Is the Internet making markets more efficient? The evidence according to price indicators in Spain

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Abstract:

It has been theorized that low search costs associated with e-commerce imply greater levels of efficiency relative to the conventional retail channels. Multiple empirical studies confirm this hypothesis concerning price level, although the evidence is mixed relative to price dispersion. This article empirically compares the efficiency of the Internet with the conventional retail channel through 4 price indicators for the CD market. The results, based on 1,603 prices collected in Spain, are surprising. The conventional channel shows greater efficiency for both posted and final prices. These findings together with the coincident results of other reviewed studies would suggest key factors related to the development of e-commerce. Implications of the study and future considerations are discussed.

Keywords: search cost, Pricing, Internet retailers marketing, ICT

1. Introduction

During the two last decades, Information and Communication Technologies (ICT) have reached high levels of sophistication and experienced successive cost reductions. Both factors have facilitated adoption of these technologies by numerous companies, as well as by the general population, resulting in increasing access to internet infrastructures. These technological advances have in turn catalyzed in the creation and growth of electronic commerce. In this context the Internet allows for consolidation as an additional commercial channel through which retailers gain access to their target markets.

Increased usage of e-commerce for retail activities awakens an interest in research in this field due to its economic implications and to understand what role ICT can play. It is generally accepted that characteristics of the Internet would lead to greater market efficiency, in accordance with economic models of perfect competition (Alba *et al.*, 1997; Bakos, 1997). This belief is premised on the idea that use of the Internet implies lower search costs for the consumer. The relation between the balance price and the forementioned costs was considered by Salop (1979) who showed that prices can stay over marginal costs if a certain level of search costs exists, even in the case of homogeneous products. On the other hand, Bakos (1997) theorized that low search costs associated with online shopping would involve a price reduction to the level of marginal costs in the case of homogeneous products, with lower price reductions in the case of heterogeneous products.

Given previous research in this area, there exists a need to investigate to what extent the Internet is more efficient than the conventional channel for retail markets. Bailey (1998) and Brynjolfsson & Smith (2000) compared the efficiency through three price related indicators. The first indicator, price level, compares the price level in both channels in order to verify if online prices are in fact lower. The second indicator, price dispersion, weighs the existing price differences for a specific product among retailers operating online against retailers operating in the conventional channel. Lastly, the authors used an indicator related to price updates: the number of price changes. This indicator was used to measure if price updates happen more often online than offline, given a particular product and time interval. Brynjolfsson & Smith (2000) used a fourth indicator, also related to the

price updates, in order to compare the magnitude of price changes in both channels. These approaches, used to compare the efficiency levels between the Internet and the conventional have also been used in successive studies both in the U.S. (e.g. Brown & Goolsbee, 2002; Clay *et al.*, 2002; Morton *et al.*, 2001), and in Europe, including one study in Sweden (Friberg *et al.*, 2000), one in Spain (Núñez *et al.*, 2001), and one in Italy (Ancarani & Shankar, 2004).

This current article provides new empirical evidence about price differences, and thus differences in market efficiency, within the context of the Spanish music CDs retail market, by comparing the online market with its conventional retail peer. We compare the price level, the price dispersion, the number of changes in prices, and the magnitude of price changes. The research hypotheses, based on each one of the aforementioned indicators, are formulated for two types of prices: posted prices and final prices. The inclusion of final price hypotheses is important in order to approximate market efficiency taking in consideration more variables beyond posted prices. Consequently, final prices online include the shipping costs that each retailer applies and calculates according to its own criteria, and final prices in the conventional channel include the access costs. Those are assumed by the buyer to look for and travel to the retail destination, and they also include emotional costs which are related with the buyer feeling about the shopping process itself. It is remarkable the exhaustive treatment given to the problems on final price calculations that has implied dealing with two scenarios of shipping costs for purchases online (Standard-SC scenario for a delivery time of 4 to 15 days and Urgency-SC scenario for a delivery time of 1 to 3 days) and three scenarios of access costs for purchases through the conventional channel (3.75€, 6€ and 8.25€). The hypotheses are tested based on data collected over a period of 6 weeks (in May and June 2004), totaling 1,603 prices of CDs from retailers that operate exclusively online (Internet Pure Retailers or IPR), exclusively in the conventional channel (Brick&Mortar Retailers or B&MR) and in both channels simultaneously (MultiChannel Retailers or MCR).

The results of this current study and those from Núñez *et al.* (2001) study turn out to be similar. The previous study found a low level of Internet development, and we would have expected greater evolution of the Internet as a retail channel, thus also expecting greater efficiencies, based on the four year difference between the two empirical studies. The discussion of the factors that make up this scenario

describes a contrast with the evolution that has happened in the United States, and can be interesting to managers by providing a greater understanding of the evolution of electronic marketplaces in different environmental contexts and in a different time.

2. Theory and literature review

Theoretical framework

According to what we state in the previous section, the theoretical foundation of our hypotheses comes from the principle that low search costs online most closely resemble an environment of perfect information about price and product characteristics. Perfect information would imply that prices decrease to the level of marginal cost in the case of homogeneous products (Alba *et al.*, 1997; Bakos, 1997). Next, we describe the implications of this theoretical foundation on price indicators that characterize the efficiency of a market.

Regarding the price level indicator, Bakos (1998:40) summarizes the awaited implications: "lower buyer search costs in electronic marketplaces promote price competition among sellers. This effect will be most dramatic in commodity markets, where intensive price competition can eliminate all seller profits. It will also be significant in markets where products are differentiated, reducing the monopoly power enjoyed by sellers, and leading to lower prices and seller profits". Consequently lower prices are expected online, and thus a progressive loss of sales in the conventional channel in favour of buying through the Internet is also expected.

Regarding the price dispersion, Stigler (1961:214) stated that it "is a manifestation - and, indeed, it is the measure - of ignorance in the market". Similarly, Bakos (1997) raised the hypothesis that if search costs were smaller online than in the conventional channel, the price dispersion would have to be smaller too.

The two indicators relative to price updates - the number of changes in price and their magnitude - are directly connected to the concept of "menu cost". I this context, "menu cost" concept refers to how much money costs to change the prices. In the case of conventional stores menu costs come from the re-labelling process when it is decided to modify prices (Levy *et al.*, 1997), and in the case of

Internet retailing they are associated with the costs incurred when changing prices in the information system database. Smith *et al.* (2000) propose the hypothesis that the existence of smaller menu costs online would imply a process of more efficient price updates. That is, prices would have to change more frequently and with smaller magnitudes in agreement with the adjustments made by changes in the seller's cost structure. To sum up, theoretical hypotheses propose that the Internet will have lower prices, smaller dispersion, and the prices will update more frequently and in a finer way than in conventional retail channels.

Studies in the United States

Table 1 shows a synthesis of the studies conducted in the U.S., classifying them in three groups. The first group is of studies that focus on the comparison of homogeneous product markets between the Internet and the conventional channel. The second group includes those studies that focus on comparing heterogeneous product markets between both channels. The third group of studies focuses on comparing product markets between two types of Internet retailers: the IPR and the MCR.

The results about the price level indicator are summarized in the fourth column of Table 1. In the first group, Bailey (1998) conducted the first empirical study and found that posted prices are higher online, with the results being explained by the immaturity of the channel. The Brynjolfsson & Smith (2000) study introduced a breaking point when observing lower prices online, both for posted prices and final prices. In addition, Brown & Goolsbee (2002) found lower prices online with respect to a type of life insurance that can be considered a homogeneous product. Also for the case of heterogeneous products, other empirical evidence of lower prices online exists (Morton *et al.*, 2001). However, all the studies after Bailey's do not confirm the existence of lower prices online. For example, Clay *et al.* (2002) find halfway results for the case of books: similar posted prices between both channels and more expensive final prices online. The studies of the third group (Pan *et al.*, 2002a, 2002b; Tang & Xing, 2001) proceed to compare prices online among retailers that sell exclusively in this channel and those that sell simultaneously online and offline. The three studies in this group found lower prices in the IPR, with some exceptions such as the prices for books and software (Pan *et al.*, 2002a). The results of all these studies show that for the price level indicator,

empirical evidence confirms the expectation of greater efficiency online, though some anomalies exist.

Comparative studies of homogeneous products between Internet and conventional channel			
Author	**Date**	**Products/Description**	**Price indicators behavior**
Bailey (1998)	1996-1997	Books, CDs and Software	**Price level:** Prices higher on the Internet **Price dispersion**: Less dispersion on the Internet not observed **Price update**: Higher number of changes on the Internet
Brynjolfsson & Smith (2000)	1998-1999	Books and CDs	**Price level:** Prices lower on the Internet (9% - 16%) with posted prices and final prices **Price dispersion:** Higher dispersion on the Internet without weights, but lower with weights (both posted prices) **Price update:** Higher number of changes and lower magnitude online
Brown & Goolsbee (2002)	1992-1997	Temporary life insurances	**Price level:** Lower prices on the Internet **Price dispersion:** Lower dispersion online **Price update:** Not applicable.
Clay *et al.* (2002)	1999	Books	**Price level:** Similar prices with posted prices. Higher prices online with final prices **Price dispersion:** Higher dispersion online. **Price update:** Not applicable
Comparative studies of heterogeneous products between Internet and conventional channel			
Morton *et al.* (2001)	1999-2000	Cars / Comparing the "Internet car referral services" to "conventional dealers"	**Price level:** Lower prices on the Internet (2%) **Price dispersion:** Lower dispersion online **Price update:** Not applicable
Clemons *et al.* (2002)	1997	Airplane tickets.	**Price level:** Not applicable **Price dispersion:** It is observed a high dispersion on the Internet **Price update:** Not applicable
Comparative online studies between Internet Pure Retailers (IPR) and Multiple Channel Retailers (MCR)			
Tang & Xing (2001)	2000	DVDs	**Price level:** Lower prices in IPR (14%) **Price dispersion:** Lower dispersion in IPR with posted prices **Price update:** Higher number of changes in MCR. Higher magnitude of changes in IPR
Pan *et al.* (2002a)	2000	Books, CDs, DVDs, Desktop, Laptop, PDAs, Software and Electronics.	**Price level:** Lower prices in IPR for CDs, DVDs, Desktop, and Laptops. Similar prices for PDAs. Higher prices in IPR for Software and books. **Price dispersion:** Not applicable **Price update:** Not applicable
Pan *et al.* (2002b)	<2002	Apparel, gifts-flowers, health, beauty, home and garden, sports equipment, computer hardware, consumer electronics, and office supplies	**Price level:** Generally, prices lower in IPR **Price dispersion:** Not applicable **Price update:** Not applicable
Own elaboration by the authors			

Table 1: Empirical studies performed in the U.S.

The studies of the price dispersion are summarized in the fourth column of Table 1. In the first group there are three studies that offer results opposite to the expected

lower dispersion online (Bailey, 1998; Brynjolfsson & Smith, 2000; Clay *et al.*, 2002). The higher level of price dispersion is explained in these studies to be a result of the immaturity of this channel, the brand factor, and other variables connected to product differentiation. Although Clay *et al.* (2002) did not find a clear connection between prices and the differential product attributes. In contrast, it must be emphasized that Brown & Goolsbee (2002) show a smaller dispersion when the number of Internet users is sufficiently large in the temporary life insurance market. This divergence of results is also repeated when considering heterogeneous products. Morton *et al.* (2001) find a smaller dispersion online for the automobile market whereas Clemons *et al.* (2002) find a greater dispersion for the airplane ticket market in the same channel. Within comparative studies online, Tang & Xing (2001) discover minor dispersion in IPR in relation to MCR for the DVD market.

Generally, previous studies show that although there are divergent results, there is little evidence to suggest more efficient price dispersion online. Consequently, several studies that have focused on studying this phenomenon stand out. Some of these studies have attempted to look for a smaller dispersion trend online, though have been unsuccessful in finding such a trend (e.g., Baylis & Perloff, 2002; Clay et al,. 2001; Pan *et al.*, 2002a). The existence of product differentiation strategies or the differences in quality of the retailer services offered are some of the explanations provided for the lack of expected findings, though these ideas explain only a small proportion of the found dispersion. In addition, Ratchford *et al.* (2003) found a substantial decrease of the dispersion between November 2000 and November 2001, but Pan *et al.* (2003) found that dispersion between November 2001 and February 2003 was maintained at the same level. Persistent dispersion is also observed by Baye *et al.* (2004). Pan *et al.* (2004) contributed with an exhaustive and interesting review of price dispersion on the Internet. It is worth noting that there have been other studies that have contributed interesting perspectives on this problem as well (e.g. Scholten & Smith, 2002; Lindsey-Mullikin & Grewal, 2006).

Studies focused on the indicators of price updates have not been as plentiful. The aggregated results are shown in the fourth column of Table 1. Bailey (1998) finds a greater number of price changes online a finding that received confirmation in the study by Brynjolfsson & Smith (2000) where, in addition, the results show

magnitudes of change up to 100 times smaller online than offline. Both results match those expected by theoretical hypotheses. Tang & Xing (2001) also analyze both indicators comparing the two types of retailers operating online: IPR and MCR. Their results show a greater number of changes in the MCR and a greater magnitude of change in the IPR. In sum, the empirical evidence is likely to confirm that there is more efficiency online with respect to price updates.

Finally, there are other studies focused on exploring some phenomena that happen in the online retail market, without explicit comparison to the conventional channel (e.g. Brynjolfsson *et al.*, 2003; Smith, 2002). In the first one, Brynjolfsson *et al.* (2003) discover what benefits are associated with the new products and services made available through the Internet. Their study shows a positive impact on customers' behaviour, which increase demand due to a wider variety of products accessible online. In the second study, Smith (2002) contributes with an exhaustive state of art covering the impact of shopbots on consumer and retailer behaviour in electronic markets.

Studies in Europe

The studies of price differences between online and traditional retailers in Europe are summarized in Table 2.

In Sweden, Friberg et al. (2000) present a theoretical model that predicts a reduction of prices in the B&MR once the number of internet consumers reaches a critical mass. Their focus is on the book and CD markets and the study compares prices for a product basket between the Internet and the conventional channel, observing smaller prices online, both for posted prices and final prices. When considering the final price of a unit, slightly smaller prices online are observed for books and for CDs. The study also compares prices between the two types of retailers that operate online, observing smaller prices in the IPR. In summary, the results tend to show a greater efficiency online.

Núñez *et al.* (2001) investigate the issue in Spain, comparing price level and price dispersion between the Internet and the conventional channel for books, technical books, CDs, perfumes, and quality wines. An interesting point of this study is that it fixes final prices for purchases in the conventional channel, adding a certain level of access costs. The authors preset different scenarios which allow for a sensitivity

analysis so as to answer the question: What level of access costs would a buyer have to assume in the conventional channel, so that the Internet was more efficient? The results relative to price level with posted prices do not show significant differences, and in fact show smaller prices in the conventional channel. For books and CDs, it is necessary to incur access costs of 6€ and 7.51€ respectively, to obtain lower final prices online. Concerning the dispersion, it turns out to be higher online, implying that the results are far from showing greater efficiency online, especially if the access costs are interpreted from the perspective of a buyer living in a metropolitan area where there exists a great number of retail choices, accessed at low costs.

Author	Date	Products/Description and Country	Price indicators behavior
Friberg et al. (2000)	1999	Books and CDs Sweden	**Price level:** *(Conventional & Internet)*: In the case of a product basket, lower prices online, with shipping costs (10%) or without (15%). In the case of a book with shipping costs, slightly lower prices online. In the case of a CD with shipping costs, similar prices in both channels. *(IPR & MCR):* Lower prices in the IPR
Núñez, *et al.* (2001)	2000-01	Books, Technical books, CDs, Perfumes and Wines Spain	**Price level:** Posted prices: prices are similar or higher online. Final prices and a book: lower prices online if access costs in the conventional channel get to 6€. Final prices and a CD: lower prices online if access costs in the conventional channel get to 7.51€. **Price dispersion:** In general, the dispersion is higher online
Ancarani & Shankar (2004)	2002	Books and CDs Italy	**Price level:** Posted prices: prices are arranged according to type of retailer: B&MR > MCR > IPR. Final prices: MCR > IPR > B&MR **Price dispersion:** in terms of standard deviation, the MCR offer the highest dispersion with both posted prices and final prices. The IPR show the lowest dispersion.
Own elaboration by the authors			

Table 2: Empirical studies performed in Europe

Ancarani & Shankar (2004) also deal with the price level and the price dispersion, though they compare prices among the three types of retailers: IPR, MCR and B&MR. For the price level, the highest posted prices are observed in the B&MR followed by the MCR and the IPR. When considering final prices, the highest are

found in the MCR followed by the IPR and the B&MR. The highest dispersion, estimated by the standard deviation, is observed in the MCR, both for posted and final prices, whereas the lowest dispersion is observed in the IPR. Paradoxically, it is in the IPR where greater dispersion is observed if this is measured as the difference between the observed maximum and minimum. In conclusion, the results differ depending on whether posted prices or final prices are considered, and depending on the method used to estimate the dispersion. It is interesting to observe that when considering the cases of Sweden, Italy and Spain in this order, the results show lower efficiency online, corresponding with smaller development of the electronic commerce and its related technologies (according to the Information Society Index (ISI) published by IDC in 2002, Sweden was the 1st country in the ranking with 7,087, United States the 4th with 6,631, Italy the 23rd with 4,748 and Spain the 24th with 4,579).

Björn & Hepperle (2002) conducted an additional empirical analysis, exploring the antiquarian bookseller market in Germany, an especially opaque market until the appearance in 1998 of an online intermediary that provides access to hundreds of catalogues (Zvab.com). On the basis of data gathered between February 2000 and January 2001, the authors conclude that increasing the sales percentage made by the seller online did not lead to a reduction of prices. In France, Frey *et al.* (2003) analyze the strategies of price decisions online for the retail CD market and empirically analyze the price dispersion, which turns out to be high. They conclude that the probability of price collusion among retailers increases in the case of CDs with little demand.

To end this section, let us refer to the results obtained by Öörni (2003) who compares on-line and conventional market efficiency in travel industry. The study compares price level and dispersion of flights between Hawaii and Brisbane, and vice-versa, without finding more efficiency online.

3. Empirical analysis

Taking into account the theoretical framework presented and the contributions from the previous literature, we have designed an empirical study with the aim of comparing the efficiency of online retailers with that of conventional ones for the CD market in Spain. This market has been selected because it is focused on a very

homogeneous product. The study was conducted on a total of 1,603 prices, captured during 6 weeks between May and June 2004. Here we introduce the hypotheses and the defining parameters of the study.

Working hypotheses

The hypotheses are designed in order to test the evidence of whether the Internet channel is more efficient than the conventional one from the point of view of each one of the four indicators of market efficiency (price level, price dispersion, number of changes in price, and magnitude of price changes). The approach used to develop the hypotheses considers the previous findings in Spain (Núñez *et al.*, 2001). Thus, our hypotheses are designed to test the existence of differences between the Internet and conventional retailers, since previous evidence does not leave us with a clear idea of which channel would show greater efficiency.

For posted prices, the hypothesis related to the price level indicator is as follows:

$H1_{PriceLevel;PostedPrice}$: The posted price level of an item online differs from its price level in the conventional channel.

$H2_{Disp;PostedPrice}$: The price dispersion of an item online differs from its price dispersion in the conventional channel, in relation to posted prices.

$H3_{NumChanges;\ PostedPrice}$: The number changes in price of an item online differ from its number changes in price in the conventional channel, in relation to posted prices.

$H4_{MagChanges}$; PostedPrice: The magnitude of posted price changes of an item online differs from its magnitude of posted price changes in the conventional channel.

The hypotheses for final prices are built in parallel form:

$H5_{PriceLevel;FinalPrice}$: The final price level of an item online differs from its final price level in the conventional channel.

$H6_{Disp;FinalPrice}$: The price dispersion of an item online differs from its price dispersion in the conventional channel, in relation to final prices.

It is important to make two observations in connection with the hypotheses for final price. First, the two hypotheses relative to price update indicators are not formulated, since the results must be coincident with the ones obtained for posted prices, an assertion we will clarify below. Second, the hypotheses for final price will be contrasted in several scenarios, as will be detailed later.

Sample of retailers

Taking Brynjolfsson & Smith (2000) as a primary reference, we selected a sample of 8 retailers for each channel: 4 operating exclusively in one channel (4 B&MR in the conventional channel and 4 IPR in the Internet) and 4 that perform simultaneously in both channels (MCR). Altogether, 12 retailers were chosen.

We estimated the population of retailers in the conventional channel through the data offered by the "Cambra Oficial de Comerç, Indústria i Navegació de Barcelona" (Official Chamber of Commerce, Industry and Navigation in Barcelona) and the telephone directory QdQ, which on the basis of 2004 data, showed 49 and 79 retailers respectively. The sample chosen includes at least 10% of the CD retailers in Barcelona. The 8 retailers that compose the final sample were chosen from the 20 retailers included in both sources, with the final sample chosen by means of a random process within each district and attempting to maximize the number of districts included.

For the Internet retailers we decided to include the same MCRs, since the current degree of development of e-commerce in Spain and the lack of official data together imply that a significant part of purchases made online are concentrated in the MCR sector, retailers which have brand and confidence factors in their favour (Mazón & Pereira, 2001). The 4 remaining retailers (IPR) were chosen from a population of 56, identified through information gathered from the Internet directories Altavista (es.altavista.com), Google (www.google.es) and Yahoo (es.dir.yahoo.com) in their Spanish versions. After verifying its validity (retailers were ruled out because of an excessive specialization, a malfunction of their website, a dedication to the musical sector but not to CD sales, or for being multi-channel), the population was reduced to 8, three of which are specific to Spain (Discopolis, DiscoWeb and Sweetdisc), four to the United States (Amazon, CD Quest, the old CD World and World Wide Music), and one to Mexico (Mix Up). The sample was designed to be representative of the e-commerce choices available

from Spain and, at the same time, of the global character of the Internet; in consequence the three Spanish retailers and the French branch of the popular Amazon were chosen. We chose amazon.fr to avoid the excessive effects of shipping costs over final prices in the case of intercontinental purchases. This criterion led us to avoid the inclusion of IPRs from other continents. Such effects are reflected in Table 3, which shows the results when comparing the posted price and the final price for a Spanish consumer buying a CD through Amazon.us, Amazon.uk or Amazon.fr. It can be observed that posted prices are smaller on Amazon.us but, due to the high shipping costs, final prices are in the end more expensive for both shipping scenarios considered (to be detailed below).

Bruce Springsteen album "Born to Run" (prices on 04/29/2004)					
Retailer	Posted price	Currency	Conversion Ratio[a]	Posted Price (€)	
Amazon.USA	$12.99	Dollar	0.845	10.98 €	
Amazon.FR	16.32 €	Euro	1	16.32 €	
Amazon.UK	£8.97	Pound	1.4975	13.43 €	
Retailer	Posted price (€)	Urgency Shipping Costs[b]	Standard Shipping Costs[c]	Urgency Final Price[b]	Standard Final Price[c]
Amazon.USA	10.98 €	23.64 €	8.86 €	34.62 €	19.83 €
Amazon.FR	16.32 €	13.57 €	7.02 €	29.89 €	23.34 €
Amazon.UK	13.43 €	21.68 €	3.26 €	35.12 €	16.70 €
[a] Currency Conversion Ratio calculated on the 04/29/2004					
[b] Urgency: time of delivery from 1 to 3 days					
[c] Standard: time of delivery from 4 to 10 days					
Own elaboration by the authors					

Table 3: Price differences when buying a CD in several Amazon divisions

Sample of CDs

We structured the sample of CDs on the basis of two kinds of discs; popular CDs (fashionable discs) and timeless disc (which maintain a good level of sales). The final sample is composed of 20 discs, 10 discs of each type. We selected the sample of popular CDs according to the list AFYVE (Asociación Fonográfica y Videográfica Española), a ranking based on the weekly sales level for each disc, widely disseminated in Spain and known internationally. The sample of timeless CDs was extracted from the data of AcclaimedMusic, a listing service that publishes a disc ranking of historical character, selecting the best disc from the best authors, according to different critics' lists. Finally, a low availability in some B&MR for some of the timeless CDs was found when verifying the sample of retailers. The substitution of the problematic discs maximized the number of posted prices

observed for a final total of 1,603, representing 83.49% of all possible prices given the number of disks, the number of retailers and the time period examined.

Final prices

The final price is a more robust indicator than the posted price since it reflects the real cost the consumer must bear in order to buy and obtain the product, although it is more difficult to calculate. Our calculation considers the posted price (taxes included) plus the costs that the use of each channel involves for the client.

In the case of Internet purchases, we considered null search costs and added the shipping costs shown in Table 4 considering the specific formula of calculation for each retailer. The variables commonly used for the calculation are the delivery time, the number of units, the method of payment, the geographic zone, and the weight. We have assumed one product unit purchase from Spain, paid by credit card. We have considered two scenarios, Standard-SC: cheaper and with a delay from 4 to 15 days and the Urgency-SC: more expensive but with a delivery time between 1 and 3 days. It is important to note that none of the retailers changed their shipping costs during the six week period of data gathering. We don't include emotional cost.

Internet retailers code	Shipping Costs (€) Urgency-SC	Shipping Costs (€) Standard-SC
e05	*Na*	4.18
e06	6	*na*
e07	4.4	3.35
e08	5.95	4.25
e09	2.95	*na*
e10	4.75	4.75
e11	6.95	2.95
e12	13.57	7.02
Average	6.37	4.42
Dispersion: standard deviation	3.43	1.43
Dispersion: Maxcost- Mincost	10.62	4.07
na = Not applicable. The retailers applied the same costs during the six weeks duration of the study. For unitary purchases, paid by credit card, to be sent to Spain and with weights under 5 KG Own elaboration by the authors		

Table 4: Shipping costs applied by the retailers

The final price in the conventional channel includes the posted price plus other costs associated with the search and purchase process (time related costs, travelling expenses, emotional costs, etc.), grouped under the name of access costs. The computation of access costs is difficult to formalize through a generally

accepted model and there is also a subjective component to calculating these costs. Because of these issues, we decided to determine final prices by adding a parameter to all posted prices that reflects the access costs, along with a sensitivity analysis that considers three levels of access cost: 3.75 €, 6 € and 8.25 €, in order to answer the question: How high must access costs be so that greater efficiency online is realized under the price level indicator perspective?

Analysis of the data

Analysis of Variance (ANOVA) techniques were used to test the equality of means, with discs categorized according to type of disc and channel. The collected data were analyzed in order to find representative values for each disk, in each channel. The price level of a disc in a channel was calculated as the average among the weekly means of the prices observed for each of the retailers in a particular channel. The dispersion of a disc in a channel was calculated as the weekly dispersions based on the standard deviation of the retailers' prices in that channel. For the price updates, each pair [disc, retailer] was examined based on the series of weekly collected prices, measuring the number of changes in price and their magnitudes. Afterwards, we calculated the average number of changes and the average magnitude of the changes for each disc according to the retailers in a channel. The obtained averages approximate the resulting series to a normal distribution.

4. Results

Posted prices

The results of the posted prices are shown in Table 5. For hypothesis H1, concerning price level, the null hypothesis can be ruled out, which indicates that there are differences among the average prices of each channel. For a 95% confidence interval it is observed that prices are higher online (13.828<14.384). Thus, we find support for hypothesis 1. In the case of the dispersion, hypothesis H2, significant differences between both channels (2.002 and 2.091) are not observed, although the estimated averages suggest, in percentage terms, a 4.26 % lower dispersion in the conventional channel. The hypotheses relative to the price updates show significant differences. The number of changes in price, hypothesis H3, turns out to be greater online (.633<.899), whereas the magnitude

of price changes, hypothesis H4, is smaller in the conventional channel (.788<1.274).

Posted prices results	Price Level	Dispersion	Number of changes in price	Magnitude of price changes
Hypothesis	H1	H2	H3	H4
Conventional Channel Averages	13.828	2.002	.633	.788
Internet Channel Averages	14.384	2.091	.899	1.274
Estimated average and 95% Confidence Interval for the difference: (Conv Ch.- Internet Ch.)	-0.556 [-0.954 , -0.159]	-0.089 [-0.383 , 0.205]	-0.265 [-0.425 , -0.106]	-0.485 [-0.968 , -0.003]
Ratio[a]: Conv Ch. – Internet Ch.	-3.87%	-4.26%	-29.59%	-38.15%
F Statistic	8.501	.406	12.280	4.463
p-Value	.009	ns	.003	.049
Is Internet shown as more efficient?	No. All the contrary	Not demonstrated	Yes	No. All the contrary

[a] Ratio calculated according to 95% Confidence Interval for the difference, taking as reference internet channel.
Price level and dispersion in €.
ns = not significant
Own elaboration by the authors

Table 5: Posted price's results

These results considered as a whole imply that the Internet is far from showing greater price efficiencies than the conventional channel. The only indicator that confirms the theoretical expectations of increased efficiencies for the retail sector online is the number of changes in price. The rest of the indicators either show the same level of efficiency or greater efficiency for traditional retailers.

Final prices

For final prices, the tests conducted concerning the price level, H5, are summarized in Table 6. The Internet is less expensive (19.828>18.745) when buying with standard shipping costs and assuming a 6€ access cost in the conventional channel. This difference is insufficient in the case of buying online with urgent shipping costs, in which case it is necessary to assume access costs of 8.25€ (20.525<22.078) in order to observe lower prices online.

Regarding the tests concerning price dispersion, hypothesis H6, we must remark first that the 6 presented scenarios are reduced to two: dispersion of the conventional channel against the Internet with standard shipping costs (Conventional&Internet.Standard-SC), and dispersion of the conventional channel against the Internet with urgent shipping costs (Conventional&Internet.Urgency-SC). This is due to the fact that the dispersion of the conventional channel with posted prices is the same as the dispersion with final prices, whatever the level of the chosen access costs, since final prices are obtained by adding access cost scenarios to posted prices.

Contrast of Hypothesis H5$_{PriceLevel;FinalPrice}$	AC = 3.75€ SC = Standard	AC = 6€ SC = Standard	AC = 8.25€ SC = Standard
Conventional Channel Averages	17.578	19.828	Deduced from the scenario SC=Urgency and AC = 8.25: if Internet is cheaper, it will be even more when we apply lower SC.
Internet Channel Averages	18.745	18.745	
95% Confidence Interval (Conv Ch. - Internet Ch.)	[-1.612 .. -0.722]	[0.638 .. 1.528]	
F Statistic	30.321	26.118	
p-Value	<.001	<.001	
Is Internet more efficient?	No, all the contrary	Yes	Yes
	AC = 3.75€ SC = Urgency	AC = 6€ SC = Urgency	AC = 8.25€ SC = Urgency
Conventional Market Averages	Deduced from scenario SC=Standard and AC = 3.75: If Internet is more expensive, it will be even more when we apply higher SC.	19.828	22.078
Internet Market Averages		20.525	20.525
95% Confidence Interval (Conv Ch. - Internet Ch.)		[-1.126 .. -0.269]	[1.124 .. 1.981]
F Statistic		11.704	57.936
p-Value		0.003	<.001
Is Internet more efficient?	No, all the contrary	No, all the contrary	Yes
SC = Shipping Costs (Internet channel). AC = Access Costs (conventional channel) Own elaboration by the authors			

Table 6: FP Results. Contrast of hypothesis H5 (price level) in the considered scenarios

The results (see Table 7) show that in no case is a smaller dispersion online observed. The null hypothesis cannot be refuted in the context of "Conventional&Internet.Standard.SC", though it is refuted in the other case, "Conventional&Internet.Urgency.SC". For the latter it is estimated that a 40.94% smaller dispersion in the conventional channel exists, with a 95% Confidence Interval.

With respect to the indicators of price updates, the results on the basis of final prices are the same as those obtained for posted prices. This is due to the fact that

the same constant is added to the posted prices of the temporary series of each pair [retailer, disc]: the level of fixed access costs (in the case of the conventional channel) and the shipping costs of each retailer (which were kept constant during the six weeks).

Contrasts of Hypothesis $H6_{Disp;FinalPrice}$	Conventional&Internet. Standard-SC Any level of AC; SC = Standard	Conventional&Internet. Urgency-SC Any level of AC; SC = Urgency
Conventional Market Averages	2.002	2.002
Internet Market Averages	2.335	3.390
Estimated average and 95% Confidence Interval for the difference: (Conv Ch.- Internet Ch.)	-0.333 [-0.680 .. 0.014]	-1.388 [-1.789 .. -0.988]
Ratio[a]: Conv Ch. – Internet Ch.	-14.26%	-40.94%
F Statistic	4.074	53.021
p-Value	ns	<.001
Is Internet more efficient?	Not demonstrated	No, all the contrary
[a]Ratio calculated according to 95% Confidence Interval for the difference, taking as reference Internet channel. SC = Shipping Costs (Internet channel). AC = Access Costs (conventional channel) ns = not significant. Own elaboration by the authors		

Table 7. FP results. Contrast of hypothesis H6 (price dispersion) in the considered scenarios

In summary, neither the price dispersion nor the magnitude of the changes shows more efficient behaviour online when considering final prices. Likewise, a high level of access costs (6 € in the best scenario) is required in the conventional channel to imply greater efficiency online with regards to the price level. Only the number of price changes indicator shows greater efficiency online. Taken together, these results seem to indicate that with final prices we are as far from showing greater efficiency online as we are with posted prices.

5. Discussion

The results suggest that we observe higher posted prices in the Internet channel than in the Conventional one. In the U.S. only one of the reviewed studies shows these results (Bailey, 1998). Taking into consideration Bailey conclusions, the immaturity of the electronic commerce in Spain (according to EuroStat data, in 2004 only the 0,4% of the revenues of the Spanish companies with 10 or more employees came from e-commerce, being the Eurozone average 2.1%) could be an explanatory factor for these results. Another relevant factor could be the greater

power of purchasing that those who buy online have (according to the 7th AIMC survey to Internet users done in 2004 by the Association for the Mass Media Research, the most common profile of Internet user was between 25 and 35 years old (39.6%), single (55.8%), worked as an employee for a company (57.6%) and with university studies (46.3%)). The previous suggests that some companies could be adapting their online price strategies, focusing on a more select market segment, which would be willing to pay higher posted prices in order to avoid the access costs associated with the conventional channel. Finally, the immaturity of the Internet would also explain the high dispersion founded online (similar to that founded in the Conventional channel) as Brynjolfsson & Smith (2000) argue too.

Another aspect related to the maturity level is the low degree of use (and performance) of the Shopbots in Spain. We obtained an illustrative evidence of its low maturity after searching some discs through the best known buyer agents, such as kelkoo (www.kelkoo.com) or bar code (compras.codigosbarras.com). They only list 2, 3, or 4 retailers' prices. Therefore, it seems that shopbots didn't play the role expected by Bakos (1997) to help customers to compare product price and characteristics, at the moment of taking our data.

A third element to consider is the differentiation of price policies in each channel. Although all the MCRs stated that they "apply the same price policy in both channels", we observed that it was true in only half of the cases. It remains unknown whether the differences found are due to a different price policy or due to the existence of temporal lag in the price synchronization between both channels. If the statement made by the MCRs is true, it would suggest that the MCR attempts to maintain the profit margins typical for the conventional channel and that perhaps the Internet has still not acquired sufficient relevance to justify a specific price policy. This result leads us to a broader issue, which is focused on managing two different channels to reach the market. Other researchers have discussed this issue, such as Friberg *et al.* (2000) who predict a reduction of prices in the B&MR once the number of Internet consumers reaches a critical mass. Achieving this critical mass of consumers implies that a loss of market share in the conventional channel in favour of the Internet will take place (travel agencies in Europe provide a clear example of this phenomenon). Once this shift takes place, it is possible that both channels differentiate and specialize to some extent in order to avoid jeopardizing each other. The importance of this kind of relationship is discussed in

the Brown & Goolsbee (2002) study that observed a decrease in prices for life insurance policies in the conventional channel as a result of the appearance of websites comparing prices, although the product continued to be purchased through the conventional channel.

Previous paragraphs assume that more maturity should imply more efficiency. But another (and complementary) point of view should be considerate: more maturity should imply a wider development of e-marketing techniques, which allow retailers to maintain high margins (making more friction in the market and reducing its efficiency). For instance, retailers could use ICT to offer better post-purchase services to retain customers (Otim & Grover, 2006), even with high prices. Other could offer complex price information and information overload to make difficult to the customers the comparison of the product's price and characteristics (Grover *et al.*, 2006). These are some examples of many retailers' marketing-mix strategies that could explain -at least partially- the persistent inefficiency observed online as some studies discuss (e.g. Kalyanam & Mcintyre, 2002; Latzer & Schmitz, 2001; Nunes, 2001).

A key aspect to discuss is the interpretation of the access costs level that must be assumed for purchases in the conventional channel, in order to realize lower final prices online. The fact that such levels rise to 6€ or 8.25€, with respect to standard or urgent shipping costs online respectively, is interpreted as a sign of inefficiency. We want to clarify that such an interpretation has been made from the point of view of a consumer who can access traditional retailers at a reasonable cost. That is not the case of a consumer who lives in a rural area and might have an opposite interpretation of high access costs.

Another aspect that invites analysis is the role of the shipping costs. First, according to the data shown in Table 4, shipping costs are a significant portion of the final price and display a high dispersion. They generally fall between 31% and 44% of the average posted price of a CD online, for the standard and urgent shipping cost scenarios respectively (see Table 5). When measured by the standard deviation the dispersion of shipping costs is 9% and 23% for the standard and urgent shipping scenarios respectively. If the dispersion is measured by the rank defined by the maximum and the minimum cost, it shows 28% and 73% for the standard and urgent shipping scenarios respectively. Therefore, it is clear that

shipping costs are an important factor in explaining the higher final prices online, and that contribute to an increase in the dispersion, especially for the scenario of urgent shipping costs. In addition, it has been found that there exists a low level of knowledge about these costs. This allows us to suspect that some retailers could be hiding a part of their profit margin in shipping costs. This could explain, at least partly, the high observed dispersion.

Finally, it is important to note that the factors identified until now can have a special relevance if we consider the context in which they happen: a period of four years in which the maturity of the retail markets online seems not to have advanced significantly in Spain. This interpretation is based on the surprising similarities between this and another study in Spain (Nuñez *et al.*, 2001). In both cases it was observed that the posted prices of the CDs were higher online and it was necessary to assume a similar level of access costs in order to obtain smaller final prices online. As a result, the situation of the electronic markets in Spain revealed by this research could be interesting to marketing directors and other managers by providing greater understanding of the operation and the evolution of the electronic markets.

6. Conclusions and future research

The study presented here, in light of previous research and the results of the empirical analysis described, allows us to assert that market's behaviour in the Internet channel does not perform higher efficiency than in the traditional one. This finding contradicts what is estimated by the model of perfect competition, which assumes more efficiency in the Internet channel due to its lower search costs.

There is no general agreement regarding what factors explaining this behaviour and the research situation is pretty dynamic. On one hand, according to the literature, the immaturity of the Internet channel is often used as an explanation, a little bit callow, for the difficulty of finding the higher efficiency promised by the classical theory. On the other hand, there are quite research studies which argue retailers are doing various marketing-mix strategies in order to elude the perfect competition and to avoid decreasing margins.

Explanations related to the immaturity of online channel are based on several factors, such as the low percentage of population with a regular access to the

Internet, the mistrust of consumers using Internet as instrument for commercial transactions, the low range and functionality of shopbots in Spain, and the lack of specific and differentiated price strategies for the Internet observed in quite multichannel retailers. In general, all the factors point out a little management attention to the online channel, perhaps, due to the (still) small contribution of online incomes to the total business or the lack of strategic commitment. In this context, it would be interesting to analyze in future studies what effects will happen when the Internet channel increase its maturity in relation to its own efficiency and to the traditional channel (due to the mutual interconnection and the pressure of competition between both channels).

Explanations related to the marketing strategies are based on the intuition that it is unlikely retailers would accept to adjust the price of their products due to the pressures from competitors and the fact of interacting with a more informed customers (who are able to obtain and compare information almost without cost). The most reasonable in this context is that online retailers will do some marketing efforts to seduce customers and to raise competitive advantages, which bring them more sales and higher margins. The strategies and tactics employed could be different from those employed by retailers in the traditional channel, but the business goals and the areas of activity -the 4 P's of the marketing mix- should be so similar. In this context is where fits the use of a rich and dynamic set of marketing techniques based on new ICT tools and conventional ones to implement the marketing mix choices. Research about the companies' behaviour in this area is recent and fragmented, usually focused on the degree of utilization of some of these marketing techniques or on how to take advantage of the technology or the services that Internet offers.

In a theoretical level, it is absent one conceptual model capable to organize and to integrate the results and findings from the empirical analysis of these new marketing techniques. This model should connect these marketing techniques with their contribution to the online retailers' success, taking into consideration the sector and customers' characteristics and the different market segments. This model would allow the design of one method to measure and diagnose in what degree a company is taking advantage of the possibilities that e-Marketing offers now. We absolutely believe this is a relevant research line to develop.

Another interesting area of research lies in drawing from the previous model, what are the functionalities and capabilities that one information system (in especial a CRM) must offer in order to provide suitable technologic support to implement the marketing mix strategies of online retailers. This would provide a background to evaluate the available technologic products and services and could help retailers in choosing those tools or methodologies more adequate to their e-commerce strategy.

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