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A comparison of Internet and Conventional Retailers: an Italian elaboration of Internet pricing Behavior across different product categories

Abstract

There have been many claims that the Internet represents a new nearly “frictionless market.” Our research empirically compares the characteristics of the Internet as a channel for three categories of products. We find that differences in price levels, sensitivity and dispersion depend on the measures employed and the category analyzed.

Introduction

Why does, for example, Amazon.com attract so many consumers though it is not the cheapest Internet retailer in many of the categories it offers? Why did Amazon.com enter some product categories more successfully than others? In this article, we hope to give some tentative answers to such questions. When the Internet rose to public perception, the conventional wisdom regarding competition was that the unique characteristics of the Internet will bring about a nearly perfect market. From the beginning, research in Internet marketing has increasingly focused on the issue of pricing (Wind and Mahajan, 2001). It was argued that the Internet is decreasing transition and transaction costs, as customers can, at very low search costs (Alba et al. 1997; Bakos 1997; Sahlman 1999), compare prices and attributes of different offerings. Cost transparency is threatening firms (Sinha, 2000) and competitors are therefore only “at a click away.” In the extreme version of this “Internet efficiency” view, the characteristics of the Internet will lead to a market where retailer “location” is irrelevant, consumers are fully informed of prices and product offerings, and all retailers make zero economic profit. Ultimately, the effects of the Internet on commerce are an empirical matter. Accordingly, our work seeks to address these questions by comparing actual prices charged by Internet and conventional retailers of books, compact discs (CDs), and groceries. Our data include over 850 individual price observations collected in 2002. We run a variety of statistical and econometric tests on our data to determine pricing characteristics. At the core of the “frictionless” argument is the assumption that price is a function of channel selection. Moreover, it is argued, implicitly, that price is determined by channel selection. We question this assumption. We put forward the hypothesis that the “frictionless” argument may be, more or less, valid only for specific product categories, and that, in many cases it is not even valid for those ones. Differences in price level, sensitivity, and dispersion are dependent on the product homogeneity or product category. In addition, even within “frictionless”-valid product categories, intermediaries have strategic choices at their hand and they are not determined by their channel type or industry characteristics.

This paper extends the results of the previous studies by investigating prices for different product categories matched across conventional and Internet channels. The categories differ in their degree of product homogeneity. Homogenous products have been identified as most likely to experience strong price competition given the characteristics of Internet channels (Bakos 1998; Brynjolfsson and Smith, 2000). We focus on a sample of goods carefully matched across conventional and Internet channels to eliminate much of the unobserved heterogeneity in the sample, leaving us with a clearer measure of the difference between and across the channels. We analyze books and CDs, both very homogenous products, and groceries, characterized by less homogeneity.

Literature review (abbreviated)

In addressing these questions, our work follows several other studies of the effect of electronic commerce on differentiated goods markets. Pricing is a well-researched topic in economics and marketing (Rao 1984). In the economics literature, much research has focused on price dispersion in the offline environment (e.g., Cohen 1998; Carlson and McAfee 1983; Dahlby and West 1986; Dana 1999; Mitchell and Sorensen 1986; Salop and Stiglitz 1982; Sorensen 2000; Stigler 1961). Basically, research has focused on (1) price levels on the Internet in comparison to conventional retailers; (2) on price sensitivity on the Internet in comparison to conventional retailers; and (3) on price dispersion on the Internet in comparison to conventional retailers.

Price levels

A variety of arguments have been provided why (and/or why not) on the Internet lower prices are to be expected (e.g., Brynjolfsson and Smith, 2000; Bakos, 1998). The discussion includes arguments related to consumer search costs (e.g., Salop, 1979; Bakos, 1997, 1998) or the threat of new entry (e.g., Salop, 1979, Milgrom and Roberts, 1982).

A variety of empirical studies have been put forward (Lee, 1998; Bailey, 1998; Brynjolfsson and Smith, 2000; Clay et al., 1999; Brown and Goolsbee, 2000; Erevelles, Rolland and Srinivasan, 2000; Morton, Zettelmeyer and Risso, 2001; Tang and Xing, 2001; Ancarani and Shankar, 2002; Pan, Ratchford and Shankar, 2002; Pan, Shankar and Ratchford, 2002) Taken together, these studies suggest that prices at online retailers are generally lower than those at offline retailers in the current environment.

Price Sensitivity

A variety of authors researched price sensitivity. Menu costs—the costs a retailer incurs when changing a posted price—might have important repercussions for both single firms and the economy at large (e.g., Levy et al., 1997). It has been hypothesized that menu costs on the Internet should be lower and that the prices offered by Internet retailer should be less “sticky” than in conventional channels (e.g., Brynjolfsson and Smith, 2000).

Empirical studies found elusive results (Degeratu et al., 2000; Lynch and Ariely, 2000; Shankar, Rangaswamy and Pusateri, 2001; Choudhury, Hartzel and Konsynsky, 1998; Baker, Marn and Zawada, 2001; In sum, the empirical evidence does not support the hypothesis of a “friction-less” Internet economy.

Price Dispersion

In the classic Bertrand model of price competition, no price dispersion should be expected as the price is set equal to marginal cost for all retailers. Still, price dispersion exists (e.g., Pratt et al., 1979; Dahlby and West, 1986). A variety of reasons can be put forward for the existence of price dispersion, such as differences in search costs (e.g., Burdett and Judd, 1983; Stahl, 1989, 1996), differences in degree of

information on price differences by consumers (e.g., Salop and Stiglitz, 1977, 1982; Varian, 1980; Van Hoomissen, 1988).

According to the “frictionless” argument, price dispersion should be lower on the Internet compared to conventional retailers due to the Internet’s lower search costs. The empirical results are contradicting (Bailey, 1998; Brynjolfsson and Smith, 2000; Clemons et al., 1998; Brown and Goolsbee, 2000; Morton, Zettelmeyer and Risso, 2001; Tang and Xing, 2001; Pan, Ratchford and Shankar, 2001). The high level of price dispersion run counter the arguments put forward by pundits of the “frictionless” commerce.

Hypotheses

Our argument that price is not determined by channel selection and that no general claim regarding “frictionless” commerce can be put forward is investigated following literature on this argument.

We argue that it cannot be generally claimed that prices on the Internet are lower than in conventional stores. We thus formulate:

First null hypothesis: Mean prices on the Internet are equal to mean prices in conventional stores.

In our perspective, it cannot be generally claimed that shoppers on the Internet are more price sensitive than shoppers in conventional stores.

Second null hypothesis: Menu costs on the Internet are equal to menu costs in conventional stores.

In our perspective, price and price dispersion is not determined by the channel selection. We thus investigate:

Third null hypothesis: Standard deviation of Internet and conventional prices are the same.

A rejection of those null hypotheses would be very important for marketing researchers and practitioners. It would support them in their effort to design customer value-based pricing strategies (Dolan and Moon 2000; Wind and Mahajan 2001; Simon and Schumann 2001) that overcome the traditional wisdom that online markets are highly competitive and that supplier in the search for profits have no discretionary power over price.

Data collection methodology

Our study gathered price data, product characteristics, and retailer characteristics for groceries sold through Internet and conventional retail outlets in the Italian market. Groceries are less homogeneous than books and CDs, but still more homogeneous than other categories. Moreover, the Internet has been identified as a disruptive force for conventional retailers (Christensen and Tedlow, 2000)

Our methodology tracks two types of retailers: those that sell over the Internet and those that sell through conventional outlets.

Our study compares groceries to books and CDs. Groceries goods cannot claim to be as homogeneous a product category as books or CDs. This was a deliberate choice. We opted for covering four sub-categories, as it became soon evident that it would not be possible to obtain a similar degree in homogeneity for this product category: Fruits and vegetables; pasta and wine; wines and liquors; and bread and sweets. Those four categories were available in the product range of all firms selected for our study. As a consequence, we selected a series of sixteen goods within our four sub-categories. For reasons of comparison, prices were identified on a per-kilogram-basis or per-liter-basis.

All of the data for our Internet retailers was gathered from the retailer’s Internet web page. Likewise, people employed by our project gathered the data for all three conventional retailers directly from the

stores in personal visits. The period of observation was March 2002, with bi-weekly observations during the same opening hours of day, resulting in 864 observations.

Empirical results

We analyze our data by examining price levels; price changes over time; and price dispersion across stores. With regard to price levels and price changes, our goal is to compare the characteristics of Internet channels for books, CDs, and groceries to the characteristics of existing conventional channels for the same products in the Italian market. We confront our results with the empirical evidence in the U.S. market as elaborated by Brynjolfsson and Smith (2000).

First, we ran both parametric (*t*-tests) and non-parametric (Wilcoxon) tests on the mean Internet and conventional prices after weighting for the popularity of Internet retailers. The weights reflect the fact that some Internet retailers receive far less traffic than others. Thus, our measure of “typical” prices on the Internet takes into account the relative number of customer visits to each site. To establish weights, we create a measure of retailer “screen share.” Our screen share measure is the average of the relative number of hits and links (reported by Alexa.com) to each Internet retailer. In all cases, the p-values of the parametric and non-parametric tests were similar. This strengthens our results because when a non-parametric test allows you to reject the null-hypothesis and confirms the results of the *t*-tests, the null hypothesis rejection can be considered valid in the majority of cases. For the remainder of the paper, we therefore use the results obtained by the *t*-tests.

Relative Price levels

As for groceries in the Italian market, we found that the mean prices are only slightly lower on the Internet than in conventional stores: by €0.24 or 5.38%. Again, *t*-tests reject the null hypothesis; conventional prices are lower than Internet prices. In the Italian grocery market, the minimum price on the Internet is, on average, €0.12 lower. Moreover, the lowest price for a given product in a given week across all retailers is found on conventional channel 51.04% and, consequently, on the Internet only 48.96%.

Table 1: Price analysis with and without market share weighting (mean price analysis and minimum prices comparison)

unweighted prices	books (US mkt)	books (US mkt)	grocery (italian mkt)
conventional mean price	13,9	16,07	4,23
Internet mean price	11,74	13,49	4,47
alternative hypotesis	p(internet)< p(conventional)	p(internet)< p(conventional)	p(internet)> p(conventional)
declared significance level	0,001	0,001	0,05
Internet minimum price<conventional minimum price	92%	84,60%	48,96%
alternative hypotesis	p(internet)< p(conventional)	p(internet)< p(conventional)	p(internet)> p(conventional)
effective significance level	0,05	0,05	0,05
market share wheighted prices			
conventional mean price	15,04	17,41	4,65
Internet mean price	13,69	15,15	5,33
alternative hypotesis	p(internet)< p(conventional)	p(internet)< p(conventional)	p(internet)> p(conventional)
declared significance level	0,001	0,001	0,05
Internet minimum price<conventional minimum price	83%	82,50%	9,38%
alternative hypotesis	p(internet)< p(conventional)	p(internet)< p(conventional)	p(internet)> p(conventional)
effective significance level	0,01	0,05	0,05

An analysis of the U.S. prices for books and CDs led to the conclusions that prices are lower on the Internet whether one examines prices alone or prices including tax, shipping and handling, and mileage charges (Brynjolfsson and Smith, 2000). The authors of the study concluded that an increasing share of sales should be expected to take place through the Internet channel and provided anecdotal evidence. Yet, we find different results for a different product category, namely grocery goods. More often than not, prices in the conventional channel are lower than purchasing goods through the Internet. Nevertheless, the Italian market for grocery goods is growing. Obviously, buyers are valuing features other than price as much or even more. Competition on the Internet and of the Internet with conventional channels does not necessarily lead to price wars and to lower overall prices for consumers but it seems focusing also on other parts of companies’ value proposition than the price.

Price Sensitivity: Price Changes and Menu Costs

To examine the hypothesis that menu costs on the Internet should be lower the size and number of price changes between the Internet and conventional channels can be analyzed. Brynjolfsson and Smith (2000) find support for the hypothesis of lower menu costs in Internet channels; Internet retailers are willing to make smaller price changes than conventional retailers. As for groceries in the Italian market, both channels offer consumers price changes of €0.01. Based on this analysis, we cannot confirm the hypothesis of lower “price stickiness” on the Internet.

	conventional prices			internet prices		
Products	smallest price change observed	largest price change observed	Change mean value	smallest price change observed	largest price change observed	change mean value
books (USA market)	0,35	8	2,37	0,05	7,5	1,84
cds (USA market)	1	7	2,98	0,01	10	1,47
Grocery (italian market)	0,01	7,72	0,33	0,01	8,21	0,17

A second way to view this data is through a histogram showing the number of price changes on the Internet and conventional outlets. Brynjolfsson and Smith (2000) used \$0.05 wide range and found that, retailers on the Internet regularly make price changes that are smaller than the smallest price change we observe in conventional stores. As for groceries, the picture in the Italian market is very similar for both conventional and Internet retailers, but very different from the U.S. market. The two channels make frequent changes at both the low and high end of the price range. Conventional retailers in the Italian market make more price changes and are more aggressive in utilizing the range of price changes. We cannot confirm the hypothesis of lower “price stickiness” on the Internet.

A third way to view the data is through a cumulative distribution function showing the probability of observing a price change smaller than a particular level within each channel. Brynjolfsson and Smith (2000) found for both books and CDs, the cumulative distribution function is larger for the Internet channel than the physical channel for all price changes up to \$6.00. The situation in the Italian market is different. In the Italian grocery market, both cumulative distribution functions mirror each other. At the low end and at the high end, the conventional retailers, not their Internet peers, score higher.

A fourth way to view the data is to calculate the standard deviation of price changes between channels. Brynjolfsson and Smith (2000) found that the standard deviation of price changes on the Internet is lower than the standard deviation of price changes in conventional outlets for both books and CDs. For Italian groceries, the standard deviation is lower for price changes on the Internet.

Table 3: Standard deviation of price changes

Products	conventional	internet
books (USA market)	0,9792	0,7539
Cds (USA market)	1,2356	0,7374
Grocery (italian market)	0,9859	0,7301

In Italy, conventional retailers do not seem to be significantly “less efficient” in price allocation than their Internet retailing peers; one cannot claim there is more “price stickiness” in the conventional retailing channel.

Price Dispersion

In testing relative dispersion in posted prices across channels, we compare measures of price ranges and standard deviation between the Internet and the conventional channels. Price range is defined as the difference between the largest and smallest price charged by the Internet and conventional retailers for a given title and date. Standard deviation is calculated using the standard formula. For each date we count the number of titles where a particular measure of dispersion is larger on the Internet.

In their study of the U.S. market, Brynjolfsson and Smith (2000) found that, for books, measures of range and standard deviation are, in general, larger for Internet prices than for conventional prices. For CDs, their data suggest that dispersion on the Internet is approximately equal to, or slightly smaller than, dispersion among conventional prices. They further investigate the dispersion in share-weighted prices, weighting the posted prices by a proxy for market share in each channel. For books, they reject the null hypothesis, whereas for CDs, they fail to reject the null hypothesis.

As for Italian groceries, the range of prices on the Internet is larger than the range in conventional outlets 76% of the time. Our analysis leads us to reject the null hypothesis ($p < 0.05$). The same results in an analysis of share-weighted prices.

Table 4: Proportion of times price dispersion is larger on the Internet

Products	range	standard deviation
books (USA market)	87%	84%
cds (USA market)	37%	33%
Grocery (italian market)	76%	75%

Brynjolfsson and Smith (2000) analyzed books and CDs to investigate differences in pricing behavior across Internet and conventional channels. The analysis performed for a different category yields mainly different results. Overall, the general claim that the Internet will lower prices and price dispersion cannot be upheld.

Discussion and conclusions

In our study of price levels of groceries, we found that, overall, prices of conventional retailers are lower than prices offered by Internet retailers; these results were obtained by all four different tests. In sum, it is not the Internet channel that offers the lowest prices, but the conventional channel. These results contradict the claims of the “frictionless” commerce pundits; retailers are not determined in their price decisions by channel selection.

A more in-depth analysis of the Italian market reveals that the various competitors position themselves differently in regards to conventional retailing. Confronting the mean value in the channels with the mean value of various competitors brings some interesting results to the front: For example, for groceries, Volendo.com, an Internet retailer, has in general lower prices in the range of 5-7%, whereas e-coop, a hybrid retailer, posts on the Internet higher prices than the mean value in the channel in the

range of 8-9%. Moreover, Coop has on its Internet outlet, e-coop, higher prices than in its conventional stores. The same applies to Esselunga, another hybrid retailer. Yet, whereas e-coop is above the mean value with its prices in the Internet channel, Esselunga’s Internet store offers prices below the mean value, but still above the prices of its conventional stores.

Table 5: Player’s mean prices in the Italian grocery market (Retailers that cater both channel are in italic)		
Channel	Companies	mean values
Internet	<i>www.spesaonline.com</i>	4,460243902
	www.volendo.com	4,503789474
	www.iovorrei.it	4,27925
internet/hybrid	www.esselunga.it	4,296593407
	www.e-coop.it	4,84
Conventional	<i>Sma</i>	4,479555556
	<i>Gs</i>	3,927444444
	<i>Coop</i>	4,48
	<i>Esselunga</i>	4,032921348

The results for price changes and menu costs are similar. The situation in the Italian market is more differentiated than the general claim put forward for lower costs on the Internet channel (Brynjolfsson and Smith, 2000). For example, for groceries, the picture in the Italian market is very similar for both conventional and Internet retailers, but very different from the U.S. market. Both make frequent changes and both make them both extensively at both ends (low and high) of the price range. Moreover, conventional retailers in the Italian market make more price changes and are more aggressive in exploring the range of price changes. In Italy, conventional retailers seem not be significantly “less efficient” in price allocation than their Internet retailing peers; one cannot claim there is more “price stickiness” in the conventional retailing channel, especially for groceries. Additionally, the general claims that the Internet will lower price dispersion cannot be upheld. Product category seems to be an important factor to be considered and price is not solely a function of channel choice.

Our study shows that the assumption of price as a function of channel selection has to be questioned. First, there are no significant differences between prices of conventional and Internet retailers across categories. Second, price levels vary substantially not only across, but also within categories.

Competitors in the Italian market do not compete primarily on price, but on other attributes of their offering. Therefore, price is not a function of channel selection, but strategic choice and positioning of the various competitors within and across categories influence price.

We find some support for this argument in the literature on Internet retailing (Lal and Sarvary, 1999). Moreover, it has been argued that the Internet may enhance loyalty, making price less important (Shankar, Smith and Rangaswamy 2002). Academic studies emphasized the significance of trust in Internet strategy (e.g., Hoffman, Novak and Peralta, 1999; Urban, Sultan and Qualls, 2000). Potential consequences and determinants of online trust have been discussed (e.g., Fogg et al, 2002; Shankar, Urban and Sultan, 2002; Sultan, Urban, Shankar and Bart, 2002; Yoon, 2002). According to Reicheld and Schefter (2000), “price does not rule the web, loyalty does” and the Internet is not a frictionless environment, but a very “sticky” place. As a consequence, branding (e.g., Reicheld and Schefter, 2000; Urban, Sultan and Qualls, 2000; Shankar, Smith and Rangaswamy, 2002) and trust (e.g., Lynch and Ariely, 2000; Shankar, Rangaswamy, and Pusateri, 2001) have been suggested as marketing levers to compete on the Internet.

These results cannot provide support for the hypothesis that the Internet is in general a more efficient channel in terms of price levels and menu costs. Previous predications that conventional retailers will

find it increasingly difficult to compete on price have to be taken with cautious considerations. A shift from conventional to Internet retailers based on price considerations cannot generally be predicated. Moreover, our results suggest that product category characteristics have to be taken into consideration. Previous research by Brynjolfsson and Smith's (2000) concluded that the Internet price dispersion may arise from two different sources of retailer heterogeneity, namely heterogeneity in customer awareness and heterogeneity in retailer branding and trust. This means that Amazon.com can charge higher prices than the lowest price competitor and still attract a larger base of customer, who value features other than price as much or even more.

Our research adds a further dimension to this: heterogeneity in category characteristics. Early work stressed the role of product heterogeneity in explaining price dispersion (e.g., Griliches, 1961; Chow, 1967); this research views products as bundles of characteristics, with price dispersion arising from the presence or absence of characteristics in a particular product. Category characteristics in our view stem from consumer's perceptions of relative homogeneity. In our sample, we selected a matched set of identical products, eliminating in this set any effects of product characteristics as discussed in the economics literature. Category characteristics relate to the relative complexity of many factors, and not solely price, to be taken into consideration in the buying decision. Amazon.com might have experienced differences in success in entering new categories due to the categories' diversity in homogeneity, thus leading to dissimilar buying behavior of customers, when shopping online and/or offline.

As a consequence we note that, far from being equalized, differences among sellers may be amplified on the Internet as compared to conventional channels and, especially, that those differences will vary according to the heterogeneity in category characteristics.

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CONGRESSO INTERNAZIONALE “LE TENDENZE DEL MARKETING”

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