Then and Now: Reality and Perceptions in the Evolution of Online and Offline Retail Pricing

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Abstract

This paper examines the evolution of online retail through objective prices and consumers' price perceptions. Objective data from 2000-2006 are generally consistent with price penetration and offer only weak support for transactions cost effects, with online prices being lower than offline prices but the gap narrowing substantially over time. Longitudinal consumer perceptions show online prices are thought to be lower than offline prices, but not as much lower as they actually are, and that perceptions have become more accurate as the market matured.

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Starting in the late 1990's Internet retailing went through a period of hectic growth and painful retrenchment to emerge as a credible and often profitable retail channel. Given the importance of pricing to the survival and profitability of all retailers it is not surprising that it attracted immediate research attention. Early online pricing research argued that the lower search and switching costs in online environments (i.e. lower transaction costs) would lead to intense price competition, which would, in turn, drive down online prices (Bakos 1997; Brynjolfsson and Smith 2000; Clay, Krishnan and Wolff 2001). Consistent with this hypothesis, much of this early research found that online retail prices were lower than offline prices (see Riquelme 2001 for review). While consistent with a transaction cost explanation, the results are also consistent with the use of a penetration pricing strategy in which prices are initially lower to generate sales volume and market share and then increase as the market matures. Since most of the online pricing data were collected in the early days of the Internet, it is impossible to determine the importance of each explanation without more recent and longitudinal data[1].

While both the transaction costs and penetration pricing explanations predict low initial online prices, they diverge in their predictions for more mature markets. The transaction cost explanation predicts permanently lower online prices while the penetration pricing explanation predicts online prices should increase towards offline prices. If both effects are at work online prices should remain lower but the gap should narrow as the online market matures.

The potential success of online retailing depends not only on how objective prices evolve but also on how consumer's price perceptions change since consumer behavior is driven by

[1] While other factors are also likely to affect retail prices, we limit our focus to whether the evolving price patterns are consistent with the transaction cost and price penetration explanations.

perceptions. However, while consumers' perceptions are as important as objective prices, no one has examined the nature and accuracy of consumer perceptions of online prices. Hence, this paper uses longitudinal data to examine how both objective prices and consumers' perceptions of online and offline retail pricing have evolved as the market has matured.

The objective data are collected from the full spectrum of online and offline outlets (multi-channel online and offline outlets, online-only retailers, and offline-only retailers) for a wide variety of items across two product categories (compact discs and books). The objective data were collected during five equally spaced time periods: before (April 2000), during (October 2001) and after (April 2003, October 2004 & April 2006) the Internet retail market shakeout[2]. A second dataset, collected in parallel with the first and last two objective data collections, examines consumers' perceptions of the relative pricing on- and offline. Some of the questions addressed include: Are online prices lower than offline prices initially (as either explanation predicts)? Have prices converged as the online market matures (as penetration pricing predicts), or has online pricing had a persistent advantage (as transaction costs predicts), or are both effects present (as seen by a persistent but narrowing price gap)? Is price dispersion among online retailers higher (as penetration pricing predicts) or lower (as transaction cost predicts) than offline retailers? Has price dispersion changed as markets matured? How do multi-channel retailers affect the results? What are consumers' perceptions of the relative prices? How accurate are they, and has accuracy improved over time?

While the nature of objective online pricing has received some attention, most of these questions are not answerable with previous data. For example some authors compare on- and offline pricing but examine only a single time period or time periods before the change in market

[2] For purposes of this research, we consider the period before the exponential growth in startup failures as the introductory phase and the period in which failures fell to pre-shakeout levels as the maturity phase.

conditions (Ancarani and Shankar 2004; Brynjolfsson and Smith 2000; Clay, Krishnan, Wolff and Fernandes 2002; Gosain and Lee 2001) and so cannot examine how the market has evolved. Others look at changes across time but examine only online prices and only for a very short time period (Cao and Gruca 2003; Gosain and Lee 2001; Ratchford, Pan and Shankar 2003) and so have only an incomplete picture of the market evolution. And as yet, no researchers have examined consumers' perceptions of the relative on- and offline pricing, nor tested how accurate these perceptions are. Hence, unlike previous data, the current data allows for simultaneously testing across time, across online and offline outlets, across different types of online and offline retailers, and across reality and perceptions.

Objective Price Differences:

Transaction cost explanation: The lower levels of two common types of transaction cost in the online market, searching for price information and switching from one retailer to another, are often posited to create a more competitive environment which in turn is expected drive online prices to be lower than offline. These lower search and switching costs should also lower price dispersion in online markets by forcing higher priced firms to lower their prices or face extinction. Pressure due to lower transaction costs should not diminish as markets mature and might even increase as more people gain access to and experience with the Internet. Thus, transaction cost theory predicts that online retail outlets should have permanently lower price levels and dispersion relative to offline retailers.

Penetration pricing strategies: Much of the existing evidence comparing online and offline prices is consistent with the transaction costs argument at least for homogeneous goods in which the effects should be most pronounced (see Riquelme 2001 for a review). For example,

Brynjolfsson and Smith (2000) examine the price levels and dispersion for books and CDs across eight online and eight offline retailers in 1998 through 1999. They find that price levels and dispersion online are lower than offline. However, all of this evidence uses data collected during the period of readily available financial market support for Internet retailers, 1998-2000, hence the results may reflect factors other than or in addition to transaction costs differences. During this time, financial markets were willing to support unprofitable online firms on the assumption that they needed to build volume and market share quickly to prosper in the long-run, thus allowing online retailers to charge unsustainably low prices. Once financial markets withdrew their support for price penetration strategies, online companies were under pressure to generate profits (Kaufman 2000).

The classic penetration pricing strategy involves charging a low introductory price to build market share quickly and then as market value increases, either through customer loyalty or increased market power, gradually increasing prices to improve profitability. The online retailing of homogenous products such as books and CDs faced many of conditions that favor the use of penetration pricing (Kalish 1983; Kotler and Keller 2006; see Noble and Gruca 1999 for a review) such as 1) few customers willing to pay a premium due to the availability of local retailers, 2) substantial economies of scale due to the large fixed start-up costs, 3) limited barriers to entry because of the initial easy access to financing, 4) trial and positive word-of-mouth important to overcoming the perceived risk of Internet retail, 5) no supply constraints that might encourage a more cautious entry strategy, and 6) elastic demand because of limited differentiation among retailers.

While transactions cost and penetration pricing do lead to some unique predictions, they should not be seen as competing models since it is possible for both effects to occur

simultaneously, for neither effect to be present, or for one or the other effect to predominate. Both explanations predict that in the introductory phase of the online retail market the price of online outlets will be lower than the price of offline outlets. However, they offer divergent predictions as pertains to price dispersion. Transaction cost theory argues that the lower search and switching costs will drive all prices down and hence lead to lower price dispersion among online than offline retailers. Conversely price penetration will most likely lead to initially higher online price dispersion because not all firms would engage in penetration pricing (Sotgiu and Ancarani 2004). Penetration pricing requires deep pockets so poorly financed or high operating cost retailers would be unable to sustain artificially lower prices (Rao and Bass 1985). In addition retailers who operate both on- and offline may not want to risk the cannibalization that online penetration pricing would entail. If only a subset of firms are following a price penetration strategy, then price dispersion among online retailers would be higher than among the more mature offline retailers (who are assumed to no longer be practicing penetration pricing). Consistent with this viewpoint, earlier research shows that price dispersion in online outlets is often substantial (Clay et al. 2001; Clemons, Hann and Hitt 2002; Pan, Ratchford and Shankar 2002). While fewer researchers have compared online and offline price dispersion, those who have most frequently find online outlets have price dispersion as high or higher than offline outlets (Ancarani and Shankar 2004; Brynjolfsson and Smith 2000; Clay et al. 2002).

A number of arguments have been presented for why this substantial online price dispersion exists, including differing brand awareness (Brynjolfsson and Smith 2001), high/low pricing strategies (Baye and Morgan 2004), and differing services (Pan et al. 2002; Pan, Ratchford and Shankar 2003; Ratchford et al. 2003). However none of these factors explain a substantial portion of online price variation (see Pan et al. 2004 for a review). In the most

comprehensive examination of the causes of online price dispersion Pan et al. (2003) find that market characteristics are the strongest drivers of online price dispersion. Thus, we hypothesize:

H1: During the introductory phase, prices at online retail outlets will be lower than prices at offline retail outlets.

$H2_{trans}$: If transaction cost effects predominate, online price dispersion will be lower than offline price dispersion during the introductory phase.

$H2_{pentr}$: If price penetration effects predominate, online price dispersion will be higher than offline price dispersion during the introductory phase.

Relative prices in more mature markets: Since transaction costs do not increase as markets mature and may actually decline as technology improves and people gain access and familiarity, transaction cost theory predicts that online prices will remain lower or become increasingly lower with low dispersion. In contrast, a price penetration explanation argues that as the financial support for market share growth at the expense of profits declines or market share goals are reached, there will be increasing pressure on firm's to raise prices to become profitable, thus diminishing the price advantage of online retailers. As the market matures online retailers are likely to follow a variety of positioning strategies (e.g., broad assortment, low price seller, high service support or trusted brand), just as the offline retailers have; and hence online price dispersion should become similar to offline. If both transaction costs and price penetration effects are co-occurring, one would expect to find a persistent but decreasing price advantage for online retailers. While no extant research examines how online and offline prices have evolved, a few projects look at how online price dispersion has evolved with mixed results. In a review, Pan, Ratchford and Shankar (2004) cite evidence of decreasing price dispersion

(consistent with transactions cost theory) as well as evidence of persistent price dispersion, although the data generally looks at short time frames before the end of the market shakeout. If transaction cost effects predominate:

$H3_{trans}$: Online price levels will remain lower than offline as online markets mature.

$H4_{trans}$: Online price dispersion will remain lower than offline as online markets mature.

If penetration price effects predominate:

$H3_{pentr}$: Online price levels will converge to offline as online markets mature.

$H4_{pentr}$: Online price dispersion will be similar to offline as online markets mature.

Pricing of multi-channel retailers: As the Internet retail market grows, multi-channel retailers are emerging as the dominant players. Operating in both channels is expected to moderate the effects of channel type. Pan, Shankar and Ratchford (2002) analytically demonstrate that online multi-channel retailers should have higher prices than online-only retailers, based on the premise that multi-channel players will only open online outlets if they are preferred over online-only retailers and hence can garner a price premium. Cao and Gruca (2003) argue for a similar outcome based on the lower discount rate for the online-only retailers. The empirical evidence of multi-channel online and online-only retailers supports these analytical models (Cao and Gruca 2003; Pan et al. 2002; Tang and Xing 2001).

In terms of price differentials between multi-channel outlets, Zettelmeyer (2000) uses analytical models to show that multi-channel retailers should charge less in their online outlets than their offline outlets, at least when Internet penetration is small, since the two outlets would be targeting different market segments. There have been no previous empirical tests of the pricing patterns of the two types of multi-channel retail outlet.

None of the analytical models include offline-only retailers; but given their higher search and switching costs and generally lower economies of scale, offline-only retailers are expected to maintain the highest prices. The only empirical evidence including multi-channel, online-only, and offline-only retailers finds that multi-channel retailers (collapsing across online and offline outlets) in Italy charge higher out-of-pocket prices (Ancarani and Shankar, 2004). Based on the existing analytical models and empirical evidence the hypothesized pricing pattern is:

H5: Online-only retailers will have lower prices than the online outlets of multi-channel retailers, who will have lower prices than the offline outlets of multi-channel retailers, who will have lower prices than offline-only retailers.

As the online retail market matures, more consumers are expected to use online retail more often. As more customers use the Internet, Zettelmeyer's models (2000) suggest that the relative pricing of multi-channel outlets should change. He argues that when the Internet is used by only a small segment, multi-channel online outlets will offer lower prices than multi-channel offline outlets. However, as more people use the Internet, such pricing differences will disappear because the online consumer segment will no longer be distinct, so there will be no reason to price the two channels differently. This model suggests the following hypothesis:

H6: As Internet retail markets mature, the difference between multi-channel online prices and multi-channel offline prices should diminish.

Perceptual Price Differences:

Understanding how objective prices compare and evolve across channels is important to understanding the effects of competitive structure on pricing strategy; but as highlighted by Kotler and Keller, "perceptions are more important than the reality, as it is perceptions that will

affect consumers' actual behavior" (Kotler and Keller 2006, p.186). Managing both the competitive and consumer aspects of the market is vital to the success of online retailing. Therefore, we examine not only objective prices but also how people perceive online and offline prices and compare the accuracy of these perceptions to the reality of the marketplace.

In the early days of online retailing, consumers had relatively little information to base their perceptions on. One source of information available to even novice Internet users was the widespread publicity on the supposed overhead cost advantage of the new medium (Somers 1998). Hence, initial perceptions of online prices would likely be biased toward expecting online prices to be less expensive. As the market matures, publicity about the supposed cost advantage subsided, but personal experience grows. Therefore, perceptions in the more mature market should reflect consumer experience with the early reality that online prices are generally lower than offline prices so consumers should continue to perceive online prices as cheaper.

H7: Online prices should be perceived to be less expensive relative to offline prices.

Personal experience leads to more strongly held beliefs than third party information such as advertising or publicity, especially for straight-forward experiential attributes such as price (Hoch and Ha 1986; Wright and Lynch 1995). This larger impact on consumer beliefs may stem from the greater accessibility and diagnosticity of direct experience (Vaidyanathan 2000). Since personal experience involves observation of objective prices, experience should improve the accuracy of perceptions. In addition, since personal experience grows as the market matures, consumers' perceptions should become more accurate over time.

Another factor that may affect the accuracy of perceptions are consumers' differing levels of brand knowledge; even the most experienced consumer will only be familiar with a subset of

the available outlets. Hence, it is logical to expect that prices at the outlets consumers are familiar with will be the primary influence on their price perceptions. Thus, consumers' perceptions should more accurately reflect the objective reality for retailers they know best.

H8: Personal experience should improve accuracy.

H9: Accuracy of consumers' perceptions should improve as the online market matures.

H10: Consumers' perceptions more accurately reflect the reality of their familiar outlets.

Methods: Objective Data

The objective pricing data was collected from both online and offline retailers across five equally spaced time periods. The first data collection occurred in April 2000 toward the end of a period of extensive hype and growth in Internet retailing. The second data collection occurred in October 2001 just after the peak in the Internet retail shakeout (Webmergers.com 2002). The third data collection occurred in April 2003 when the market was coming out of the collapse with about 50% of online retailers showing a profit (Cox 2002) and the failure and merger rate had fallen to pre-market shakeout (i.e., early 2000) levels (Webmergers.com 2002). The final two data collections occurred in October 2004 and April 2006 when the percentage of profitable online retailers had flattened out around 79% (Shop.org 2004; Loechner 2006).

The objective data are shelf prices for a collection of CDs and books. These product categories were chosen because of their early online penetration and the comparability of the products purchased across outlets. Forty-five CDs and fifty-five books were initially selected (April 2000) at random while visiting two of the smaller offline outlets so as to increase the odds that the titles would be available in most outlets. In subsequent data collections, data on those of the original items that were still available were collected (CDs = 29 of the original items still

available in 2001, 20 in 2003 and 2004, 19 in 2006; books = 46 of the original items still available in 2001, 21 in 2003 and 2004; 20 in 2006), and additional random items were selected in a similar way (CDs = 22 additional items in 2001, 33 in 2003, 29 in 2004 and 44 in 2006; books = 25 additional items in 2001, 25 in 2003, 52 in 2004 and 43 in 2006). For the data analysis, the single item shipping charge is added to the online shelf price, and a 5% sales tax (equal to the national average state sales tax and the state sales tax rate in the state where the store data was collected) is added to the offline store shelf prices; these 'out-of-pocket' prices are used throughout the analysis.[3] Each item was searched at offline-only retailers, multi-channel retailers (both offline and online outlets), and online-only retailers. A total of 20 different offline (11 CD and 9 book retailers) and 30 different online retailers (19 CD and 11 books retailers) were visited and prices were collected on a total of 373 items (173 CDs and 200 books) across the five periods (See Appendix for additional dataset details).

Results: Objective Data

The data are analyzed using a mixed random and fixed effect dummy variable regression with out-of-pocket price as the dependent variable. The model includes a fixed effect dummy variable for type of store (online = 1, offline=0), a variable for the five time periods (Time 2000=0, 2001=1, 2003=2, 2004=3, 2006=4), and an interaction of these two factors. The items and the stores (nested within type of store) were included as random effects to control for the effects of the specific items and stores that were included in the data collection.

[3] No explicit transportation cost was added to the offline prices since there is little agreement about how to best calculate such a cost and consumers don't consciously include the cost of getting to and from the store into their value assessment so it would be unlikely to enter their perception of the cost of offline products. Additionally, no sales tax was added to the online prices since in the early data collections retailers did not charge sales tax and in the later data collections only a small subset did.

Price Level Effects:

Online prices being initially (in 2000) lower than offline prices (H1) would be seen in a significant negative effect of the online store type dummy. Table 1 (and Figure 1) shows that online prices were significantly lower in 2000 (CDs: -$1.23, p<.02; Books: -$3.28, p<.001). For CDs online prices were 6.83% lower than offline prices ($1.23/$18.01) and for books online prices were 15.81% lower ($3.28/$20.75). Thus H1 is supported.

(Insert Table 1 and Figure 1 here)

A change in the relative means of online to offline prices across time would be seen in a significant interaction between type of store and time period (see Table 1 and Figure 1). In both markets, there is a significant positive interaction between type of store and time (CDs: $0.23, p<.001; Books: $0.43, p<.001), demonstrating that as the online retail market has matured the gap between online and offline prices has narrowed. In both markets the price difference between online and offline retailers has diminished over time consistent with the use of a penetration pricing strategy, $H3_{pentr}$. The book market (Figure 1) shows the classic picture of penetration pricing in a market with relatively stable supply and demand, with prices of the new entrants (online retailers) increasing over time and relatively little change in the traditional channel prices. In the CD market, online and offline prices have converged but both types of retail outlet are experiencing decreasing unit prices, possibly due to the external supply increase from music downloads driving down prices.

The continuing presence of transaction cost effects would be demonstrated in a significant price advantage for the online outlets even in the most recent time period. The CD market shows no evidence of a persistent online price advantage (2006 CD difference p>.77). However, the book market stills shows a significant online price advantage (2006 Book

difference p<.01). Thus, there appears to be only partial support for the transactions cost explanation in the maturing market, $H3_{trans.}$[4]

Price Dispersion Effects:

The coefficient of variation[5] is used as the measure of price dispersion. Both the online CD and book markets fail the strongest test of the transaction cost model, which argues price dispersion in a highly competitive market should approach zero. Online retailers show significant price dispersion across time (Figure 2), with 13-15% variation in the book market and 11-13% variation in the CD market. This substantial online price dispersion is consistent with the findings of other researchers (see Pan et al. 2004 for a review). Pan et al. (2003), in a comprehensive examination of the causes of online price dispersion, find markets for higher priced products with larger numbers of competitors had the lowest online price dispersion.

(Insert Table 2 & Figure 2 here)

A weaker test of transaction cost effects on price dispersion is whether online retailers have lower price dispersion than offline retailers. In both markets, the type of store has a significant effect on price dispersion but in opposite directions (see Table 2 & Figure 2). In the book market, contrary to the transaction cost argument online retailers show significantly more price dispersion than offline retailers (Coeff. of Var. = .121, p<.001); this finding is likely driven

[4] Since the 2001 data collection was less extensive, the analysis was also run limiting the stores to those with data in all four other periods (i.e.2000, 2003, 2004, 2006) to allow for more complete comparability across stores. The results are directionally similar although not all effects are equally significant, the book results are basically the same but, while directional, the interaction in the CD market does not reach significance. An additional robustness test was run using only the items that existed in all four periods. Using only this restricted sample (CDs n=19 and books n=20 items), for CD the nature of the effects are identical and significant. For books the online prices are marginally lower (p <.10) but show no significant convergence over time (p>.06) mostly because the online prices for these items have remained largely constant across time.

[5] Coefficient of variation = (standard deviation of price for each item)/(mean price for each item price)*100; an alternative measure of price dispersion, percentage price difference (range of prices for each item/mean price for each item) gives substantially similar results.

by the traditional practice of offline stores selling most books at or close to publisher's list price leading to very low price dispersion among offline retailers. Thus, in the book market online retailers have more diverse pricing practices than the more mature offline retailers, consistent with the penetration price explanation ($H2_{pentr}$). However, there is no support for $H4_{pentr}$ since price dispersion is not converging over time (time period = .001, p>.94; store type x time = -0.005, p>.11). The book market offers no support for either transaction cost hypotheses ($H2_{trans}$ or $H4_{trans}$) since online price dispersion is consistently and significantly higher than offline.

In the CD market, however, price dispersion effects are more consistent with transaction cost theory (Table 2 & Figure 2); online price dispersion is significantly lower than offline (time period = -.022, p<.01) and the two are directionally trending apart as the market matures (time * store type = -.005, p<.13). These results are consistent with the transaction cost model since online price dispersion has been lower than offline ($H2_{trans}$) and the trend is toward it becoming relatively even lower ($H4_{trans}$). The CD market shows no support for the penetration pricing explanation since price dispersion is not significantly higher in the introductory market ($H2_{pentr}$), nor is it approaching offline levels as the market matures ($H4_{pentr}$).[6]

In sum, the price level results support H1 in that online prices are initially significantly lower than offline prices. The longitudinal data is consistent with penetration pricing effects ($H3_{pentr}$) but offers only limited support for transaction cost effects ($H3_{trans}$) in that price levels are converging in both markets but remain significantly different in the more mature market of 2006 only in the book category. The price dispersion results offer limited support for either model with the CD market results being more consistent with transaction cost effects and the

[6] The results for both books and CD are the same if one limits the analysis to only those stores with data in all four periods (2000, 2003, 2004, 2006) to allow for more complete comparability across stores.

book market results being more inline with the effects of penetration pricing, although this later result may be due to the idiosyncratic practices of the offline book retailers.

Multi-Channel Retailer Effects:

Multi-channel retailers have been capturing a growing share of online retail sales but have received only limited research attention. The current data allows for the comparison of online to offline retailers to be further broken out to examine the differential behavior of multi-channel players. Similar to the previous price level regression, fixed effect dummy variables are used to code for each type of retail outlet (offline-only, online-only, multi-channel online outlet, and multi-channel offline outlet), a time period variable captures the effects across time and interactions of the dummy variables and time period capture the differing effects of outlet type across time. The specific items and stores nested within the outlet types are included as random effects as controls (see Table 3 & Figure 3).

(Insert Table 3 & Figure 3 here)

Figure 3 shows the nature of the effects and the lower half of Table 3 shows the significance levels of the differences between the various outlet types. In the CD market the offline multi-channel prices have remained consistently lower than the offline-only prices (no change across time, p=.192; but strong mean difference, p= .000). The relative pricing between the online-only and multi-channel online outlets has changes somewhat over time (p=.018) with the multi-channel outlets initially charging slightly higher prices but more recently charging nearly identical prices. Interestingly, unlike the book market where the multi-channel outlet prices have converged over time, the multi-channel prices in the CD market have diverged over time (p=.009); initially the multi-channel outlets charged similar out of pocket prices online and offline but more recently the offline prices are lower than the online prices. This may reflect a

shift to offering the same list price at both outlets, thus driving up relative online prices since shipping is generally more costly than taxes on small ticket items (e.g., 5% tax on $16 = $0.80 versus $1.99 for shipping).

The initial pricing of the CD market looked similar to the hypothesized pattern of offline-only outlets being most expensive followed by offline multi-channel outlets and online multi-channel outlets and finally online-only outlets being the least expensive. However, the more recent data does not follow this pattern; offline-only outlets remain the most expensive but the offline multi-channel outlet is now the cheapest outlet. Thus the CD market offers little support for H5.

In the book market the offline-only and offline multi-channel outlets price very similarly; with is no significant mean prices differences ($p = .098$) nor any differences in pricing behavior over time ($p = .160$). However, the online book outlets have a substantial mean difference in prices with the multi-channel online outlets having consistently higher prices than the online-only outlets ($p = .000$). There is also a modest change in their relative prices across time with the multi-channel online outlets increasing their prices more than the online-only outlets ($p = .046$). The two multi-channel retail forms started out pricing quite differently but have converged their pricing over time ($p = .000$) mostly through an increase in online prices. While there has been some convergence in price across all channels, the major change has come in the pricing of the multi-channel online outlets. As predicted in H5, the online-only channels are the lowest priced outlets, the online multi-channel outlets are the next lowest priced, and the offline-only retailers are among the most expensive. Thus, the pattern of relative prices generally supports H5 in the book market.

Zettelmeyer (2000) predicts that as Internet penetration increases the two multi-channel outlets should be priced more similarly because they no longer serve different market segments (H6). The two markets offer mixed support for H6 with the book market showing a strong convergence of prices at the two multi-channel forms over time ($p<.000$) but no evidence of this pattern in the CD market, where multi-channel online and offline outlets charged similar out-of-pocket prices in the early stages of the market ($p>.50$) but increasingly different prices as the market has matured ($p=.009$).

Methods: Perceptual Data

The perceptual data were collected in parallel with the first, fourth and fifth objective data collections (i.e., April 2000, October 2004, April 2006). In 2000, 965 responses were collected online via email quota sampling by 45 trained student fieldworkers.[7] The 2004 and 2006 data collections involved a subset of data collected using a similar quota sampling technique as used in 2000 and a subset from an opt-in online research panel maintained to represent the U.S. online population. In 2004 (2006) 118 (174) responses were collected by quota sampling and 710 (817) were collected from the online panel.[8] In both the 2004 and 2006 the quota and panel sample data differ demographically, with the panel sample being significantly older (2004 and 2006 median panel = 41-45 years old, quota = 36-40 years old, $p<.000$) and significantly less educated (2004 and 2006 median panel = some college, quota =

[7] The fieldworkers were required to sample equally from four major regions of the USA (northeast, midwest, south and west) and for four major age brackets (under 30, 30-40, 40-50, over 50), no quota was required for gender, income or internet usage level since these were expected to be well distributed without quota. Fieldworkers were encouraged to use a variety of sample sources to fill their quotas, including personal contacts, chat rooms, online registries and intercepts at the airport. This sampling plan was used because of the limited availability of online research panels at this time.

[8] The two-source data collection was done to verify that the results were not sensitive to the sampling method. Panel members are recruited via a variety of means including ads on high traffic web sites and targeted websites for underrepresented groups. Samples are drawn at random from the panel but with an equal number of men and women initially invited.

college graduate, p<.000). After controlling for these demographic differences, perceptions of relative online and offline prices did not differ between the two data sources (2004: CD: p>.32; books: p>.72; 2006: CD: p>.53; books: p>.20), hence the two samples were combined and all subsequent analysis controlled for the demographic differences.[9]

All three samples closely parallel the general online population of the time.[10] Only gender in the 2004 and 2006 samples are poorly matched, with the sample having 74% and 70% women respectively as compared to the Internet population of 52%; while not ideal, it is not uncommon for women to be over-represented in surveys (Green 1996) and not surprising given the focus on shopping.

In all surveys, respondents are asked "After you figure in the cost of shipping and taxes, would you expect that a CD (book) bought online is more or less expensive than the same CD (book) bought in the store" (7 categories scale: at least 15% less expensive online than in the store, 10-15% less expensive online, 5-10% less expensive online, about the same price online as at the store, 5-10% more expensive online, 10-15% more expensive online, at least 15% more expensive online than in the store). A follow-up open-ended question asks why they thought prices online are in general more or less expensive than offline across categories (respondents who thought they were about the same price did not answer this question). Four 7-point scales were used to assess personal experience with the Internet (hours spent online, number of website visited, frequency of gathering product information, and past purchase frequency).

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[9] Gender is entered as a dummy variable, age and education are entered as covariates after being mean-centered.

[10] Sample Demographics: 2000 Sample (2000 Internet Population from Nua Internet Surveys 2000, Pastore 2000) = Income $65k ($65K); Age 36-40 (41); Education college grad (college grad); Gender 52% women (50% women); States represented all but ME, RI, VT, WV, WY; Hours online per week 4 (2); Bought online last year 73% (70%); New sites visited per week 4 (3). 2004 Sample (2004 Internet Population from McGann 2004, Greenspan 2003) = Income $50k ($54K); Age 36-40 (35-44); Education some college (some college); Gender 74% women (52% women); States represented all but VT; Hours online per week 10 (13). 2006 Sample demographics very similar to 2004 demographics = Income $55k; Age 41-45; Education some college; Gender 70%; States represented all but ND and RI.

Demographics (e.g., gender, age, education level) were included as controls. The second and third perceptual data collections also included a set of 7-point items concerning brand awareness for the retailers in the objective dataset.

Results: Perceptual Data

In assessing the consumer perceptions, ranges of percentage differences are used because people are unlikely to be able to accurately distinguish the difference between small percentage price differences (i.e., 13% & 14%). However, while ranges are more realistic of how people can process information they do necessitate recoding the perceptual data for analysis purposes. Hence, the perceptual scale values were recoded to the lowest percentage in the range[11]. Using this recoded data and controlling for the differences in demographics by including the mean-centered values for age, gender and education, out-of-pocket prices online are thought to be significantly less than comparable prices offline (all p-values < .001), supporting H7 (see Table 4 for perceptual relative price differences).

(Insert Table 4 here)

The open-ended question asking respondents why they thought online and offline prices differ offers several insights into why people hold their stated perceptions.[12] The reasons for thinking online prices are less expensive than offline prices are very similar in the three time periods. The dominant reason to think online prices are less expensive is the belief that the costs

[11] The perceptual scale values were recoded as follows: at least 15% less expensive online than in the store = -15%, 10-15% less expensive online =-10%, 5-10% less expensive online = -5%, about the same price online as at the store = 0%, 5-10% more expensive online = 5%, 10-15% more expensive online = 10%, at least 15% more expensive online than in the store = 15%. This recoding was chosen, rather than a midpoint of the range, because it is the most conservative estimate of the perceived price differences. Using a midpoint recoding does not qualitatively change the results. Hence, 0 = out-of-pocket prices are about the same and negative (positive) numbers signify thinking online prices less (more) expensive than offline prices.

[12] For all three data collections, the open-ended data was coded by two different independent blind judges. Inter-judge reliability was above 90% in each data collection.

of doing business online are lower (2000: 66% (358/541); 2004: 66% (240/364); 2006: 56% (196/351)). This reason is distantly followed by thinking it is due to marketing strategy (2000: 13% (71/541); 2004: 16% (58/364); 2006: 16% (55/351)) or driven by volume of sales (2000: 10% (53/541); 2004: 5% (19/364); 2006: 9% (33/351)). The only differences in the breakdown of reasons is the presence in the later data (2004: 8% (29/364); 2006: 11% (39/351)) of participants citing market forces driving down online prices (e.g., ease of comparing, higher competition), suggesting some growing awareness of the lower transaction cost explanation and a number of respondents in the 2006 data citing the absence of sales tax as a driver for lower online costs (2006: 8% (28/351)).

Among those who thought online prices are more expensive than offline prices the reasons are again very similar across time. The dominant and increasing reason for thinking online prices are more expensive is the added cost of shipping and handling (2000: 61% (269/441); 2004: 79% (172/218); 2006: 89% (239/268)). This reason is distantly followed by other costs being higher (2000: 16% (72/441); 2004: 9% (20/218); 2006: 3% (7/268)) and getting a price premium for convenience (2000: 10% (46/441); 2004: 4% (9/218); 2006; 7% (18/268)). Thus, the perception that online prices are more expensive is driven by the belief that shipping costs drive online prices to exceed offline prices and the perception that online prices are less expensive is driven by the belief that the costs of doing business are lower online.

Accuracy of Perceptions

The matched periods of objective market prices and perceptions of relative market prices allows an examination of the accuracy of consumer's perceptions. An accuracy measure is constructed by taking the objective percentage difference between online and offline prices (i.e.,

(average online prices minus average offline prices)/average offline prices) and subtracting the perceived percentage difference in online and offline pricing. Hence, negative (positive) numbers indicate objective online prices are less expensive (more expensive) than people think they are, and values are more accurate as they approach zero. For example, in the 2000 CD data even though people believed online prices were 1.55% cheaper, objective prices were actually 6.83% cheaper online, hence people underestimated how much less online prices were by 5.28%. Although people tend to think online prices are less expensive than offline prices, they consistently underestimate how much cheaper online out-of-pocket prices are (see Table 4).

Dummy variable regression is used to test whether accuracy has improved over time (H9). The regressions in Table 5 use the accuracy of the price perceptions as the dependent variable, code the constant to represent accuracy in the initial 2000 data, and including dummy variables to test the change in accuracy from 2000 to the more recent time periods and between the two more recent time periods.[13] Table 5 (Columns 1 & 2) shows that people initially underestimated the cost saving of shopping online by 5.28% (CD, $p<.001$) and 13.39% (books, $p<.001$) but by the 2004 data accuracy had improved significantly in both markets (accuracy improvement: CD = 4.03%, book = 7.07%, $p<.001$), although people still tended to underestimate the online cost saving (2004 accuracy: CDs = -1.26%, books = -6.32%). Between the 2004 and 2006 data collections there has been little additional improvement in accuracy, with no significant improvement in the CD market (accuracy improvement: CDs = 0.01%, $p>.97$) and only a modest 1.01% improvement in the book market ($p<.01$). Thus there is support for an initial accuracy improvement but it has leveled off as the market has matured, supporting H9.

(Insert Table 5 here)

[13] Since the three perceptual data collections are not evenly spaced during the time period, dummy variables are used to capture the change in accuracy over time.

The improvement in accuracy could come from shifts in both the objective prices and the consumers' perception of prices. A further examination of the data in Table 4 and Figure 4 shows that in both markets the large improvement from 2000 to 2004 (CDs 4.03%; books 7.07%) is caused by the narrowing of the objective price gap rather than by shifting consumer perceptions, with 87% of the accuracy improvement being caused the decreasing objective price differences.[14] In 2006, while objective online and offline prices continued to converge (i.e. move toward 0% difference), the perceptions did not stay steady or close in on the objective price difference but rather largely paralleled them, thus leading to no improvement in accuracy (i.e., objective price differences got no closer to perceptual price differences in the CD market (0.01% change) and only slightly closer in the book market (1.01% change)). These results suggest that the accuracy of perceptions improved as the market gained experience but people continue to consistently underestimate the cost savings from buying online.

(Insert Figure 4 here)

To further examine the role of Internet experience on accuracy, Columns 3 and 4 of Table 5 include a mean-centered composite Internet usage measure constructed from the four items concerning Internet usage (lowest factor load = .70; alpha = .77) along with its interaction with the change in accuracy dummy variables. The results show that, as expected, in 2000 Internet usage significantly improved accuracy (CD .21%, $p<.001$; books .59%, $p<.001$); those with more Internet experience had more accurate perceptions of the market (supporting H8). The interactions show that this improved accuracy due to higher Internet usage continued as the market matured through the 2004 data (CD .66%, $p<.05$; books .66%, $p<.05$) but was longer significant in the more mature market of 2006 (CD .12%, $p>.05$; books -.53%, $p>.05$). These

[14] 2000 to 2004 objective price change/improvement in accuracy: CDs (6.83% – 3.32%)/4.03% = 87%; books (15.81% - 2.42%)/7.07% = 87%.

results are consistent with the logic that Internet usage should increase the accuracy of price perceptions but at a decreasing rate as more people become more familiar with the Internet.

Another possible influence on the accuracy of consumer perceptions is respondent's differing familiarity with the retailers in the objective sample. One would expect that consumer's perceptions would more accurately reflect the objective reality of the brands that they are most familiar with. To test this hypothesis the perceptual data from 2004 and 2006 include questions concerning the respondent's familiarity with each of the outlets in the objective data collection.[15] From these brand awareness measures an individually informed measure of objective online minus offline difference was constructed using only those outlets that the respondent was certain were a retail outlet for CD/books.[16] A brand-awareness-based accuracy measure is constructed for each respondent using their own online and offline store knowledge and their perception. Similar to the full-market accuracy measure, this brand-awareness-based accuracy measure is more accurate as it approaches zero. The brand-awareness-based accuracy is then compared to the full-market accuracy by looking at the difference between the absolute values of the two accuracy measures (abs(full-market accuracy) – abs(brand-awareness-based accuracy)); absolute values are used since only the magnitude of bias away from perfect accuracy (0), not its direction, is relevant. Contrary to expectations, in neither market is this individually informed brand-awareness-based accuracy more accurate than the full-market accuracy. In fact, in three of the four cases perceptions are significantly are more accurate when

[15] Brand awareness choice options included: 1=never heard of it, 2=not sure but think it is a store, 3=fairly sure it is a store, 4=certain it is a store but have never bought from them, 5=certain it is a store have occasionally bought from them, 6=certain it is a store and sometimes buy from them, 7=certain it is a store and buy from them frequently.

[16] Responses on the brand awareness scale of 1-3 were given zero weight since these represent uncertainty about the outlets existence, responses of 4 were given a weight of 1, 5 a weight of 2, etc. The brand-awareness-based accuracy score was computed as follows: ((brand-awareness-based online prices – brand-awareness-based offline prices)/brand-awareness-based offline prices) – perceived percentage price difference. With the brand-awareness-based prices calculated as follows: (∑(brand awareness weight* outlet's average objective price)/∑(brand awareness weights).

based on the full sample of outlets than when based on the respondent's familiar set (full-market accuracy minus brand-awareness-based accuracy: CD: 2004 = -2.29%, $p < .001$, 2006 = -4.26%, $p < .001$; book: 2004 = -0.96%, $p < .001$, 2006 = -0.20, $p > .20$).[17] Thus, H10 is not supported. It is possible that perceptions more accurately reflect the full market because the question is framed around the respondents' beliefs for the entire market rather than their perceptions based on personal experience, hence people may have drawn on not only their own experience but also a broader array of information including publicity and word of mouth.

Discussion:

The retailing of homogenous products offers a best case environment for observing both transaction cost effects and price penetration strategies and both effects appear to be present to some extent. In both markets the price gap is closing as the market is maturing, consistent with penetration pricing. However, the support for transaction cost effects is less consistent; the book market continues to show a significant price advantage for online outlets in the more mature market but the online price advantage is no longer significant in the most recent CD data. While the current data offers the most time periods and the longest time frame of any published data, additional future data collections would be needed to assess whether these patterns persist. If the gap continues to narrow then the price penetration explanation would receive increasing support, whereas if the gap persists then both explanations are supported. To date the relative online and offline prices offer at least partial support for both explanations.

[17] This result is robust to various weightings of the brand awareness measures including equal weighting of all outlets the respondent is sure are stores and an overweighting based only on the outlets the respondent has bought from. It is also robust to a brand awareness accuracy measure based on the sample's average brand awareness rather than the individual's brand awareness (Outlets the full sample is sure are stores include CD: Amazon.com, Barnes and Noble (on- and offline), Best Buy (on- and offline), Borders offline, Circuit City offline, and Sam Goody offline; Books: Amazon.com, Barnes and Noble (on- and offline), Borders offline, B. Daltons, and Walden's).

The price dispersion results offer further mixed support for the transaction cost model; neither the book nor CD market show a decreasing price dispersion over time and only the CD market shows online price dispersion to be significantly lower than offline price dispersion. This mixed support for transaction costs in price dispersion suggests these markets may be less 'perfectly competitive' than they appear based on market characteristics. This conclusion echoes Pan et al. (2004) in their review of online price dispersion effects; "It appears that greater information flow and easier consumer search facilitated by the Internet has not made online markets more competitive and "frictionless" as predicted by theory" (p 120).

Although the book and CD markets share many characteristics, there are a number of differences that might account for the somewhat different results. First, the on- and offline CD market faces a new and substantial competitor in the music download industry that is not prevalent in the book market. This should make the CD market more competitive and hence may lead to the larger impact of the competitive economic forces represented in the transaction cost explanation. Conversely in the book market, there has long been only limited price competition among the offline retailers due to the strong influence of the publishing houses. Hence, this less price competitive market has more room for strategic pricing.

Managerially, it is worth noting that while online retailers have maintained a price advantage, the level of this advantage is modest and shrinking. The current price advantage is small enough (CD (2006) = 2.05%; book (2006) = 7.63%) that it would be largely eliminated if sales taxes are required and enforced online.

Multi-channel retailers face a more complex decision than pure-play retailers which is reflected in the differences in the two markets. In the CD market, multi-channel players initially priced their online and offline outlets to have very similar out-of-pocket prices that were closely

aligned with the prices at online-only outlets, but have since switched to offering similar list pricing. Whereas in the book market multi-channel players ini8tally used a strategy of aligning their pricing with the parallel pure-play pricing but have subsequently brought online put of pockets prices to be inline with their offline outlets. The separate examination of the on- and offline outlets of the multi-channel retailers is an important contribution of the current multi-channel analysis. Much of the past research on multi-channel players lumps together their two outlet types even though there is no reason multi-channel pricing strategies are necessarily the same across outlet type and, as our data shows, they are not always the same.

While the results for multi-channel players are generally as hypothesized with online-only retailers offering lowest prices, multi-channels retailers offering middle range prices and offline-only retailers offering highest prices, they are not without limitations, most notably the relatively small number of observation units (i.e. 2-8 retailers; see Appendix 1). While the current data offers more sampling units than most of the published work on multi-channel retailers it still has low power of the test. This limitation is only partially surmountable, since most naturally occurring markets have only a limited number of multi-channel retailers but given the growing market share of multi-channel retailers, their strategies deserve additional research.

People's perceptions of the online and offline prices are generally in the right direction (i.e., the majority of people correctly think online prices are less expensive) but they tend to underestimate how much lower online prices are. Perceptions have gotten significantly more accurate since the early days of Internet retailing, though mostly due to converging objective prices rather changes in consumers' perceptions. Perhaps online retailers are changing objective prices in response to the inaccuracy of consumer's perceptions. If consumers consistently underestimate online savings then online retailers are leaving money on the table if they

continued to price below the consumer's expectations. Rather surprisingly, perceptions do not more accurately reflect the reality of the outlets the respondents know, possibly because the perceptual questions are framed around beliefs for the entire market not just the outlets one knows which encourages people to draw on information other than their personal experience.

While the current research offers many contributions it is not without limitations. First, the objective data is cross sectional and in only five time periods; while this is more than in previous data, additional time periods would allow for testing more complex patterns. Second, while the sampled stores represent over 80% of the market, there may still be bias due to the outlets that were not included. Additionally, bias may have been introduced by the disappearance of some outlets. However, this potential bias does not appear to be substantial since only 16% (8 of 50) outlets closed and there is no pattern across the closures, with three low priced, three mid-priced and two high priced outlets closing (see Appendix 1). Additionally, analysis excluding the stores that subsequently closed does not change any of the findings. Finally, the use of ranges in the measurement of price perceptions, while more reasonable for the respondents, requires an arbitrary rescoring to make them comparable with the market reality.

Even with these limitations the current research offers many contributions unavailable previously. First, it includes both objective price data and parallel perceptual data so that both the competitive and consumer maturation process can be assessed. Second, within the objective data it offers more time periods and a longer time frame, with four data collections across the critical times of market transition from boom through bust to stabilization. This time frame allows for more complete testing of how pricing strategies have evolved as the markets mature. Third, we examine a large number of all four retail outlets (online and offline, pure-play and multi-channel) in two categories, allowing for a more powerful test than previously possible.

Appendix: Estimate Marginal Means (SE) of Stores in Objective Dataset[a]

Compact Discs:

Store Type	Store Name	Sp'00	F'01	Sp'03	F'04	Sp'06
Offline-Only:	Coconuts		17.76 (0.34)	18.49 (0.36)	18.27 (0.34)	15.91 (0.33)
	Joseph Beth		18.36 (0.34)	18.82 (0.39)	16.18 (0.38)	15.94 (0.32)
	Record Town/FYE	19.56 (0.35)		19.30 (0.36)	17.39 (0.35)	17.59 (0.32)
	Specs	16.80 (0.35)		17.65 (0.36)	18.48 (0.35)	17.45 (0.32)
	CD Warehouse	18.30 (0.35)		13.69 (0.45)	11.91 (0.47)	---b
Multi-Channel Offline Outlets:	Barnes and Noble	18.12 (0.35)		18.62 (0.36)	17.72 (0.34)	17.31 (0.32)
	Best Buy	15.30 (0.35)	15.30 (0.34)	14.90 (0.37)	14.43 (0.34)	13.80 (0.32)
	Borders		18.17 (0.34)	18.37 (0.39)	16.56 (0.34)	16.07 (0.32)
	Circuit City	14.15 (0.40)	14.84 (0.34)	14.71 (0.37)	14.40 (0.35)	14.19 (0.32)
	Sam Goody	18.96 (0.35)		19.42 (0.38)	17.34 (0.36)	15.84 (0.32)
	Virgin Megastores	17.93 (0.35)		18.60 (0.36)	18.18 (0.34)	12.42 (0.32)
Online-Only:	800music.com		16.90 (0.34)	---	---	---
	Amazon.com	17.09 (0.35)	17.29 (0.34)	17.07 (0.36)	16.62 (0.34)	15.19 (0.32)
	Buy.com		15.34 (0.37)	15.58 (0.36)	14.91 (0.34)	14.57 (0.32)
	CDConnection .com	17.23 (0.35)		15.47 (0.36)	14.91 (0.34)	14.51 (0.32)
	CDNow.com	16.58 (0.35)		17.23 (0.36)	16.62 (0.34)	15.24 (0.32)
	CDQuest.com		17.83 (0.35)	17.33 (0.36)	16.85 (0.34)	17.82 (0.32)
	CDUniverse .com	16.61 (0.35)	17.70 (0.39)	17.34 (0.36)	15.90 (0.34)	15.26 (0.32)
	EveryCD.com	15.84 (0.35)		---	---	---
	MyMusic.com		15.11 (0.34)	15.67 (0.36)	17.30 (0.34)	19.46 (0.32)
	PlayCentric.com		13.18 (0.36)	14.47 (0.36)	13.56 (0.34)	---
	Spun.com		17.70 (0.35)	17.98 (0.36)	17.40 (0.34)	15.64 (0.32)
Multi-Channel Online Outlets:	Barnes&Noble .com	17.31 (0.35)	18.04 (0.34)	18.09 (0.36)	18.21 (0.34)	17.49 (0.32)
	BestBuy.com	17.43 (0.35)		14.68 (0.36)	15.01 (0.34)	14.52 (0.32)
	Borders.com	17.67 (0.35)		17.23 (0.36)	16.62 (0.34)	15.19 (0.32)
	CircuitCity .com			14.02 (0.36)	14.86 (0.34)	14.69 (0.32)
	JandR.com	15.67 (0.35)		16.47 (0.36)	15.48 (0.34)	14.40 (0.32)
	SamGoody .com			18.68 (0.36)	18.18 (0.34)	17.46 (0.32)
	TowerRecords .com	16.64 (0.35)		17.06 (0.36)	17.28 (0.34)	15.99 (0.32)
	VirginRecords .com	16.71 (0.35)		---	---	---

a = means controlling for item effects and including shipping for online and 5% sales tax for offline
b = 2006 CD Warehouse was dropped because only 23% of the titles were available new
--- = outlet closed

Appendix con't.: Estimate Marginal Means (SE) of Stores in Objective Dataset[a]

Books:

Store Type	Store Name	Sp'00	F'01	Sp'03	F'04	Sp'06
Offline-Only:	Appletree		21.19 (0.69)	19.94 (0.72)	20.68 (0.69)	19.75 (0.70)
	B. Daltons	20.98 (0.70)	21.38 (0.69)	19.05 (0.73)	20.43 (0.69)	20.18 (0.70)
	Books and Books	20.91 (0.70)		20.06 (0.72)	20.43 (0.69)	20.41 (0.70)
	Downtown Books	18.44 (0.73)		19.93 (0.72)	20.77 (0.69)	20.33 (0.70)
	I Love Books	20.93 (0.70)		---	---	---
	Joseph Beth		21.45 (0.69)	19.79 (0.72)	20.51 (0.69)	20.28 (0.70)
	Waldens	20.97 (0.70)		19.63 (0.72)	20.74 (0.69)	20.29 (0.70)
Multi-Channel Offline Outlets:	Barnes and Noble	20.98 (0.70)	21.47 (0.69)	19.71 (0.72)	20.59 (0.69)	20.11 (0.70)
	Borders	20.97 (0.70)	21.35 (0.69)	19.81 (0.72)	20.37 (0.69)	20.29 (0.70)
Online-Only:	1BookStreet.com		17.69 (0.69)	21.94 (0.72)		18.37 (0.70)
	A1Books.com	17.43 (0.70)		16.66 (0.72)	15.58 (0.69)	17.57 (0.71)
	AllDirect.com	14.88 (0.70)	15.33 (0.69)	16.42 (0.72)	16.27 (0.69)	16.39 (0.70)
	Amazon.com	18.16 (0.70)	18.90 (0.69)	18.62 (0.72)	18.49 (0.69)	18.30 (0.70)
	BookVariety.com		20.47 (0.69)	---	---	---
	Buy.com	16.65 (0.70)	17.99 (0.69)	17.01 (0.72)	15.97 (0.69)	15.82 (0.70)
	eCampus.com	14.88 (0.70)	15.68 (0.69)	18.07 (0.72)	19.23 (0.69)	19.02 (0.70)
	KingBooks.com	19.07 (0.70)		---	---	---
Multi-Channel Online Outlets:	Barnes&Noble.com	17.66 (0.70)	21.41 (0.69)	21.59 (0.72)	20.70 (0.69)	21.52 (0.70)
	BooksaMillion.com	17.53 (0.70)		19.88 (0.72)	19.41 (0.69)	18.93 (0.70)
	Borders.com	18.26 (0.71)		18.62 (0.72)	18.49 (0.69)	18.29 (0.70)

a = means controlling for item effects and including shipping for online and 5% sales tax for offline
--- = outlet closed

Table 1
Regression Results (Std Err) for Online versus Offline Out-of-Pocket-Prices

Dep. Var. = Out-of-Pocket-Prices	CDs	Books
Constant	\$18.01*** (0.45)	\$20.75*** (0.76)
Online Store Type Dummy Online = 1	-\$1.23* (0.49)	-\$3.28*** (0.59)
Time Period	-\$0.48*** (0.04)	-\$0.11* (0.06)
Online x Time Period	\$0.23*** (0.04)	\$0.43*** (0.06)
R^2	.53	.92
Observations	5,391	4,666
Number of Stores[a]	30	20

[a] Items and stores nested within store type are included as random effects.
* p-value < .05; ** p-value < .01; *** p-value < .001

Figure 1
Interaction of Type of Store by Time Period

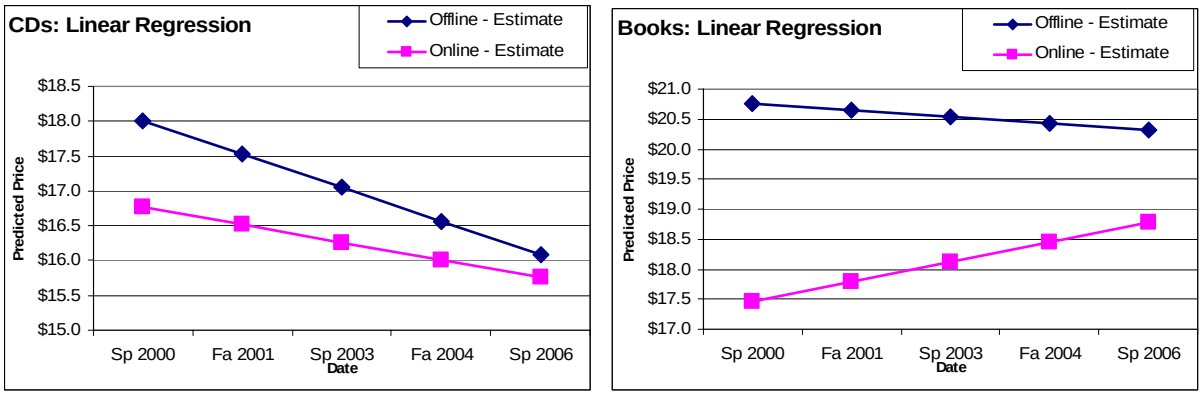


Table 2
Regression Results (Std Err) for Online versus Offline Coefficient of Variation

Dep. Var. = Coefficient of Variation	CDs	Books
Constant	0.127*** (0.005)	0.026*** (0.005)
Online Store Type Dummy	-0.022** (0.008)	0.121*** (0.008)
Time Period	0.010*** (0.002)	0.001 (0.002)
Online x Time Period	-0.005 (0.003)	-0.005 (0.003)
R^2	.15	.51
Observations	500	614

* p-value < .05; ** p-value < .01; *** p-value < .001

Figure 2
Price Dispersion by Type of Store and Time Period

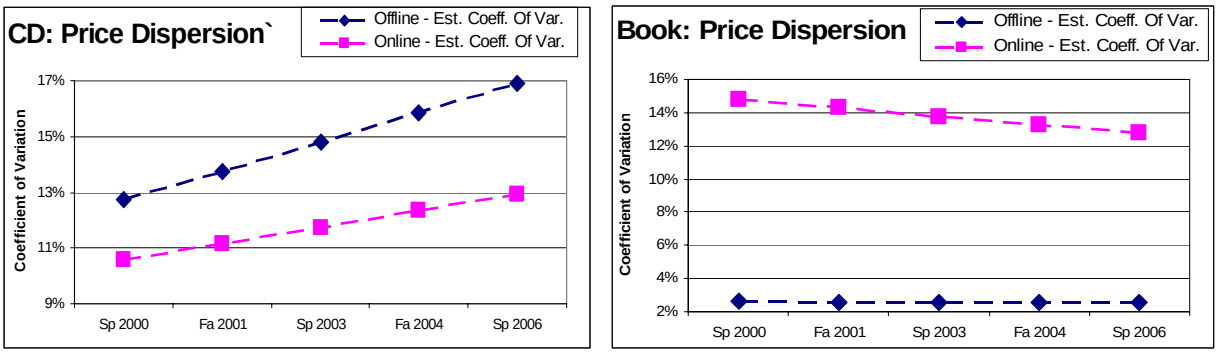


Table 3: Regression Results (Std Err) for Multi-Channel Outlets on Out-of-Pocket-Prices

Dep. Var. = Out-of-Pocket-Prices	CDs	Books
Constant	\$16.83***	\$23.76***
	(0.70)	(0.52)
Multi-Channel Online Dummy	\$0.53***	\$1.58***
	(0.16)	(0.21)
Multi-Channel Offline Dummy	\$0.56***	\$3.86***
	(0.17)	(0.22)
Offline Only Dummy	\$1.81***	\$3.47***
	(0.19)	(0.17)
Time Period	-\$0.17***	\$0.18**
	(0.05)	(0.06)
Multi Online * Time Period	-\$0.14*	\$0.16*
	(0.06)	(0.08)
Multi Offline * Time Period	-\$0.30***	-\$0.34***
	(0.06)	(0.09)
Offline Only x Time Period	-\$0.21**	-\$0.21**
	(0.07)	(0.07)
Hypothesis Tests:	p-value	p-value
Online-Only = Multi Online	.001	.000
Multi Offline = Multi Online	.871	.000
Offline-Only = Multi Offline	.000	.098
Offline-Only = Online-Only	.000	.000
(Online-Only = Multi Online) x Time	.018	.046
(Multi Offline = Multi Online) x Time	.009	.000
(Offline-Only = Multi Offline) x Time	.192	.160
(Offline-Only = Online-Only) x Time	.002	.002
R^2	.55	.92
Observations	5,391	4,666
Number of Stores[a]	30	20

[a] Items and stores nested within outlet type are included as random effects.
* p-value < .05; ** p-value < .01; *** p-value < .001

Table 4
Mean Relative Price Differences: Objective, Perceptual and Accuracy Differences
Negative numbers signify online prices less than offline prices

	CDs			Books		
	Objective[a]	Perceptual[b]	Accuracy[c]	Objective	Perceptual	Accuracy
2000	-6.83%	-1.55%	-5.28%	-15.81%	-2.42%	-13.39%
2004	-3.32%	-2.07%	-1.25%	-9.65%	-3.33%	-6.32%
2006	-2.05%	-0.81%	-1.24%	-7.63%	-2.31%	-5.32%

[a] (mean objective online prices – mean objective offline price)/ mean objective offline prices
[b] Mean transformed relative price perceptions
[c] Objective percentage price difference – perceived percentage price difference

Table 5
Regression Results (Std Err) for Accuracy of Relative Price Perceptions
Accuracy = (% objective price difference) - (% perceived price difference)

Dep. Var. = Accuracy of Price Perceptions [a, b]	(1) CDs	(2) Books	(3) CDs	(4) Books
Constant (Accuracy in 2000)	-5.28%*** (0.24)	-13.39%*** (0.25)	-5.28%*** (0.24)	-13.39%*** (0.25)
Change in Accuracy from 2000 to 2004/2006	4.03%*** (0.36)	7.07%*** (0.37)	4.02%*** (0.36)	7.06%*** (0.37)
Change in Accuracy from 2004 to 2006	0.01% (0.36)	1.01%** (0.37)	0.01% (0.36)	1.01%*** (0.37)
General Internet Usage			0.21%*** (0.16)	0.59%*** (0.17)
Change in Accur. 2000 and 2004/2006 * Usage			0.66%* (0.26)	0.66%* (0.27)
Change in Accur. 2004 and 2006 * Usage			0.12% (0.27)	-0.53% (0.28)
Observations	2628	2628	2628	2628

[a] Zero signifies perfect accuracy, negative values signify objective online prices are less expensive than people think they (i.e. people underestimate the cost savings of online).
[b] To more correctly specify the model age, education level and gender are also included. Age, education and general Internet usage are means-centered in each time period so that the constant represents accuracy in 2000 at the mean covariate values. The results of the covariates are not shown to conserve space; more educated consumers and men tend to be more accurate and younger book consumers tend to be more accurate.
* p-value < .05; ** p-value < .01; *** p-value < .001

Figure 3
Multi-Channel Outlet Type by Time Period

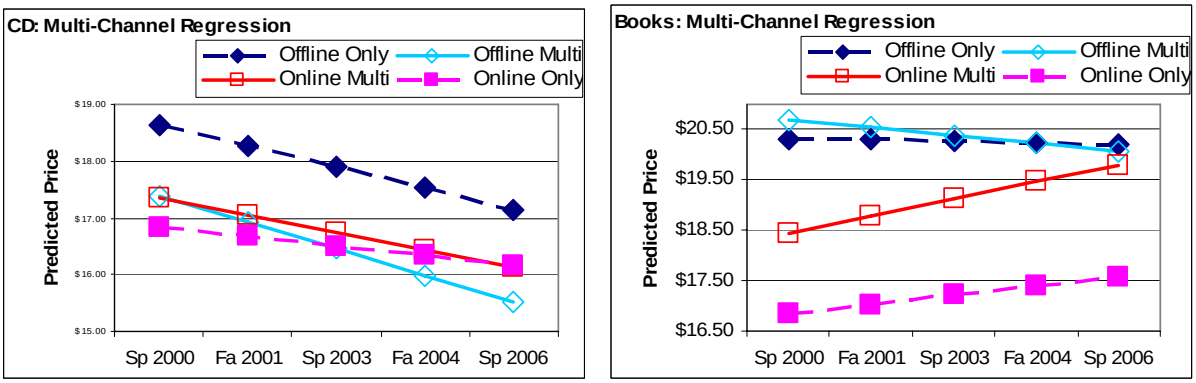
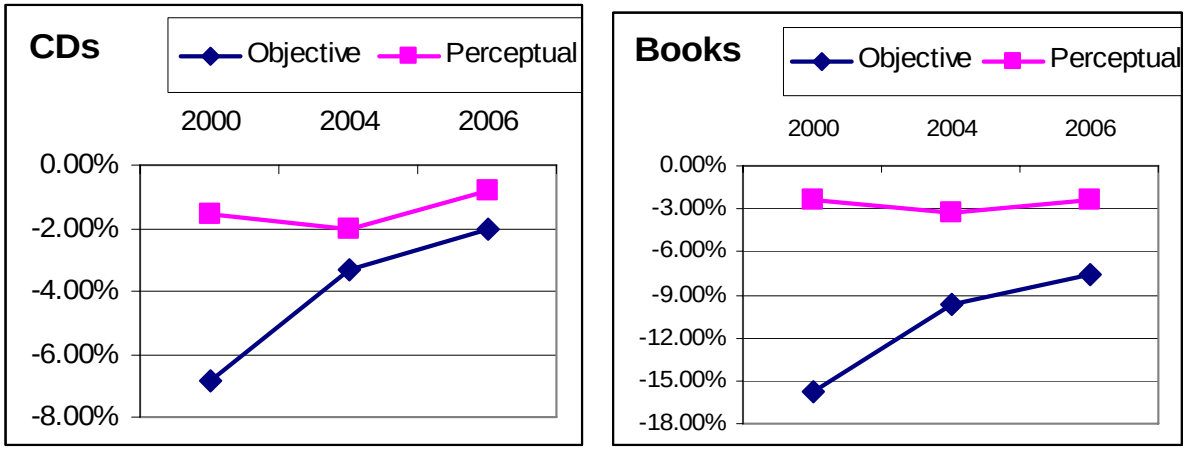


Figure 4
Mean Objective and Perceptual Relative Price Differences



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