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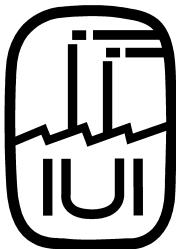
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Pricing Strategies in E-Commerce: Bricks vs. Clicks

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PRICING STRATEGIES IN E-COMMERCE: BRICKS VS CLICKS

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June 21, 2001

Abstract

What is the impact of the increasing dominance of conventional firms in e-commerce?

We use a simple model to show that retailers who only sell through Internet have lower online prices than retailers who also sell through conventional stores. This proposition is firmly supported by our empirical analysis which uses a rich data set covering the Swedish markets for books and CDs. On average, prices of these goods are 15 percent cheaper on Internet, but if a single item is bought transport costs will make it as expensive to buy over Internet as in a conventional store (if a basket of goods is bought it is some 10 percent cheaper on Internet since transport costs are fixed).

JEL codes: L11, L81, D12, D43

Keywords: retail pricing, consumer behavior, e-commerce, price discrimination

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1 Introduction

Internet retailing is increasingly dominated by firms that also have an important presence in conventional stores.¹ What are the implications of this "brick-and-click" dominance for prices in retail markets? We analyze a simple model and show that firms which sell both on the web and in conventional stores have higher on-line prices than firms that only sell on the Internet. The reason is the wish to avoid price competition between different retail channels. This proposition is firmly supported by our empirical analysis, in which prices of well specified goods (books and CDs) from all Swedish e-commerce sites and a large sample of Swedish B&M stores are examined.²

The next section presents the model. The perhaps closest in modeling terms is Anderson and Ginsburgh (1999) who examine deviations from the law of one price when there is both second and third degree price discrimination.³ Section 3 examines the main prediction of the model - that firms which only sell on-line have lower on-line prices than firms which also retail in conventional stores - and present some further empirical evidence on prices in B&M stores relative to prices in on-line stores. Section 4 concludes.

¹A recent study by McKinsey quoted in the Financial Times May 25,2001 showed that 30 per cent of all surveyed internet retailers was making an operating profit. Of those retailers making an operating profit, 82 per cent had links to incumbents.

²A related question is what the price level is on-line relative to the price level in brick-and-mortar stores, which was one of the first issues regarding e-commerce to be explored by researchers; e.g. Lee (1997), Bailey (1998), Brynjolfsson and Smith (2000), Smith, Bailey and Brynjolfsson (2000), Bakos (2001).

³There are a number of related literatures. We assume that the firm perfectly controls price setting in both retail channels - an issue examined in the voluminous literature on vertical restraints (see for instance Martin, 2001 for an overview). Carlton and Chevalier (2001) examine empirically the choice of retail channels for producers. We take the difference in consumer utility from buying from the different channels as given - a related literature studies the endogenous choice of quality, see for instance the seminal article by Mussa and Rosen (1978). Related are also papers that examine the optimal pricing schemes for multi-product firms, see for instance Armstrong (1999).

2 The Model

This section sets out a simple partial equilibrium model which derives demand from consumers' maximization problems. We examine a market for a physically homogeneous good that is sold both over the Internet and in a conventional store. There is a continuum of consumers whose valuation of the good is given by θ which is uniformly distributed on $[0, 1]$. Each consumer will buy at most one unit of the good. Utility will depend on where (if) the good is bought according to

$$u = \begin{cases} 0 & \text{no consumption} \\ \theta(1-t) - p_B & \text{B\&M shopping} \\ \theta - T - p_W & \text{web shopping} \end{cases} \quad (1)$$

where p_B is the price in the B&M (brick and mortar) store, $t\theta$ the opportunity cost of shopping (assume that $0 < t < 1$) and p_W is the on-line price in the web shop. T is the fixed cost of buying the goods on-line (assume that $T < t$). We refer to a firm that only sells through the internet as "e-tailer" and to a firm that retails both on-line and through conventional stores as B&C (brick and click) retailer. The optimal choice for a consumer depends on θ and we define the following cut-off points:

$$\theta_B = \frac{p_B}{1-t} \quad (2)$$

$$\theta_W = \frac{T + p_W - p_B}{t} \quad (3)$$

where θ_B is the consumer that is indifferent between B&M shopping and no consumption and θ_E is the consumer that is indifferent between B&M shopping and web shopping.

We compare two market structures. The first is a duopoly with a B&M firm and an independent e-tailer. Firms compete in prices. The second market structure is a monopoly that sells the good both in a B&M store and on the web. Superscripts on the optimized prices refer to

the market structure, monopoly(M) or duopoly(D). For simplicity marginal costs are assumed to be 0 throughout.

2.1 Are e-tailers cheaper than brick-and-click retailers?

Consider first the B&C duopoly with an independent e-tailer and independent B&M store. The e-tailer solves

$$\max_{p_W} (1 - \theta_W) p_W \quad (4)$$

and the B&M retailer solves

$$\max_{p_B} (\theta_W - \theta_B) p_B. \quad (5)$$

The assumption that $0 < T < t < 1$ is sufficient to ensure that both firms meet positive demand, i.e. $0 < \theta_B < \theta_W < 1$.⁴ The first order condition for the e-tailer is

$$(1 - \theta_W) - \frac{d\theta_W}{dp_W} p_W = 0 \quad (6)$$

and, correspondingly, the first order condition for the B&M firm is

$$(\theta_W - \theta_B) + \left(\frac{d\theta_W}{dp_B} - \frac{d\theta_B}{dp_B} \right) p_B = 0. \quad (7)$$

In a non-cooperative Nash equilibrium prices are:

$$p_B^D = \frac{(t + T)(1 - t)}{3 + t}, p_W^D = \frac{(2t - T(1 + t))}{3 + t}. \quad (8)$$

⁴Inserting the optimal prices into $0 < \theta_B < \theta_W < 1$ yields $0 < \frac{t+T}{3+t} < \frac{t+T}{3+t} \cdot \frac{1+t}{t} < 1$ which is true for $0 < T < t < 1$.

Now, consider the monopoly market structure. A B&C monopoly would solve the following:

$$\max_{p_W, p_B} (1 - \theta_W) p_W + (\theta_W - \theta_B) p_B. \quad (9)$$

The B&C retailer's interior first order conditions are:

$$(1 - \theta_W) - \frac{d\theta_W}{dp_W} p_W + \frac{d\theta_W}{dp_W} p_B = 0 \quad (10)$$

$$(\theta_W - \theta_B) + \left(\frac{d\theta_W}{dp_B} - \frac{d\theta_B}{dp_B} \right) p_B - \frac{d\theta_W}{dp_B} p_W = 0 \quad (11)$$

Comparing (10) with (6) we note the additional term in the latter, capturing that the B&C firm takes account of the effect on B&M demand when setting price on the web. For a given B&M price, the B&C firm will always set a higher on-line price.⁵ The possibility to set a different price on-line can be used to exploit some consumers higher willingness to pay for the physical good. In other words, the B&C monopoly is engaging in price discrimination. The equilibrium prices are⁶

$$p_W^M = \frac{1}{2} - \frac{1}{2}T, p_B^M = \frac{1}{2} - \frac{1}{2}t. \quad (12)$$

Comparing the two market structures we can now state our main result:

Proposition 1 *The on-line price of a brick-and-click monopoly is strictly higher than the on-line price of an independent e-tailer, i.e. $p_W^M > p_W^D$.*

⁵It follows from the mixed firm's first order condition (eq. 10) that the optimal p_W as a function of p_B is $p_W = \frac{t-T+2p_B}{2}$. The e-tailers first order condition (eq. 6) yields $p_W = \frac{t-T+p_B}{2}$ which is strictly less for any $p_B > 0$.

⁶Again, for an interior equilibrium to exist the following inequalities must hold $0 < \theta_B < \theta_W < 1$. Inserting the proposed equilibrium prices p_W^M and p_B^M we obtain $0 < \frac{1}{2} < \frac{1}{2} + \frac{T}{2t} < 1$, which is true for $0 < T < t$.

Proof. Use (12) and (8) to establish that the on-line price differential is

$$p_W^M - p_W^D = \frac{(3-T)(1-t)}{2(3+t)} \quad (13)$$

which is strictly positive (using $T < t < 1$). ■

The optimal on-line price of a B&C firm is strictly higher than the optimal price of an independent e-tailer. The intuition for this result is that the brick-and-click retailer is charging a higher price on-line to avoid stealing customers from its B&M store. The pure e-tailer, on the other hand, is going to compete for B&M customers by charging a lower price, neglecting the negative effect on the total industry profitability.⁷

3 Empirical results

We analyze the markets for books and music CDs in Sweden. These two goods are well suited for Internet sales: Transport costs are relatively low, the goods are homogenous and the demand for services is small. Books and CDs are also easy to present to the consumer on an Internet site. Further, these markets are, by Internet standards, mature. Sweden offers a good laboratory for examining e-commerce since it has been at the forefront of Internet development.⁸ The homogeneity of sales taxes and costs across locations in Sweden facilitates analysis compared to the US - where differences in local sales taxes appears to be an important factor driving Internet buying (Goolsbee, 2000a).

We collected the prices of four books and six CDs in a total of 64 B&M book stores and

⁷We may also note that the stronger competition in the duopoly case is manifested in lower B&M price as well, The B&M price differential is $p_B^M - p_B^D = \frac{(1-t)(3-t-2T)}{2(3+t)}$ which is strictly positive (using $0 < T < t < 1$).

⁸At the time of the study, fall 1999, Internet penetration in Sweden is deeper than almost anywhere else in the world. Around 60 percent of the total population regularly uses the Internet and in the age-group 15-29 years the figure is 91 percent. E-commerce accounts for 1.2 percent of total retail sales - about the same share as in the US, and much larger than in most other European countries.

98 B&M music stores located in 19 local markets across Sweden. These stores were picked at random from the yellow pages of the country's 19 largest cities. We also collected prices of these products at all eight Swedish e-commerce sites that sold books at the time of the survey, and at all eight sites that sold music CDs. All observations were made during two weeks in October 1999.

It is well established that even though we examine physically homogenous goods, the prices do not represent identical goods since service and location are also attributes of the good. Clearly, a book bought on the Internet is in some ways a different good from the same book bought in a department store or in a specialized book store. To gain some understanding of how this affected results, we recorded information on the stores: on location (city center, or not), type of store (such as book store, department store, supermarket), assortment (large/small) and whether it belonged to a retail chain.

First, we will test Proposition 1. Second, we will explore the price level on-line relative to brick-and-mortar stores. This issue has been addressed in several previous studies. The evidence to date, however, remains thin. An important reason is that while it is easy to gather price information on the Internet, doing so in local retail markets is much more costly. In his survey, Bakos (2001), finds that the results are mixed and cites Brynjolfsson and Smith (2000) as the most thorough study.⁹ They examine the prices of books and CDs in conventional and Internet stores and conclude that prices are lower on the Internet. Lee (1997) finds that prices for used cars are higher on the net and Bailey (1998) finds the same for books, CDs and software. A number of issues leads one to question the generalizability of these results however. Lee does not control for quality differences and Brynjolfsson and Smith only include data from four pure

⁹ A survey by Smith, Bailey and Brynjolfsson (2000) presents mixed evidence about the relative price level on the Internet and in conventional stores citing a couple of studies during the period 1996-1999 and the authors conclude that "one possible explanation for the differences is that Internet markets became more efficient between 1996 and 1999".

B&M stores dispersed across the US.¹⁰ This paper tries to address some of these problems.

The data are analyzed by comparing the mean prices for the different categories of stores, and by running a few simple regressions. We analyze the prices for separate items of CDs and books, and for baskets of goods. When goods are bought on the Internet, the customer usually has to pay a fee for packaging and delivery. In one sense, this fee is of course a part of the price. On the other hand, it may be viewed as payment for a service - it may be more convenient to get the goods delivered home than to go to a B&M store. To make prices comparable if we do include packaging and delivery charges in the Internet prices, we would require extremely detailed information on the consumer's opportunity cost of shopping in a conventional store as well as her cost of shopping on-line. Lacking such data, we analyze prices both including and excluding packaging and delivery charges.

3.1 A first glance at prices

Data was collected on the prices of four books with different characteristics: "ALFONS" is a children's book, "CARAMBOLE" is a recent best-seller, "SAOL" is a Swedish dictionary and "LONGMAN" an English dictionary. The six CDs included in the study represent different categories of popular music. Three are international best-sellers at the time of the study: Red Hot Chilli Peppers' "Californication" (RHCP), Back Street Boys' "Millenium" (BSB) and Shania Twain's "Come on Over" (TWAIN). One is an international "classic": U2's "The Joshua Tree" (U2). One is a current Swedish best-seller: Tomas Di Leva's "För Sverige i Rymden" (DILEVA) and one is a previous Swedish best-seller: Eva Dahlgren's "En Blekt Blondins Hjärta" (EVA).

¹⁰ Related are also number of very recent papers not discussed in Bakos survey; Clay et al (2001) examine how prices and price dispersion of books sold through on-line retailers develop over a six-month period. They find no evidence of changes in price level or price dispersion over the period. Using detailed data from California, Morton et al (2000) find that the average customer who buys her car through an internet referral service pay 2 percent less. Goolsbee (2000b) finally, uses the responses from a survey of computer purchases in the US to estimate local retail prices. He then uses these prices to measure the probability that a consumer chooses not to buy from the local retailer.

Summary statistics are presented in Table I.

Table I about here.

It is clear from this table that there is substantial price dispersion. This is the case both for B&M and on-line stores. The average within market price range (difference between highest and lowest price in a given location) is over one tenth of the mean price for each of the products.¹¹ In one case (EVA), the average within market range is 44 percent.

An illustration of the data is given in Figure 1, where the prices of two of the books are plotted for each location. A standout feature is the great price dispersion within locations while there are few obvious signs of price dispersion across locations. A rough comparison of prices on the Internet and in B&M stores indicates that prices are somewhat lower on the Internet, or at least that the lowest price on the Internet is lower than the minimum price on most of the local markets.

Figure 1 about here.

It is also evident from these diagrams that there is considerable variation in prices on the Internet. In fact, the price range for on-line stores is larger than the average within market price range for all books and about the same for four of the six CDs (for the two remaining CDs, it is higher for one and lower for the other). Including the cost of transportation in the Internet prices does not alter this picture. The high price dispersion on the Internet is somewhat surprising given the relative ease for consumers to compare prices of different e-retailers.¹² The least price dispersion, both in absolute and relative numbers, is found for the best-seller CDs, both on-line and in B&M stores. A possible explanation is the relatively strong competition on these products.

¹¹The one exception to this is LONGMAN, where the average within market price range is only 5 percent of the mean price. However, that figure is misleading since LONGMAN was either unavailable or sold in only one store in all but one local market. On this market (Uppsala), it was sold in two out of the five stores included.

¹²See Ellison and Ellison (2001) for an analysis of how Internet affects search costs.

3.2 Where is the price lowest?

In all the Internet stores, the consumer pays a fixed cost for transportation and packaging regardless of how many books or CDs she orders. Thus, it may be cheaper to buy on the Internet for a consumer who buys several items while it is cheaper to buy in a conventional store for a consumer buying only one item. To take account of this, we analyze the prices of both separate items and of baskets of goods. The book basket contains three books (LONGMANS was excluded because of the few observations). For CDs, two different baskets are constructed. One which we call "Top 4" includes current bestselling CDs - RHCP, BSB, TWAIN and DILEVA, and the other contains all six CDs.

In Table II, summary statistics for the different categories of retailers is presented for the book-basket, and for one book, CARAMBOLE. On average, prices of both CARAMBOLE and the basket are lower on the Internet. The basket is on average close to 15 percent cheaper if bought on the Internet rather than in a B&M store. A two tailed t-test rejects that the mean price in B&M stores equals the mean price on the Internet at the 10 percent level. If transport costs are included in the price the basket is on average some 9 percent cheaper if bought on the Internet. The difference is, however, not significant at any usual levels of significance using a two tailed t-test.

Table II about here

As predicted by Proposition 1 B&C stores have higher on-line prices than the pure Internet retailers. In fact, all the pure Internet retailers have lower prices than the cheapest B&C firm's Internet prices, whether or not transport costs are included. Since this is the full population of Swedish Internet stores, the difference in means is in one sense significant by definition.¹³ The

¹³If instead we view the prices in themselves as a result of a stochastic process, we may apply the conventional tests. The hypothesis that the means are the same within the two groups may then be rejected at any usual level of significance.

prices of the pure Internet retailers are also lower than in B&M stores, whether or not transport costs are included. The hypothesis that the mean prices are equal in B&M stores and pure Internet stores can be rejected at least at the 1 percent level in both cases. It is worth noticing that this holds also for CARAMBOLE, i.e. also when buying just one book. The gain is thus large enough not to be outweighed by transport costs.

Another way of comparing the prices on-line and in B&M stores is to consider a well informed consumer who lives in one of the local markets and buys the books so as to minimize the total price he pays for the basket. Thus, she may buy from one or several on-line stores, from one or several B&M stores in the city where he lives, or any combination thereof. In all but one of the local markets, the cheapest alternative is to buy all three books from one on-line bookstore. In the remaining market, the cheapest alternative was to buy one book only from a B&M store, and the two other from an on-line store.¹⁴

The conclusions of the analysis of the CD market are very similar to those from the analysis of the book market. In Table III, summary statistics for the different categories of retailers are presented for the "Top 4" basket, and for two individual CDs. Looking first at the basket we see that prices are some 14 percent lower on the Internet than in B&M stores. Using a two tailed t-test, the hypotheses that the outlets have equal mean prices is rejected at the 1 percent level of significance. When transport costs are included, the difference between average prices shrinks to some 10 percent, but we still reject the hypothesis that the two types of outlets have equal mean prices.

If the consumer chooses to buy just one CD on the Internet, the picture changes - average prices including transportation costs are almost identical to prices charged by B&M retailers for single item purchases. The difference between the two is not statistically significant. On

¹⁴On this market, Umeå, CARAMBOLE was very cheap. It cost SEK 119, which was SEK 64 less than the second lowest price found for that book, which was the same as in the cheapest on-line store.

average, shipping and handling for an individual CD adds 15 percent to the price charged on-line. Since shipping and handling costs are fixed and independent of the number of CDs bought, the average transportation cost falls when more than one item is bought at the same occasion.

Table III about here.

Also on the CD market Proposition 1 is supported - pure Internet retailers have lower on-line prices than B&C retailers. On average, the pure on-line retailers have lower prices on all CDs in the Top 4 basket. For the two baskets, the pure Internet retailers are on average cheaper than the B&C firms whether or not transport costs are included. When transport costs are excluded, the maximum price of the Top 4 basket among pure Internet retailers is lower than the minimum price among the B&C retailers.

Of the in total 16 on-line retailer from which we collected price data, six are B&C retailers. It is of some interest to compare the prices in the on-line and B&M operations of these firms. Two of these six firms are large book retail chains with operations in most Swedish cities (17 each in our sample) and one is a large chain of department stores that also sells CDs on the Internet (12 in our sample). Of the remaining three, one is a bookstore with two B&M outlets and two are CD stores with one B&M store each. None of these firms had consistently lower prices on-line than in the B&M business.¹⁵ The evidence is consistent with the notion that the B&C firms do not want to undercut the prices in their B&M operations.

3.3 A few simple regressions

As noted previously, the price of a good should reflect not only if it is bought on Internet, but also other characteristics of the outlet. To partly control for such characteristics, we ran simple

¹⁵ For the two book chains, the prices online including transport costs were higher than in any of the B&M outlets (with the exception of one observation on LONGMAN). The book retailer with two B&M outlets had a lower on-line price on two books, a higher price on one book, and a price in between the two B&M outlets on one book. With a few exceptions, the mixed CD stores had virtually identical prices online and in the B&M stores (in two of these cases the prices including transport costs were the same as in the B&M stores, and in the third case the prices excluding transport costs were the same.)

OLS regressions to examine how prices depend on characteristics of the outlet. A number of dummy variables are used as explanatory variables. BOOKST/CDST is one for specialized book/CD stores, CENTER is one for stores located in the city center, LARGE is one for B&M stores with large assortment and NOCHAIN, finally, is one for retailers that do not belong to a retail chain.¹⁶

We estimated regressions on the separate items as well as on the book-basket and the two CD-baskets. The regressions were estimated both with prices including and excluding transport costs and with two alternative "Internet-dummy" specifications. One group of regressions contained only the dummy for Internet stores (INTERN), and the other group had separate dummies for e-tailers (INTPURE) and B&C (INTMIX) Internet firms. All in all, that makes 32 CD-regressions and 16 regressions on books. To spare the reader, we will not present the full results from all of these. In Table IV, the results from the regressions on the book basket, with and without transport costs, and regressions on three books without transport costs are presented. In Table V, corresponding regressions on one of the CDs and on the two CD-baskets are presented.

Tables IV and V about here.

The coefficients of prime interest are on the three Internet-dummies. Our earlier conclusions are again seen in the regression results: Buying on the Internet is cheaper than buying in B&M stores, and e-tailers are cheaper than B&C firms.

For books, the dummy for e-tailers is negative and significant in most regressions, while the dummy for B&C firms is not significant. This result holds for the basket whether or not we include transport costs. For the individual books, we get the same results when transport costs

¹⁶We also experimented with other explanatory variables such as the number of firms in each city and some fairly crude measures of costs. Our ability to explain variation in prices across locations was limited. Given the scant evidence of systematic differences in prices across locations for these two types of goods this comes as no surprise. There exists a large literature that examines prices of goods across markets and try to relate such variation to measures of the market structure. See for instance Asplund and Sandin (1999) for a recent contribution.

are not included. When transport costs are included (not reported), the Internet-dummies are no longer significantly different from zero, except in one case.¹⁷ For CDs, every single Internet-dummy is negative and significant at the 1 percent level in all regressions with basket prices as dependent variable, and also in the regressions on individual CDs when transport costs are excluded. In the regressions on individual CDs where transport costs are included, not any of the Internet-dummies are significantly different from zero.

That the characteristics of the store in which the good is bought affect price is confirmed by the estimation results for the other explanatory variables. Prices of the basket are higher in specialized bookstores (BOOKST), likely reflecting better service. However, there is some variation across individual books: CARAMBOLE is cheaper in specialized book stores. Being located in the center of the town is associated with some 5 percent lower prices. This may be because of greater proximity to competitors is driving prices downwards and is largely due to the lower prices of CARAMBOLE in city centers. Independent firms tend to have lower prices but the effect is generally not statistically significant. In the CD-regressions, the coefficient of CDSTORE is positive in all the regressions. (However, it is only significantly different from 0 for RHCP). Again, this probably reflects that specialized stores provide better service than supermarkets or general department stores. For the basket with all 6 CDs, the coefficient on CENTER is negative, as in the book regressions. This is not the case in the other CD-regressions, however. In contrast to the case for books, larger stores tend to have higher prices. There is little evidence that the price of independent stores differed from the average.

Adjusted R-square in the basket-regressions ranges from 0.08 to 0.61 with, in general, higher explanatory value for the regressions with separate dummies for B&C and e-tailers, and for the regressions where transportation costs are excluded from the on-line prices. Explanatory power

¹⁷The exception is the CARAMBOLE-regression, in which the INTMIX-dummy is positive and significant at the 10 percent level.

is however mostly weak in the regressions on separate items.¹⁸

4 Conclusions

The empirical evidence shows that prices on the Internet are lower than B&M prices for books and CDs in Sweden. Prices for a basket of books or CDs is some 15 percent cheaper if bought on the Internet rather than in B&M stores (some 10 percent if transport costs are included in the on-line price). While this indicates a relatively strong pro-competitive effect of e-commerce, our results stress that increasing dominance on the web by firms that also sell in conventional stores will limit this pro-competitive effect. These firms will be cautious of "cannibalization", i.e. that they will loose profits if they set too low prices in their on-line operation.

The model we presented was very stylized and can be extended to accommodate a number of institutional features of the Internet. For instance, in a working paper version of this paper (Friberg et al, 2000) we explore the impact of changes in the share of consumers with Internet access. Here we have chosen to focus on one issue which was testable with the data at hand. Given the potentially dramatic implications of Internet for how markets will work will be interesting to study as more data become available. The Mosaic browser, which first made the Internet available to non-specialists, was launched less than 10 years before this study. Thus, the worn out phrase that "more research is needed" may be more appropriate than usual.

¹⁸For the CDs, adjusted R-square is between 0.00 and 0.13 when transport costs are included, and between 0.19 and 0.33 when transport costs are excluded from the online prices. In the book-regressions, adjusted R-square is below 0.06, and in a few regressions it is even negative (ALFONS and SAOL). However, the explanatory power of the regressions on CARAMBOLE are considerably stronger: 0.15 and 0.30, when transport are included and excluded, respectively. There is some logic to these results. A firm would forego much profit if its price is ill adjusted on the CDs, all of which are good selling or on the bestseller CARAMBOLE. The two remaining books, however, are not top-selling products, and as a consequence, the loss from setting a suboptimal price is smaller. Thus, the pure random components of these prices are likely to be larger.

References

- [1] Anderson, Simon P. and Victor A. Ginsburgh, 1999, International pricing with costly consumer arbitrage, *Review of International Economics* 7, 126-139.
- [2] Armstrong., Mark, 1999, Price discrimination by a many-product firm, *Review of Economic Studies* 66, 151-168.
- [3] Asplund, Marcus and Rickard Sandin, 1999, Competition in Interrelated Markets: An Empirical Study. *International Journal of Industrial Organization* 17, 353-369.
- [4] Bailey, Joseph P. Intermediation and electronic markets: Aggregation and pricing in Internet commerce, PhD Thesis, Massachusetts Institute of Technology.
- [5] Bakos, Yannis, 2001, The emerging landscape for retail e-commerce, *Journal of Economic Perspectives* 15, 69-80.
- [6] Brynjolfsson, Erik and Michael D. Smith, 2001, Frictionless commerce? A comparison of Internet and conventional retailers, *Management Science* 46, 563-585.
- [7] Carlton, Dennis W and Judith A. Chevalier, 2001, Free riding and sales strategies for the Internet, NBER Working Paper No 8067.
- [8] Clay, Karen, Ramayya Krishnan and Eric Wolf, 2001, Prices and price dispersion on the web: evidence from the on-line book industry, NBER Working
- [9] Ellison, Glenn and Sara Fischer Ellison, 2001, Search, obfuscation and price elasticities on the Internet, manuscript, Massachusetts Institute of Technology.
- [10] Friberg, Richard, Mattias Ganslandt and Mikael Sandström, 2000, E-commerce and prices: Theory and evidence, Stockholm School of Economics, Working paper no 389, <http://swopec.hhs.se>

- [11] Goolsbee, Austan, 2000a, In a world without borders: The impact of sales taxes on Internet commerce, *Quarterly Journal of Economics*, 561-576.
- [12] Goolsbee, Austan, 2000b, Competition in the computer industry: on-line versus retail, manuscript, Graduate School of Business, University of Chicago.
- [13] Lee, Ho Geun, 1998, Do electronic marketplaces lower the price of goods? *Communications of the ACM* 41, 73-80.
- [14] Martin, Stephen, 2001, Advanced Industrial Economics, Blackwell Publishers, London, second edition.
- [15] Morton, Fiona Scott, Florian Zettelmeyer and Jorge Silva Risso, 2000, Internet car retailing, NBER Working Paper 7961.
- [16] Mussa, Michael and Sherwin Rosen, 1978, Monopoly and product quality, *Journal of Economic Theory* 18, 301-317.
- [17] Smith, Michael D., Joseph Bailey and Erik Brynjolfsson, 2000, Understanding Digital Markets: Review and Assessment, in *Understanding the Digital Economy* by Erik Brynjolfsson and Brian Kahin (editors), The MIT Press, Cambridge, Massachusetts

Table I
Summary Statistics For the Price Data.

	(SEK)	N	Mean	Std. Dev.	Min	Max	Range		
							All firms	Intra- market	On-line
Books:	SAOL	67	208.09	32.76	146	268	122	58	122
	CARAMBOLE	60	263.70	37.91	119	332	213	52	80
	ALFONS	49	118.78	21.94	84	148	64	35	54
	LONGMAN	14	391.14	76.20	288	528	240	19	125
	Delivery cost	8	33.75	14.33	0	45	45		
CDs:	RHCP	96	158.53	13.41	127	189	62	22	22
	BSB	87	159.87	13.94	129	199	70	21	20
	TWAIN	92	159.72	12.91	129	189	60	21	20
	DILEVA	96	159.67	13.99	125	199	74	23	24
	U2	79	166.15	18.32	109	189	80	30	40
	EVA	47	104.00	23.86	69	189	120	46	20
	Delivery cost	7	21.34	9.96	0	29	29		

Statistics in all except the two rightmost columns are computed on the full sample. The intra-market range is the mean of the range of prices in all local markets, excluding markets where zero or one stores sold the product. The last column is the range of prices among the online stores.

Table II

Summary Statistics On the Prices of Books for Different Categories of Stores.

		Mean <i>Std.dev</i>	Min 25 th	Median 75 th	Max 75 th	Mean <i>Std.dev</i>	Min 25 th	Median 75 th	Max 75 th	N	
Excluding transport		Including transport					Including transport				
Caram-	All	263.7 37.91	119 249	259 288	332	267.4 34.35	119 249	259 288	332	60	
(SEK)	B&M	269.5 35.1	119 259	259 288	332	269.5 35.1	119 259	259 288	332	53	
	All	219.7 29.94	183 -	209 -	263	251.8 24.59	222 -	248 -	299	7	
	Internet	261 2.828	259 -	- -	263	281 25.46	263 -	- -	299	2	
	B&C on-line	203.2 12.21	183 -	207 -	215	240.2 12.26	222 -	238 -	254	5	
	Pure e-tailers										
Basket	All	0 10.88	-30.04 -7.34	1.47 6.05	18.24	0 9.97	-23.96 -7.98	0.77 -	18.60 5.31	45	
(Dev.)	B&M	1.94 8.57	-14.11 -4.12	2.49 8.25	18.24	1.23 8.51	-14.71 -4.79	1.78 -	17.42 7.50	39	
from sample	mean, %)	All Internet	-12.59 16.22	-30.04 -	-18.18 -	12.65	-7.98 15.34	-23.96 -	-13.03 -	18.60 -	
	B&C on-line	7.06 7.91	1.47 -	- -	12.65	9.68 12.61	0.77 -	- -	18.60 -	2	
	Pure e-tailers	-22.41 5.62	-30.04 -	-20.80 -	-18.01	-16.81 5.23	-23.96 -	-15.64 -	-12.02 -	4	

The statistics are computed for ordinary, “B&M” stores, for all Internet stores, and for the latter category subdivided between B&C stores, meaning firms that also sell in B&M stores, and pure e-tailers. The statistics are displayed for one separate item, CARAMBOLE, and for a basket consisting of three of the books. (LONGMAN dictionary was excluded due to too few observations.)

Table III

Summary Statistics On the Prices of Music CDs for Different Categories of Stores.

		Mean <i>Std.dev</i>	Min 25 th	Median 75 th	Max 75 th	Mean <i>Std.dev</i>	Min 25 th	Median 75 th	Max 75 th	N
		Excluding transport costs				Including transport costs*				
Red Hot	All	158.5 <i>13.41</i>	127 <i>149</i>	159 <i>169</i>	189	160.4 <i>11.85</i>	139 <i>149</i>	159 <i>169</i>	189	96
Chilli										
Peppers	B&M	160.5 <i>12.05</i>	139 <i>149</i>	159 <i>169</i>	189	160.4 <i>12.05</i>	139 <i>149</i>	159 <i>169</i>	189	88
(SEK)										
	All	137.4 <i>8.815</i>	127 -	139 -	149	159.9 <i>9.736</i>	149 -	157.4 -	178	8
	internet									
	B&C	145.7 <i>5.774</i>	139 -	- -	149	161.5 <i>14.92</i>	149 -	- -	178	3
	on-line									
	Pure	132 <i>6.066</i>	127 -	129 -	139	158.8 <i>6.076</i>	153 -	- -	164	5
	e-tailers									
U2	All	166.2 <i>18.3</i>	109 <i>149</i>	169 <i>179</i>	189	168.2 <i>16.42</i>	126 <i>159</i>	196 <i>179</i>	189	79
(SEK)	B&M	169.0 <i>16.1</i>	126 <i>159</i>	169 <i>179</i>	189	169.0 <i>16.15</i>	126 <i>159</i>	169 <i>179</i>	189	72
	All	137.3 <i>14.4</i>	109 -	139 -	149	159.4 <i>18.62</i>	127.4 -	164 -	178	7
	internet									
	B&C	135.7 <i>23.09</i>	109 -	- -	149	151.5 <i>25.4</i>	127.4 -	- -	178	3
	on-line									
	Pure	138.5 <i>7.371</i>	129 -	139 -	147	167.3 <i>5.774</i>	164 -	- -	174	4
	e-tailers									
Basket	All	0 <i>7.84</i>	-18.85 <i>-6.27</i>	0.02 <i>4.74</i>	22.04	0 <i>7.046</i>	-13.06 <i>-6.81</i>	-0.55 <i>4.14</i>	21.34	74
(Dev.										
From	B&M	1.52 <i>6.71</i>	-12.56 <i>-3.12</i>	0.02 <i>6.31</i>	22.04	0.94 <i>6.67</i>	-13.06 <i>-3.68</i>	-0.55 <i>5.70</i>	21.34	66
sample										
mean,	All	-12.58 <i>4.47</i>	-18.85 -	-12.56 -	-6.27	-8.85 <i>3.48</i>	-12.75 <i>-11.66</i>	-2.27 <i>-6.81</i>	8	
(%)	internet									
	B&C	-8.36 <i>3.63</i>	-12.56 -	-	-6.27	-6.42 <i>3.97</i>	-10.18 -	-	-2.27	3
	on-line									
	Pure	-15.1 <i>2.66</i>	-18.85 -	-15.39 -	-12.56	-10.68 <i>1.82</i>	-12.75 -	-	-9.15	5
	e-tailers									

The statistics are computed for conventional, “B&M” stores, for all Internet stores, and for the latter category subdivided between B&C stores, meaning firms that also sell in B&M stores, and pure e-tailers. The statistics are displayed for two separate items, RHCP and U2, and for a basket consisting of four of the CDs: RHCP, BSB, TWAIN and DILEVA, our “Top 4” basket.

Table IV
Regression Results On Books.

	Alfons		Carambole		SAOL		Basket		
			Excluding transport				Excluding transport		Including transport
	49	49	60	60	67	67	45	45	45
N	0.185	0.180	0.120	0.119	0.160	0.153	0.097	0.084	0.095
Std.d.	0.107	0.165	0.357	0.381	0.041	0.142	0.290	0.483	0.187
R ²	0.003	0.046	0.298	0.311	-0.038	0.056	0.199	0.402	0.083
Adj. R ²	-0.102	-0.130 **	0.227 ***	0.211 ***	0.031	-0.004	0.028	-0.033	0.015
Const.	<i>0.063</i>	<i>0.058</i>	<i>0.057</i>	<i>0.060</i>	<i>0.095</i>	<i>0.087</i>	<i>0.053</i>	<i>0.046</i>	<i>0.052</i>
Intern	-0.117		-0.137 ***		-0.092		-0.119 *		-0.068
	0.072		0.042		0.075		0.065		0.063
Intpure		-0.232 ***		-0.188 ***		-0.247 ***		-0.243 ***	-0.179 ***
		<i>0.062</i>		<i>0.050</i>		<i>0.046</i>		<i>0.044</i>	<i>0.043</i>
Intmix		0.057		-0.037 *		0.084		0.058	0.091
		0.063		0.021		0.088		0.043	0.065
Bookst	0.108	0.117 *	-0.106 ***	-0.097 **	-0.003	0.013	0.064 **	0.097 ***	0.066 **
	<i>0.071</i>	<i>0.067</i>	<i>0.039</i>	<i>0.041</i>	<i>0.079</i>	<i>0.072</i>	<i>0.031</i>	<i>0.032</i>	<i>0.031</i>
Center	0.033	0.038	-0.136 ***	-0.132 ***	-0.026	-0.026	-0.066 *	-0.055 *	-0.064 *
	<i>0.073</i>	<i>0.067</i>	<i>0.048</i>	<i>0.048</i>	<i>0.053</i>	<i>0.052</i>	<i>0.036</i>	<i>0.031</i>	<i>0.035</i>
Large	0.007	0.012	0.046	0.045	0.013	0.022	-0.004	0.003	-0.003
	<i>0.062</i>	<i>0.062</i>	<i>0.033</i>	<i>0.033</i>	<i>0.045</i>	<i>0.045</i>	<i>0.031</i>	<i>0.030</i>	<i>0.030</i>
Noch.	-0.050	-0.010	-0.077 *	-0.059	-0.013	0.026	-0.044	0.005	-0.039
	<i>0.049</i>	<i>0.053</i>	<i>0.040</i>	<i>0.044</i>	<i>0.040</i>	<i>0.040</i>	<i>0.038</i>	<i>0.034</i>	<i>0.037</i>
									0.034

Results are presented for regressions on three of the books on the prices excluding transportation costs and for the regressions on the book basket excluding and including transportation costs. Two different specifications were run on all of these, with only an Internet dummy, and with separate dummies for pure and mixed Internet retailers. Standard errors in italics. One, two and three asterisks denote that the coefficient estimate is significant at, respectively, the 10, 5 and 1 percent level of significance.

Table V
Regression Results On CDs.

	Californication		Basket 1: All 6 CDs				Basket 2: Top 4		
	Excluding transport	Including transport	Excluding transport						
N	95	95	34	34	33	33	73	73	72
Std.d.	0.070	0.069	0.060	0.059	0.058	0.059	0.065	0.064	0.064
R ²	0.351	0.373	0.678	0.692	0.599	0.603	0.369	0.394	0.238
Adj. R ² .	0.315	0.331	0.620	0.623	0.525	0.512	0.322	0.339	0.180
Const.	-0.023	-0.026	0.083	0.068	0.070	0.063	-0.026	-0.029	-0.033
	0.020	0.020	0.055	0.056	0.055	0.055	0.021	0.021	0.021
Intern	-0.160 ***		-0.213 ***		-0.181 ***		-0.161 ***		-0.118 ***
	0.024		0.019		0.015		0.022		0.019
Intpure		-0.195 ***		-0.234 ***		-0.192 ***		-0.192 ***	-0.142 ***
		0.022		0.018		0.016		0.020	0.018
Intmix		-0.105 ***		-0.173 ***		-0.163 ***		-0.113 ***	-0.088 ***
		0.018		0.023		0.018		0.016	0.019
CDst	0.051 ***	0.053 ***	0.011	0.025	0.015	0.021	0.025	0.028	0.026
	0.017	0.017	0.025	0.027	0.024	0.026	0.017	0.017	0.017
Center	0.000	0.000	-0.105 *	-0.105 *	-0.104 *	-0.104 *	0.020	0.020	0.020
	0.022	0.022	0.055	0.055	0.055	0.054	0.023	0.023	0.023
Large	0.036 **	0.036 **	0.046 **	0.049 **	0.047 **	0.048 **	0.017	0.016	0.017
	0.016	0.016	0.023	0.023	0.022	0.023	0.017	0.017	0.017
Noch	-0.035 *	-0.033 *	0.027	0.029	0.027	0.028	0.004	0.006	0.005
	0.019	0.019	0.023	0.023	0.023	0.023	0.020	0.020	0.020

Results are presented for the regression on one of the CDs on the prices excluding transportation costs and for the regressions on the two baskets, one including all six CDs and one including only the “Top 4” CDs (RHCP, BSB, TWAIN and DILEVA). For the baskets, the results are presented on prices excluding and including transportation costs. Two different specifications were run on all regressions, with only an Internet dummy, and with separate dummies for pure and mixed Internet retailers. Standard errors in italics. One, two and three asterisks denote that the coefficient estimate is significant at, respectively, the 10, 5 and 1 percent level of significance.

Figure 1 Price of "Carambole" and "Alfons" in the 19 local markets and on the Internet (location 0)

