

WISE '98 Extended Abstract

Internet Market Efficiency: Fact or Friction? Evidence from Internet and Traditional Retailers of Books and CDs

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Our research empirically analyzes the efficiency of Internet markets for homogeneous products — books and CDs. Using a data set of approximately 10,000 price observations collected from 35 Internet and traditional retailers over a period of 7 months, we find mixed support for the hypothesis of increased efficiency in Internet markets. Supporting greater efficiency, we find that prices on the Internet are lower than prices in traditional retailers. Additionally, we find that Internet retailers are willing to make smaller price adjustments than traditional retailers — possibly reflecting lower menu costs (Sheshinski, Weiss 1993) or more informed consumers (Varian 1982). In opposition to the Internet market efficiency hypothesis, we find that price variance on the Internet is statistically identical to price variance among traditional retailers and that Internet retailers who can leverage a traditional brand name are able to charge a premium relative to retailers who only sell goods on the Internet.

The question of efficiency in Internet markets takes on increased importance as the Internet market for consumer goods grows from \$2.4 billion in 1997 to an estimated \$12 billion in 2000 (Forrester Research, cited in *Business Week*, January 26, 1998). Our results represent one of the first large-scale systematic studies of the efficiency of homogeneous goods markets on the Internet. Further, in the coming months, our continued data collection will allow us to incorporate new data to validate our existing findings and analyze potential changes in market efficiency over time.

Introduction

Questions regarding the efficiency of Internet markets have sparked much discussion among industry observers. Recent statements by Bill Gates touting “friction-free” capitalism and by Robert Kuttner predicting that the Internet will bring about “fierce price competition, dwindling product differentiation, and vanishing brand loyalty” (*Business Week*, May 11, 1998) are representative of the efficient market view. According to this view, the increasing availability of price and product information on the Internet will reduce price cost margins, lead to more homogeneous prices, increase consumer surplus, and eliminate (economic) profits.

At the same time there is also anecdotal evidence that Internet markets may not be completely efficient. For example, if economic profits will be eliminated on the Internet why are markets so

bullish for Internet retailers such as Amazon.com and CDnow who sell undifferentiated products — the products most likely to experience fierce competition in fully informed markets? If markets will be fully informed of prices in the near future, why are Internet retailers making million dollar multi-year deals for the right to advertise their sites on major Internet portals and content sites? While there may be answers to these questions consistent with the efficiency hypothesis, the degree of efficiency in Internet markets deserves empirical verification by academic research.

Theoretical Foundation

In addressing the question of efficiency in Internet markets, we draw on three economic models. Bakos' (1997) model of search costs analyzes an environment where consumers incur search costs to discover the prices and characteristics of different products. Under the hypothesis that search costs are lower on the Internet and that marginal costs are comparable for both markets, Bakos' model generates two testable hypotheses for undifferentiated goods:

- (1) prices on the Internet will be lower than prices in traditional retailers,
- (2) prices on the Internet will have less variance than prices in traditional retailers.

In addition to price levels, we also study price changes made by Internet retailers. We hypothesize that Internet consumers are more informed of prices than consumers shopping at traditional retailers. This hypothesis is motivated by the existence of a variety of price search intermediaries on the Internet (e.g., www.acses.com, shopguide.yahoo.com, www.infospace.com, www.jango.com) and the ease with which one can "visit" a large number of Internet retailers even without price intermediaries.

We also hypothesize that Internet retailers have lower menu costs than traditional retailers. This hypothesis is motivated by the observation that to change a price, Internet retailers may only need to change a single entry in a database, while traditional retailers may need to change databases in multiple stores, and potentially change price tags for individual items on store shelves.

Economic theory of menu costs predicts that in the presence of lower menu costs, retailers will be willing to make smaller price adjustments (Sheshinski, Weiss 1993; Levy et al 197). This increases efficiency by allowing retailers to better adjust to changing supply or demand conditions. Varian's (1980) theory of sales predicts that in the presence of more informed consumers, retailers will make fewer large price changes (fewer "sales").

Thus, if Internet markets have lower menu costs and more informed consumers, both of these economic theories predict that we would see smaller price changes on the Internet relative to traditional retailers.

Methodology

To empirically analyze the efficiency of Internet markets, we gather price data for books and CDs from three sets of retailers: those who sell exclusively on the Internet (Internet retailers), those who sell exclusively through physical stores (traditional retailers), and those who sell in both channels (hybrid retailers). The products studied, books and CDs, were specifically chosen

because they are exactly identical across retailers (for a given ISBN number or CD title and version), eliminating most any unobserved heterogeneity in this dimension.

For each type of retailers we gather prices and product characteristics for a set of 10 popular and 10 general interest titles. Internet observations are gathered with an automated price gathering tool and verified by regularly checking selected prices manually. Physical observations are gathered by 6 paid research assistants operating in 4 states in the U.S.. These research assistants record prices directly off the titles on store shelves. For hybrid retailers, we gather separate prices from their Internet and physical stores.

Results

To analyze our data, we conduct a variety of tests including standard normality-based hypothesis test (F-tests, t-tests), nonparametric hypothesis tests (Mann-Whitney tests, signtests), and hedonic regressions to control for differences in characteristics across retailers.

These tests reveal mixed support for the hypothesis that Internet markets are more efficient than traditional markets. Supporting increased efficiency, t-tests and Mann-Whitney tests reveal that prices on the Internet are significantly lower than prices charged in traditional stores. Our findings hold for both the price of the products alone and prices including shipping and handling and tax charges (where applicable). (Shipping cost calculations are made assuming consumers purchase five items per transaction — roughly equivalent to the number of items reported by industry observers; Ghemawat and Baird 1998 for example.) As noted above, lower prices on the Internet suggest more competition, lower search costs, and greater market efficiency.

We also use standard hypothesis tests to examine the size of price changes made by Internet and traditional firms. Our data suggest that Internet retailers make smaller price changes relative to traditional retailers. As noted above, this finding is consistent with either the presence of lower menu costs on the Internet or the presence of more informed consumers. In either case, this finding suggests that Internet markets may be more efficient than physical world markets.

At the same time our data suggest that Internet markets are not yet fully efficient. Far from being homogeneous, the price variance in Internet markets is statistically the same as the price variance in traditional markets. This is true in spite of the fact that we gathered physical world prices from multiple geographic locations. Gathering physical world prices from multiple locations should increase the price variance of the physical prices (because of geographic variation in demand conditions) and bias our test toward finding lower price variance on the Internet.

We further test this finding by using hedonic regressions to control for heterogeneity across Internet retailers. Here, we find that retailers who can leverage a physical world brand name (i.e., hybrid retailers such as Barnes & Noble and Tower Records) can charge a price premium relative to retailers who only sell goods over the Internet. Controlling for the characteristics of the retailers' sales channels, we find that a physical world brand name results in price premiums of 5-10% for books and 7-14% for CDs. Premiums for physical world brand names could arise from information asymmetries regarding the existence of reliability of retailers. However, in either case they are suggestive of markets that are not yet fully efficient.

Conclusions and Future Work

Thus, our initial findings are mixed with respect to the efficiency of Internet markets. Our data suggest that prices are lower on the Internet relative to traditional retailers and that Internet retailers make smaller price adjustments — consistent with either lower Internet menu costs or more informed consumers on the Internet. At the same time, Internet prices exhibit larger price variance than would be expected from fully efficient markets and the existence of premiums from physical world “brand names” suggests information asymmetries among Internet consumers.

In the coming months, we plan to incorporate additional findings from our continuing data collection efforts to validate these findings and analyze how Internet efficiency changes with the recent entry of Amazon.com (CDs) and Borders and the anticipated entry of market giants such as Bertlesman and Ingram (through drop shipping arrangements with Crown Books and Lauriat’s).

References

- Bailey, Joseph P. 1998. Intermediation and Electronic Markets: Aggregation and Pricing in Internet Commerce. Ph.D., Technology, Management and Policy, Massachusetts Institute of Technology, Cambridge, MA.
- Bakos, J. Yannis. 1997. Reducing Buyer Search Costs: Implications for Electronic Marketplaces. *Management Science*, Volume 43, Number 12, December.
- Bresnahan, Timothy F. and Peter C. Reiss. 1991. Entry and Competition in Concentrated Markets. *Journal of Political Economy*, Vol. 99, No. 5. (October), pp. 977-1009.
- Degeratu, Alexandru; Rangaswamy, Arvind; Wu, Jeremy. 1998. "Consumer Choice Behavior in Online and Regular Stores: The Effects of Brand Name, Price, and Other Search Attributes." Presented at *Marketing Science and the Internet*, INFORM College on Marketing Mini-Conference. Cambridge, MA. 6-8 March.
- Ghemawat, Pankaj; Baird, Bret. 1998. "Leadership Online: Barnes & Noble vs. Amazon.com." Harvard Business School Case No. N9-798-063. Harvard Business School Publishing, Cambridge, MA. April 8.
- Lee, Ho Geun. 1997. Do Electronic Marketplaces Lower the Price of Goods. *Communications of the ACM*. Volume 41, Number 12 January.
- Levy, Daniel; Bergen, Mark; Dutta, Shantanu; Venable, Robert. 1997. "The Magnitude of Menu Costs: Direct Evidence From Large U.S. Supermarket Chains." *The Quarterly Journal of Economics*. August, pp. 791-825.
- Lynch, John G.; Ariely, Dan. (1998). "Interactive Home Shopping: Effects of Search Cost for Price and Quality Information On Consumer Price Sensitivity, Satisfaction With Merchandise, And Retention." Presented at *Marketing Science and the Internet*, INFORM College on Marketing Mini-Conference. Cambridge, MA. 6-8 March.
- Shankar, Venkatesh; Rangaswamy, Arvind; Pusateri, Michael. 1998. "The Impact of Internet Marketing on Price Sensitivity and Price Competition." Presented at *Marketing Science and the Internet*, INFORM College on Marketing Mini-Conference. Cambridge, MA. 6-8 March.
- Sheshinski, Eytan, and Yoram Weiss, eds. 1993. *Optimal Pricing, Inflation, and the Cost of Price Adjustment*. Cambridge, MA: MIT Press.
- Varian, Hal R. 1980. "A Model of Sales." *The American Economic Review*. Volume 70, Issue 4 (September), pp. 651-659.