Consider a situation faced by a stylized biotech firm:

“Ken, it’s brilliant science, but I just don’t see how we can make any money from it.” CEO Allison Schreter of biotech startup BioStern is discussing strategy with CFO Charles Miller and Research Director Ken Goldman. “It will cost at least $20mm to complete the research and get regulatory approval. If we charge $10/dose to meet the US market, we can’t expect to recoup more than $15mm. But at that price no one outside the US can afford it. If we charge a lower price, we can attract the overseas markets, but our overall profit picture is even worse.”

Ken is crestfallen. Two years ago, he left a tenured research position at NYU to pursue an idea. Whatever its commercial merits, he felt his team was doing pathbreaking science, and he hoped that commercial success would make further breakthroughs possible.

Charles, meanwhile, was doodling on his Palm V, apparently oblivious to the discussion. Suddenly he stood up. “I have an idea,” he said. “What if we charge a high price in the US, where people can afford it, and a lower price elsewhere? If we do it right, we might be able to make enough money to cover our development costs and keep the firm going for another five to ten years.”

Allison wondered. If Charles was right, there was hope. But she needed to base her decision on more than hope.

We won’t be quitting our jobs any time soon to write screenplays. But you get the picture: there may be situations in which you can increase profits by charging different prices in different markets. We refer to any such scheme as “price discrimination.” In practice, price discrimination is connected to a number of related decisions, including product differentiation and bundling.

**Price Discrimination**

Our analysis to date has been based on uniform pricing: a firm charges the same price for a homogeneous good to all buyers. But it’s not hard to think of examples of non-uniform pricing or price discrimination:

- Student, child, and senior discounts. Kids, for example, pay less at New York movie theaters, although they use the same size seat as anyone else.
• Airfares. Business customers pay far more for seats, and in return get more room (large seats), better service, and greater flexibility (the tickets can be purchased late and changed with no additional cost).

• Site licenses for software. A classic example of a volume discount.

No doubt you can think of other examples yourself.

Roughly speaking, firms can generally increase revenue and profit by "extracting" some of the consumer surplus. The extreme case is to charge each customer exactly his/her willingness to pay, thereby extracting all the consumer surplus.

The trick is doing it. There are two basic questions a firm must address in considering whether price discrimination makes sense. The first is whether it can distinguish between markets. If you can't tell the customers who are willing to pay more from those who are not, you're in trouble. The second is whether you can keep the low-price customers from reselling to the high-price customers.

Take the biotech example. The answer to the first question is that we distinguish between customers by where they live. Presumably you can do this reasonably well. The second is more difficult. What if (say) the Brazilians buy at a low price, but some unethical intermediaries manage to buy in bulk and resell in the US? In finance, we call this arbitrage and think of it as a good thing. Here it may be either good or bad from a social perspective ("it depends"), but it clearly puts a dent into the producer's US profits, and might even make the drug unprofitable.

Or take airfares. Here the airlines let the customers distinguish themselves. When a family goes on vacation, it may be sensitive to price and willing book in advance. But a management consultant or investment banker often travels on short notice and is less sensitive to price, the cost of the plane ticket being small relative to the value of the trip. So airlines have learned that differentiating tickets on how long in advance they are booked is a good way to segment the market.

Like other things in this course, it's as much art as science. What follows is a catalog of approaches.

Two-Part Tariffs

One way sellers can extract a consumer’s surplus is by setting a two-part tariff. Suppose that each consumer has a known downward-sloping demand curve. By setting MR=MC and setting the corresponding price, the seller would be leaving demand on the table (a positive surplus that is captured by the consumer and a potential surplus that is neither captured by the seller nor the buyer). Suppose however that seller sets a two-part tariff: a fixed fee and a variable fee. Suppose moreover that (a) the variable fee is equal to marginal cost; (b) the fixed fee is equal to consumer surplus given that price is equal to
marginal cost. Given this, it is easy to see that the seller would be extracting all of the buyer's surplus.

**Discrimination among Groups**

Firms usually cannot ask every consumer her willingness to pay, but they can segment their consumers into various groups with differing elasticities and demand curves. For example, some mail order companies send out retail catalogues to various U.S. markets. These catalogues are identical with one important exception: prices. A New York City consumer would receive a catalogue with prices of, say, 10% higher than that for a consumer in Des Moines. In addition to geographical segmentation, firms can offer special rates to certain segments (students, senior citizens, etc.). In this way, they can capture more consumer surplus by better targeting various consumers’ willingness to pay.

Geographic differentiation is particularly common across countries, where international borders and local regulations help to reduce arbitrage. Thus similar cars and electronic appliances (TVs and stereos) still sell for significantly different prices in the countries of the European “single market.”

**Self-Selection Schemes**

Firms often do not have the required information to know your willingness to pay, and thus are unable to capture your surplus. Yet firms in many industries are adept at inducing consumers to reveal that information about themselves.

For example, airlines measure differing consumers’ elasticities in several ways. If you need a ticket for a business trip, you are likely to be willing to pay a lot for it. You are less price elastic; you need to take the trip and you need to take it now. Other consumers who are very price sensitive may book their flights far in advance so they can “shop around” many rates. In any event, the amount of time you wait to book a flight reveals important information about your elasticity. Likewise, firms can offer a product line with various attributes across products to discriminate between consumers who will choose their selection based on their particular demand and elasticity. 3COM, for example, offers a full line of Palm Pilot devices. The Palm Vx costs $500 whereas newer, cheaper versions of the Palm with fewer features and less aesthetic quality cost under $200. By giving consumers this choice, they will reveal their willingness to pay by their choice of product. If Palm only had offered one version, say priced at $350 with a medium amount of features, they would have lost customers margin from some high-end consumers and sales from some low-end consumers.

When setting different prices for different versions of a product ("versioning"), the seller must be careful not to set prices so different that the high-end consumers prefer to buy the low-end product. That would defeat the whole purpose of versioning as a means for price discrimination.
Coupons are another well-known strategy. Some customers will take the time to lug 50 coupons to the checkout counter while other, more inelastic customers will rush to the check-out without caring about paying the full price.

Bundling is yet another strategy. If you want a stereo but are not willing to pay much, you can probably buy a standard unit with a tape deck, CD player, and speakers for less than $100. But if you are interested in a CD burner, a mini-disc player, and a karaoke function, you are probably willing to pay a lot more. Firms know this, and offer much higher prices for base model stereos with these “bells and whistles” – bundled attributes that some are willing to pay for.

Another is discrimination over time. The idea is that the high valuation customers are less patient, so you can start with a high price and reduce it once the impatient have bought it. Many information goods work this way (computer software, books).

Non-linear pricing (e.g., quantity discounts) is also an example of customers revealing themselves.

**Numerical Examples**

*Example 1.* Biotech startup BioGar has developed Xamoff, an over-the-counter medicine that reduces exam-related anxiety. A patent currently protects Xamoff from competition. It is now thinking of entering the European market but wonders whether it should charge the same price in the two markets. They estimate that the demand curves have the form

\[ q_i = a_i - b_i p_i. \]

In the US (market \(i=1\)), the parameters are \(a_1=12\) and \(b_1=2\). In the EU (market \(i=2\)), the parameters are \(a_2=4\) and \(b_2=1\). The marginal (and average) cost per unit is \(c=1\). All of these units are millions. How much could BioGar gain by charging different prices in the two markets?

**Answer.** Consider first the problem of setting one uniform price. Total demand at price \(p_1=p_2=p\) is

\[ Q = q_1 + q_2 = (a_1+a_2) - (b_1+b_2) p = A - B p. \]

(The idea is to save ourselves some writing by defining \(A=a_1+a_2\) and \(B=b_1+b_2\).) To find profit as a function of output \(Q\), we solve for price \(p=(A-Q)/B\) and substitute:

\[
\text{Profit}(Q) = pQ - cQ = [(A-Q)/B]Q - c Q = (A/B)Q - Q^2/B - c Q.
\]

To maximize, we differentiate with respect to \(Q\) and set the result equal to zero. The result is
Q = (A-cB)/2 = 6.5.

Price is p=(A-Q)/B=3.17, quantities are q₁=5.67 and q₂=0.83, and Profit=14.08.

Now find the best prices in the two markets separately. The presumption is that we can avoid “parallel” imports from Europe (which we guess is the cheap location) back to the US. Mathematically, this is two separate monopoly problems, but we’ll do them simultaneously. Profit is in this case depends on both quantities, but otherwise we follow similar logic:

\[
\text{Profit}(q_1, q_2) = \frac{(a_1-q_1)}{b_1} q_1 + \frac{(a_2-q_2)}{b_2} q_2 - c (q_1+q_2).
\]

This time we differentiate with respect to q₁ and q₂ (one at a time) and set each derivative equal to zero. The result is q₁=(a₁-cb₁)/2=5 and q₂=(a₂-cb₂)/2=1.5. The prices are now p₁=3.5 and p₂=2.5, and Profit=14.75.

For your own enlightenment: Verify that the elasticity rule applies to each market. Show, too, that total consumer surplus falls when we charge different prices.

**Example 2.** You are working with a friend to launch a new soft drink, Manhattan Juice, a fresh juice drink that lasts one day after it’s been opened. The question is how to price one- and two-liter bottles. Market research tells you that the product appeals to two consumer segments, A and B. There are 1000 As and 1200 Bs. The marginal cost of production is $1 a liter regardless of the size of bottle used. Customers from segments A and B cannot be distinguished prior to purchase. An individual from segment A values one liter a day at $3.25, two liters at $5, and three or more liters at $5. An individual from segment B values one liter a day at $4, two liters at $7, and three or more liters at $8. These numbers are interpreted in the following way: every consumer maximizes her surplus, the difference between her valuation (above) and what she pays for the product. Thus if a type B consumer buys a 1-liter bottle for $2, her surplus is $2. Each consumer chooses the option that delivers the highest surplus. What prices should you charge for one- and two-liter bottles?

Answer. The trick is to charge Bs more, since they are willing to pay more, without discouraging As altogether. The question is how. There are several steps to solving problems of this sort. The first step is to identify a set of reasonable menus. The number of possibilities depends on the problem, but two you should definitely consider are (a) serving both consumers with self-selecting prices and (b) serving only one or both segments of consumers with a price that does not distinguish between them. Once you identify some reasonable menus, you can calculate prices that induce consumers to buy the desired quantities. With these prices you can calculate profits under each scenario and determine which menu is most profitable.

What menus should we consider? Some considerations: (i) People will buy 2-liter bottles only if they cost less than twice the price of a 1-liter bottle. Thus, you would
never set $p_2 > 2p_1$.  (ii) If you set $p_1 > 3.25$, type As will not buy it.  (iii) If you set $p_1 = 3.25$ (or just under, if you prefer), type As will buy it, but you then cannot charge $p_2 > 6.50$ or Bs won’t buy the 2-liter bottle.  (iv) In fact, even at $p_2 = 6.50$, Bs prefer to buy only one liter (the surplus is 0.75 for one, 0.5 for two).  The highest possible price to get Bs to pay for the 2-liter (given a 1-liter price of 3.25) is 6.25.

Consider, then, these pricing schemes:

1. $p_1 = 3.25$, $p_2 > 6.5$.  Result: everyone buys a 1-liter bottle.  Profit=4950.
2. $p_1 = 7$, $p_2 > 3.5$.  Result: Bs buy a two-liter bottle, As buy nothing.  Profit=5400.

Option 3 is the winner.  One point of this is to show you how complex even a relatively simple scheme can be.  Good price discrimination schemes are often based on years of experimentation.

**Policy**

Price discrimination is not *per se* illegal.  But it raises issues if used in a way that restricts competition.  It also raises political issues (think of drugs).  Perhaps for that reason, many price discriminations schemes are disguised, either through bundling or versioning or more complex means.  See how long it takes you to figure out the Met’s scheme!

*Written by Chris Chamberlain under the supervision of Luis Cabral and David Backus.  © 2001 Luis Cabral and David Backus.*