t like switching companies once they decide on a provider, existing customers tend to be less price-sensitive than potential new customers. As a result, it is common for firms in these industries to give special discounts to new customers, such as reduced premiums during the first policy period or the first three months of a subscription free. These are ways to price discriminate based on whether the customer has bought the product before.

For some other products, the price sensitivity of new customers is lower than that of past purchasers. For example, it is notoriously difficult to convince people to upgrade their software to a new version. When Microsoft releases a new version of Windows, the price of upgrading an older version is typically much lower than buying the new version outright. With this low price, Microsoft is trying to entice the more price-sensitive customers to purchase the new version.

**By Location** Customers living in one area may have a hard time getting to another to take advantage of a lower price, or they might not even have knowledge of the prices in other locations. This often allows sellers to charge different prices in different locations, depending on the price sensitivity of local demand.

**Over Time** One way to price discriminate in certain markets is to take advantage of the different kinds of people who buy a product at different times. When a new generation of computer CPUs first hits the market, for example, the new CPUs usually sell at a substantial premium, sometimes hundreds of dollars more than the last generation’s chips. Yet only a few months later, they are available for a fraction of their original price. Maybe marginal cost fell that much, you say? Perhaps. But how about movies in first-run theaters that cost $10 but then cost only $4 when the same movie runs at a discount movie house several weeks later? Or hardcover books that cost $26.95 while their paperback versions cost only $10.95, when the actual difference in production cost is only about a dollar? These are all cases in which the kinds of people who want the latest, greatest, most current version of a product—PC gamers, big movie fans, and active readers—tend to be less sensitive to price than the folks who enter the market later.

In other cases, demand can become less price-sensitive (more inelastic) over time, and price discrimination will lead to price increases over time. Many goods and services that have initially uncertain quality have this feature. For example, tickets to a new play or musical that hasn’t been reviewed are often relatively inexpensive. But once local reviewers have given the play a “thumbs up,” demand can become much more inelastic and the producers raise the price accordingly.

In either situation, a firm that prices the same good differently in two different time periods applies the basic segmentation rules and uses the standard monopoly pricing rule as it applies to the state of demand in each period.

However, there is one complication in pricing across time that is worth keeping in mind. Technically, pricing across time is only segmenting if the seller directly assigns customers to a given time period. That is, in segmentation strategies, the seller is effectively saying, “You buyers over here, this is your price. You buyers over there, you have a different price.” Buyers are stuck paying the price designated for their group (assuming again as we have throughout this chapter that the seller can prevent resale). With
time-based segmentation, however, if customers are forward-looking, meaning that they consider what the seller might do in the future even as they decide whether to buy today, then the seller is not actually directly segmenting its customers. The seller cannot prevent its customers from changing groups; the buyers choose when to buy. So, for example, if buyers believe that the seller is charging a high price today but will reduce the price in the future, they might consider waiting to purchase, even if they had the type of relatively inelastic demand that the seller was trying to take advantage of with the high current price. In cases like this, the seller needs to consider how the different prices it plans to charge over time will affect the consumer’s decision of when to buy.

For instance, Intel might want to initially price its fast new CPU at an extremely high level to take advantage of a segment of high-horsepower PC gamers with really inelastic demand, while making deep discounts thereafter. But if gamers realize Intel is likely to do this, they might be willing to trade off waiting to purchase the new CPU in exchange for enjoying the deep discount. This potential response will limit Intel’s ability to segment the market in the first place. It could lead to Intel having to charge a lower initial price than it would have otherwise, and perhaps also reduce the discount applied to that price later.

The more forward-looking consumers are, the more segmenting across time actually becomes something known as indirect price discrimination, the pricing strategy we discuss next.

## theory and data

### Segmenting by Location in the European Market for Cars

Car manufacturers like Volkswagen and BMW who do a lot of business in Europe sell the same car in many different countries. The customers in these countries have very different incomes and tastes in cars. Because the automakers in this market likely have some market power, this is an excellent opportunity for segmenting if the automakers can prevent their customers in one country from selling to those in another. Manufacturers could then segment their customers by country, selling the same car at different prices in each country using the price discrimination methods we’ve been discussing. This practice would allow these manufacturers to earn higher profits and more producer surplus than they could by selling their cars at the same price everywhere.

It turns out the auto companies have many options for preventing resale across countries. First, they can print all manuals and documents only in the country’s language. Swedish drivers don’t want manuals in Greek, and vice versa. Second, they can forbid servicing a car in a country other than the one in which it was purchased. No one wants to get towed to Romania when their car experiences problems in Spain. Third, they can punish dealers who sell cars to people from a different country.

Economists Pinelopi Goldberg and Frank Verboven gathered evidence on car prices in Europe to investigate this issue. They found that the price of the same car could vary substantially across countries. For example, in 2003, the price of a VW Golf in Germany was 10% higher than in Portugal and almost 25% more expensive than in Greece.

Goldberg and Verboven concluded that some of the price differences across countries in Europe arose from differences in the taxation of autos, but that much of the price

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Part 3  Markets and Prices

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10.4 Indirect/Second-Degree Price Discrimination

When to Use It  Indirect/Second-Degree Price Discrimination

1. The firm has market power and can prevent resale.
2. The firm’s customers have different demand curves.
3. The firm cannot directly identify which customers have which type of demand before purchase.

We’ve seen how firms with market power can use direct price discrimination to increase their producer surplus above the amount they could earn by charging only a single price. The key is to charge higher prices to customers with relatively inelastic demand and lower prices to those with more elastic demand. However, being able to directly observe a customer’s demand type before purchase (as required with direct price discrimination) is often difficult. A firm might know that its customers have different price sensitivities, but it may not be able to tell to which group any particular customer belongs.

Even without this knowledge, a firm can still earn extra producer surplus through price discrimination by using a pricing strategy called indirect price discrimination, also known as second-degree price discrimination. In this pricing strategy, a firm gives its customers various pricing choices and allows the customers to choose among them. For example, airlines choose ticket rules and prices so that business travelers with inelastic demand pay more, on average, for their tickets than leisure travelers with relatively more elastic demand. At the same time, however, the airline wants to keep business travelers from deciding that tickets meant for them are too expensive and instead buying up cheaper tickets intended for leisure travelers.

Indirect Price Discrimination through Quantity Discounts

The most basic type of indirect price discrimination is the quantity discount, a pricing strategy in which customers who buy larger quantities of a good pay a lower per-unit price. For quantity discounting to work, customers who purchase larger quantities of a product need to have relatively more elastic demands than consumers who buy smaller quantities. If the consumers in the market do not have these elasticity characteristics,
the firm would be trying to find a way to raise prices on the people who buy greater quantities, the opposite of a quantity discount.

To illustrate the idea, let’s say there are two types of customers of the online brokerage house E*TRADE. One type of customer is not very interested in trading stocks. Because of this, these customers don’t have a big incentive to shop across different online trading houses in search of lower commission rates (the fees they pay a brokerage firm to facilitate a trade). Thus, their demands are relatively inelastic with respect to the commission charged. The demand curve for uninterested traders is \( D_u \) in panel a of Figure 10.6. The other type of customer is obsessed with trading stocks. Because these individuals trade many times each day, they are very sensitive to the commission rate. Thus, their demands are relatively elastic with respect to the commission. The demand curve for these obsessed traders is shown as \( D_o \) in panel b. The marginal revenue curves for each group are \( MR_u \) and \( MR_o \) respectively. The marginal cost is the same for both groups.

E*TRADE would like to charge higher commissions to the uninterested traders with an inelastic demand than it charges the obsessed traders with the more elastic demand. This third-degree price discrimination (segmenting) would bring E*TRADE more producer surplus, but the company cannot pursue this strategy because it cannot tell which type of trader each person is when she signs up for an account. What E*TRADE does know, however, is what the demand curves of the two groups look like, even if it can’t identify to which group any given trader belongs. Based on the demand curve \( D_u \), for example, E*TRADE would want to set its standard profit-maximizing quantity and price (commission per trade) for uninterested traders where \( MR_u \) equals \( MC \): For \( Q_u \) trades per month, E*TRADE would charge uninterested traders \( P_u = $30 \) per trade. For obsessed traders, E*TRADE would like to follow the same procedure and charge them a price of \( P_o = $9 \) per trade; at that commission, the obsessed traders would make \( Q_o \) trades per month.

**Figure 10.6  Quantity Discounts at E*TRADE**

![Diagram](image)

(a) The online brokerage company E*TRADE has two types of customers: uninterested traders and obsessed traders. Uninterested traders have a relatively inelastic demand curve \( D_u \). E*TRADE would like to charge uninterested traders the profit-maximizing commission rate \( P_u = $30 \) per trade and sell quantity \( Q_u \) trades per month.

(b) Obsessed traders have a relatively elastic demand curve \( D_o \). E*TRADE would like to charge them the lower commission rate \( P_o = $9 \) per trade. Although E*TRADE cannot directly identify which group any particular trader belongs to, it can set different prices for the two groups using a quantity discount by requiring traders to make at least \( Q_o \) trades per month to get a reduced commission rate.
If E*TRADE could segment the market, it would charge each group $P_u$ and $P_o$ per trade, and at those prices, each group would make $Q_u$ and $Q_o$ trades per month. However, E*TRADE can’t directly assign different commission rates to different traders. And it can’t just offer new customers a choice of whether to pay $30 or $9 commissions no matter how much or little they trade because every customer would choose the cheaper option. What can E*TRADE do to take as much of each trader’s surplus for itself? Rather than offer all customers a $9 per trade commission, E*TRADE can tie that commission rate to a requirement that the customer make at least $Q_o$ trades per month. For customers who do not want to make at least $Q_o$ trades per month, E*TRADE can offer a $30 per trade commission plan that allows them to trade as little or much as they’d like in one month.

The idea behind this strategy is that an obsessed trader, who demands a high quantity of trades and has a more elastic demand, will choose the $9 plan that requires a purchase of at least $Q_o$ trades each month. An uninterested trader, on the other hand, will choose the $30 per trade plan. In other words, traders from both groups will sort themselves into the price and quantity combinations designed for them, even though E*TRADE cannot directly identify either type. This is the essence of any kind of successful indirect price discrimination strategy: The firm must set its prices so that a customer doesn’t try to fake her demand type and buy the package meant for another customer type. We discuss this requirement for the successful implementation of all indirect price discrimination (including quantity discounts) next.

**Incentive Compatibility** The plan to charge uninterested traders a higher commission than obsessed traders is logical, but for such a plan to work well and allow E*TRADE to reap the maximum producer surplus available to it, E*TRADE needs to make sure that the uninterested trader won’t want to switch from her $30/Q_o$ package to the $9/Q_u$ package designed for the obsessed traders. That is, the $9 commission deal can’t be so good that the uninterested trader will make extra trades just to obtain the lower price. E*TRADE has to be sure that the uninterested trader’s consumer surplus is bigger with the $30 per trade package than with the $9 package that requires a purchase of at least $Q_o$ trades. The offers need to be internally consistent so that each type of buyer actually chooses the offer designed for it.

Economists have a term for this type of internal consistency: **incentive compatibility**. In this example, the two packages are incentive compatible if:

1. An uninterested trader prefers the $30 package over the $9 package (and she will make this choice if the $30 package gives her greater consumer surplus than the $9 package).
2. An obsessed trader prefers the $9 package because it offers her more consumer surplus than the $30 package.

Let’s see whether this set of offers is incentive compatible. First, we need to show that the uninterested trader’s consumer surplus from trades at $30 each is greater than her surplus from making $Q_o$ trades at $9 each. Finding the consumer surplus from the first offer is familiar territory. As shown in Figure 10.7, at a price of $30 per trade, an uninterested trader makes quantity $Q_o$ trades, and the consumer surplus is the area under the uninterested trader’s demand curve and above the $30 price. This is triangle $A$ in panel a.

Finding the uninterested trader’s consumer surplus for the $9 package offer is a bit trickier. The first thing we need to do is put the $9 package’s price and quantity combination in the diagram showing the demand for trades of an uninterested trader. Call this point $X$, as shown in panel a. Notice that point $X$ lies above the uninterested trader’s demand curve. That means if an uninterested trader were to make trade number $Q_o$ (at a commission of $9$), she would actually lose consumer surplus by doing so. At a price of $9$, an uninterested trader really only wishes to purchase $Q_{max}$ trades, the quantity demanded at that price.

The fact that $Q_{max}$ is less than $Q_o$ implies that the uninterested trader’s willingness to pay for the trades between $Q_{max}$ and $Q_o$ is lower than the $9 she would have to pay.
for them. In fact, all trades for which her demand curve (which indicates her willingness to pay) lies below $9 will result in a loss of consumer surplus. In panel a, these surplus-destroying trades are those between $Q_{max}$ and $Q_o$, and the total consumer surplus lost is the area labeled $L$. (The demand curve just runs along the horizontal axis once it hits the axis, because willingness to pay for higher quantities is zero.) That area is the downside for an uninterested trader accepting the lower-commission offer. There is an upside, however. The first $Q_{max}$ trades she conducts create consumer surplus, area $A$ in the figure. This consumer surplus is quite a bit larger than her surplus under the $30 per trade offer (area $A$) because the price is so much lower. The net consumer surplus an uninterested trader gets from taking the $9 package offer is therefore area $A + area B – area L$.

Comparing the uninterested trader’s consumer surpluses from the two offers, we can now see that she will choose to pay $30 per trade if area $B$ is greater than area $L$.

(b) Under the pricing policy for uninterested traders, obsessed traders would have to pay both a higher price ($P_u = $30 > $P_u = $9) and make fewer trades per month ($Q_o > Q_u$). Therefore, the quantity discount is incentive-compatible for these traders.
We know that at a commission rate of $9 per trade, an obsessed trader earns consumer surplus on every trade up to $Q_0$; she is happy to trade that much at that price. Taking the $30 offer would require her to make a smaller quantity of trades than $Q_0$ at a higher price per unit. Having to consume a smaller quantity even holding the price fixed at $9 per trade would make an obsessed trader worse off, because it would eliminate surplus-creating trades she would have made otherwise at that price. Even worse, however, would be that the trader would have to pay $30 instead of $9 for each of the trades she did make. Both the quantity restriction and the increase in price reduce the obsessed trader’s consumer surplus. Thus, the $9 package offer is better for obsessed traders.

We saw that an uninterested trader also faces a higher price and lower quantity if she takes the $30 per trade offer instead of the $9 package. So, why isn’t an uninterested trader automatically worse off by taking the $30 offer as is an obsessed trader? The reason is that if an uninterested trader faced a price of $9 per trade but got to choose how many trades she made, she would never choose to make $Q_0$ trades. She would only choose to make $Q_{\max}$, the quantity of trades demanded at a price of $9 per trade. Any trades between $Q_{\max}$ and $Q_0$ destroy consumer surplus for an uninterested trader because the price is higher than her willingness to pay. It is the potential consumer surplus-destroying trades tied to the $9 package that make it likely that an uninterested trader would prefer the $30 offer.

### 10.3 figure it out

Suppose you are a pricing analyst for MegaDat Corporation, a firm that recently developed a new software program for data analysis. You have two types of clients who use your product. Type A’s inverse demand for your software is $P = 120 - 10Q$, where $Q$ represents users and $P$ is in dollars per user. Type B’s inverse demand is $P = 60 - 2Q$. Assume that your firm faces a constant marginal cost of $20 per user to install and set up this software.

**a.** If you can tell which type of buyer is buying the product before a purchase is made, what prices will you charge each type?

**b.** Suppose instead that you cannot tell which type of buyer the client is until after the purchase. Suggest a possible way to use quantity discounts to have buyers self-select into the pricing scheme set up for them.

**c.** Determine whether the pricing scheme you determined in part (b) is incentive-compatible.

#### Solution:

**a.** To maximize profit, set $MR = MC$ for each type. Therefore, we first need to solve for the marginal revenue curves for each type. Because we have linear inverse demand curves, we know that the $MR$ curves will have the same vertical intercept but twice the slope. This means that $MR = 120 - 20Q$ for Type A buyers and $MR = 60 - 4Q$ for Type B buyers. Now set $MR = MC$ to find the profit-maximizing quantity for each type:

For Type A:

$120 - 20Q_A = 20$

$20Q_A = 100$

$Q_A = 5$

For Type B:

$60 - 4Q_B = 20$

$4Q_B = 40$

$Q_B = 10$

At these quantities, the prices will be

For Type A:

$P_A = 120 - 10Q_A$

$= 120 - 10(5)$

$= 70$

For Type B:

$P_B = 60 - 2Q_B$

$= 60 - 2(10)$

$= 40$

**b.** The firm could charge $70 per user for a package where the buyer can purchase any quantity she wishes and a price of $40 for any buyer willing to purchase 10 or more units.

**c.** This plan is incentive-compatible for Type B users. They are willing to continue to purchase $Q = 10$ at a price of $40 each.

For a Type A consumer, we need to consider the amount of consumer surplus she receives under each scheme. We can do this with the help of a diagram showing the Type A demand curve and the two prices, $70$ and $40$. 
Indirect Price Discrimination through Versioning

Airline tickets are a classic example of what we call **versioning**—offering a range of products that are all varieties of the same core product. Airlines have a group of business travel customers who are not very sensitive to prices and a group of leisure travelers who are highly sensitive to price. Airlines want to charge different prices to the two passenger groups, but they can’t tell who is flying on business when a customer buys a ticket. So, the airlines instead offer different versions of the product (tickets on a given flight) available at different prices. The cheaper version, with many restrictions, is intended for leisure travelers who buy generally well in advance of the travel date, stay over a Saturday night, and book a round-trip flight. The more expensive version has fewer restrictions and is intended

\[
P = 120 - 10Q \\
40 = 120 - 10Q \\
10Q = 80 \\
Q = 8 \\
\text{Area } C = \frac{1}{2} \times \text{base} \times \text{height} \\
= (0.5)(8 - 5)(70 - 40) \\
= (0.5)(3)(30) \\
= 45 \\
\]

Therefore, area \( B + \text{area } C = 150 + 45 = 195 \).

To calculate area \( L \), we need to be able to determine the height of the triangle. To do so, we need the price at which a Type A buyer would be willing to purchase \( Q = 10 \) units:

\[
P = 120 - 10Q \\
= 120 - 10(10) \\
= 120 - 100 \\
= $20 \\
\text{Area } L = \frac{1}{2} \times \text{base} \times \text{height} \\
= (0.5)(10 - 8)(40 - 20) \\
= (0.5)(2)(20) \\
= $20 \\
\]

So, we know that area \( B + \text{area } C = 150 + 45 = 195 \) and area \( L = 20 \).

Because area \( A + \text{area } B > \text{area } L \), the $40 10-unit pricing scheme is not incentive-compatible for Type A buyers. These buyers will want to receive the quantity discount and will purchase 10 units at a price of $40 each. Thus, this pricing scheme would not be successful at making the buyers self-select into the pricing scheme established for their types.

At a price of $70, a Type A buyer would choose to purchase 5 units. Consumer surplus would equal area \( A \), the area below the demand curve but above price.

If a Type A buyer were to opt to purchase the other package (10 units at a price of $40 each), her consumer surplus would be the area above the price and below demand (areas \( A + B + C \)), but she would also lose consumer surplus because she would be buying units that she values less than the price of $40. This would be area \( L \) in the diagram.

Thus, opting for the quantity discount would change the Type A buyer’s consumer surplus by area \( B + \text{area } C - \text{area } L \). The $40 10-unit package would be incentive-compatible only if area \( L > \text{area } B + \text{area } C \). Let’s calculate those values:

\[
\text{Area } B = \text{base} \times \text{height} \\
= (5)(70 - 40) \\
= (5)(30) \\
= $150
\]

To calculate area \( C \), we need to determine the base of the triangle. This means that we need to know the quantity at which the Type A buyer’s willingness to pay is exactly $40:

\[
P = 120 - 10Q \\
40 = 120 - 10Q \\
10Q = 80 \\
Q = 8 \\
\text{Area } C = \frac{1}{2} \times \text{base} \times \text{height} \\
= (0.5)(8 - 5)(70 - 40) \\
= (0.5)(3)(30) \\
= $45 \\
\]

To calculate area \( L \), we need to be able to determine the height of the triangle. To do so, we need the price at which a Type A buyer would be willing to purchase \( Q = 10 \) units:

\[
P = 120 - 10Q \\
= 120 - 10(10) \\
= 120 - 100 \\
= $20 \\
\text{Area } L = \frac{1}{2} \times \text{base} \times \text{height} \\
= (0.5)(10 - 8)(40 - 20) \\
= (0.5)(2)(20) \\
= $20 \\
\]

So, we know that area \( B + \text{area } C = 150 + 45 = 195 \) and area \( L = 20 \).

Because area \( A + \text{area } B > \text{area } L \), the $40 10-unit pricing scheme is not incentive-compatible for Type A buyers. These buyers will want to receive the quantity discount and will purchase 10 units at a price of $40 each. Thus, this pricing scheme would not be successful at making the buyers self-select into the pricing scheme established for their types.
Part 3  Markets and Prices

for business travelers who generally don’t like spending a weekend away from home, often need to buy their tickets at the last minute, and may choose to purchase a one-way flight for each segment to provide them with added flexibility. By offering two versions of tickets for a given flight, the airline attempts to make the two types of customers sort themselves (and by doing so, the airline captures more producer surplus).

For this scheme to work, the airlines need to make sure the prices of each version are incentive compatible. If the airline sets the prices for each group based on the markup formula it would use with direct price discrimination, the restricted-travel version might be too cheap relative to the ticket with fewer restrictions. In this case, business travelers might actually bite the bullet and start planning trips earlier or stay at their destination over the weekend. In some cases, business travelers might try to skirt the rules altogether. For example, it’s possible to avoid the Saturday stay requirement by buying what is known as “back-to-back” tickets. For example, a business traveler wishing to fly from Philadelphia to Orlando and back for a Wednesday meeting might buy one Philadelphia-Orlando round-trip with a departure on Wednesday morning and a return on Sunday, and an Orlando-Philadelphia round-trip with a Wednesday evening departure and a Sunday return. The traveler would only use the first leg of each trip. As you might expect, this kind of behavior is intensely hated by the airlines, which try to forbid it in every way they can, but, basically, it’s just the market’s normal response to indirect price discrimination.

**Versioning and Price-Cost Margins**  With versioning, the different versions’ marginal costs do not need to be the same. All that is necessary for versioning to work is for the markup of price over marginal cost to be bigger for the versions bought by customers with less elastic demand.

Consider the example of an automaker like Toyota, which sells a lot of midsize sedans. Some of Toyota’s buyers in this segment will not be very price-sensitive. Maybe they are status-conscious, or just have a particular taste for cars with many fancy features. Others will be more price-sensitive. If Toyota could tell which type of customer was which when they walked through the door, Toyota could just use direct price discrimination and charge different prices according to the strategy we discussed in Section 10.3. In reality, however, it’s not always easy to tell what type of customer comes through the door at any particular time. So, Toyota uses indirect price discrimination and designs two different versions of the car that it can sell at different markups, hoping to induce buyers to segment themselves based on their sensitivity to price and tastes for features.

For example, Toyota makes the Camry, one of the highest-selling cars in the world. It sells, nicely equipped, for about $25,000 in the United States. But Toyota also makes the Lexus ES 350, which is built on the same platform and in the same plant as the Camry. It is similar in many ways to the Camry but is more luxurious. Think of the ES 350 as being a Camry but with a sun roof, dual-zone climate control, a GPS navigation system, xenon headlights, and a premium stereo system. The ES 350 sells for around $38,000.

While a sunroof, xenon headlights, and all those extra options raise Toyota’s marginal cost of producing an ES 350, it’s unlikely that this increase in marginal cost would amount to $13,000 per car. Toyota charges more than the cost difference because the different versions split its customers into groups based on their price sensitivities. The Lexus group has less elastic demand, so Toyota’s markup over marginal cost can be higher, just like the Saturday-night stay splits an airline’s customers into leisure and business travelers.

To be incentive compatible, Toyota can’t make the deal for the cheap version so good that it convinces the luxury customers to purchase Camrys instead. Quantitatively, think of it the following way: Suppose there are just two types of customers whose willingness to pay for each car is listed in Table 10.1.

<table>
<thead>
<tr>
<th>Table 10.1</th>
<th>Consumer Valuations for Camrys and ES 350s</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Toyota Camry</strong></td>
<td><strong>Lexus ES 350</strong></td>
</tr>
<tr>
<td>Budget consumer</td>
<td>$27,000</td>
</tr>
<tr>
<td>Luxury consumer</td>
<td>$28,000</td>
</tr>
</tbody>
</table>

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Notice that both consumers believe the Lexus is worth more than the Camry. It’s not that Toyota has made a version that one group likes and the other doesn’t. The budget consumers value a Lexus more than a Toyota, but not very much more: $30,000 versus $27,000. The luxury consumers, however, value the ES 350 a lot more than the Camry: $42,000 versus $28,000.

If Toyota prices the Camry at $25,000 and the Lexus ES 350 at $38,000, the budget consumers get $2,000 of consumer surplus from buying the Camry and $8,000 from buying the Lexus (it costs more than they value it), so they will buy the Camry. The luxury consumers get $3,000 of surplus from buying the Camry and $4,000 from the Lexus, so they go with the Lexus. Each group chooses the version designed to take advantage of the nature of their demand curves. That means these prices are incentive compatible.

What would happen if Toyota priced the Lexus at $40,000 rather than $38,000? The budget consumers would still buy the Camry. Now, however, the status consumers would get more consumer surplus from buying the Camry ($3,000) than from buying the Lexus ($2,000), so they would also decide to buy the Camry. That $2,000 price increase for the Lexus would cause Toyota to lose $13,000 (losing a sale of a $38,000 Lexus at the old price for a $25,000 Camry instead) for each luxury consumer. (Or worse: The luxury consumers might go buy another automaker’s luxury car.) By charging the group with the less elastic demand too high a price, Toyota would not be setting incentive-compatible prices and its attempt at indirect price discrimination would fail.

One detail that is important to note is that it is not the mere existence of customers with inelastic demand that allows Toyota (or any other firm) to indirectly price-discriminate with versioning. What is required is that differences exist in demand elasticities across customer groups. If different consumer groups had the same price elasticities of demand, even if relatively inelastic, then designing versions specifically for each group will not help a firm price discriminate. Automakers offer cars with different paint colors, for example, but there is rarely price discrimination based on paint color because the price sensitivities of people who like blue cars and silver cars are no different.

There is virtually no limit to the kinds of versioning a company can implement to get its customers to self-select into groups based on their price sensitivities. Now that you understand this kind of price discrimination, you will start to see it everywhere you look. Some firms offer “enhanced” features, such as the way Intuit does with its TurboTax software. It has a bare-bones version that is actually free online, versions with special Q&A features, and a small business application package that includes the ability to handle more complex structures like partnerships. The marginal cost difference between editions is trivial, but by offering “bells and whistles” versions, Intuit is able to get the less price-sensitive business customers to pay more.

**Indirect Price Discrimination through Coupons**

Coupons are also a form of indirect price discrimination. Retailers would like to charge shoppers who have less elastic demands more for products while setting a lower price for consumers who are more sensitive to price. Again, however, they have no way of directly identifying and separating these different groups when they buy, so they have to get the groups to do it themselves. Coupons are the device they use to do so.

The key to the way coupons work is that the trouble of using coupons—searching for the right site or deal online, combing through junk mail, or searching through newspaper inserts—is more likely to be borne by consumers who have more elastic demand. Because both the willingness to do the work clipping the coupons and the willingness to shop around for cheaper groceries are determined by the consumers’ perceived value of time, coupon clipping and the price elasticity of demand are likely to be correlated. That way, the people who actually end up getting a price discount from a coupon are those consumers with more elastic demand—exactly the group to whom the retailers would like to offer lower prices. The shoppers who are less sensitive to price end up paying the higher, undiscounted price.
That’s why coupons usually aren’t right next to (or especially already attached to) the items to which they apply. If they were, it would be easy for even the shoppers with less elastic demand to use them, and everyone would receive the discount. The fact that firms require consumers to expend a little effort to use a coupon is not coincidence; it is exactly the point. Mail-in rebates work on the same principle: Only those consumers willing to go through the trouble of filling out the form and sending it in—presumably the most price-sensitive ones—will receive the discount.¹

10.5 Bundling

Another indirect price discrimination strategy that firms with market power can use to increase their producer surplus over the standard monopoly pricing surplus is called bundling. This strategy involves putting together two or more products that a firm produces and selling them as a single package with its own price.

When you subscribe to cable or satellite television, for example, you are buying a bundled good. You pay a single monthly fee for service, and the cable or satellite company delivers a number of networks together. You don’t pick and choose every channel individually. For your $45 per month, you get, say, 90 channels rather than paying $6 per month for ESPN, $4 a month for MTV, and so on.

Sometimes, things can be bundled just because people really prefer buying things together. Think about a pair of basketball shoes. Although shoemakers could sell shoes individually, there really isn’t much demand for single shoes or for mixing a Nike basketball shoe for the left foot with an Under Armour shoe for the right. People want to buy both shoes together. This sort of bundling, which occurs because the goods are strong complements to one another (i.e., one good raises the marginal utility of the other), is not a price discrimination strategy. Nike and Under Armour would bundle their left and right shoes together even if they operated in a perfectly competitive market.

In this chapter, we’re interested in ways that companies can use bundling as a way to price discriminate. To explain how bundling can be a strategic pricing decision, it is vital that we first clear up an extremely common misconception. Bundling will generally not allow a company with market power in one product to leverage its market power into a second product. To illustrate what we mean, let’s look at a specific example.

Take a cable company providing TV channels to your home. To make it easy, let’s say there are only two cable networks: ESPN and the soap opera network SOAPnet (ESPN is among the most watched cable networks, and SOAPnet is not). Why would the cable company force you to buy both as a bundle for some price rather than just sell them separately?

At first glance, people tend to think it’s a way for the cable company to leverage market power/high demand for ESPN to force people to pay more for the lesser product (SOAPnet). But this “forcing it down their throat” argument usually does not make sense. To see why, suppose there are two customers (Jack and Dakota) in the market.

¹ That said, there is occasionally a coupon right next to (or even attached to) an item. In this case, the point of the coupon is not to price discriminate as much as it is to advertise. It’s essentially a little sign that says, “Buy me . . . I’m cheaper than usual.”
Both like ESPN a lot and SOAPnet less, as reflected in Table 10.2. Jack values ESPN at $9 per month and Dakota values it at $10 per month. Jack values SOAPnet at $1 per month, while Dakota values it at $1.50. For simplicity, let’s assume the marginal cost of supplying the networks is zero. Does the cable company raise its producer surplus by bundling the prized ESPN with SOAPnet? If it sells the channels separately, it would have to price each channel at the lower of the two customers’ valuations for each channel ($9 for ESPN and $1.00 for SOAPnet). Otherwise, the company would sell to only the one customer and would lose the revenue from the other.\(^5\) Thus, it sells ESPN for $9 per month and SOAPnet for $1 per month, earning a total surplus of $20 per month \((2 \times 9) + (2 \times 1)\) from selling the channels separately.

Now suppose the cable company sells the channels as a bundle. The combined value the customers put on the bundle ($10.00 per month for Jack and $11.50 for Dakota) means the company will again set the price at the lower valuation so it won’t lose half of the market. It therefore prices the bundle at $10 and sells it to both customers. This yields a surplus of \((2 \times 10)\), or $20 per month, the same amount it earned selling the networks separately. Bundling has not raised the firm’s surplus.

Furthermore, if the company combines ESPN with something customers don’t actually want at all (say, e.g., that the valuation on SOAPnet was zero or even negative), then the amount that customers would be willing to pay for that network plus ESPN would be that much lower. As a general matter, then, a company can’t make extra money by attaching a highly desired product to an undesired one.

How should a firm bundle products to make more producer surplus? Suppose that, instead of the valuations being what they are in Table 10.2, the two valuations for SOAPnet are switched. Both customers value ESPN far more, but now Jack has a higher valuation for SOAPnet ($1.50 per month) than does Dakota ($1.00). The key thing that has changed, as will become clear in a minute, is that \textit{the willingness to pay for the two goods is now negatively correlated across the consumers}. This means that one of the customers has a higher willingness to pay for one channel than the other customer, but a lower willingness to pay for the other channel. In our example, Jack has lower willingness to pay for ESPN than Dakota but greater demand for SOAPnet, as shown in Table 10.3.

With this change, the firm receives more producer surplus using the bundling strategy. If the cable company sells the channels separately, the calculation is the same as before: ESPN for $9 per month, SOAPnet for $1, and earns a total of $20 of surplus per month. If the firm bundles the channels, however, it can sell the package to both customers for $10.50 per month. This earns the company \((2 \times 10.50)\) or $21 of producer surplus per month, more than the $20 per month from selling the channels separately.

The reason why bundling works in the second scenario is the negative correlation between the two customers’ willingness to pay, which occurs because Dakota values one part of the bundle (ESPN) more than Jack, while Jack values SOAPnet more than Dakota. If the cable company wants to sell to the entire market, it can only set a price equal to the smaller of the two customers’ willingness to pay, whether pricing separately or as a bundle. In the first example with positively correlated demand (when Dakota had a higher willingness to pay for both channels), the

\(^5\) In reality, most network owners like Disney, which owns ESPN and SOAPnet, do not own the cable company, so they actually bundle the channels they sell to the cable company that then passes along that bundle to you. The point is the same, however.
lower of the customers’ valuations for the bundle ($10 per subscriber for Jack) is smaller by $1.50 than the larger valuation ($11.50 per month for Dakota) because it reflects Jack's lower valuations for both channels. Therefore, if the cable company wants to sell the channels as a bundle, it must offer Dakota a discount that embodies the fact that Jack has a lower willingness to pay for both channels. As a result, the cable company does no better than having sold the channels separately.

With a negative correlation of demands across customers, there is less variation (only $0.50) in each customer’s willingness to pay for the bundle: $10.50 per month for Jack and $11.00 per month for Dakota. This reduced variation means the cable company doesn’t need to give as large a discount to Dakota to sell to both customers. Bundling has reduced the difference in total willingness to pay across the customers. What’s important is that the smaller of the two combined valuations is larger when the channel demands are negatively correlated. Jack will pay $10.50 instead of only $10, which allows the company to raise its price. In this way, bundling allows sellers to “smooth out” variations in customers’ demands, raises the prices sellers can charge for their bundled products, and increases the amount of surplus they can extract.

**Mixed Bundling**

The previous example shows why a firm might choose to sell two products as a bundle instead of separately. Sometimes, however, firms simultaneously offer the products separately and as a bundle and then let the consumer choose which to buy. This indirect pricing strategy is called mixed bundling. The Extra Value Meals at McDonald’s include a sandwich, fries, and a drink at one price. McDonald’s also offers these three things individually. This is where mixed bundling acts as a form of indirect price discrimination because the firm offers different choices and lets customers sort themselves in ways that increase producer surplus.

Mixed bundling is a lot like the bundling strategy we’ve just discussed (offering only the bundle is often called pure bundling). It is useful in the same type of situations, but is better than pure bundling when the marginal cost of producing some of the components is high enough that it makes sense to let some customers opt out of buying the entire bundle.

Returning to our cable network example, let’s suppose there are four customers and that they value the networks according to Table 10.4. The willingness to pay is negatively correlated across the networks, so we know bundling can work as a pricing strategy.

Now suppose instead of marginal costs being zero, the marginal cost of supplying ESPN is $6.00 per month and SOAPnet is $1.00 per month. Therefore, the marginal cost of producing the bundled package is $7.00. If the cable company sells the bundle for $12.15 (the minimum valuation of the bundle across the customers), it will sell the bundle to all four customers. Subtracting costs, this will net a per-customer producer surplus of $5.15 per month for a total of (4 × $5.15), or $20.60.

But look more closely at Penny and Sheldon. Their relative values for the two channels are extreme. Penny really values ESPN and barely values SOAPnet, while the opposite is true for Sheldon. And crucially, the value they put on one of these channels is below the marginal cost of supplying it: SOAPnet for Penny and ESPN for Sheldon. As we will see, in these cases it makes sense for the cable company to try to split these customers off from the bundle, because it does not want to supply channels to customers who value them at less than the cost of providing them.

<table>
<thead>
<tr>
<th>Table 10.4</th>
<th>Negatively Correlated Valuations When the Marginal Cost Exceeds the Valuation for Some Customers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ESPN (MC = $6)</td>
</tr>
<tr>
<td>Penny</td>
<td>$12.00</td>
</tr>
<tr>
<td>Leonard</td>
<td>$11.00</td>
</tr>
<tr>
<td>Raj</td>
<td>$9.00</td>
</tr>
<tr>
<td>Sheldon</td>
<td>$5.00</td>
</tr>
</tbody>
</table>

**mixed bundling**
A type of bundling in which the firm simultaneously offers consumers the choice of buying two or more products separately or as a bundle.

**pure bundling**
A type of bundling in which the firm offers the products only as a bundle.
Figuring out the right mixed bundling strategy is slightly complicated because of incentive compatibility, so we’ll take it one step at a time. Given the issues we just discussed, the cable company would like to end up selling the bundle to Leonard and Raj, only ESPN to Penny, and only SOAPnet to Sheldon. Because both Leonard and Raj value the bundle at $12.15 per month, that’s a reasonable starting point for thinking about the price of the bundle. If this is the price of the bundle, however, the company can’t charge Sheldon his full $7.75 valuation for SOAPnet. If it tried to, Sheldon would choose the bundle instead because it would give him 60 cents more consumer surplus ($12.75 – $12.15) than if he bought only SOAPnet (consumer surplus of zero if priced at $7.75). A price of $7.75 for SOAPnet is therefore not incentive compatible. To set an incentive-compatible price for SOAPnet, the cable company has to leave Sheldon with at least 60 cents of consumer surplus per month. Thus, the incentive-compatible price for the purchase of SOAPnet alone would be $7.75 – $0.60, or $7.15 per month. And because Leonard and Raj value SOAPnet at less than $7.15, both will buy the bundle rather than take the SOAPnet-only option, so incentive compatibility holds in the other direction, too.

We can do the same type of calculations with ESPN and Penny. The cable company can’t charge $12.00 for ESPN alone, because Penny would opt for the bundle to get 35 cents ($12.50 – $12.15) of consumer surplus rather than zero from buying ESPN at $12.00. So, the company has to leave Penny with at least 35 cents of surplus from buying just ESPN. The highest price that will achieve this is $12.00 – $0.35, or $11.65. Again, offering this option won’t move Leonard and Raj away from the bundle, because both value ESPN at less than $11.65.

So with those three prices—ESPN alone for $11.65, SOAPnet alone for $7.15, and the bundle for $12.15—the cable company will sell two bundles (to Leonard and Raj) to earn a producer surplus (subtracting out the marginal costs) of $5.15 per month for each bundle. Additionally, it will sell ESPN alone to Penny to earn a surplus of $11.65 – $6.00 = $5.65 and SOAPnet alone to Sheldon for a surplus of $7.15 – $1.00 = $6.15. The total monthly producer surplus from using mixed bundling is therefore $(2 \times $5.15) + $5.65 + $6.15 = $22.10. That is more than the $20.60 per month the cable company would make by using pure bundling.

Producer surplus has increased because the cable company has saved itself the trouble of delivering a product to a customer who values it at less than it costs to produce.

Fit Club, Inc. is a health club that offers two types of equipment: weight machines and a swimming pool. There are currently three customers (Abe, Betty, and Chris), whose willingness to pay for using each type of equipment per month is listed in the table below:

<table>
<thead>
<tr>
<th>Willingness to Pay (per month)</th>
<th>WEIGHT MACHINES</th>
<th>INDOOR POOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abe</td>
<td>$60</td>
<td>$50</td>
</tr>
<tr>
<td>Betty</td>
<td>$50</td>
<td>$125</td>
</tr>
<tr>
<td>Chris</td>
<td>$25</td>
<td>$140</td>
</tr>
</tbody>
</table>
The weight room and the swimming pool each have a constant marginal cost of $20 per month. In the case of the pool, the marginal cost is the price of the water and chemicals used, while the marginal cost of the weight machines is the cost of cleaning and maintaining them. Each customer is considering monthly access to each type of equipment, and the firm has to decide what type of membership package to offer the customers.

a. What price will the firm charge for each product if it wishes to sell a health club membership to all three customers? What is the firm’s producer surplus if it sells separate access to the weight room and the pool room at these prices?

b. What price will the firm charge for a bundle of access to both the weight room and the swimming pool if it wishes to sell the bundle to all three customers? How much producer surplus will Fit Club, Inc. earn in this case?

c. Suppose the firm is considering offering its customers a choice to either purchase access to the weight room and the swimming pool separately at a price of $60 for the weight machine and $140 for the pool, or to purchase a bundle at a price of $175. Which option will each customer choose? How much producer surplus will Fit Club, Inc. earn in this situation?

Solution:

a. To sell access to the weight machines to all three customers, the health club must charge a price no greater than $25, the lowest willingness to pay of the customers (Chris). For the same reason, the price for the pool will be $50.

At these prices, the firm’s producer surplus for its sales of access to the weight machines will be

Producer surplus for weight machine = (Price − marginal cost) × quantity

= ($25 − $20) × 3

= $15

For access to the pool, producer surplus will be

Producer surplus for the pool = ($50 − $20) × 3

= $90

Total producer surplus will be $15 + $90 = $105.

b. To determine the price of the bundle, we need to calculate each buyer’s willingness to pay for the bundle. This is done simply by summing the customers’ willingness to pay for each product as shown in the table below:

<table>
<thead>
<tr>
<th></th>
<th>WEIGHT MACHINES</th>
<th>INDOOR POOL</th>
<th>BUNDLE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Abe</strong></td>
<td>$60</td>
<td>$50</td>
<td>$60 + $50 = $110</td>
</tr>
<tr>
<td><strong>Betty</strong></td>
<td>$50</td>
<td>$125</td>
<td>$50 + $125 = $175</td>
</tr>
<tr>
<td><strong>Chris</strong></td>
<td>$25</td>
<td>$140</td>
<td>$25 + $140 = $165</td>
</tr>
</tbody>
</table>

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11/5/12   4:01 PM
So, the maximum price the health club can charge for its bundle (and still sell to all three buyers) is $110. It will sell 3 bundles at this price. Therefore, its producer surplus will be

Producer surplus for bundle = (price – marginal cost) \times quantity
= ($110 – $40) \times 3
= ($70)(3) = $210

c. We need to compare each buyer’s willingness to pay to the prices set for purchasing access to each room separately and the price of the bundle.

Abe will only purchase a weight machine membership. His willingness to pay for the pool is below the price of $140. The same is true for the bundle, which he values only at $110. Therefore, the health club will only sell Abe access to the weight machines.

Betty will not be willing to buy either membership separately, because her willingness to pay for each is below the set price. However, Betty’s willingness to pay for the bundle ($175) is exactly equal to the price, so she will purchase the bundle.

Chris will only purchase access to the indoor pool. His willingness to pay for weight machines is only $25, far below the price of $60. Likewise, Chris is willing to pay at most $165 for the bundle. Thus, the health club will only be able to sell pool access to Chris.

Total producer surplus will therefore be:

Producer surplus for weight machines = (price – marginal cost) \times quantity
= ($60 – $20) \times 1
= $40
Producer surplus for the pool = ($140 – $20) \times 1
= $120
Producer surplus for bundle = ($175 – $40) \times 1
= $135

Total producer surplus when the health club offers customers a choice of bundling or separate prices is $40 + $120 + $135 = $295.

10.6 Advanced Pricing Strategies

When to Use It  Block Pricing and Two-Part Tariffs

1. The firm has market power and can prevent resale.
2. The firm’s customers may have either identical or different demand curves.

In the previous sections, we analyzed pricing strategies based on price discrimination, the ability of a firm to charge more for units of output sold to those willing to pay more and, as a result, extract producer surplus by departing from the single-price monopoly pricing discussed in Chapter 9. In this section, we look at how firms with market power can achieve that goal not by charging a given price per unit, but by varying unit prices offered to the same customer or charging lump-sum fees on top of per-unit prices. We start with a return to our discussion of quantity discounts.
Block Pricing

We call the strategy in which a firm reduces the price of a good if the customer buys more of it **block pricing**. You see this sort of thing all the time. Buying a single 12-oz can of Pepsi might cost $1, but a six-pack of 12-oz cans costs only $2.99. However, unlike indirect price discrimination (such as quantity discounts), block pricing does not require that buyers have different demand curves and price sensitivities. All buyers of Pepsi may, in fact, have the same demand curve, but Pepsi could still gain producer surplus from providing buyers with an option to buy a larger quantity of soda at a lower price.

Consider Figure 10.8, which shows a demand curve for Walmart’s photo holiday cards. Here, we assume this is the demand curve of just one customer (or we could suppose all customers have this same demand curve), so the firm is not trying to price-discriminate across customers with different types of demand, as would be the case if Walmart offers quantity discounts. If Walmart follows the pricing rule for firms with market power in Chapter 9, it will pick the quantity at which marginal revenue equals marginal cost and charge a price equal to the height of the demand curve at that quantity. In the figure, the monopoly quantity is 100 cards and the price is 25 cents per card. Walmart’s producer surplus from pricing at that point equals the area of rectangle $A$.

If Walmart can prevent resale, however, it doesn’t have to charge a single price. Suppose it offers the first 100 holiday cards for sale at 25 cents each, but then allows a consumer to buy as many as 25 more cards (numbers 101–125) at a lower per-unit price of 20 cents each. The customer will take advantage of this offer because the incremental purchase at the lower price yields an additional consumer surplus equal to the area of triangle $B$. Walmart is better off, too, because it adds an additional amount of producer surplus equal to the area of rectangle $C$.

Walmart could keep offering discounted prices on larger quantities. For example, it could offer the next 50 cards, up to the 175th photo card, for 10 cents each. Again, the consumer will take the deal because the consumer surplus from that block of cards (area $D$ in the figure) is positive. Walmart also comes out ahead because it earns producer surplus equal to the area of rectangle $E$.

Walmart’s producer surplus increases from area $A$ to $A + C$ to $A + C + E$, respectively, and consumer surplus increases by area $B$ and areas $B + D$, respectively.

---

**Figure 10.8**  |  Block Pricing

$D$ is the demand curve of an individual consumer of Walmart’s photo cards. Under monopoly pricing, Walmart sells at the point on the demand curve corresponding to the quantity where $\frac{MR}{MC} = Q = 100$ photo cards, $P = 0.25$ per card. When Walmart can prevent resale, it can use a block pricing strategy instead. It could still sell the first 100 at a price of 0.25 per card, while charging a lower price of 0.20 each for the next 50 photos purchased (for a total quantity of 125 cards) and 0.10 each for the next 50 cards (for a total of 175 cards). Producer surplus increases from area $A$ to $A + C$ to $A + C + E$, respectively, and consumer surplus increases by area $B$ and areas $B + D$, respectively.
from the quantity discounts we saw when discussing indirect price discrimination. Here, no customer sorting needs to occur for Walmart to gain producer surplus.) A block-pricing strategy like this raises more producer surplus for a firm than does the conventional single-price monopoly strategy because it allows a firm to better match the prices of different quantities of its output to consumers’ valuations of those quantities. For the first set of units that customers buy—the units for which customers have a high willingness to pay—the firm charges a relatively high price. With block pricing, the firm doesn’t have to completely give up selling a large number of units by charging that initial high price. Block pricing lets it sell additional units of its product, those for which consumers have lower willingness to pay, at lower prices.

This example shows how block pricing can work for even a single customer type, though if there were lots of identical customers, the firm would need to be able to prevent resale to avoid being undercut by its own customers.

**Two-Part Tariffs**

Another pricing strategy available to firms with market power and identical consumers is the **two-part tariff**, a pricing strategy in which a firm breaks the payments for a product into two parts. One component is a standard per-unit price. The second is a fixed fee that must be paid to buy any amount of the product at all, no matter how large or how small.

For example, a lot of mobile phone “unlimited service” calling plans have this structure. You might pay, say, $50 a month for service and then be able to make as many calls as you would like at no additional cost. Here, the fixed fee portion of the two-part tariff is $50 and the per-unit price is zero (though for other markets and products, the per-unit price is often positive). A video game system such as Microsoft’s XBox is like a two-part tariff, too. Here, the cost of the console itself is the fixed fee and the cost of the individual games represents the per-unit price.

To see why using a two-part tariff can be advantageous for a firm with market power, consider the market in Figure 10.9. It shows the demand for mobile phone service offered by the firm, the marginal revenue curve corresponding to demand, and the firm’s constant marginal cost.

The firm’s conventional single-price monopoly profit-maximizing quantity is found where marginal revenue equals marginal cost. The quantity at which this condition holds is 300 minutes per month, and the price at which consumers are willing to

**Figure 10.9 | Two-Part Tariff**

As a single-price monopoly, a mobile phone service will sell 300 minutes of mobile service per month at a price of $0.10 per minute. Using a two-part tariff, however, the firm can increase its producer surplus from rectangle $B$ to the triangle $A + B + C$. To do this, it will charge the per-unit price of $0.05 per minute, where $D = MC$, and set a fixed fee equal to the consumer’s surplus at this quantity, the area $A + B + C$. Under this pricing scheme, the firm will sell 600 minutes of mobile service per month.
purchase that quantity is 10 cents per minute. At the price of 10 cents per minute, the consumer surplus is area $A$ and the firm’s producer surplus is rectangle $B$.

Now suppose instead that the firm uses the following two-part tariff pricing structure. First, it reduces the per-unit price all the way to marginal cost, 5 cents. This change increases the number of units it sells from 300 minutes to 600, but drives per-unit profit to zero. However, the firm knows that each customer will buy a quantity of 600 minutes per month of air time at this price and have a consumer surplus equal to area $A + B + C$ as a result. Knowing that this consumer surplus represents the willingness of the consumers to pay above the market price, the firm will set a fixed fee to try to capture that consumer surplus. Therefore, the firm decides to set the fixed-fee portion of the two-part tariff equal to $A + B + C$. This fee is not per minute; it’s a one time per month fee for any consumer who wants to buy any number of units at 5 cents per minute.

What happens under this two-part tariff pricing structure? At a unit price of 5 cents per minute, the consumer buys 600 minutes of air time. This part of the price structure doesn’t make the phone company any money, because its marginal cost of delivering service is also 5 cents per minute. However, the company is also charging the fixed fee $A + B + C$. And importantly, the consumer is willing to pay that, because if she uses 600 minutes of air time, she will enjoy consumer surplus equal to the same area. The company has set the size of the fixed fee so that the consumer is no worse off (and actually it could make her strictly better off if it charged just a touch less than $A + B + C$) than if she bought nothing. By using a two-part tariff, the firm captures the entire surplus in the market for itself, as opposed to only area $B$ under standard market power pricing.

Again, if you spread this insight to a market with many identical customers, the ability to prevent resale would be crucial for making the pricing strategy work. If the phone company couldn’t prevent resale, one customer could pay the fixed fee, buy up a huge amount of minutes at marginal cost, sell off these extra minutes at a small markup to other consumers who did not pay the fixed fee, and make lots of money. For example, if the consumer could rig her phone so other people would pay her 6 cents per minute to make calls on it when she wasn’t using the phone, this would defeat the company’s strategy.

### 10.5 figure it out

You have been hired as an intern at the Golden Eagle Country Club Golf Course. You have been assigned the task of creating the pricing scheme for the golf course, which typically charges an annual membership fee and a per-use cost to its customers. Each of your customers is estimated to have the following demand curve for rounds of golf per year:

$$Q = 300 - 5P$$

If Golden Eagle can provide rounds of golf at a constant marginal cost of $50 and charges that amount per round of golf, what is the most that members would be willing to pay for the annual membership fee?

**Solution:**

This pricing scheme, with an annual membership fee and a per-unit price, is a two-part tariff. If the price per round of golf is set at $P = 50$, then each member will want to play

$$Q = 300 - 5P$$

$$= 300 - 5(50)$$

$$= 300 - 250$$

$$= 50$$

With this knowledge, we can determine the maximum annual membership fee each customer is willing to pay. This will be equal to the amount of consumer surplus the customer will get from playing 50 rounds of golf each year at a price of $50 per round.

To calculate consumer surplus, it is easiest to draw a diagram, plot the demand curve, and find the area of consumer surplus. To simplify matters, let’s rearrange the demand function into an inverse demand function:
Being able to capture the entire surplus in the market is great if you’re running a firm, but it’s important to realize that a firm can attain this extreme result only if its customers have the same demand curve. The problem is much more complicated when there are customers with different demand curves.

For this more advanced two-part tariff pricing case, think about a firm that faces two kinds of customers whose demand curves for the firm’s product are shown in Figure 10.10. Panel a shows the demand curve of the firm’s relatively low-demand customers. The firm would want to sell a quantity of $Q_{cL}$, charge a per-unit price of $P_{cL}$ and a fixed fee equal to the consumer surplus $A + B + C$. Since this is much lower than the consumer surplus for high-demand customers ($D + E + F$ in panel b), such a pricing strategy will leave a lot of surplus to the high-demand customers in the market.

If the golf course set the price of a round of golf at $50, the consumer would purchase 50 rounds per year. This gives the golfer a consumer surplus equal to $250. Therefore, customers would be willing to pay up to $250 for an annual membership.

\[
Q = 300 - 5P \\
5P = 300 - Q \\
P = 60 - 0.2Q
\]

The vertical intercept is 60 and the consumer surplus is the area below the demand curve and above the price of $50, area $A$. We can calculate the area of triangle $A$:

\[
\text{Area of } A = \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 50 \times ($60 - $50) = 0.5(50)($10) = $250
\]
customers, while panel b shows the demand of the firm’s relatively high-demand customers. If the firm tries to use a two-part tariff where it sets the unit price at marginal cost $MC$ and the fixed fee at $A + B + C$, it will capture all of the surplus from the relatively low-demand customers in panel a but leave a lot of surplus to the relatively high-demand customers in panel b, because area $A + B + C$ is much smaller than area $D + E + F$. If the firm instead sets the fee at $D + E + F$ to capture the surplus of the high-demand customers, low-demand customers won’t buy at all. This is not necessarily better than the first strategy. If the firm has a lot of low-demand customers, this could be a big loss for the firm, even if the reduction in profit from losing any given low-demand customer might be small. So, neither approach is perfect. Computing the profit-maximizing two-part tariff when consumers have different demands is a mathematical challenge beyond the scope of this book, but it usually entails a unit price above the firm’s marginal cost.

10.7 Conclusion

We explored a number of different ways in which firms with market power, under the right conditions, can increase the producer surplus they earn above and beyond the surplus they can earn by following the standard, one-price market power pricing rule we focused on in Chapter 9. These pricing strategies are all around us; after learning about them in this chapter, you will start to recognize them in practice. You may also find yourself wondering why a particular firm isn’t using one of these strategies. Just remember that certain conditions must be met for the price discrimination to work.

These various pricing strategies work in different ways, but there are some common threads. First, none will work unless the firm has market power. Therefore, any firm operating in a perfectly competitive market cannot use these strategies because it is a price taker. Second, the firm must prevent resale. Without the ability to prevent resale, doing anything besides the single-price monopoly pricing in Chapter 9 is futile. Third, while price discrimination strategies differ in the specifics of their mechanisms and the types of markets in which they are applicable, all of these methods work on the basic principle that the firm can make more producer surplus if it can adjust the price it charges so that consumers end up paying higher prices for those units of its output that provide them with greater consumer surplus. Price discrimination also works by charging higher prices to consumers with less elastic demand and lower prices to consumers with more elastic demand.

Other pricing strategies, such as block pricing and two-part tariffs, can be used even in markets where all consumers have the same demand. These strategies work by allowing consumers to buy relatively large quantities at a low price on the margin, but then grab back producer surplus for the firm through higher up-front payments.

In the next chapter, we examine firms with degrees of market power that fall between perfect competition and monopoly. We will find that these firms’ decisions are not made in a vacuum (where they only consider their own costs and their customers’ demands), but are also based on the decisions made by other firms in the same market. Although many may choose to follow the pricing strategies discussed in this chapter, each firm has to take into account how its competitors may react to such a move before determining if the strategy increases its producer surplus.
Summary

1. By using **pricing strategies**, a firm with market power can extract more producer surplus from a market than it can from following the monopoly pricing rule of Chapter 9 (where the firm produces the quantity at which marginal revenue equals marginal cost, and then charges the price at which buyers would consume that quantity). It can only do so, however, if the situation satisfies certain criteria. A crucial factor is that in addition to market power, the firm has to be able to prevent resale among customers. If the firm can prevent resale, the amount of information it has on its customers determines what kind of pricing strategy it can follow. [Section 10.1]

2. When customers differ and the firm has sufficient information about its customers’ demands to charge every person a different price, **perfect or first-degree price discrimination** is possible. This **direct price discrimination** strategy allows the firm to capture the entire surplus in the market for itself. It is very rare to have this kind of information, however. [Section 10.2]

3. If the firm has different types of customers and can directly identify at least two groups whose price elasticities of demand differ, it can charge different prices to the two groups and earn more producer surplus. The profit-maximizing direct price discrimination strategy in this case is to follow the single-price monopoly pricing rule separately for each group. There are many ways to directly separate customers, including customer characteristics, geography, past purchase behavior, the timing of the purchase, and so on, a practice known as **segmenting**, or **third-degree price discrimination**. [Section 10.3]

4. If the company knows that there are different types of customers but cannot directly identify which group a customer belongs to before the purchase, it must rely on **indirect (second-degree) price discrimination**. This involves designing choices that induce customers to sort themselves into groups. **Quantity discounts** can be used if customers who demand a higher quantity also have a more elastic demand. **Versioning** a product can also work. The key additional requirement for indirect price discrimination is that the pricing structure has to be **incentive compatible**, meaning that each consumer group wants to take the offer designed specifically for them. [Section 10.4]

5. If a company sells multiple products and consumers’ demands for the products are negatively correlated, it can sell the products together as a bundle and increase producer surplus beyond what it could earn by selling the products separately. Sometimes, particularly if the marginal cost of producing one of the products exceeds the value that a customer places on that product, the company may be better off using **mixed bundling**, which gives customers the choice of buying individual products at high prices or a bundle of products at a discount. [Section 10.5]

6. Even when there are not different types of customers, a firm can use advanced pricing strategies like **block pricing** (a discount for buying extra quantity) or a **two-part tariff** (a fixed fee paid up-front in addition to a price per unit of the good) as a way to capture more producer surplus than it could earn with standard monopoly pricing. However, each of these strategies is much more complicated to implement when there are many consumers with different demand curves. [Section 10.6]

Review Questions

1. What are the two requirements of price discrimination?
2. Why is producer surplus maximized under perfect price discrimination?
3. What are the two types of direct price discrimination?
4. What are some ways that a firm can segment its customers?
5. Contrast direct price discrimination and indirect price discrimination.
6. What is incentive compatibility? Why is it necessary for an indirect price discrimination strategy to be incentive compatible?
7. Provide an example of product versioning.
8. What are the differences between the following three pricing strategies: block pricing, segmenting, and quantity discounts?
9. What is the difference between mixed bundling and pure bundling?
10. What are the two component prices of a two-part tariff?
Part 3  Markets and Prices

Problems (Solutions to problems marked * appear at the back of this book. Problems adapted to use calculus are available online at http://worthpublishers.com/GLS1e)

*1. Consider the demand for schnitzel in the diagram below. Suppose that there is a single seller of schnitzel, who acts as a single-price monopolist.

   ![Demand Diagram]

   Price ($/schnitzel)
   MC
   MR
   D
   C
   B
   A
   P
   Q1
   Q2
   Quantity of schnitzels

   a. Indicate the profit-maximizing price and quantity.
   b. List the areas of consumer and producer surplus.
   c. Suppose the seller begins perfectly price discriminating. How many schnitzels will she sell?
   d. What happens to areas A and B when the seller begins perfectly price discriminating?
   e. What happens to areas E and H when the seller begins perfectly price discriminating?

2. Indicate whether the following statement is true or false, and explain your answer: Because the potential profit from perfect price discrimination is always higher than the potential profit from third-degree price discrimination (segmenting), firms that practice third-degree price discrimination must not be maximizing profit.

3. There are seven consumers, each of whom is hungry for exactly one Butterfinger. The consumers' maximum willingness to pay is given in the table below:

<table>
<thead>
<tr>
<th>Consumer (age, gender)</th>
<th>Maximum Willingness to Pay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marge (34, female)</td>
<td>$2</td>
</tr>
<tr>
<td>Homer (38, male)</td>
<td>4</td>
</tr>
<tr>
<td>Lisa (6, female)</td>
<td>5</td>
</tr>
<tr>
<td>Maggie (2, female)</td>
<td>6</td>
</tr>
<tr>
<td>Ned (46, male)</td>
<td>1</td>
</tr>
<tr>
<td>Krusty (95, male)</td>
<td>3</td>
</tr>
<tr>
<td>Bart (9, male)</td>
<td>7</td>
</tr>
</tbody>
</table>

   a. Given that each consumer wants one and only one Butterfinger, draw the demand curve for Butterfingers.
   b. If Butterfingers are priced at $7, only one will be sold. Who buys that Butterfinger? Label the point at $7 on the demand curve with the name of that buyer.
   c. If Butterfingers are priced at $6, a second buyer will be priced into the market. Who is that buyer? Label the point at $6 on the demand curve with the name of that buyer.
   d. Continue to label each point on the demand curve with the name of the buyer represented by that point.
   e. Suppose that you are a monopoly seller of Butterfingers, which you can produce at a constant marginal and average total cost of $2. Suppose you charge every customer the same price for Butterfingers. What price should you set to maximize your profit? How many Butterfingers will you sell? Calculate your profit. Calculate the consumer surplus received by the buyers. Calculate the deadweight loss.
   f. Suppose that every customer that comes into your Butterfinger store has their maximum willingness to pay displayed in neon on their foreheads. You decide to use this information to increase your profit by practicing first-degree price discrimination. How many Butterfingers will you sell? Calculate your profit. Calculate the consumer surplus received by the buyers. Calculate the deadweight loss.
   g. Where does the consumer surplus go when you begin price discriminating?
   h. What happens to the deadweight loss?

4. Consider the problem faced by the Butterfinger seller in Problem 3.
   a. Assume that the seller is able to prevent resale between customers. In the real world, why is the seller still unlikely to be able to perfectly price discriminate?
   b. Because of the reason you just indicated, the Butterfinger seller decides to segment her customers into two groups, each of which will be charged a different price. In order to maximize profit, should the seller sort by gender or by age?
   c. Based on your answer to (b), determine who is in each group, and indicate (1) the price the seller should set for each group, (2) the total profit received by the seller, (3) total consumer surplus, and (4) the deadweight loss.
d. Is this pricing strategy (segmenting) more profitable to the seller than perfectly price discriminating? Is this pricing strategy more profitable than charging every consumer the same price?

e. What happens to consumer surplus and deadweight loss when a single-price monopolist begins segmenting in this way?

*5. Promoters of a major college basketball tournament estimate that the demand for tickets on the part of adults is given by \( Q_{ad} = 5,000 - 10P \), and that the demand for tickets on the part of students is given by \( Q_{st} = 10,000 - 100P \). The promoters wish to segment the market and charge adults and students different prices. They estimate that the marginal and average total cost of seating an additional spectator is constant at $10.

a. For each segment (adults and students), find the inverse demand and marginal revenue functions.

b. Equate marginal revenue and marginal cost. Determine the profit-maximizing quantity for each segment.

c. Plug the quantities you found in (b) into the respective inverse demand curves to find the profit-maximizing price for each segment. Who pays more, adults or students?

d. Determine the profit generated by each segment, and add them together to find the promoter's total profit.

e. How would your answers change if the arena only had 5,000 seats?

6. In Problem 5, you found the profit that a promoter of a major college basketball tournament would earn if he were to segment the market into adults and students. Suppose that the promoter’s CEO decides that price discrimination presents a poor public image, and announces that everybody will be charged the same price. His resident economist (you) is tasked with figuring out what that price should be.

a. Find the total demand for tickets by adding the demand curves of adults and students.

b. Derive the inverse demand curve for tickets, as well as the associated marginal revenue curve associated with that demand.

c. Find the profit-maximizing quantity of tickets and the corresponding price.

d. Determine the promoter’s profit.

e. Compare the promoter’s profit when he tries to price for the entire market, to his profit when he simply charges the adult price from the previous problem. Is it better for the promoter to price for the entire market and almost fill the arena, or to price for adults only and have a lot of empty seats?

7. You are the owner of a nail salon. Your female customer’s price elasticity of demand for manicures is \(-2.5\); your male customer’s price elasticity of demand for manicures is \(-1.2\). The marginal cost of manicuring a customer’s nails is $12.

a. If you segment the market by gender, what price should you charge women? What price should you charge men?

b. Explain intuitively why you should charge each group a different price.

8. Movie theaters often charge substantially less for afternoon showings than for evening showings. Explain how theaters use time of day to segment their customers into low-elasticity and high-elasticity groups.

*9. Owners of a movie theater have determined that the elasticity of demand for movie tickets equals \(-2.0\) for students and \(-1.5\) for adults.

a. If the owners of the theater decide to segment the market, who should be charged a higher price, students or adults? Use your knowledge of microeconomic theory to explain why.

b. Use the Lerner index as described in the text to determine the ratio of prices. In percentage terms, how big a price premium should be charged to the group that pays the higher price?

10. Owners of a Florida restaurant estimate that the elasticity of demand for meals is \(-1.5\) for senior citizens and \(-1.33\) for everyone else.

a. Given this information, how big (in percentage terms) should the senior citizen discount be?

b. Suppose that the restaurant owners discover that seniors tend to demand more attention from their waiters and send back more food as unsatisfactory, to the extent that the marginal cost of serving a senior is twice as high as serving an adult. Accounting for these costs, how large should the senior citizen discount be? (Hint: Refer back to the example in the text, but don’t cancel out marginal costs!)

c. Were your results in part (b) surprising? Explain them, intuitively.

11. A local golf course’s hired-gun econometrician has determined that there are two types of golfers, frequent and infrequent. Frequent golfers’ annual demand for rounds of golf is given by \( Q_f = 24 - 0.3P \), where \( P \) is the price of a round of golf. In contrast, infrequent golfers’ annual demand for rounds of golf is given by \( Q_i = 10 - 0.1P \). The marginal and average total cost of providing a round of golf is $20.
a. If the golf course could tell a frequent golfer from an infrequent golfer, what price would it charge each type? How many times would each type golf? How much profit would the golf course generate?

The greens manager has difficulty telling frequent from infrequent golfers, so she decides to use second-degree price discrimination (quantity discounts) to make different types of golfers self-select into the most profitable pricing scheme. The course sets a price for individual rounds of golf, but also offers a quantity discount for members willing to buy a rather large quantity of rounds in advance. The course’s owners hope that frequent golfers will self-select into the discount plan, and that infrequent golfers will choose to buy individual rounds.

b. What price should the golf course set for individual rounds of golf? Why?

c. If the course wishes to maximize profit, what price and minimum quantity should it establish for the discount plan?

d. Which plan will generate the greatest consumer surplus for frequent golfers, the individual-round plan or the discount plan? Illustrate your answer by showing and measuring the areas of surplus on frequent golfers’ inverse demand curves.

e. Which plan will generate the greatest consumer surplus for infrequent golfers, the individual-round plan or the discount plan? Illustrate your answer by showing the areas of surplus on infrequent golfers’ inverse demand curves.

f. Based on your answers to (d) and (e), will the plan be successful in making golfers self-select into the most profitable plan for the golf course?

g. Suppose that each type of golfer came to the course with the word “frequent” or “infrequent” tattooed on his or her forehead. Is this information of any value to the golf course owner? (In other words, can the owner earn any more profits by segmenting than it did with its quantity discount plan?)

12. Many textbooks are now available in two versions, a high-priced “domestic” version and a low-priced “international” version. Each version generally contains exactly the same text, but slightly altered homework problems.

a. Why would a textbook publisher go to the trouble to produce two versions of the same text?

b. Discuss whether the publisher’s strategy would be more effective if it made the alterations secret, or if it announced them boldly.

c. The production of international versions of textbooks was concurrent with the explosion of the Internet. Explain why this is likely to be more than just a coincidence.

*13. Rockway & Daughters Piano Co. wishes to sell a piano to everyone. But some consumers are budget-conscious, and others are not, and unfortunately, Rockway cannot tell which is which. So, Rockway produces a premium line of pianos that it markets under the Rockway name, and a similar line of pianos that it markets under the Dundee name. While the cost of producing these pianos is quite similar, all consumers agree that Rockway pianos are of higher quality than Dundee pianos, and would be willing to pay more for a Rockway. Budget-conscious consumers feel that Dundee pianos are worth $6,000, and Rockways are worth $8,000. Performance artists believe that Dundee pianos are worth $7,000 and Rockways are worth $12,000.

a. Suppose Rockway & Daughters prices its Dundee pianos at $5,000 and its Rockway pianos at $10,500. Are these prices incentive compatible—that is, will more price-conscious consumers purchase the Dundee line, while more performance-oriented players choose the Rockway? Explain.

b. How much must Rockway & Daughters reduce the price of its Rockway line in order to achieve incentive compatibility?

c. Suppose instead that Rockway & Daughters tries to achieve incentive compatibility by raising the price of its Dundee line. Can it do so? And if so, how?

14. London’s Market Bar has a unique pricing system where a computer sets the price based on demand. When demand picks up, the computer begins to gradually reduce prices. This pricing strategy is puzzling to those who have studied supply and demand. Celene Berman, the assistant manager, says a group of “young city-boy types” recently kept asking why prices “were going the wrong way around.” Explain, using your knowledge of block pricing, why the owner’s strategy of reducing prices as sales increase might actually lead to increased profit for the bar.

*15. Microsoft sells two types of office software, a word processor it calls Word, and a spreadsheet it calls Excel. Both can be produced at zero marginal cost. There are two types of consumers for these products, who exist in roughly equal proportions in the population: authors, who are willing to pay $120 for Word and $40 for Excel, and economists, who are willing to pay $50 for Word and $150 for Excel.
a. Ideally, Microsoft would like to charge authors more for Word and economists more for Excel. Why would it be difficult for Microsoft to do this?

b. Suppose that Microsoft execs decide to sell Word and Excel separately. What price should Microsoft set for Word? (Hint: Is it better to sell only to authors, or to try to sell to both authors and economists?) What price should Microsoft set for Excel? What will Microsoft’s profit be from a representative group of one author and one economist?

c. Suppose that Microsoft decides to bundle together Word and Excel in a package called Office, and not offer them individually. What price should Microsoft set for the package? Why? How much profit will Microsoft generate from a representative group of one author and one economist?

d. Does bundling allow Microsoft to generate higher profit than selling Word and Excel separately?

16. Three consumers, John, Kate, and Lester, are in the market for two goods, dates and eggs. Their willingness to pay for dates and eggs is given in the table below:

<table>
<thead>
<tr>
<th></th>
<th>Dates (1 package)</th>
<th>Eggs (1 dozen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>John</td>
<td>$0.60</td>
<td>$2.00</td>
</tr>
<tr>
<td>Kate</td>
<td>$1.30</td>
<td>$1.30</td>
</tr>
<tr>
<td>Lester</td>
<td>$2.00</td>
<td>$0.60</td>
</tr>
</tbody>
</table>

a. If you are a local farmer who can produce dates and eggs for free, what is the optimal price for dates and eggs if you price them individually? How much profit will you generate?

b. If you bundle dates and eggs together, what price should you set for a bundle containing one package of dates and a dozen eggs? How much profit will you generate?

c. Is there any advantage to mixed bundling in this case? Why or why not?

d. Suppose that the cost of producing dates and eggs rises to $1.00 per package and $1.00 per dozen, respectively. Now is there any advantage to mixed bundling? Why or why not? Explain your answer with a numerical illustration.

e. What accounts for the change in optimal strategy when costs change?

*17. Elaine makes delicious cupcakes that she mails to customers across the country. Her cupcakes are so delicious that she has a great degree of pricing power. Elaine’s customers have identical demands for cupcakes. A representative customer’s demand is shown in the diagram below. Elaine can make a cupcake for a constant marginal and average total cost of $0.50.

![Diagram](image_url)

a. If Elaine is an ordinary monopolist, what price should she charge for cupcakes? How many will each customer order? How much profit will Elaine earn? How much consumer surplus will the buyer get?

b. Suppose that Elaine decides to offer a quantity discount according to the following terms: The first 10 cupcakes can be bought for $1.50 each; any cupcake over 10 will be offered at a discounted price. What discount price will maximize Elaine’s profit from this pricing scheme? (Hint: Draw a new demand curve for Elaine’s customers’ demand, but since her customers have already purchased 10, begin your demand curve at the 11th unit. Alternatively, shift the vertical axis to the right by 10 units.)

c. How many cupcakes will customers order at full price? How many at the discounted price?

d. What will Elaine’s profit be? How does this scheme compare to the profit she earned as an ordinary monopolist?

e. Suppose that Elaine gets super-greedy and decides to implement a three-tiered pricing system. What three prices should she choose to maximize her profit? At what quantities will the price points change? What will her profit be?

f. Suppose Elaine decides to charge $2.40 for the first cupcake, $2.30 for the second, and so on. How many cupcakes will she sell, and what will her profit be?

g. What happens to consumer surplus as Elaine adds more price points? Where does it go?

Part 3 Markets and Prices

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a. How much would customers be willing to pay to obtain a 20-pack of Elaine’s cupcakes? (Hint: Remember that the value of each cupcake is given by the corresponding point on the demand curve. Add up those values for cupcakes 1–20.)
b. How much profit will Elaine earn from each customer?
c. How does the profit from this scheme compare to the profit Elaine earned in part (f) of Problem 17?

19. Many gyms offer a mixed two-part tariff pricing scheme. One can join the gym and then have daily access at a very low cost (often, free); alternatively, one can choose not to join and pay a higher daily fee (perhaps $10 or $15). Explain the rationale for this dual pricing scheme. What must be true of the gym’s customers’ demands?

20. SmacFone is a major provider of pay-by-the-minute, no contract cellphones that are very popular with ordinary consumers. They are also quite popular with drug dealers, who appreciate the anonymity that such phones provide. The demand curves for talking minutes that SmacFone faces from each type of customer are given in the diagrams below. SmacFone’s marginal and average total cost of service is 5 cents per minute.

(a) Drug dealer’s demand

(b) Ordinary person’s demand

a. Determine the profit-maximizing price and quantity that SmacFone would like to charge each type of consumer, and show it on the appropriate graph. Then, determine the potential profit that SmacFone could generate from each segment.

Because SmacFone cannot tell whether a new customer is an ordinary person or a drug dealer, it decides to use second-degree price discrimination to separate consumers. SmacFone sets a Plan A price of 15 cents per minute, but offers a special Plan B price of 10 cents per minute if a customer purchases 300 or more minutes.

b. Determine how much consumer surplus ordinary consumers would receive under Plans A and B. Which plan should ordinary consumers choose if they are trying to maximize their surplus?
c. Determine how much consumer surplus drug dealers would receive under Plans A and B. Which plan should drug dealers choose if they are trying to maximize their surplus?
d. Is the plan SmacFone derived incentive compatible? (In other words, will the plan successfully direct drug dealers to Plan A and ordinary consumers to Plan B?) How much profit will SmacFone generate with this set of plans?
e. SmacFone is considering making some adjustments to their plans. One option is to change Plan B to 11 cents per minute with a 240-minute minimum. Determine whether the new plan selection is incentive-compatible. Why doesn’t SmacFone simply raise the price to 11 cents without altering the 300-minute minimum? How much profit will the new set of plans generate for SmacFone?
f. Another option that SmacFone is considering is dropping the price of its ordinary service to 14 cents per minute. Determine whether the new plan selection is incentive compatible. How much profit will the new set of plans generate for SmacFone?
g. Why does lowering the price of ordinary service work better at creating an incentive-compatible set of calling plans than raising the price of the large-quantity plan?