from "Industrial Organization: A Strategic Approach" by Church J., and Ware R.

1. *IBM LaserPrinter E.* In 1990 IBM introduced the LaserPrinter E, a low-cost alternative to its well-established LaserPrinter. The LaserPrinter E, apparently, was identical to the standard model in every respect except that it contained extra chips whose function was to *slow down the printing speed!* Nevertheless, the "damaged" laser printer sold for about $1000 less than the original model.
2. *Sony MiniDiscs.* Sony's MiniDisc recording technology comes in a prerecorded form and with blank discs for recording. The latter come in two sizes, 60-minute and 74-minute record times. The recording capacity of the two discs is apparently identical, but the 60-minute version has an encoded instruction (presumably embedded at additional cost) that limits the quantity of recorded material to 60 minutes.
3. *Buying Clubs.* Many households now shop at large warehouse chains like Price Club/Costco and Sam's. In order to segment the market, manufacturers are supplying the warehouses with packages in large volumes, for example, several cereal packages wrapped together. Despite the additional cost of bundling these packages, they are of course sold at a lower unit price by the buying clubs than the price charged for single units by the regular grocery stores.

5.4.5 Optimal Non-Linear Pricing

Consider a two-part tariff $\{p, A\}$. Suppose that a consumer makes a choice of q' in response to this tariff. The monopolist could equivalently make a take-it-or-leave-it offer to the consumer of the quantity q' for an outlay T', where $T' = A + pq'$. In this section we consider a choice among offers of this type when there are two consumer types. There is an option intended for each group: $\{T_1, q_1\}$ for type 1 and $\{T_2, q_2\}$ intended for type 2, where $T_2 > T_1$ and $q_2 > q_1$. As in our earlier example, type 2's have a higher willingness to pay than type 1's and the percentage of low-demand types is α.

We need to be a little more detailed in our modeling of consumers. We can imagine that consumers have preferences defined over combinations of T and q. We can graphically illustrate these preferences in an indifference map like that found in Figure 5.10.

The indifference curves slope up, since expenditure, T, is a bad. Increases in T reduce the amount of money that consumers have available to spend on other goods. Thus increases in T must be compensated by increases in q to keep a consumer indifferent. More preferred bundles are found by moving in the direction of the arrow—they have lower T and greater q. The slope of the indifference curve is the maximum amount of other goods that the consumer is willing to give up to get one more unit of q. The difference between the type 1 and type 2 is that at a common bundle the slope of the indifference curves for type 2's is greater, since their willingness to pay is greater.

A two-part tariff $\{A, p\}$ is the equivalent of a budget constraint for consumers. In T, q space it is simply a line: $T = A + pq$. Consumers choose any point on it. The one they choose is the one that maximizes their utility. This will be where there is a tangency between the two-part tariff line and the indifference curves of the two types. At the optimal consumption level the slope of the indifference curves will equal the slope of the two-part tariff, p. The monopolist chooses the optimal two-part tariff to maximize profits, knowing how both types of consumer will respond. The optimal two-part tariff gives type 1 consumers a utility or surplus of zero. (Recall that $A = S_1(p)$.) Figure 5.11 shows the optimal two-part tariff as well as the consumers' optimal choices, q_1^a and q_2^a, with payments of T_1^a and T_2^a, respectively.

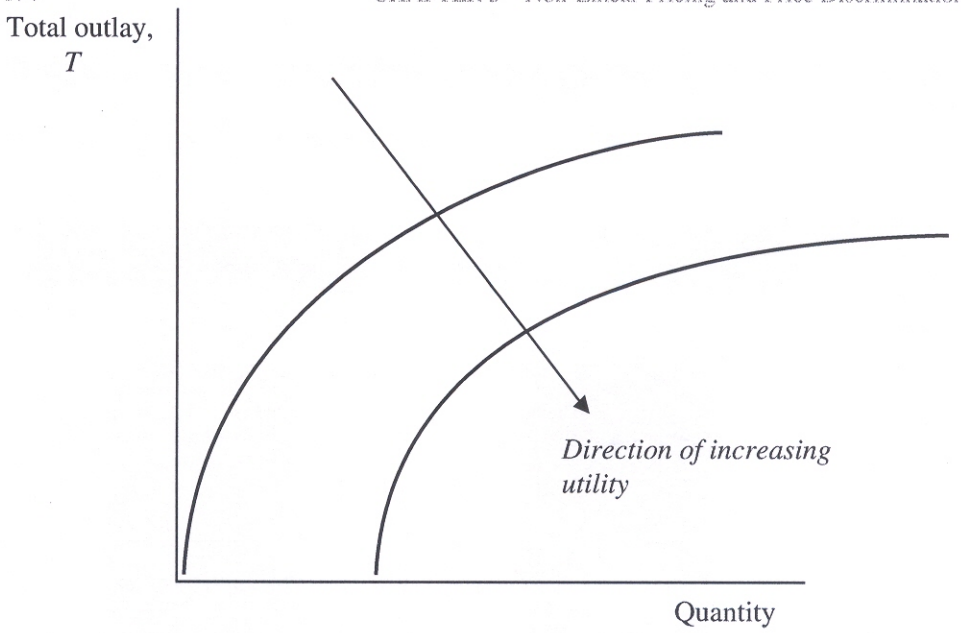

Figure 5.10 Consumer Preferences

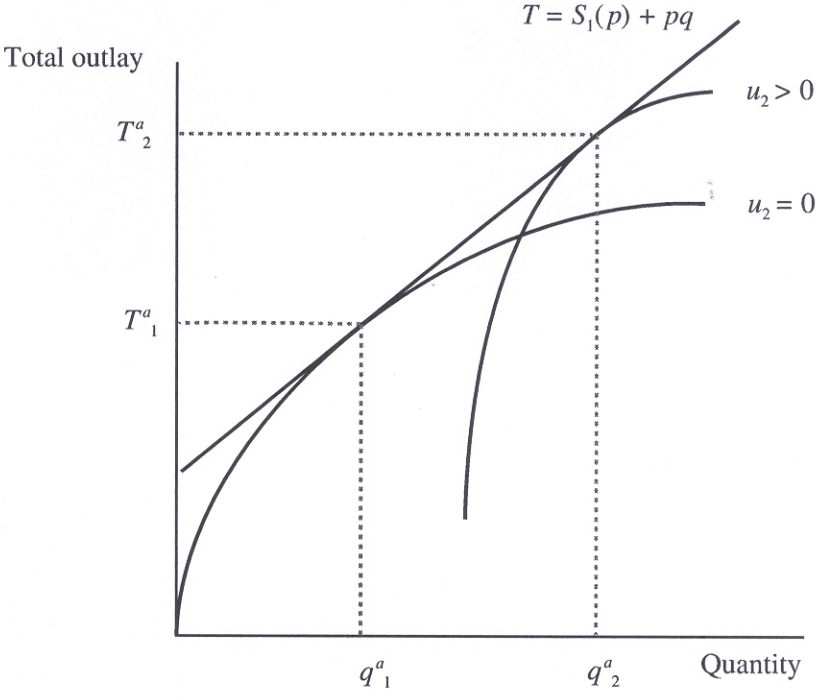

Figure 5.11 Consumer Choice and the Optimal Two-Part Tariff

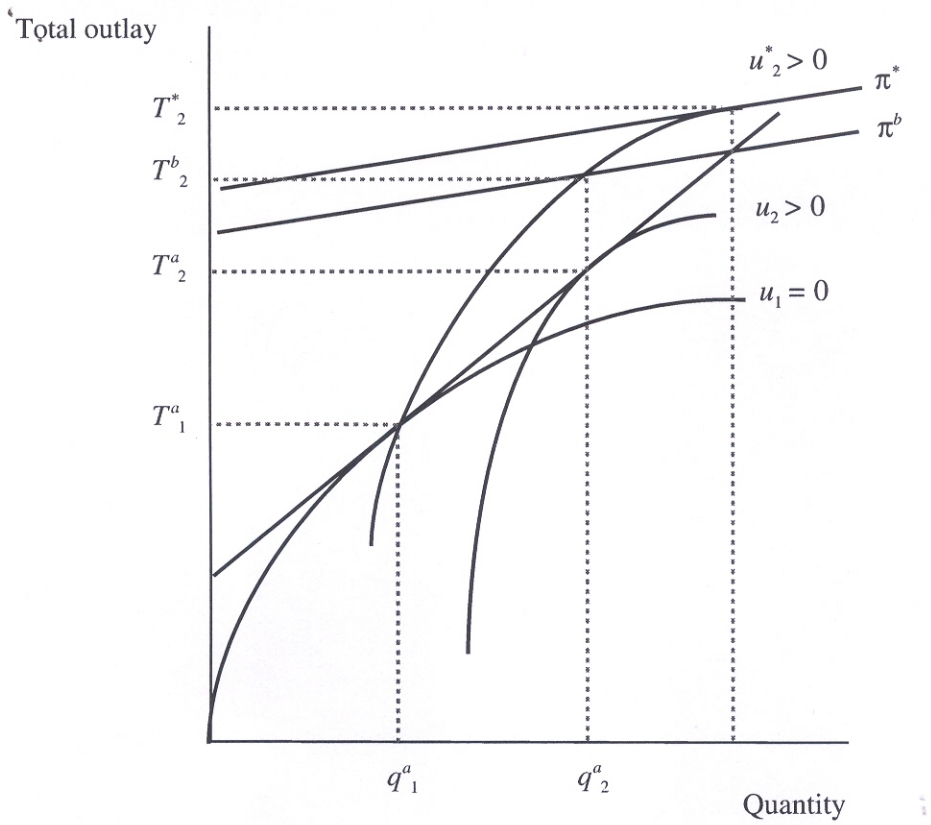

Figure 5.12 Optimal Bundle for High Willingness to Pay

We now demonstrate that the monopolist can increase her profits by offering only two options (instead of the complete two-part tariff schedule) and we characterize the nature of the optimal fully non-linear pricing menu as $\{T_1^*, q_1^*\}$ and $\{T_2^*, q_2^*\}$. To characterize $\{T_2^*, q_2^*\}$ and to show that $\{T_1^a, q_1^a\}$ and $\{T_2^a, q_2^a\}$ are not profit maximizing, consider Figure 5.12.

The monopolist can increase her profits by offering $\{T_2^b, q_2^a\}$ instead of $\{T_2^a, q_2^a\}$. Type 2 consumers will be just indifferent between $\{T_2^b, q_2^a\}$ and $\{T_1^a, q_1^a\}$, whereas they strictly preferred $\{T_2^a, q_2^a\}$ to $\{T_1^a, q_1^a\}$. The additional surplus is extracted by raising T_2 to T_2^b. However, the monopolist can do even better than this. The profit that the monopolist earns by supplying type 2 is $\pi_2 = (1-\alpha)(T_2 - cq_2)$. We can rewrite this as $T_2 = \pi_2/(1-\alpha) + cq_2$. If we fix π_2, this expression gives the different combinations of T_2 and q_2 that yield profits of π_2. This is called an iso-profit line. Different values of π_2 give different iso-profit lines. Iso-profit lines that are higher up the page represent higher profits for the monopolist. The monopolist, in choosing the profit-maximizing $\{T_2^*, q_2^*\}$, is free to choose any combination of T_2 and q_2 so long as the utility that type 2's get is at least as large as they would get if they masqueraded as type 1's. This means that the monopolist is constrained to offering T_2 and q_2 on indifference curve u_2^*. The optimal fully non-linear bundle is the one which reaches the highest iso-profit line. This is not the iso-profit line which goes through $\{T_2^b, q_2^a\}$ (with

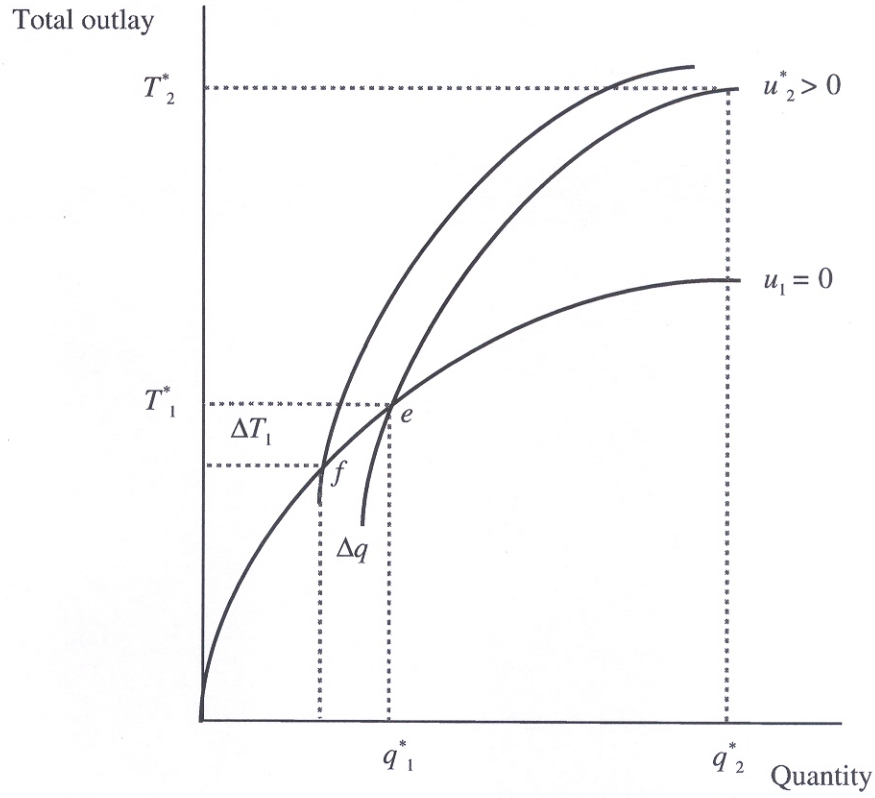

Figure 5.13 Inefficiency of the Low Willingness to Pay Bundle

profits of π^b) since the slope of the indifference curve through $\{T_2^b, q_2^a\}$ is the same as the slope through $\{T_2^a, q_2^a\}$ (and is equal to p).[13] The slope of the iso-profit lines is c. The monopolist can do better by offering T_2^* and q_2^*, reaching the iso-profit line where profits are π^*. This happens where there is a tangency between the indifference curve u_2^* and the iso-profit line π^*. Hence the slope of u_2^* at $\{T_2^*, q_2^*\}$ is c. This means that q_2^* is socially optimal, since the willingness of type 2's to pay exactly equals the marginal cost of production!

We can also conclude that $\{T_2^*, q_2^*\}$ forces the personal arbitrage constraint on the type 2 consumers to bind; they get the same surplus consuming $\{T_2^*, q_2^*\}$ as they would taking the bundle intended for type 1 consumers. This also means that the surplus of type 2 consumers is positive, since all the surplus of type 1 consumers is extracted and type 2 consumers get more surplus than type 1 consumers when they both consume the same option. It is also clear that we need not worry about the personal arbitrage constraints for the type 1 consumers. They will strictly prefer the option that gives them zero surplus over the option intended for type 2.

What about the social optimality of $\{T_1^*, q_1^*\}$? Suppose that it is optimal; that is, q_1^* is such that the marginal willingness to pay of type 1 consumers equals marginal cost. This is shown in Figure 5.13

[13] For simplicity we have assumed that the preferences of consumers are quasi-linear. This means that the slope of indifference curves depends only on q.

where the point e is $\{T_1^*, q_1^*\}$. Consider the effect on the monopolist profits of moving to f, i.e., reducing quantity by Δq_1 and reducing the payment by ΔT_1. The type 1's would still purchase f since their surplus is still zero. The revenues of the monopolist decrease from type 1 consumers by ΔT_1. Costs also change by $c\Delta q_1$. Since the bundle at e is by hypothesis efficient, the slope of the indifference curve at e is c. This means that $\Delta T_1/\Delta q_1 = c$, or $\Delta T_1 = c\Delta q_1$. Hence, the change in revenues exactly equals the change in costs, provided f is close to e. However, the monopolist can increase T_2^*, since the attractiveness of $\{T_1^*, q_1^*\}$ to a type 2 has been reduced. This increases the monopolist's profits. Thus q_1^* will not be socially optimal, it will be too small.

In our analysis we have interpreted q as quantity. However, the exact same analysis holds if q is interpreted as quality and c as the marginal cost of increasing quality.

5.5 Antitrust Treatment of Price Discrimination

Section 2 of the Clayton Act, amended in 1936 by the Robinson-Patman Act, makes it "unlawful for any person ... to discriminate in price between different purchasers of commodities of like grade and quality ... where the effect ... may be substantially to lessen competition or tend to create a monopoly...."[14] The Robinson-Patman Act was not passed by Congress to enhance economic efficiency, but to protect small businesses against the encroaching success of larger ones. In particular, distribution economies plus the buying power of large grocery chains were threatening the existence of many Mom and Pop corner stores. The Act has been universally condemned by economists for focusing on the protection of competitors rather than on competition, and for condemning *price differences* rather than making any attempt to identify true discrimination of the kinds we have discussed in this chapter. Finally, price discrimination is sometimes welfare improving and sometimes not. A per se prohibition is clearly unwarranted and almost certainly has had a chilling effect on many procompetitive practices.

Broadly speaking, two types of cases have been brought under the Robinson-Patman Act. **Primary-line** cases involve injury to (horizontal) rival firms through "discriminatory" prices. Thus, this kind of practice should be analyzed in the same terms as predatory pricing, which we discuss in Chapter 21. At this point we will note that findings or the threat of findings of primary line violations of the Act will hurt competition probably more often than they will protect it. If a firm cannot meet competition in a particular market by lowering prices, without lowering prices equally in all its markets, it may be tempted to just withdraw from the threatened market, thus ending competition there.

The classic case of a primary-line antitrust action being used to suppress competition was Utah Pie.[15] Utah Pie was the dominant frozen pie maker in Utah, with at least a 50% market share, and was facing vigorous competition from three independent pie makers, none of which had a market share in excess of 20%. Because the three competitors were found by the Supreme Court to have priced in Salt Lake City below what they charged in other cities, they were found in violation of the Act. In reality these three companies were simply trying to gain market share in a fiercely competitive market, and one that was becoming more competitive over time.

Secondary-line violations of Robinson-Patman cover "injury" to a disfavored customer, i.e., the customer who is being discriminated against. As we noted above, a major problem is that the Act makes no attempt to identify when price differences might be cost based, or when they might not be cost based but still enhance economic efficiency. Quantity discounts, for example, are usually made in response to actual cost savings in supplying larger volumes. A manufacturer of grocery products can supply a large retail store at a lower unit cost than the lower volumes supplied to a small store.

---

[14] 15 U.S.C. §13(a).

[15] *Utah Pie v. Continental Baking*, 87 S.Ct. 1326 (1967).

Although in the landmark case of Morton Salt the Court found against the defendant for charging quantity discounts that may well have corresponded to cost differences, it is unlikely that a modern court would find quantity discounts liable under the Robinson-Patman Act where the discounts can be shown to reflect cost savings.

A debate among antitrust scholars exists as to whether secondary-line cases should be considered at all when competition in the relevant market is strong and is not threatened by the discriminatory pricing.[16] In the courts, however, this message has not penetrated very far. In *Texaco v. Hasbrouck,* Inc., for example, Texaco was convicted of selling gasoline to wholesale distributors at lower prices than sales to retail gasoline dealers. The Supreme Court noted in its decision, however, that the market for gasoline was "highly competitive."[17]

In the analytical sections we have seen that tying can be motivated by price discrimination objectives. Because a tying scheme corresponds to second-degree price discrimination, it is unlikely to fall foul of the Robinson-Patman Act because the same price schedule is being offered to all buyers. However, tying is explicitly prohibited under Section 1 of the Sherman Act and Section 3 of the Clayton Act; these sections therefore have also had the effect of attacking and limiting price discrimination. A recent and much debated example is the *Kodak* case. Kodak tied the supply of replacement parts for its photocopiers to the supply of service, effectively excluding independent service operators. We have seen that a plausible explanation for this practice is price discrimination: high-intensity users will require more service than low-intensity users, and by the arguments developed in this chapter, Kodak can increase profits by raising the price of service above marginal cost. This, of course, can only be accomplished with a tie.

The outcome of the case in fact hinged substantially on whether the aftermarket could be treated as a separate antitrust market, and, if so, whether Kodak possessed market power in that market, even though they did not in the primary (copier) market. The Supreme Court concluded that it was a matter of fact, not law, and thus to be determined on a case by case basis whether competition in the primary market eliminates market power in aftermarkets. This followed from the Supreme Court's observations that "significant information and switching costs" might break the link between the primary and aftermarkets alleged by Kodak. Kodak was found guilty on remand to District Court of monopolizing the service markets for its high volume photocopiers and micrographic equipment. The independent service organizations were awarded $23.9 million in damages.[18]

5.6 Chapter Summary

- Although price discrimination is often defined in terms of selling different units of a good at different prices, it is much more insightful to study it as a set of pricing strategies for extracting more surplus than is available under uniform pricing.
- Price discrimination may cause total surplus to increase or decrease. If the sole effect is to allow previously excluded buyers to purchase the good at a lower price, a price discrimination scheme can even be Pareto efficient.
- In order to price discriminate, a seller must satisfy two conditions: it must possess market power and it must be able to prevent arbitrage, or resale.
- A variety of strategies can help a firm to prevent arbitrage. Good examples are the use of territory-specific warranties and vertical integration.

---

[16] See, for example, the discussion in Hovenkamp (1994), section 14.6a.

[17] *Texaco, Inc. v. Hasbrouck,* 110 S.Ct. 2535 at 2538 (1990).

[18] *Eastman Kodak Co. v. Image Technical Services, Inc.,* 112 S.Ct. 2072 (1992).

- In first-degree price discrimination a firm perfectly extracts all the surplus from every buyer and from every unit purchased. First-degree price discrimination is also Pareto optimal.
- In second-degree price discrimination a firm cannot identify individual consumers, so must construct pricing schemes which are the same for all consumers. Since some consumers will purchase more than others, however, average prices and marginal prices may differ among consumers.
- Two-part tariffs, with a fixed fee and variable charge per unit, are the simplest and most common form of second-degree price discrimination schemes.
- In third-degree price discrimination a firm is able to segment the market between groups of consumers with differing demands. Higher prices will be charged to groups with a lower price elasticity of demand.
- Both tying and bundling can be techniques for price discrimination. Bundling works best when buyers have negatively correlated reservation prices, that is, one type of buyer has a strong taste for one component of the bundled good and the other type of buyer has a strong preference for the other component of the bundled good.
- In general, non-linear pricing buyers are offered a menu of quantities available at given prices for the given quantity. This kind of pricing schedule can make the firm even better off than, say, two-part pricing.
- Price discrimination is illegal under the Robinson-Patman Act. However, the Act has been used far more to protect small businesses from more efficient rivals than it has to enhance economic efficiency.

Key Terms

arbitrage
average price
bundling
fixed fee
first-degree price discrimination
marginal price
primary line
second-degree price discrimination
secondary line
third-degree price discrimination
two-part tariff
tying
variable charge

5.7 Suggestions for Further Reading

The modern literature on price discrimination starts with L. Phlips (1983), *The Economics of Price Discrimination*. An excellent theoretical treatment for the advanced student is Chapter 3 of J. Tirole's (1988) *The Theory of Industrial Organization*. An advanced treatment of non-linear pricing is R. Wilson's (1993) *Nonlinear Pricing*. Good discussions of the antitrust issues and the Robinson-Patman Act can be found in Hovenkamp (1994) and Viscusi, Vernon, and Harrington (1995), Chapter 9.

Discussion Questions

1. On the Paris metro, first-class and second-class compartments used to be identical in every respect except for the signs "First Class" and "Second Class," and the higher fare for riding first class. What's going on? Is this price discrimination?