Pricing Information Goods

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Abstract. I describe some of the issues involved in pricing information goods such as computer software, databases, electronic journals and so on. In particular I discuss the incentives to engage in differential pricing and examine some of the forms such differential pricing may take. This paper was presented at the Research Libraries Group Symposium on "Scholarship in the New Information Environment" held at Harvard Law School, May 2-3, 1995 and will be published in the conference proceedings.

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Pricing Information Goods

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Digital materials typically have the property that it is very costly to produce the first copy and very cheap to produce subsequent copies. It is often said, for example, that the "first copy costs" are more than 70% of the cost of an academic journal. Cost structures of this form pose special problems for pricing.

The first problem is that it is very difficult to sustain a competitive market with this sort of cost structure. Economists define a *purely competitive market* to be one where there are "several" producers of an identical commodity. The market for wheat, corn, shares of IBM stock, etc. are all examples of purely competitive markets. The market for automobiles is not purely competitive since there are not multiple producers of identical products. Instead, there are several somewhat different products some of which are close substitutes. Economists call this a situation of *monopolistic competition.*

The market for academic journals (or other sorts of information goods) tends to be much more like the automobile market than the wheat market. The high-fixed-cost/low-incremental-cost structure forces this outcome. To see why, let us suppose that there are several producers of a "generic" database. By this I mean a standardized set of data that anyone can produce: CD ROMs containing telephone directory listings, for example. There may be very large costs to producing the first copy of such a database, but subsequent copies can be stamped out at less than $1 a piece. Suppose that several firms have produced such CDs. If the products have similar user interfaces and similar data, consumers will buy only from the cheapest producer. But then the producers with no sales all have an incentive to undercut the competition, and there is no natural floor on prices except the $1 a copy reproduction costs. Since this price is likely inadequate to recover fixed costs, producers will be forced out of business until only a single seller remains. This single seller can now operate as a monopolist unconstrained by competition.

Since a purely competitive market is not viable, we turn our attention to a market where producers have some market power. That is, the product that they sell is different enough from

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products produced by other producers that their primary concern has to do with the customers' willingness to pay for the product rather than their competitition's behavior.

1. Price Discrimination

If all customers for the product place essentially the same value on the product, the profit-maximizing pricing decision is easy: just price the product at this common value and charge what the market will bear. The difficulty arises when consumers' willingnessess to pay are heterogeneous. In this case the producer's choice is not so obvious, since fewer consumers will buy at higher prices. Furthermore, if willingness-to-pay differs across customers, the producer would generally find it advantageous to charge different users different prices. As we will see below, this will be true even for a producer who is only interested in cost recovery. I will illustrate some of these phenomena via a series of examples involve the demand for an electronic book. In each example the cost structure will be the same: \$7 to produce the first copy of the book, and the second copy can be produced at zero incremental cost.

Example 1. There are two consumers, A and B. A is willing to pay \$5 for a book, B is willing to pay \$3 for the book.

Note that the total benefits 8 = 5 + 3 exceed total cost, 7, so it is socially desireable to produce the book. However, the producer cannot recover his costs at any uniform price: if he charges \$5 only one consumer will buy the book, so his revenues will be \$5. If he charges \$3, both consumers will buy, but revenues will only be \$6. If the producer can price discriminate—sell to different users at different prices—then it will be possible to cover the development costs of the book.

Example 2. A is willing to pay \$8, B is willing to pay \$3.

In this case, total benefits minus total costs would be maximized if both parties got copies of the book. But again this outcome cannot be supported at any uniform price: the highest price at which both parties would buy is \$3, and this generates inadquate revenues to cover the cost. However, if the producer could charge different users different prices, he would find it profitable to sell books to both consumers.

Example 3. A is willing to pay \$20, B is willing to pay \$8. In this case, a producer who is only interested in cost recovery could price the book at \$3.50 and be assured of recovering his costs. But

a profit-maximizing producer would pursue a very different strategy: it is in his interest to price the book at $20 and sell only to the high end of the market. Note that this is the case *even though consumer B is willing to pay the entire cost of production!*

2. Price discrimination in practice

The above examples show that it will typically be desireable for a profit-maximizing producer to practice price discrimination and it will often be desireable to do this even for a non-profit who is only interested in cost recovery. There are two problems with implementing price discrimination in practice: determining the willingness to pay of different consumers, and preventing consumers with high willingess to pay from purchasing the product intended for the consumers with low willingness to pay.

Since consumers will not willingly reveal their true willingess to pay, pricing needs to be based on something that is correlated with willingess to pay. For example, it is often thought that business users have higher willingess to pay than educational users, so many software manufactuerers often educational discounts. Similarly prices often depend on whether you are a large user, an on-peak or off-peak user, domestic or foreign, member of a particular group, etc.

Another dimension on which producers can price discriminate is on characteristics of the product. It is often thought that users who want the product immediately are willing to pay more than those who are willing to wait. Note that this has nothing to do with the cost of providing immediate service: the producer may want to charge differentially for different degrees of timeliness regardless of the cost of providing such service. A nice example of this is stock market quotations: quotations that are 5 minutes old demand a premium price, while those that are 1/2 hour old sell for much less.

Yet another dimension is the quality of the good itself. In an electronic text, one could price discriminate on resolution (screen, 300 dpi, 600 dpi, etc.), whether the data is formatted or unformatted, structured, unstructured, etc.

We turn now to the second problem: how do we ensure that the consumers with higher willingess to pay actually pay the higher price? One answer is to degrade the quality of the product offered to the consumers with a low willingess-to-pay.

Consider, for example, the case of airline pricing. There are two broad classes of travellers: business travellers and tourists. The airlines price discriminate between the two by offering a

degraded product: a much cheaper ticket with restrictions (Saturday night stayover, advanced purchase, no changes, etc.) The consumers with low-willingness to pay tolerate this degraded product while those with high willingness to pay do not.

This strategy is common in high technology. Deneckere and McAfee (1994) describes several examples:

- Student versions of mathematical software that disable calls to the math coprocessor in order to slow down calculations.
- The 486SX chip, which is simply a 486DX chip with the coprocessor disabled.
- Federal Express offers both morning and afternoon delivery. It appears that FedEx does not deliver afternoon packages in the morning, even if they arrive in time for morning delivery. Instead they will make two trips to the same location.
- The IBM Laser Printer Series E was a low-cost alternative to the IBM Laser Printer. The series E printed at 5 pages per minute rather than the 10 pages per minute of its higher cost brother. Apparently, both printers use exactly the same print engine, the only difference being 5 chips that inserted wait states to slow down the series E printer.

In each of these cases, the producer finds it advantageous to differentiate the product in order to support a differential prices. Indeed, several of the strategies described above fall into this category: it may be just as costly to deliver delayed information as immediate information, but it is prefereable to delay the information in order to maitain the two-tiered price system. Similarly with resolution: it would probalby be cheapter to offer an image in one resolution, but low and high resolution products make price discrimination viable.

The fact that producers will find it advantageous to degrade the product in order to differentiate prices has been recognized for centuries. Witness the observation of a 18th centurey economist:

> It is not because of the few thousand francs which would have to be spent to put a roof over the third-class carriages or to upholster the third-class seats that some company or other has open carriages with wooden benches . . . What the company is trying to do is to prevent the passengers who can pay the second class fare from traveling third class; it hits the poor, not because it wants to hurt them, but to frighten the rich . . . And it is again for the same reason tha the companies, having proved almost cruel to the third-class passengers and mean to the second-class ones, become lavish in dealing with first-class passengers. Having refused the poor what is necessary, they give the rich what is superfluous. (Dupuit (1849), quoted in Ekelund (1970))

As this quote suggests, observers typically find this sort of quality degradation unattractive. However, it may well be a big win from the viewpoint of consumers since the low-quality market may not be served at all with out the degradation. By differentiating the product the producer can segment the market and recover revenue from the low-demand sector without destroying the revenue from the high-demand component. Indeed, Deneckere and McAfee (1994) shows that the use of product degradation can, under some circumstances, make all parties to the transaction strictly better off!

3. Bundling

Another very attractive form of price discrimination is known as product *bundling*. This occurs when distinct products are sold together as a package. Again, this is a common practice for information goods. One of Microsoft's most successful products in recent years has been Microsoft Office, which is a bundle of different software products. Similar, academic journals are a bundle of articles, and a subscription to a journal is a bundle of issues. More recently, producers have been offering bundles of subscriptions of related journals at special rates.

In order to understand the economics of bundling, let us again consider a simple example of two mathematics professors and two journals, the *Journal of Addition* and the *Journal of Subtraction.* Professor A, an expert in addition, is willing to pay \$120 for the *Journal of Addition* but only \$100 for the *Journal of Subtraction*. Professor B is an expert in subtraction, and has just the opposite willingess to pay: \$120 for the *Journal of Subtraction* and \$100 *Journal of Addition*.

If the producer sells both journals at the separate prices, his profit maximizing strategy is to set a price of \$100 for each. Each mathematician will buy each journals, yielding a revenue of \$400. But suppose that the producer offers a bundle of the two journals: if the willingess to pay for the bundle is just the sum of the willingess to pay for the components, each professor would then be willing to pay \$220 for the bundle. This yields the producer a revenue of \$440!

Bundling is profitable in this example because it reduces the heterogeneity of the consumers' willingess to pay: as I indicated initially if consumers have different willingnesses to pay, and the producer cannot price discriminate, all the consumers who buy the product buy at the price of the buyer with the lowest willingness to pay. By creating the bundle, the producer can sell at the *average* willingness to pay, and this will typically be more profitable.

Indeed, this is one of the rationales for having journals in the first place. A journal is simply a bundle of articles and it is likely the case that there is much more heterogeneity in valuations of individual articles than there is in bundles of articles. Hence bundling articles together will generate more revenues than selling each individual article at a flat price.

Of course this sort of revenue enhancement is not the only reason for bundling. Collecting articles on similar topics together helps to reduce consumer search costs, lowers production costs, etc. However, these cost and search based effects are less compelling in an electronic environment, whereas the revenue effect may still be quite strong. It seems likely that producers will want to continue to use the subscription model even if it isn't warranted solely on cost grounds.

4. Summary

Producers of information goods such as electronic journals will want to consider the possibility of differential pricing, letting prices vary both across consumers and across qualities of the good. Quality variation may take the form of offering a degraded quality in order to sell to the low end of the market while still maintaining revenue from the high end of the market. Such quality variation can generate additional revenue to cover costs as well as increasing access to the good making all parties to the transaction better off. Bundling articles, journals and services together may be attractive as additional means of raising revenue.

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