

September 24, 2002

**"Internet and pricing issues: Relationship of prices charged by fixed price vendors in cyberspace and those in bricks and mortar stores"**

Richard Friberg, Stockholm School of Economics

Outline:

- I. E-commerce – alive and kicking
- II. An empirical example
- III. Price discrimination – preliminaries
- IV. Consumers separated into different groups – third degree price discrimination
- V. Self-selection by consumers – second degree price discrimination
- VI. Knowing each consumer's willingness to pay – first degree price discrimination
- VII. Fairness concerns
- VIII. Future

Keywords:

**Cannibalization:** When customers that are willing to pay a higher price choose to buy from a firm's lower priced channel. For instance when low internet prices of a firm cut into its sales in Brick and Mortar stores.

**E-commerce:** The selling and buying of goods or services over the internet.

**Law of One Price:** The idea that, absent information costs, a given good is sold at the same price by all sellers in the same market.

**Market segmentation:** When prices of the same good in two markets differ by more than can be explained by transport costs, they are said to be segmented. For instance, despite low transport costs, the distribution structure of the automobile industry has led to European car markets to be segmented along national borders.

**Price discrimination:** When a seller charges different prices for the same, or very similar goods. Examples of frequently observed cases of price discrimination are student discounts and different prices of airline tickets depending on the time of flight.

September 24, 2002

**"Internet and pricing issues: Relationship of prices charged by fixed price vendors in cyberspace and those in bricks and mortar stores" <sup>1</sup>**

Richard Friberg, Stockholm School of Economics<sup>2</sup>

The selling of goods and services over the Internet is increasingly dominated by firms that also retail in bricks and mortar (B&M) stores. How are prices set on the Internet and in the B&M stores and what is their relation? As an organizing framework we use the literature on price discrimination – which analyzes the practice of charging different prices for the same, or very similar, goods. We start with a setup where only a share of the population has access to Internet. We analyze a number of mechanisms that affect optimal prices on the Internet and in B&M stores – for instance different consumer characteristics, different strength of competition in the two channels and the decision to price discriminate when there is competition. We continue with applications of price discrimination based on self-selection by consumers and of price discrimination when the retailer has accurate information about a particular consumer's willingness to pay. We end with a discussion of experimental evidence on fairness concerns and discuss the implications of these for pricing strategies.

---

<sup>1</sup> Much of my thinking around these issues has been shaped by my coauthors on an Internet pricing study – Mattias Ganslandt and Mikael Sandström. I want to thank them for many fruitful discussions. This survey was written while I was a visiting fellow at the Economics department of Princeton University, I thank them for their hospitality and the Tom Hedelius and Jan Wallander Foundation for financial support.

## **1. E-commerce – alive and kicking**

After a period of what can perhaps be described as irrational exuberance, stock market valuations of e-commerce firms have come down. Many of the e-commerce firms have also experienced financial difficulties or outright bankruptcy. In most markets e-commerce has remained a relatively small market segment - even for books, where Amazon.com appeared as the first big poster boy of e-commerce, only some 5 percent of US sales are online.

Even at this stage however it is not hard to understand the enthusiasm with which e-commerce was greeted. Even though e-commerce has yet to live up to the expectations that were placed on it at the initial stages, it is important to remind ourselves that e-commerce is in many ways alive and healthy. In particular, the failure of specialized e-commerce dealers should not be seen as an indication of the failure of selling goods over the Internet. The last couple of years have in many countries been associated with steady growth rates in the share of retailing that is done over the Internet. The Swedish institute of trade (HUI) monitor e-commerce developments with a particular focus on Sweden. The Swedish case is particularly interesting since the share of people with access to the Internet is very high in comparison to most other countries. In the 2002 proposal for new laws regulating e-commerce the government cites that during 2001 some 70 percent of Swedish households had access to Internet at home and 55 percent of households had used the Internet to order goods or services online (compared to the European average of 14 percent). The share of consumers who had bought something over the Internet in 1999 was only half of what it is today – pointing to the continued increase of e-commerce. Table 1 illustrates the

---

<sup>2</sup> Stockholm School of Economics, PO Box 6501, SE-113 83 Stockholm Sweden. E-mail: [nerf@hhs.se](mailto:nerf@hhs.se), url: <http://www.hhs.se/personal/friberg>

ongoing increase in the share of retail sales that take place over the Internet. With but two exceptions, all quarters in the last three years have seen two digit increases in Internet sales.

Table 1 about here

Also in the US, the retail share of Internet continues to increase. According to the US department of commerce, e-commerce sales in 2001 were estimated to be 19.3 percent higher than in 2000 and the share of e-commerce in total retailing is up from 0.9 to 1 percent.

Table 1 also illustrates that in Sweden the share of retailers that have Internet sales is increasing, pointing to the increased importance of firms who retail both online and in B&M stores. In 2000, for instance, there were some 250 pure e-commerce retailers in Sweden, many of whom have since gone bankrupt or been taken over. At the same time, more than 7000 conventional retailers have sales over the Internet. With the benefit of hindsight, the increasing importance of B&M retailers seems obvious. While they generally were slow starters brand recognition, knowledge of the business and customers, associations with suppliers and functioning distribution networks are considerable advantages. A case that has received some media attention is that of Tesco, the UKs leading grocery retailer. Rather than building a new business from scratch, it was able to simply use its existing stores as storage space and basis for expansion into Internet retailing. While issues of cross-subsidization put some question marks around the profitability of its e-commerce business, it is clear that it has significant advantages over its “pure-play” adversaries. This implies that the economic impact of e-commerce is far from stillborn – it does point to that issues

about the relation between B&M prices and prices charged online will be of ever greater importance in many lines of business.

This article examines the relationship between the price of a good sold online and the price of the same good sold in a B&M store. We limit our attention to sales to consumers (B2C in somewhat dated parlance). In particular we focus on the relation between the prices of the same firm. We examine the theoretical arguments that decide how prices should be set when a firm retails through several channels. If prices (or rather the markup over marginal cost) differ across the channels, the firm engages in price discrimination and that will be the organizing principle of this article. Since we are not explicitly focusing on one single industry the discussion will necessarily have the appearance of a list of different mechanisms – the relative strength and applicability of these will depend on the characteristics of the good and industry in question.

The relation between online and B&M price is of course of the greatest importance for firms where the Internet channel is an important (potential) competitor. This regards in particular any good or service that does not have to be physically delivered, that is in particular various information goods. Music, film, computer programs and in a near future books are products that come to mind. Today, even in those markets, Internet is typically of limited importance as a retail channel. However, this is likely to change in the future – Rudiger Dornbusch of MIT has offered that as a general rule “things happen a lot later than you expect, but when they do, they happen a lot quicker than you expect”. This is really a statement of the S-shaped adoption pattern of new technologies and new network goods. Adoption is initially slow, and only after some time does it take off in earnest, showing a rapid increase and only tapering off as satiation sets in. The spread of the Internet has been

remarkably fast, in 1991 less than 3 million users had access to the Internet, e-commerce applications were essentially non-existent and web browsers of the type we have today were not available. By 1999 250 million had access to the Internet and about a quarter of those were estimated to have bought something over the Internet. Despite this impressive growth we are likely to see much more in the future, access to high-speed broadband will become ubiquitous (currently only some 15 percent of US Internet access is broadband), better payment security (according to a 2002 report from Gartner group more than 1 percent of online sales were lost to fraud, almost 20 times higher than the corresponding figure for offline sales), better delivery systems will develop and consumer protection laws will become more aligned with the demands of e-commerce. In some markets sales over the Internet are already today an important share of revenue – in his survey for the Journal of Economic Perspectives Yannis Bakos for instance reports that it accounted for almost 30 percent of US leisure travel in 2000 and it is estimated that of Swedish banks' stock trades more than 40 percent of orders come over Internet. Having spent some time motivating our interest in the relation between online pricing and that in B&M stores let us proceed with a quick glance at the data.

## **2. An empirical background**

A large number of studies have compared prices online to prices in B&M stores. In which channel it is cheaper varies across studies and results are sensitive to the size of the bundle bought and relations may change over time. Nevertheless we may distinguish two "stylized facts": 1) Prices are generally lower online than in B&M stores, also if we include transport costs. A number of exceptions exist however, and

if only a single item is bought transport costs are frequently high enough to make it dearer to buy online. 2) There is considerable price dispersion online as well as in B&M stores.

On the particular issue of interest in this survey, a comparison of prices from the *same* retailer in the two sales channels there exists little work. Let us illustrate with one study below, the results are taken from work by myself, Mattias Ganslandt and Mikael Sandström. In Table 2 we examine the prices of a basket of three books and five CDs respectively. The baskets include both recent best sellers and "golden oldies". Online prices are from all Swedish online retailers at the time of the study (October 1999) and the B&M prices are from a random sample of retail stores located throughout Sweden. While the sample of goods is relatively small, the sample of B&M prices is unusually comprehensive for the literature. Prices were collected in some 150 B&M stores across 19 localities spread out over Sweden. The facts that emerge from this study are well in line with the international evidence and it can therefore serve as an illustrating example.

Table 2 about here

The numbers in Table 2 give the percentage deviation from the mean price across all stores for the respective basket. Looking at the first row for instance the mean deviation for the book basket for all firms is by construction 0. We then see that the lowest price is 23.96 percent cheaper than the average and the highest price is 18.6 percent higher than the average. We see that retailers that only sell over the Internet have lower online prices than retailers that sell both online and in B&M stores. For books for instance the pure-play internet retailers have an average price that is 16.8

percent lower than the average for all firms, while multi-channel retailers charge 9.68 percent more online than the average price for all firms. Lower online prices of pure-play internet retailers is also seen in a study of Fang-Fang Tang and Xiaolin Xing of Singapore who compare online prices of DVDs – average prices of pure Internet retailers are 14 percent lower than those of multi-channel retailers.

In the Swedish data the relation between the prices online and in B&M stores of firms that had sales through both channels varied considerably, prices in some cases being higher online and in others lower. For books the prices are on average higher on the net and for CDs they are on average lower. This reflects that the relation between prices online and in B&M stores from the same retailer is more complex than if the two retail channels had non-overlapping sets of players. If prices are lower or higher on the net, will depend on various characteristics of the market. For the framework of price discrimination to be relevant two conditions have to hold – there must be some limits to arbitrage by consumers and, less trivially than at first might appear, the good has to be sold in both retail channels. We now look at these two issues in some detail.

### **3. Price discrimination – preliminaries**

The first issue regards the possibility of arbitrage – will there be positive demand in both channels even if prices differ? One question regards personal arbitrage, different consumers have the possibility to choose the price and outlet where they shop, and can be assumed to choose the one which yields the highest utility. This will be the most relevant to our case and we will return to it further below when we analyze the issue of second degree price discrimination, of self-selection.

In reality, are markets interconnected – that is do consumers in one market have the possibility to buy in the other? For many goods this will be the case, a typical consumer will have access to a certain product in a retail store as well as through the Internet. The choice of where to buy will be determined by relative prices, the consumer information set and additional costs associated with buying through the different retail channels. Austan Goolsbee has examined the decision of whether to buy a new computer online or in a local retail store. His results confirm that for this market the Internet and retail markets are linked – a 1 percent higher retail price in a locality is associated with a 1.5 percent increase in the probability that a new computer is bought from a remote supplier, that is over Internet.

There is also the issue of arbitrage across consumers. Think of a situation where one group of consumers only has access to the Internet channel and another group only has access to the B&M store. For price discrimination to be possible across these two groups, resale from the group that is targeted with the low price has to be impossible or unprofitable.

The second issue regards whether goods should be available in both outlets. A manufacturer has the ability to (imperfectly) control the distribution of its good. The pricing issue only arises if the good is available on both locales. A firm can decide who may retail its good and may attach various conditions thereto. Typically such control is incomplete and there are informational asymmetries. For instance if the retailer has some market power it will add its own markup over the markup of the manufacturer, leading to less sales than optimal. The manufacturer is also unable to perfectly monitor the sales and promotion efforts of the retailers – there may be too little effort exerted by the retailer. It may also be the case that pre-sales services are provided by B&M retailers and then after haven gotten the information they need,

consumers choose to buy from a discount Internet retailer. This freeriding by Internet retailers may undermine the incentives for B&M retailers to provide pre-sales service and hurt overall profits of the manufacturer. There is a large literature in economics on vertical restraints - various forms of contractual remedies that can be used to align the interests of the retailers with those of the manufacturer. Dennis Carlton and Judith Chevalier of the University of Chicago provide an empirical examination of the markets for fragrances, DVDs and refrigerators. They find that manufacturers that limit the number of B&M stores which may carry their good, also limit distribution online, in particular to discount Internet retailers. They also find that prices on manufacturer websites tend to be high, pointing to a desire not to undermine B&M sales. In the management literature this issue has been known as channel conflict, pressure from GMs dealer network for GM not to launch Internet distribution is an example of this that made some headlines.

For the rest of the paper we take as given that the firm wishes to retail both over the Internet and in B&M stores. To focus on the pricing issue we assume that the firm can perfectly control prices and sales related activities in the two different channels. That is we focus on the issue of price discrimination while for the most part ignoring issues related to vertical restraints.

#### **4. Consumers separated into different groups – third degree price discrimination**

This is the perhaps most clearcut form of price discrimination. In essence we think of a firm that faces several different consumer groups that have different elasticities (percentage response of quantity to changes in price) of demand and/or the marginal cost of supplying them differs. If resale between the two groups can be prevented the

optimal prices to the two different groups differ. The optimal price to each group will be determined by setting the price or quantity such that marginal revenue (the gain in revenue from producing one more unit) equals marginal cost. For a minute assuming marginal costs to be the same across groups, the consumer group where demand is the least elastic will thus face the highest prices. The classic example is that of student discounts on transportation – students generally have low incomes, are easily identifiable by student IDs and the service can not be resold.

As a first step, let us see what third degree price discrimination tells us about a situation where the two groups are 1) consumers with access to Internet and 2) consumers without. This has clearly been the case in most markets this far. Let us examine some considerations that will affect the sensitivity of demand on the two markets – Internet vs non-Internet.

#### 4.1. Consumer characteristics

Computer ownership and Internet access are not universal. It is reasonable to expect that the consumers that do have Internet access differ systematically from those that do not. This presumption is confirmed for instance in a study by Peter Klenow and Goolsbee. Their goal is to determine if there are network effects in the adoption of computers – that is indeed the case – as a byproduct they estimate how computer ownership correlates with demographic characteristics. In particular, a household is more likely to own a computer if it has higher education and higher income. This is typically the group that we hypothesize is less price sensitive. All else equal optimal Internet prices should thus be higher than B&M prices. The more widespread adoption of Internet becomes, the less important should this effect be.

## 4.2 Differential strength of competition

The optimal prices on the two markets will also be affected by the strength of competition on the respective markets. Think for instance of a firm that has a monopoly in its B&M store but faces fierce competition on the Internet. Clearly price will be lower on Internet of this firm's good. Two mechanisms leading to vigorous competition are frequently invoked – one is that the barriers to entry in Internet retailing are very low and the second that price transparency is so great that competition tends to be very strong.

### *Entry barriers*

The presumption that entry barriers are very low on the Internet does not find strong empirical support. It may be cheap to set up a website but in particular it is costly to build a reputation. Expectations regarding delivery lags, the security of the payment, return policies and the handling of faulty shipments all affect a consumer's shopping decision. Michael Smith and Erik Brynjolfsson have examined consumer click patterns at a consumer shop bot. The consumers are given prices of the same book by at most 33 different retailers. Most consumers do not choose the lowest offer and the chosen offer is on average more than 20 percent higher. They find that consumers strongly prefer offers from well known retailers (Amazon, Barnes and Noble and Borders). Existing B&M firms with well known brand names have a strong advantage when they enter into Internet retailing..

*Low search costs.*

The explanation typically offered for why prices should be lower online than in B&M stores is that competition is harder online – search costs are low and “competition is just a click away” as the cliché goes. While there is no reason for us to expect that this holds universally it is confirmed in a number of studies. In a series of papers Florian Zettelmeyer, Fiona Scott Morton and Jorge Silva-Risso study the prices of cars paid by customers who used an Internet referral service. They find that using the Internet referral service reduces the average price that a given customer pays by more than two percent. One avenue that is thought to lead to strong price competition on the net is the existence of price comparison engines, shop bots. Using data from an Internet shop bot Glenn Ellison and Sara Fisher Ellison of MIT confirm that, for upgrades of computer memory, online competition does indeed appear fierce. They also point to the possibilities of manufacturers to distort information and make the shop bots less efficient. For goods that are more differentiated, where consumer trust and brand recognition are important, the pro-competitive effect of search engines appear much less pronounced.

Indeed, the simplest symptom of strong competition – that rivalry is so strong that no one can charge a higher price than someone else is strongly rejected by experience so far. For instance Michael Baye and Patrick Scholten of Indiana University together with John Morgan of Princeton have examined prices over 8 months of the 1000 best selling electronics products at the comparison site Shopper.com. Average difference between the highest and lowest price was a full 40 percent. The average gap between the two lowest prices was on average 5 percent. By making prices harder to compare (obfuscation in the words of Ellison and Ellison),

and by differentiating the product, the retailers try to limit the pro-competitive effect of shop bots. Kathy Bayliss and Jeffrey Perloff of University of California at Berkeley for instance find that in the markets for two electronic products, there not only is considerable price dispersion but also that firms which follow user-unfriendly practices tend to charge higher prices. Also, they document significant search costs – up to 15 minutes on some sites to determine the price and whether a good is in stock.

Thus intuition, and the studies so far, point to that competition on the Internet is quite strong – but they also clearly document that we are far removed from the frictionfree model of perfect competition. The main conclusion that we can draw from this, for the purpose of discussing the relation between prices on the Internet and in B&M stores is that competition can be expected to be stronger on the Internet but also that firms are typically expected to have some market power in both retail channels, that is, some possibility of driving up price above marginal cost.

It is also worth to point out that the dividing line between Internet sales and B&M sales is not razor sharp. Consumers can use the Internet to search for information while still choosing to buy in B&M stores. This is the case for instance in the car retailing studies of Zettelmayer, Scott-Morton and Silva Risso. Also in other markets, consumers turn to the Internet to learn about the product and make price comparisons. The pro-competitive effect of lower search costs is therefore not likely to be isolated to Internet sales.

#### 4.4 Price discrimination vs uniform prices

In the standard type of theory that economists apply a monopolist always earns at least as high profits if it price discriminates as if its sets the same price across the

board, practices uniform pricing. The intuition is simple, by setting prices optimally to different groups the firm will do at least as well as if charges the same price to all consumers. For a monopolist the issue is thus clear – as long as different groups can be segmented, it will almost always be optimal to charge them different prices. This result abstracts from any administrative costs of setting different prices and issues relating to fairness and reputational concerns of the seller. We return to the latter at the end of our discussion. Importantly it also abstracts from strategic interaction - it does not necessarily hold true that profits are increased by third degree price discrimination when there is competition. Consider two firms that compete on two markets and sell a product that is differentiated, that is, the products are not perfect substitutes. If tastes are such that the same market is the high price market for both firms, then the intuition from the monopoly case carries over to competition – price discrimination raises profits. If, on the other hand one firm's high price market is the other firm's low price market and vice versa, then price discrimination can lower prices in all markets by all firms and result in lower profits. Take the example of two firms – Inetdeluxe and Mainstreetdeluxe that sell both online and in a B&M store. Half the population has Internet only and the other half have no access to Internet. For Inetdeluxe the Internet is its strong market and the B&M store its low cost warehouse-style outlet. For Mainstreetdeluxe the opposite holds true. Think of Inetdeluxe, it now has incentives to set a low price in its B&M store, by setting a low price it will take some customers away from the competition and it will not have any direct effect on the price it charges to its high price clients online. Mainstreetdeluxe however faces the reverse incentive to set low a price on the Internet and as a result the ability to price discriminate can lower prices in both markets and lead to what Kenneth Cortis of Harvard Business School has called “all out competition.” If both firms had uniform

prices and charged the same price in their respective B&M and Internet sites, then the incentive to lower price in their weak market would be tempered by the loss of profits that results from the lower price to its high price market. Making some form of credible commitment not to price discriminate could raise profits of the firms. The result stresses that having the same prices on the Internet and in regular stores can indeed be the strategy that maximizes profits.

#### 4.5 Dynamic issues – switching costs

An important aspect of the high stock market valuation of Internet companies was the expectation of relatively strong lock-in effects. For a number of reasons people are often more likely to buy a brand or from a retailer that they have bought from before. It may be because it takes time to learn to use another product (such as is the case with computer programs), or you associate with the brand and have a high emotional cost of switching (think of allegiance to sports teams or brands like Harley-Davidson). On the Internet it may be that you are familiar with the website, and have grown to trust the retailer to ship correctly and promptly and offer hassle-free shopping. Economists have extensively studied competition when there are these type of costs of switching brands, switching costs for short. As discussed in a forthcoming survey in the Handbook of Industrial Organization by Joseph Farrell and Paul Klemperer, the basic setup is one of two firms that compete over two periods. The model predicts a bargain-then-ripoffs pattern, in the first period competition is fierce to attract customers. In the second (and last period) the sellers want to squeeze as much out of consumers as they can. Sophisticated consumers will realize this and will look at the total price over the two periods, if the seller cannot commit to a low price in period 2

she can only affect the price by lowering the first period price. When a new market such as the Internet appears we thus expect low markups in the initial period. This will clearly tend to promote low Internet prices in the period this far.

#### 4.6 Geographic coverage

The geographic coverage of the B&M market and the Internet will often differ. In the simplest example think of a firm that operates a single B&M store but also has an Internet shopping site. Typically the B&M store will only compete for customers that live in the vicinity but the Internet site will compete for customers from the whole region or country, if not internationally. Also for retail chains, the geographical coverage of B&M and Internet retailing will typically differ and Internet sales will be available in regions or countries where the firm has no B&M presence.

Of particular interest is whether the Internet markets are segmented along national borders or not. It is well established that prices differ much more between locations if these locations are in different countries. The size of the so called border effect is very large, much above what can be explained by tariffs or shipping costs. This holds for instance in the broad comparisons of relative price variability conducted by Charles Engel and John Rogers on US/Canadian and European data. Also more detailed studies of for instance car pricing in Europe demonstrate that national markets are segmented. One reason why also Internet markets may be partly segmented along national lines are that shopping abroad is associated with different rules and return policies and may be perceived to be associated with higher risks. Also, shipping charges usually see large discrete increases as you cross a border. Are Internet markets segmented along national lines? Evidence from the market for

textbooks collected by Karen Clay and Choom Hong Tay points to that for this market it is so. They find international price differentials that are much larger than the price differentials that are typically found within countries. To some extent arbitrage opportunities based on for instance tax differences will affect purchasing patterns. Goolsbee indeed finds that the probability that a consumer buys a good online is higher, the higher are local sales taxes. For locations that have high B&M prices because of high local sales taxes or VAT, or because of low demand elasticity, this thus predicts a downward pressure on online prices relative to B&M prices.

#### 4.7 Cost differences

If marginal costs are different between B&M sales and Internet sales this will also affect the relation between prices. B&M stores are likely to have higher marginal costs because of costly retail and storage space and less automatization of sales and thus a higher personnel intensity, whereas Internet retailing may have high fixed costs. In particular the costs of building up Internet retailing may be high in the initial stage that we have witnessed so far. For firms that retail through both channels the effects may be somewhat blurred, deliveries are likely to come from the same warehouse. An important difference in prices is that while price in a B&M store does not include shipping to your home prices on the Internet may or may not include this.

#### 4.8 Price rigidities

Prices may also differ between the Internet and B&M stores because of differential rigidity of prices. Casual evidence, a number of case studies and interview studied

such as the one conducted by Alan Blinder of Princeton with a number of coauthors all show that prices are typically rigid, in the sense that they do not change as soon as there is some change in demand or marginal costs, as standard theory would predict if it were costless to change prices. Indeed, the median price interval for price changes in low inflation OECD economies appears to be one year. The distribution is skewed so that many firms will change price much more frequently than this but few will change prices more seldom than every two or three years. The reasons for why prices are rigid are still not really well understood by economists. The macro-economic literature, which has shown the greatest interest in price rigidity, typically relies on either some exogenously determined interval of price adjustment or on fixed costs of changing a price, so called menu costs. Menu costs are the actual costs of printing a new menu, putting new price tags on the merchandise and so forth. Careful interview evidence by for instance Mark Zbaracky of University of Pennsylvania and several coauthors indicate however that while fixed costs of adjusting prices are indeed non-trivial, they are not seen as the main obstacle to changing prices. Rather fears of disturbing relations to long-term customers appear to be the central element in why prices are rigid.

The reasons for why prices are rigid matter for the predictions of whether prices on the Internet will be more flexible than the prices in B&M stores. A natural presumption is that it is much cheaper to change prices on the Internet than in regular stores. On the Internet you just change a website (or program a price as an automatic markup on some observed marginal cost) whereas re-pricing in B&M stores conjures images of store clerks walking around the store, marker in hand. The prediction of this kind of reasoning is then that we expect firms' Internet prices to be much more flexible than their B&M prices. Indeed in their early survey of Internet economics

Michael Smith and Erik Brynjolfsson of MIT's Sloan School together with Joseph Bailey of University of Maryland found support for this presumption. Price changes appear more frequent online than in B&M stores for goods such as books. In addition, if fixed costs of adjusting prices are important then we expect to see no small price changes since the benefit of adjusting price must outweigh the cost and very small changes are likely to entail small benefits. Indeed these authors site evidence that the minimum size of the price change is up to 100 times smaller on the Internet than in B&M stores. We are thus left with a somewhat disparate picture, since the evidence on price rigidities generally points to that menu costs are quite small and do not play a central role for price rigidity (as long as they are not 0). Thus lower menu costs on the web should not lead to much greater price flexibility. Also we may note that information technology lowers the cost of changing prices also in B&M stores, for instance through electronic price markers on shelves.

The consumer characteristics discussed thus far are likely to largely be of a passing nature. Once all consumers have Internet access, they all belong to the same group. Geographic price differentials may persist but other price differentials are not likely to depend on third degree price discrimination – at least not Internet vs B&M differences. A retailer may offer student discounts both in his B&M and Internet store, but that is not our focus here. The next type of price discrimination however is not a passing phenomenon, but rather can be expected to gain in importance.

## **5. Self selection by consumers – second degree price discrimination<sup>3</sup>**

---

<sup>3</sup> As discussed for instance by Luis Cabral in his introductory textbook there is some confusion as to if some mechanisms should be classified as second or third degree price discrimination. As is clear from the title we take second degree price discrimination to be synonymous with price discrimination when

The existence of different channels also indicate the possibility that consumers attach different value to the different channels, and therefore the potential to tailor those characteristics so as to gain the maximum out of the customers with a high willingness to pay. That is, we are now interested in second degree price discrimination, or price setting under self-selection constraints. The classic example of this type of price discrimination is that of first class vs second or third class on transportation. As noted already in the 19<sup>th</sup> century by Jules Dupuit it was not the high cost of providing roofing on third class train cars that explained their very low comfort. Rather, third class had to be uncomfortable enough that first and second class passengers would be willing to pay a substantial price premium to ride more comfortably. Similarly, anyone who has been shopping for plane tickets is familiar with the Saturday night requirement, the idea is that businessmen (who, since someone else is picking up the bill) have low price sensitivity and will travel home Friday night or Saturday morning, even if it is absurdly more expensive than returning on Sunday. In the same manner, sales on the Internet and in B&M stores represent different bundles of services with respect to time spent on purchase, service content and delivery speed. For simplicity, think of all consumers as having access to both retail channels; by for instance versioning or bundling a firm may induce high valuation consumers to sort themselves into buying from the high priced channel. Consumers are thus given a menu of choices regarding prices, delivery times, service content and so forth.

Consider a situation where a local grocer has a monopoly and can sell to its customers either in the store or over Internet. Shopping in the store entails certain prices, taking a trip to the store and wandering around the aisles looking for goods.

---

there is self-selection. A more narrow definition where second degree price discrimination (or non-linear pricing) only applies to quantity discounts is sometimes employed in the literature.

Buying over the Internet is likely to be quicker since you do it from your home and includes home delivery. Assuming that there are no systematic differences in how much people like to shop (after all, where are you going to learn the village gossip if not in the local store) consumers who place a relatively high value on their time are likely to get greater utility out of the speedy option, shopping over the Internet. How should you then set prices? The lesson that theory holds is that you design the optimal package for these high valuation consumers – in the language of second degree price discrimination we say that there is “no distortion at the top”. Set the optimal prices and service level to the consumers with the highest willingness to pay. We can then think of the decision problem as making shopping in the store unattractive enough that the high valuation consumers will prefer to shop over Internet, even though the price there is higher. Of course you may try to induce consumers to self-select also on the Internet – many computer programs offer different versions of programs, cheaper versions with ads, various levels of customer support and bundling – selling the product in lump with another. In their seminal book on competing in the information economy, Varian and Shapiro go through the various mechanisms that may be used to induce consumers to self-select at great length.

This is also the place to discuss the issue known as cannibalization in the management literature, of whether the firm is just stealing customers from itself by setting a too low price in one of the channels. In particular this may be a concern if the firm has low prices online due to strong competition online. Think again of the small town grocer, but now include a competitor that has low prices on the Internet. By competing online, the local grocer not only competes for a given set of customers on the online market, low prices in its online business will also attract some of the customers that otherwise would have shopped in the local store. To make the analogy

with the railroads – you have customers with a high willingness to pay toughing it out in second or even third class only because the price difference was so large so as to be irresistible. Clearly this is not good for profits – as a firm you want high valuation consumers to pay high prices, this is the essence of price discrimination.

One aspect of the new information technology, and in particular new production technology, is that it often makes it easier to engage in what has been called mass customization or build to order. Dell computers have been the showcase of this movement of building to order. This technology is well suited for sales over Internet – the consumer creates her own configuration in terms of hard drive, screen, colors and what have you. Internet creates a very well suited platform for taking these orders and directly processing them into the supply chain. So different consumers will purchase different bundles of goods and services at different prices. The dividing line against the last form of price discrimination that we will look at, perfect price discrimination, is that here different consumers will still pay the same price if they buy the same good (in the same quantity and with the same service content and so forth). The more of a development towards build to order that we see, the more difficult is it to talk of comparing prices of a good on the Internet and in B&M stores. As the menu of prices and options becomes ever larger it becomes increasingly difficult to compare. As with many management fads, there can also be a tendency to overestimate the importance or range of applicability of new phenomena – as Mani Agrawal and coauthors state in a 2001 article in the McKinsey Quarterly; “For more than two decades, mass customization has been the future of manufacturing – and for some manufacturers it will probably always be”.

## **6. Knowing each consumer's willingness to pay - First degree price discrimination.**

We are nearing the end of our application of price discrimination to Internet and B&M pricing. Following the categorization of Arthur Pigou from 1920, the last form of price discrimination that we cover is known as first degree price discrimination. When a firm practices this, it charges each consumer depending on that particular individual's willingness to pay. Under first degree (also known as perfect) price discrimination two consumers belonging to the same group (e.g. Dutch students) pay different prices for the very same specification of the good. Obviously this requires a lot of information about the potential buyer to implement; only a fool would walk around and publicly declare her maximum willingness to pay for various goods. The classical example used to be that of a country doctor who knew all his patients and their economic means well. The emergence of Internet has since provided economists with another example – through the dramatic reduction in the cost of assembling (for instance through cookies that track click behavior) and analyzing information, retailers can get much more information about consumers' shopping behavior and preferences. A firm might actually come close to the theoretical simplification of perfectly observed reservation prices. Before you as a manufacturer aggressively pursue first degree price discrimination, I would recommend reading the next section however.

## **7. Fairness concerns.**

The logic of in particular first degree price discrimination dictates that the firm (or monopolist rather, since this has rarely been studied under competition) should set price equal to the reservation price of the consumer, equal to her maximum willingness to pay. Anyone doing so should at least be aware of some stylized facts from experiments in economics. The situation of a monopolist making offers to a consumer is very like that envisioned in the so called ultimatum game. In this game two agents have to agree on some way to split what is figuratively described as a pie, usually a given sum of money. One agent – the dictator – gets to propose a split of this pie and the other agent can accept or reject this offer. If she accepts each party gets the share originally proposed by the dictator, whereas if she rejects each get 0. If we think of the pie as the difference between marginal costs (for simplicity assume that they are constant so that average cost is equal to marginal cost) and reservation price it is clear that there is close correspondence to the situation where a firm makes price offers and a consumer may reject or accept. Standard economic theory suggests that the dictator should offer the other just a sliver and that this offer will be accepted; after all something is better than nothing. The game has been extensively studied in experimental economics and the results are striking –in their survey for the Journal of Economic Perspectives Ernst Fehr and Simon Gächter conclude that offers that give less than 30 percent to the respondent have a very high probability of rejection. The finding is robust across countries (even though there are differences) and appears robust also to higher stakes, such as a split of USD 100 offered to college students. The motivation that respondents typically give is a comment about fairness – they consider an offer that gives them too little as unfair, and are willing to take a cost to punish or get revenge on the proposer. This does not invalidate the logic behind first

degree price discrimination, it just adds an additional constraint that the probability of rejection increases as the unevenness of the split increases.

The lesson is more general than this however, given that there are switching costs in many consumer markets the reputation of sellers is extra important, you want to have a reputation for fairness. Firms that are seen as taking advantage of consumers run the risk of being deserted. This does not mean that firms are becoming givers of good that do not care about profits, but it does warn against squeezing that last penny out of the consumer in every period. Relationships between consumers and firms take place over time, often in a changing environment filled with unforeseen contingencies that have not been contracted on. The trust that you place in your supplier is thus important, and a firm that is seen as taking advantage of a position may be harshly punished.

What is judged as fair cannot really be determined by theory but will depend on the cultural setting and the current state of the world - anything may be fair in love and war as the old saying has it. Thus lower prices to students, older people, people in significantly poorer countries and expensive hard cover books that precede much cheaper pocket books seem fully acceptable to most consumers (even though firms rarely formulate such policies as higher prices to non-students...). The widely discussed pricing “experiments” – offering the same good at different prices to consumers depending on their shopping history by Amazon on DVD movies is an excellent case in point. What for an economist looked like straightforward attempts at first degree price discrimination provoked a public outrage and much negative publicity. Amazon responded that these were simply experiments to learn about demand. In one sense the lesson is simple - if you want to offer different prices to different consumers – make sure they are not offered the same good, this is were

buying to order comes into play. On the other hand people again don't want to be taken advantage of, and a menu of choices and options that becomes too complex also carries a warning flag. Topics such as these are harder to integrate conveniently into the models of price discrimination – they do not alter the fundamental logic but do introduce some fuzzy constraints that require a “feel for the market”.

### **VIII. The future**

Throughout we have stressed that on no account should the failure of a number of pure-play Internet retailers be seen as damning for e-commerce. Even a technology pessimist would have a hard time envisioning anything else for the future than widespread access to cheap and speedy ways to convey digitalized information. Of course such channels will be used for the selling and buying of goods and services. This article has argued that our well-honed tools of price discrimination are useful as a guide also for such a future. As such it is also clear why we do not end this article with a simple prediction of price effects of how online prices will develop vis-à-vis B&M prices. Whether they will be (much) lower or higher will depend on the characteristics of the particular market. Based on the logic of second and first degree price discrimination we are likely to see an increase in the use of different menus of prices and qualities and quantities and more offers based on information about a certain customer's characteristics. New information technology that dramatically lowers the cost of gathering and analyzing information and new production techniques that facilitate various tailored versions of goods are likely to imply much greater prevalence of second and first degree price discrimination. Note that this is likely to be true of both Internet and B&M sales – through use of scanner data,

customer loyalty cards, coupons and so forth retailers can also gather much information and tailor offers to consumers in their B&M outlets. Pricing in the airline business displays patterns that we will probably come to see in more industries – whether you shop online or go to a travel agent you are met with a bewildering array of prices and options. In such a setup it becomes very hard to think of the relation between *the* price online and *the* B&M price, rather we may have to get used to analyzing full distributions of prices.

We would also like to caution against relying too much on extrapolation from today's experiences in predicting the future. Low prices of pure Internet retailers in the initial stages of operation were by many perceived to be crucial for building up market shares. The relatively high online prices of multi-channel retailers probably reflect a fear of taking profitable business away from its own B&M stores. It is also true however that many multi-channel retailers are still only starting to take the Internet market seriously and as an important element of their portfolio of offerings.

Further reading.

**Some overviews of applications to the Internet:**

Bakos, Yannis, 2001, The emerging landscape for retail e-commerce, *Journal of Economic Perspectives* 69-80.

Borenstein Severin and Garth Saloner, 2001, Economics and electronic commerce, *Journal of Economic Perspectives* 3-12.

Brynjolfsson, Erik and Brian Kahin (eds.), 2000, *Understanding the digital economy: data, tools and research* (Cambridge: MIT Press).

Porter, Michael E., 2001, *Strategy and the Internet*, Harvard Business Review.

Saloner Garth and and A Michael Spence, 2002, *Creating and capturing value: Perspectives and cases on electrical commerce* (New York: Wiley).

Westland, J.C. och T.H.K. Clark, 2000, *Global electronic commerce - Theory and case studies* (Cambridge MA, MIT Press)

**For the basics of price discrimination and vertical restraints:**

Cabral, Luis, 2000, Introductory Industrial Organization, (Cambridge MA, MIT Press) is a masterful introduction. A very clear and rigorous yet accessible overview is given in

Tirole, Jean, 1989, Theory of Industrial Organization, (Cambridge MA, MIT Press).

Some detailed studies:

Clay, Karen, Ramayya Krishnan and Eric Wolf, 2001, Prices and price dispersion on the web: Evidence from the online book industry, NBER Working paper 8271.

Ellison, Glenn and Sara Fisher Ellison, 2001, Search, obfuscation and price elasticities on the Internet, manuscript, MIT.

Friberg, Richard, Mattias Ganslandt and Mikael Sandström, 2001, Pricing strategies in e-commerce: Bricks vs Clicks, IUI Working paper no 559 ([www.iui.se](http://www.iui.se)).

Zettelmeyer, Florian, Fiona Scott Morton and Jorge Silvia-Risso, 2001, Cowboys or cowards: Why are Internet prices lower? NBER Working paper 8667.

Table 1, Retail sales over Internet in Sweden.

period	Share of retailers with Internet sales	Share of Internet sales in total retail trade	Growth rate of Internet sales
1999 Q3	8	0.7	38
1999 Q4	10	0.7	23
2000 Q1	11	1.1	30
2000 Q2	12	1.2	19
2000 Q3	13	1.4	19
2000 Q4	13	1.6	29
2001 Q1	13	1.8	-8
2001 Q2	13	1.6	-3
2001 Q3	13	1.8	13
2001 Q4	13	1.9	17

Table 2

Prices of a basket of books and a basket of CDs for Different Categories of Stores (including transport costs - deviations from sample means).

		Mean	Min	Median	Max	Number of Obs.
		<i>Std.dev</i>				
Books	All stores	0 9.97	-23.96	0.77	18.60	45
	only B&M	1.23 8.51	-14.71	1.78	17.42	39
	All Internet	-7.98 15.34	-23.96	-13.03	18.60	6
	Online, firms retailing through both channels	9.68 12.61	0.77	-	18.60	2
	Online, firms that only sell online	-16.81 5.23	-23.96	-15.64	-12.02	4
CDs	All	0 7.046	-13.06	-0.55	21.34	74
	Only B&M	0.94 6.67	-13.06	-0.55	21.34	66
	All Internet	-8.85 3.48	-12.75		-2.27	8
	Online, firms retailing through both channels	-6.42 3.97	-10.18	-	-2.27	3
	Online, firms that only sell online	-10.68	-12.75	-	-9.15	5