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Understanding Digital Markets: *Review and Assessment*

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Abstract

As the Internet develops into a robust channel for commerce, it will be important to understand the characteristics of electronic markets. Businesses, consumers, government regulators, and academic researchers face a variety of questions when analyzing these nascent markets. Will electronic markets have less friction than comparable conventional markets? What factors lead to dispersion in Internet prices? What are the major electronic commerce developments to watch in the coming years? This paper addresses these questions by reviewing current academic research, discussing the implications of this research, and proposing areas for future study.

We review evidence that Internet markets are more efficient than conventional markets with respect to price levels, menu costs, and price elasticity. However, several studies find substantial and persistent dispersion in prices on the Internet. This price dispersion may be explained, in part, by heterogeneity in retailer-specific factors such as trust and awareness. In addition, we note that Internet markets are still in an early stage of development and may change dramatically in the coming years with the development of cross-channel sales strategies, infomediaries and shopbots, improved supply chain management, and new information markets.

1. Introduction

A basement computer room at Buy.com headquarters in Aliso Viejo, California holds what some believe is the heart of the new digital economy. Banks of modems dial out over separate ISP accounts, gathering millions of prices for consumer products: books, CDs, videos, computer hardware and software. Specially programmed computers then sift through these prices, identifying the best prices online and helping Buy.com deliver on its promise of having “the lowest price on earth.”

Buy.com’s model seems to represent the economic ideal for frictionless markets: low search costs, strong price competition, low margins, low deadweight loss. However, the \$1 trillion dollar question¹ for Internet consumer goods markets is: “Will strong price competition prevail in electronic markets or will other market characteristics allow retailers to maintain significant margins on the goods they sell?”

This paper approaches this question by exploring three aspects of business to consumer electronic commerce markets. Section 2 discusses several ways to measure *efficiency* in Internet markets and discusses the empirical evidence relating to these hypotheses. Section 3 focuses more specifically on several potential sources of *price dispersion* in Internet markets. Section 4 introduces important *developments to watch* in electronic commerce markets and discusses how they may effect efficiency and competition in the coming years. The appendix also includes an extensive, if necessarily incomplete, bibliography of related research.

2. Characterizing Competition in Electronic Markets

There are a variety of ways to analyze the level of friction in Internet markets. Some studies in this area compare the characteristics of electronic markets to conventional markets while others analyze behavior within electronic markets. In this section, we identify four dimensions of efficiency in Internet markets when compared to brick and mortar markets: price levels, price elasticity, menu costs, and price dispersion.

¹ The market capitalization of the 55 stocks that comprise Hambrecht and Quist’s “Internet Index” was \$1,000,489,700,000 at the time this paper was written.

2.1 Price Levels

In the classic economic models of social welfare, efficiency is maximized when all welfare enhancing trades are executed. In retail markets where sellers set prices, efficiency occurs when prices are set equal to the retailer's marginal cost. Marginal cost pricing is the efficient outcome since pricing above marginal cost excludes welfare enhancing trades from consumers who value the product at a level between the price and the marginal cost.

The most cited reason why one might expect electronic markets to be more efficient than conventional markets is a reduction in information asymmetries that arise from lower search costs. Economic theory predicts that high consumer search costs will lead to prices above marginal cost in equilibrium (Hotelling 1929, Salop 1979 for example). If electronic markets allow consumers to more easily determine retailers' prices and product offerings, these lower search costs will lead to lower prices for both homogeneous and differentiated goods (Bakos 1997).

Table 1: Four Dimensions of Internet Market Efficiency

Price Levels: Are the prices charged on the Internet lower?

Price Elasticity: Are consumers more sensitive to small price changes on the Internet?

Menu Costs: Do retailers adjust their prices more finely or more frequently on the Internet?

Price Dispersion: Is there a smaller spread between the highest and lowest prices on the Internet?

More advantageous retailer cost structures may also contribute to lower price levels in electronic marketplaces. Better cost structures may lead to more efficient pricing in two ways. First, low market entry costs may limit the price premiums sustainable by existing market participants by increasing actual or potential competition (Milgrom and Roberts 1982). Second, favorable cost structures can lead to lower equilibrium price levels in a long-run equilibrium by decreasing the underlying costs on which any price premiums are based.

Lee (1997) conducted one of the first studies involving pricing in electronic markets. His study analyzes prices in electronic and conventional auction markets for used cars sold from 1986 to

1995. He found that prices in the electronic markets were *higher* than prices in the conventional markets and that this price difference seems to *increase* over time.

At first glance, this finding seems opposed to the efficiency hypothesis. However, two aspects of his study are important to note. First, Lee studies an auction market and the characteristics of auction markets are different than retail markets. In auction markets efficiency results when the good is sold to the bidder with the highest valuation. Thus, higher prices may be a signal of more efficient auction markets *ceteris paribus*. A second consideration is that there were systematic differences between the cars sold in the two markets and Lee was unable to control for these differences. Specifically, cars sold in the electronic markets were, in general, newer than the cars sold in the conventional markets and the electronic market cars went through an extra pre-sale inspection process that was not used in the conventional markets.

Bailey (1998a, 1998b) offers a more direct test of the efficiency hypothesis in electronic markets. He examines Internet market efficiency by comparing the prices for books, CDs, and software sold on the Internet and in conventional channels in 1996 and 1997. As with Lee, Bailey finds higher prices in the electronic channel for each product category during this time period. However, in this study, the physical goods are entirely homogeneous and are matched across the channels. Thus, unobserved product heterogeneity should not be the source of Bailey's findings.

Bailey argues that the higher prices he observes could have been caused by market immaturity. This argument is supported, in part, by an analysis of pricing behavior surrounding the entry of Barnes and Noble into the Internet market for books. Bailey notes that during the 3 months following Barnes and Noble's Internet entry on March 19, 1997, Amazon.com dropped its prices by nearly 10 percent to match the prices charged by their new competitor.

In a related study, Brynjolfsson and Smith (2000) examine prices for books and CDs sold through Internet and conventional channels in 1998 and 1999.² Unlike Bailey, they find that prices are 9-16% lower on the Internet than in conventional outlets — even after accounting for costs from shipping and handling, delivery, and local sales taxes. The differences in the

² The authors decided not to track software prices because the decline in the number of conventional software retailers from 1997 to 1998 made it difficult to find a representative sample. For example, Egghead Software decided to close their conventional outlets and become a pure-play Internet retailer. Of course, this data problem is itself an interesting bit of evidence on the relative efficiency of the new Internet channel.

methodologies (including the retailers, products and time period sampled) used by these authors prevent direct comparison of their results. However, one possible explanation for the differences in their findings is that Internet markets have become more efficient between 1996 and 1999.

2.2 Price Elasticity

Price elasticity measures how sensitive consumer demand is to changes in price.³ For commodities, price elasticity may be an important signal of market efficiency. In efficient markets, consumers are more sensitive to small changes in prices, at least as long as substitute vendors or products exist. Higher (absolute values of) price elasticity may result from lower search costs or lower switching costs for Internet consumers.

Three studies analyze different aspects of price sensitivity in Internet markets. Goolsbee (2000) uses survey data to analyze how sensitive customers are to local sales tax rates. He finds that online consumers are highly sensitive to local tax policies: consumers who are subject to high local sales taxes are much more likely to purchase online (and presumably avoid paying the local sales tax). While this study does not specifically test price elasticity between Internet firms, it does point to a high degree of price sensitivity between the total cost of a good online and the total cost in a conventional outlet.

For differentiated goods, measuring price elasticity to infer efficiency requires more interpretation. In differentiated goods markets, price sensitivity could be lower online than in conventional outlets for two reasons. First, lower online search costs may allow consumers to more readily locate products that better meet their needs (Alba et al 1997). Second, evaluating products online may lead to “missing information” regarding the characteristics of the product (Degeratu, Rangaswamy, and Wu 1998) and missing information may lead consumers to rely more heavily on other signals of quality, such as brand. Either of these factors could soften price competition — however, they have opposite outcomes with respect to efficiency.

Two empirical studies analyze price sensitivity in electronic markets for differentiated goods. Degeratu, Rangaswamy, and Wu (1998) compare the price sensitivity of groceries sold through conventional and electronic outlets. They find that price sensitivity is lower among online

grocery shoppers than it is for conventional-world shoppers. In a related study, Lynch and Ariely (2000) test customer price sensitivity by manipulating the shopping characteristics in a simulated electronic market for wine. The authors find that consumers will tend to focus on price when there is little other information available to differentiate products. However, providing better product information to customers softens price competition and increases product-customer fit.

2.3 Menu Costs

Menu costs are the costs retailers incur when making price changes. In a conventional setting, menu costs result primarily from the costs to physically re-label products on shelves (Levy, Bergen, Dutta, and Venable 1997). In an electronic market we hypothesize that menu costs should be lower, comprised primarily of the cost to make a single price change in a central database.

Menu costs are important in an efficiency context because high menu costs can lead to price stickiness. Price stickiness results because retailers will only make a price change when the benefit of the price change exceeds the cost. If menu costs are high, retailers will be less willing to make small price changes, and as a result will be less able to adapt to small changes in supply and demand.

Two empirical papers have analyzed this hypothesis and both suggest that menu costs are lower online than in conventional outlets. Bailey (1998a) tests whether menu costs are lower in Internet markets by measuring the number of price changes undertaken by Internet and conventional retailers. He finds that Internet retailers make significantly more price changes than conventional retailers and concludes that there are lower menu costs on the Internet compared to conventional outlets.

Brynjolfsson and Smith (2000) test the menu cost hypothesis by comparing the propensity of retailers to make small price changes — the types of price changes that would be prevented by large menu costs. They find that Internet retailers make price changes that are up to 100 times smaller than the smallest price changes observed in conventional outlets.

³ Price elasticity is defined as the percentage change in quantity sold, q , for a given percentage change in price, p : $(dq/dp)(p/q)$.

2.4 Price Dispersion

The Bertrand model of price competition represents the extreme view of market efficiency. The Bertrand model assumes that products are perfectly homogeneous, consumers are informed of all prices, there is free market entry, a large number of buyers and sellers, and zero search costs. This setting yields pure price competition: the retailer with the lowest price receives all sales and as a result all prices are driven to marginal cost. Given the stark assumptions in the Bertrand model, it is not surprising that the existence of price dispersion — different prices charged for the same good at the same time — is one of the most replicated findings in economics (see Pratt, Wise, and Zeckhauser 1979; Dahlby and West 1986; Sorensen 2000 for example).

Price dispersion is typically seen as arising from high search costs (Burdett and Judd 1983; Stahl 1989, 1996) or from consumers who are imperfectly informed of prices (Salop and Stiglitz 1977, 1982; Varian 1980). Given these factors, it is natural to assume that if search costs are lower in Internet markets (Bakos 1997) and if consumers are more readily informed of prices, price dispersion on the Internet should be lower than it is in comparable conventional markets.

This hypothesis is not supported by existing empirical evidence. Both Bailey (1998a, 1998b) and Brynjolfsson and Smith (2000) find that price dispersion is no lower in Internet markets as compared to conventional markets. Brynjolfsson and Smith find that prices for identical books and CDs at different retailers differ by as much as 50% and price differences average 33% for books and 25% for CDs. The authors attribute their findings to several factors, including market immaturity and heterogeneity in retailer attributes such as trust and awareness.

Clemons, Hann, and Hitt (1998) study markets for airline tickets sold through online travel agents. They find that prices for airline tickets can differ by as much as 20% across online travel agents even after controlling for observable product heterogeneity. While this study does not compare the dispersion in online markets to dispersion in conventional markets, the amount of dispersion they find is higher than one might expect. The authors attribute the observed price dispersion to retailer segmentation strategies and, in one case, to price discrimination.

Table 2: Recent Empirical Research Findings Relating to Internet Efficiency

<i>Study</i>	<i>Data</i>	<i>Finding</i>
<i>Price Levels</i>		
Lee (1997)	Prices for <i>used cars</i> sold in electronic and conventional auction markets from 1986-1995	Prices are <i>higher</i> in electronic auctions and increase over time
Bailey (1998a, 1998b)	Prices for matched set of <i>books, CDs, and software</i> sold through conventional and Internet outlets from 1996-1997	Prices are <i>higher</i> in Internet markets
Brynjolfsson and Smith (2000)	Prices for matched set of <i>books and CDs</i> sold through conventional and Internet outlets from 1998-1999	Prices are <i>lower</i> in Internet markets
<i>Price Elasticity</i>		
Goolsbee (2000)	Survey data for Internet purchases of a <i>variety of goods</i> by 25,000 online users in late 1997	Internet purchases <i>highly sensitive</i> to local tax rates
Degeratu, Rangaswamy, and Wu (1998)	Shopping behavior for <i>groceries</i> sold online (300 Peapod customers) and in conventional outlets (IRI scanner data) from 1996-1997.	Price sensitivity <i>lower</i> online.
Lynch and Ariely (2000)	Shopping behavior for <i>wine</i> sold in a simulated electronic market	Providing better product information <i>softens</i> price competition and <i>increases</i> fit.
<i>Menu Costs</i>		
Bailey (1998a, 1998b)	Prices for matched set of <i>books, CDs, and software</i> sold through conventional and Internet outlets from 1996-1997	Menu costs are <i>lower</i> in Internet markets
Brynjolfsson and Smith (2000)	Prices for matched set of <i>books and CDs</i> sold through conventional and Internet outlets from 1998-1999	Menu costs are <i>lower</i> in Internet markets
<i>Price Dispersion</i>		
Bailey (1998a, 1998b)	Prices for matched set of <i>books, CDs, and software</i> sold through conventional and Internet outlets from 1996-1997	Price dispersion <i>no lower</i> online than in conventional outlets
Clemons, Hann, and Hitt (1998)	Prices quoted by online travel agents for airline tickets in 1997	<i>Substantial</i> price dispersion online (average price differences of up to 20%)
Brynjolfsson and Smith (2000)	Prices for matched set of <i>books and CDs</i> sold through conventional and Internet outlets from 1998-1999	<i>Substantial</i> price dispersion online (average price differences of 25-33%)

2.5 Summary and Areas for Future Research

To date, empirical studies are mixed on the question of efficiency in Internet markets (see comparison table above). Both studies of menu costs suggest that menu costs are lower in Internet markets and the most recent test of price levels suggests that prices are lower online for books and CDs. In addition Goolsbee (2000) suggests that consumers are highly sensitive to

differences between conventional and Internet prices. At the same time, the three studies of price dispersion all find high degrees of price dispersion in Internet markets — a finding inconsistent with a strong efficiency view.

There are a variety of ways to extend the current research to gain a better understanding of the efficiency characteristics of Internet markets.

- **Analyzing efficiency in other Internet markets:** It is important to confirm the results in the aforementioned studies by measuring the efficiency of other product categories. This will be particularly important for emerging Internet markets for such diverse products and services as pet food, prescription drugs, and financial instruments and for sales outside the U.S.
- **Observing changes in efficiency over time:** It is also interesting to analyze the behavior of Internet markets over time as markets mature through entry and customer acceptance. This will be important for both relatively mature Internet markets (e.g., books, CDs, hardware, software, and airline tickets) and emerging markets such as those discussed in the previous paragraph. Nascent markets, in particular, may provide an opportunity to observe pricing changes as markets mature over time.
- **Differences in search behavior for more expensive items:** One could also test whether Internet price dispersion varies with product cost. Consumers may be more inclined to search aggressively for the best price on expensive items such as cars than they are for low price items such as books and CDs. (Note that Pratt, Wise, and Zeckhauser (1979) found the opposite to be true in conventional markets for a variety of standardized goods).
- **Price elasticity in differentiated goods markets:** We noted above that electronic markets for differentiated goods may have lower price elasticity than comparable conventional markets for two reasons: “missing information” in the product evaluation, and the ability to find goods that better fit a consumers preferences. The methodology used by Lynch and Ariely (2000) may provide an interesting way to isolate these two effects and better understand how the observed price elasticity results relate to market efficiency.
- **Consumer price search behavior:** One interesting anomaly in results mentioned previously is that Internet consumers appear to be highly sensitive to prices in conventional outlets (Goolsbee 2000) and yet the price dispersion statistics suggest that consumers may not be as sensitive to price differences between Internet retailers. It would be interesting to explore this issue in more detail to understand how aggressively consumers compare prices in online markets.

3. Sources of Price Dispersion in Electronic Markets

While research to date on price levels, price elasticity, and menu costs are consistent with the hypothesis that the Internet has served to increase market efficiency, the existence of significant price dispersion in Internet markets and its persistence over time raise interesting questions for the future of competition in electronic markets. In this section we discuss several potential sources of price dispersion in electronic markets. In each case we discuss why the particular factor might be important on the Internet, review the relevant literature, and identify potential areas for future research.

3.1 Product Heterogeneity: The Value of Unmeasured Features

The first, and most obvious, source of price dispersion online is product heterogeneity. If the products being compared are different in some way, then it should not be surprising if their prices are also different. One can take this a step further and note that even when the products are physically identical, they are not always good substitutes. For instance, they may be available in different locations or time periods — a bottle of wine in a supermarket is not a perfect substitute for the identical vintage in a fine restaurant. It is easy to extend this kind of argument to goods that are accompanied by different levels of customer service, advertising or even customer awareness. However, rather than take this line of reasoning to its logical conclusion, it typically makes more sense to George Stigler's advice that "it would be metaphysical, and fruitless, to assert that all dispersion is due to heterogeneity" (Stigler 1961, p. 214). For most purposes, a reasonable approach is to consider product heterogeneity as relating only to the tangible or essential characteristics of the product. These characteristics include differences in the product's physical characteristics or differences in retailer services that must be consumed with the product (e.g., return policies). We discuss other sources of heterogeneity in subsequent sections.

It is possible to control for this type of product heterogeneity using hedonic regressions (see for example Chow 1967, Griliches 1961). Hedonic regression models assume that products can be modeled as (heterogeneous) bundles of (homogeneous) characteristics. In the regression of product prices onto product characteristics, the coefficients on the product characteristics can be interpreted as shadow prices of that characteristic. The shadow prices reveal how much the market values the particular characteristic. For instance the price of a computer can be expressed

as a function of its memory, microprocessor, disk storage and other components (e.g., Dulberger 1989, Gordon 1989).

It is important to note, however, that while product differentiation is an important potential source of price dispersion, it does not seem to explain the price dispersion discussed in section 2.4. Clemons, Hann, and Hitt (1998) use hedonic regressions to control for several sources of heterogeneity in the airline tickets they observe: arrival and departure times, number of connections, and Saturday night stays. Even after controlling for these sources of price dispersion the authors find price dispersion of up to 20%.

Similarly, Brynjolfsson and Smith (2000) find little evidence that the most obvious types of heterogeneity can explain the price dispersion they find. First, they deliberately selected products — books and CDs — which can be perfectly matched across retailers. A book with a given ISBN number will be identical down to the commas, regardless of where it is purchased. Furthermore, they then used hedonic regressions of book and CD prices onto several retailer service characteristics. The authors find that the coefficients on the primary service characteristics “either do not vary significantly across retailers or are negatively correlated with price” (p. 22). The authors suggest that these findings could be due to other unobserved retailer-specific factors such as brand, trust, and awareness. These factors are discussed in more detail below.

3.2 Convenience and Shopping Experience: The Value of Time

Shopping convenience may also provide a source of price dispersion in online markets. Retailers who make it easier to find and evaluate products may be able to charge a price premium to time sensitive consumers. Sources of convenience may include better search tools, general suggestion tools, extensive product reviews, product samples (e.g., book chapters and CD audio clips), and faster checkout services.

It is important to note that several of the factors mentioned above are purely informational. Product information used to evaluate homogeneous goods is typically separable from the physical product. In and of itself, providing better information on a homogeneous good should not provide a retailer with strategic advantage. It is possible, however, that product information is a useful strategic tool because of substantial search costs or switching costs in Internet

markets.⁴ Customers may be drawn to a site because of its outstanding product information and then choose to purchase from that site because of the high search costs to find the good (at a potentially lower price) at another site.

Offering a compelling shopping experience may also effect competition in Internet markets (Novak, Hoffman, and Yung 1998). Several recent papers explore how web design may influence consumer purchase behavior. Mandel and Johnson (1998) show that background wallpaper can influence the importance of product attributes and consumer choices in online environments. Similarly, Menon and Kahn (1997) show that Internet shopping behavior is influenced by the characteristics of products encountered early in a shopping experience. Specifically, highly novel products lead to less exploration, lower response to promotional incentives, and fewer purchases of other novel products during the rest of the shopping experience.

3.3 Awareness: The Value of Neural Real Estate

The three critical success factors for conventional retailers are sometimes said to be location, location, and location. Geography largely determines the set of potential customers that know of a store and that make purchases there. Many Internet retailers aggressively purchase premium locations on Internet “portals” and spend hundreds of millions of dollars on advertising through online, print and traditional broadcast media. This suggests that customer awareness, or “neural real estate,” may be just as important in online markets as physical real estate is in conventional markets.

The importance of awareness can be traced to the high search costs to locate retailers in Internet markets. These search cost result from the sheer volume of information available. At times, searching for retailers online takes the form of the proverbial search for a “needle in a haystack.” Thus, while some retailers such as Amazon.com have used strategic marketing and large advertising budgets to develop high brand awareness, it can be difficult to locate other, more obscure, retailers among the millions of Internet sites available online.⁵ The heterogeneity in

⁴ Brynjolfsson and Smith (1999) note that product information may also serve as a signal of trust and reliability in online markets.

⁵ To illustrate this, note that the book retailer section in Yahoo lists 6,219 unique sites. Likewise, searching for online bookstores at Altavista returns 5,173,884 possibly relevant web pages.

retailer awareness is, in part, reflected by a recent Xerox study that found that just 5% of the websites online receive nearly 75% of the hits (Adamic and Huberman 1999).

Economists have long recognized the effect of asymmetrically informed consumers on pricing behavior. Salop and Stiglitz (1977) and Varian (1980) consider markets where some consumers are aware of all prices in the market while other consumers are aware of the price at only one retailer. Informed customers purchase from the store with the lowest price while uninformed customers purchase if the price they are aware of is lower than their reservation value. The result is that retailers randomize over prices: some retailers always charge a low price while others always charge a high price (Salop and Stiglitz 1977) or retailers occasionally have sales, where they charge a low price on selected items (Varian 1980).

Greenwald and Kephart (1999) apply these models to an Internet setting with analogous results in pricing behavior. The authors suppose that some consumers have access to price search intermediaries, or shopbots, while others do not. Consumers with access to the search intermediaries purchase at the lowest price, while consumers who do not have access to intermediaries purchase if the price they are aware of is lower than their reservation value. We note that this behavior is consistent with Brynjolfsson and Smith (2000) who observe that retailers with strong customer awareness, such as Amazon.com and CDnow, are able to charge prices that are 7-12% higher than lesser known retailers such as Books.com and CD Universe.

3.4 Retailer Branding and Trust

It is natural to assume, with Greenwald and Kephart, that shoppers who use price intermediaries will purchase from the retailer with the lowest price. However, conversations with shopbot executives reveal that this is not always the case. These executives observe that some of their visitors regularly buy from branded retailers such as Amazon.com, even when these retailers do not have the lowest price. This suggests that other factors, such as trust, may play an important role in Internet markets.

Trust may take on a heightened importance in electronic markets because of the spatial and temporal separation between buyers and sellers imposed by the medium (Brynjolfsson and Smith 2000). An Internet transaction does not typically involve the simultaneous exchange of money

and goods, but instead they are typically transmitted from different locations and different times. When selecting a retailer, a consumer must beware that the other party is an expert at attracting traffic and in cashing credit cards, but not in actually delivering the goods. Consumers may be willing to pay a premium to purchase a product from a retailer who they trust in favor of an unknown retailer. Thus, heterogeneity in retailer trust may lead to price dispersion in online markets.

Recent studies suggest that there are a variety of ways retailers may be able to signal trust in an online world:

- **Online communities:** The robust online communities housed at retailers' sites may provide a signal of trust. Likewise, reputation systems used in online communities can signal the trustworthiness of other members of the community (Kollock 1999).
- **Links from other trusted sites:** Trust may be signaled through links from trusted individuals (e.g., associate programs) or links from respected sites (e.g., Barnes and Noble's link from the online version of the New York Times book review) (Brynjolfsson and Smith 2000).
- **Unbiased product information:** Urban, Sultan, and Qualls (1998) use customer feedback data from an online environment called "Truck Town" to demonstrate that unbiased recommendation services may enhance a retailer's trust evaluation among consumers.
- **Existing conventional world brand name:** Having a conventional world brand name may signal trust and soften price competition. Shankar, Rangaswamy, and Pustateri (1998) use survey data to show that prior positive experience with a brand in the physical world can decrease price sensitivity online. Brynjolfsson and Smith (2000) show that retailers with established conventional-world brand names are able to charge a price premium of 8-9% over prices at pure-play Internet retailers.

The role of trust in both Internet and conventional marketing and the cues that help to build trust are explored in more detail by Urban, Sultan, and Qualls (1998).

3.5 Lock-in

Retailers may also be able to charge a price premium by leveraging customers' switching costs. Loyalty programs, long used by airlines, may also prove effective for online shoppers. Varian (1999) discusses various loyalty programs in existing Internet markets.

There may also be other, more subtle, sources of switching costs on the Internet. For example, switching costs may be created through familiarity with a retailer's site. Given the differences in interface design among Internet retailers, a customer who was familiar with an Internet retailer's interface well may face a switching cost when shopping at a new retailer whose interface is unfamiliar. Similarly, customization features may introduce switching costs. A customer who had a "one-click" ordering account at a particular retailer may face switching costs when deciding whether to shop somewhere else.

Collaborative filtering tools may be another form of building switching costs. Collaborative filtering tools compare a customer's purchase patterns of other like-minded customers to develop personalized recommendations based on a customer's inferred tastes (Shardanand and Maes, 1995). Unlike most information used to evaluate homogeneous goods, personalized recommendations are specific to the customer and become more accurate as the customer interacts more with the system. Thus, under the current retailer-owned systems, customers may face a switching cost equal to the decline in the value of the recommendations when switching to another retailer. If the data on a customer's tastes were owned by the customer and were portable from site to site, switching costs would be commensurately lower.⁶

3.6 Price Discrimination

The sources of price dispersion discussed above deal with differences in prices across retailers. Price dispersion may also arise when a single retailer charges different prices based on a consumer's willingness to pay. These price discrimination strategies may take on heightened importance in Internet markets for two reasons. First, while the Internet allows consumers to easily collect retailer information about prices, the same characteristics allow retailers to gather better information about consumer characteristics (Bakos 1998). Second, low menu costs may make it more cost effective for retailers to dynamically change prices online. The net result is that prices on the Internet need not gravitate to a single value across retailers, time, or customers.⁷

⁶ Proposals such as the Platform for Privacy Preference (<http://www.w3.org/P3P/>) would facilitate such portability.

⁷ Odlyzko (1996) provides an interesting account of many examples of retailers using multiple prices to price discriminate and argues that this may be quite common on the Internet.

There are a variety of ways for Internet retailers to price discriminate among consumers. One is to leverage the fact that price sensitive consumers tend to have a lower value of time than other consumers do. In this situation retailers can create a menu of “prices” and “convenience levels” so that consumers self-select the price corresponding to their willingness to pay (Chiang and Spatt 1982). To obtain a low price a consumer must use an inconvenient or time-consuming process compared to higher prices, which can be obtained in a less time-consuming fashion. Below, we identify three ways Internet retailers may be using “convenience” as a price discrimination technique.⁸

First, retailers may be able to establish separate “storefront” interfaces differentiated by their level of convenience. This is the strategy identified by Clemons, Hann, and Hitt (1998) in the Internet online travel agent market. The authors observe that the lowest priced and the highest priced online travel agents in their study were both owned by the same parent company. More interestingly, the lowest priced agent had a user interface that was very difficult to use while the high priced agent had a “state-of-the-art,” user-friendly interface. They conclude that “the difficulty in using [the lower priced travel agent’s] user interface serves as a screen to prevent the time sensitive-travelers from exercising personal arbitrage” (p. 25) and thus facilitates price discrimination.

Price matching policies — which at first appear to be evidence of strong competition — may provide a second price discrimination technique for Internet retailers.⁹ The price matching system at online retailer Books.com may be an example of such a system. Books.com advertises that it will beat the best price available from the “big 3” Internet book retailers: Amazon.com, Barnes & Noble, and Borders. Figures 1 and 2 in Appendix A show screen shots from such a sequence. In the Figure A.1, Books.com displays a price of \$16.72 for John Grisham’s book “The Testament.” Next to this price is a button labeled “Price Compare.” If a consumer presses this button, Books.com automatically queries the prices for Amazon.com, Barnes and Noble, and Borders. If Books.com already has the lowest price (which is usually the case), its price remains the same. If it does not have the lowest price, Books.com automatically sets its price to beat the best price offered by its three major competitors. This is displayed in Figure A.2 where the new

⁸ Shapiro and Varian (1998) review a variety of other techniques that sellers of information goods use to facilitate price discrimination.

lower price of \$13.65 is displayed. Similar features are appearing in other markets, e.g. by electronics retailer NECX.

While this sequence may at first seem to be evidence of strong price competition in Internet channels, three factors suggest that it is more consistent with Books.com using consumer heterogeneity to price discriminate. First, the price change is not permanent — the lower price is only offered if a consumer asks for it (by pressing the appropriate buttons as above). Second, the lower price is only in effect for the individual transaction — if the consumer comes back later, they must again request the lower price. And third, the process is time consuming (taking up to a minute to complete). A recent sample of 20 books suggests that the expected value to an online consumer from pressing this button is only \$0.15. One might suppose that only price-sensitive consumers would be willing to wait up to 1 minute for an expected \$0.15 payoff.¹⁰

Online auctions may provide a third example of using convenience to sort consumers by their willingness to pay. Figure A.3 displays a screen from an auction conducted by online retailer Shopping.com.¹¹ Shopping.com auctions several goods that are also available for purchase at Shopping.com's "everyday low price." In Figure A.3, Shopping.com is auctioning a Palm V organizer. The winning auction bid is \$323 while the regular Shopping.com store price is \$333.99 — a difference of less than \$11. As above, at first glance it appears that Shopping.com is willingly undercutting its own price on this particular good. However, auction shoppers must be willing to wait for the auction to close, accept the uncertainty associated with the auction's outcome, and incur the time necessary to place bids and monitor the progress of the auction.¹² Thus, Shopping.com may also be using a consumer's willingness to participate in the auction as a credible signal of high price sensitivity.

Just as the Internet has provided powerful new tools for consumers in their quest to compare competing retailers and obtain the best possible price, it has also provided a new array of tools for retailers seeking to market to very small groups of customers, in some cases including

⁹ See Corts (1996) for a general model of how price matching policies can be used as price discrimination tools.

¹⁰ We note that academics also seem prone to push this button independent of price-sensitivity considerations.

¹¹ Similar auctions are conducted by other Internet retailers such as Electronics.net, CompUSA, Nordic Track, Outpost.com, and zones.com.

¹² See Easley and Tenorio (1999) for a model of the effect uncertainty and consumer time have on auction bidding behavior.

segments of less than one,¹³ and to dynamically adjust those prices. The end result of this “arms race” may, in some cases, be a reduced reliance on a single one-size-fits-all pricing scheme. As shown by Varian (1985), such price discrimination is often efficiency enhancing because it may enable consumers with low valuations to get access to the good even if they would have been priced out of the market under a single price scheme.

Table 3: Some Research Findings Relating to Sources of Price Dispersion

<i>Study</i>	<i>Summary</i>
<i>Convenience and Shopping Experience</i>	
Mandel and Johnson (1998)	Web page design can effect the importance of product attributes and consumer buying behavior.
Menon and Kahn (1997)	The characteristics of products encountered early in a shopping experience influences subsequent purchases made during the same visit.
Novak, Hoffman, and Yung (1998)	Discuss the <i>flow construct</i> as a way to measure the elements of a “compelling consumer experience online.” Present quantitative techniques to measure the <i>flow construct</i> in online environments.
<i>Awareness</i>	
Adamic and Huberman (1999)	Use log files from AOL to show that web site popularity is highly concentrated among a few sites online. Propose a model that explains this behavior based on network effects and brand loyalty.
Greenwald and Kephart (1999)	Develop a simulation model similar to Varian (1980) to show that in the presence of asymmetrically informed consumers, retailers will randomize over prices.
Ogus, de la Maza, Yuret (1999)	Use a simulation model to show that the presence of both network effects and brand loyalty can explain high concentration in Internet markets.
<i>Retailer Branding and Trust</i>	
Kollock (1999)	Discusses the importance of “community” in facilitating the smooth operation of Internet auction markets such as eBay
Shankar, Venkatesh, and Rangaswamy (1998)	Use survey data for travelers to show that prior positive experience with a brand in the physical world can decrease price sensitivity online.
Urban, Sultan, Qualls (1998)	Argue that online retailers can build trust among consumers by providing accurate information and unbiased advice. Validate these claims using an online environment for evaluating light trucks for consumer purchase.
<i>Price Discrimination</i>	
Clemons, Hann, and Hitt (1998)	Argue that the site characteristics of two online travel agents owned by the same company may be evidence of the use of a price discrimination strategy by the travel company.
Odlyzko (1996)	Presents many examples of retailers using multiple prices to price discriminate. Argues that price discrimination may be common on the Internet.

¹³ A single individual may choose to have multiple personae: the books recommended when a professor shops to keep up on research may be quite different from those read for entertainment and the same web store can distinguish and serve both sets of preferences if so informed.

3.7 Summary and Areas for Future Research

A better understanding of the sources of price dispersion online may assist consumers, regulators, and marketers in evaluating Internet markets. Several potential sources of price dispersion are outlined above. Future research should focus on verifying and extending this list, measuring the degree of importance of each item, and analyzing changes in these sources of dispersion over time. Several potential topics are mentioned below:

- **Welfare effects of Internet price discrimination:** More research is needed into how flexible pricing systems develop online and how they are used as price discrimination tools. The two examples mentioned above represent early price discrimination models. More sophisticated systems are likely to appear over time. It would be interesting to better understand the welfare effects of these systems. With respect to welfare analysis, Varian (1985) demonstrates that a necessary condition for third degree price discrimination to be welfare enhancing is that it increases market output. A natural question, then, is how do these systems effect market participation on the Internet.
- **Product information and retailer strategies:** We noted above that providing superior product information might be used to signal trust and reliability or to provide shopping convenience. Zettlemyer (1996) notes that the incentives to provide product information are interdependent with the retailer's conventional strategy and with the reach of the electronic channel. It would be interesting to empirically analyze this theory by tracking differences in the information provided by pure-play Internet retailers and retailers who operate conventional outlets or by tracking how these strategies change with the increasing penetration of the Internet.
- **The importance of convenience in web page design:** As noted above, convenience and the customer experience are both important sources of differentiation in online environments. However, to an extent, they are in opposition to one another. More complex web pages may increase customer download time and detract from the retailer's overall convenience. Delleart and Kahn (1999) find that slower web pages can (but do not necessarily) lead to lower web page evaluations by consumers. It would be interesting to explore the interplay between these two design strategies.
- **Importance of trust and awareness in online markets:** Ogus, de la Maza, Yuret (1999) use simulation models to show that the combination of brand loyalty and network effects produce highly concentrated "winner-take-all" Internet markets. Interestingly, including either of the effects separately does not produce highly concentrated markets in their simulation. It would be interesting verify their findings using an empirical analysis of Internet markets. It may even be possible to use online experiments to isolate the importance of each factor separately.

- **Changes in price dispersion over time:** It may also be possible to analyze how the importance of factors such as trust and awareness changes over time. Ward and Lee (1999) argue that as consumers become more experienced with the Internet they will rely less on brands in their shopping decisions. Likewise, the development of more efficient and well-known price intermediaries may decrease the importance of awareness as a source of price dispersion (Bakos 1998).

4. Developments to Watch

The research examining early digital markets not only provides an insight into what has occurred, but gives an indication of what the future might hold. There are a number of research issues that have been raised beyond the investigations of friction and price dispersion in electronic markets. While these issues often build on prior work, they address broader and more complex issues related to economics, business strategy, and public policy. This section explores four research issues likely to be among the most important developments to watch in the years ahead.

4.1 Marketing Channels

The first wave of Internet retailers developed a new channel to communicate with their consumers, challenging the more traditional marketing channels of retail stores, catalog sales, and home shopping. This new Internet channel of business-to-consumer interaction was pioneered by pure-play Internet companies such as Amazon.com. The companies with an existing channel watched as the newcomers experimented with this new medium. Once it was known that consumers (and, more particularly, Wall Street) valued Internet retailers, the second wave of Internet retailers includes companies with an existing marketing channel complemented by an Internet channel. This list of retailers includes such industry heavyweights such as Barnes and Noble, Macy's and Compaq.

While pure-play Internet retailers continued to grow their brand equity and gain market share, the Internet retailers with more than one channel began to address some of their channel conflicts. Channel conflict occurs when a company's Internet channel becomes a competitor for its physical channel. For example, Barnes and Noble was able to let stores in different geographic locations choose prices for many of their titles. With an Internet channel that is available to consumers worldwide, it is impossible to have a single price consistent with each

and every geographical area when the price changes by geography.¹⁴ Furthermore, companies such as Barnes and Noble are very cautious to separate their Internet and traditional channel because they do not want to be taxed for their Internet channel because of their traditional channel retail locations.¹⁵

It is unlikely that the channel conflicts of today will last forever. Given that digital markets will mature, Internet retailers will either manage their channels simultaneously or they will reduce the number of channels. Some retailers, such as Egghead, are already abandoning their physical assets and relying solely on their electronic channel. At the same time, some retailers who made a foray into Internet commerce using Marketplace MCI abandoned their electronic channel. Meanwhile, other retailers are finding ways to use their physical assets to gain a competitive advantage in the electronic channel. Borders.com, for example, allows its Internet customers to return products to Border's physical outlets. For this reason, it is unlikely that all markets and all retailers will choose the same course of action. Rather, different business models will evolve depending upon market- and firm-level characteristics. Future research can help determine how channel conflict issues will be resolved.

One mechanism to resolve channel conflicts from Internet retailers with more than one channel can involve the introduction of auction markets. For example, hotels and airlines can keep their current sales model in place but then sell their excess capacity through an electronic channel via auction. The electronic channel then has an associated price uncertainty so that it is not selling exactly the same product as the physical channel. Through this differentiation, consumers see the products as less direct substitutes. Increasingly, we may see goods sequentially or even simultaneously available for fixed prices, dynamically updated prices, auction prices and negotiated prices. Another way to use auctions is during the early stage introduction of a product. Since demand curves are generally unknown for new products, using an electronic auction channel can help firms determine the potential demand for their product and provide consumer feedback in a timely fashion.

¹⁴ Furthermore, it can be difficult to reliably ascertain the geographic location from which a customer contacts an Internet site, undermining attempts to have web pages customized on this basis.

¹⁵ Applicable sales taxes (or "use taxes") must be collected by retailers with physical "nexus" in the taxing jurisdiction. BarnesandNoble.com is considered a separate legal entity from its progenitor, which owns the physical stores.

4.2 Intermediation, Disintermediation, and Reintermediation.

The shifting roles of intermediaries in electronic markets often lead to changes in the value chain. In a market with friction, intermediation in the value chain may reduce this friction because the intermediaries can specialize in some market roles (Bailey 1998a). For example, distribution of information by an author to all readers may be too costly. Rather, the author can rely on a publisher to disseminate this information at lower costs, thereby reducing market friction, because the publisher can specialize in the roles of printing and distribution. With the advent of the Internet, some argue that disintermediation, the removal of intermediaries from the value chain, will occur (Gellman, 1996; Hoffman 1995). In the publishing example, it is clear that the printing and distribution roles of the publisher may no longer be needed once the medium becomes electronic. However, intermediaries will not necessarily be totally removed. Rather, reintermediation will occur whereby intermediaries take on new roles to provide value in ways different than the traditional intermediaries. In the publishing example, a new intermediary can help provide editorial comments to the author and help market the information. Two intermediary roles where there is growing interest include trust and search.

While trusted relationships continue to be an important part of conducting commerce on the Internet with known retailers, competition among retailers is made more fluid once consumers can costlessly switch from one retailer to the next. To this end, the trusted third parties are intermediaries who will certify the trustworthiness of an Internet retailer. The trusted third party reintermediation process has already started with companies such as TRUSTe and BBB Online. These two companies will verify the privacy policy of different Internet retailers to help protect consumer privacy. Consumers are more likely to trust a retailer if they show the TRUSTe or BBB Online logo on the retailer's web site (*The Industry Standard* 1999). While this is only an initial step in using intermediaries to help promote trust, the brand equity that TRUSTe, BBB Online, and other such sites are building during Internet commerce's growth period will put them in a better position to offer new trust service in the future.

While search costs are likely to decrease with digital markets, consumers may be left with an information overload problem that compels them to use a search intermediary. For example, an Internet search engine can find all documents with the phrase "digital economy" so that a document, such as this paper, is only one click away. Of course, search engines will also turn up

thousands of other web pages related to the “digital economy” that are also one click away. Since it takes a person time to filter through all of these matches, which is costly to do, it might be cheaper to use an intermediary. One example of this type of intermediary is an “infomediary,” a concept introduced by Hagel and Singer (1999).

When applied to digital markets, infomediaries can help consumers find products that best match their individual preferences. DealPilot.com allows consumers to search for the best deals on books, CDs, and videos from more than 100 different Internet retailers. Consumers enter the product (or products) they are interested in and are presented with prices and delivery times from online retailers (Figure A.4). Similar systems are available for computer hardware (pricewatch.com), golf clubs (jango.excite.com), and bank certificates of deposit (bankrate.com). For more complex products, second generation intermediaries (e.g., frictionless.com) rate products based on how well they correspond to the preferences entered by individual customers. By focusing competition on product features —not just price — these tools may soften price competition in online markets (Lynch and Ariely 2000).

4.3 Logistics and Supply Chain Management

Even though the most visible developments in digital markets recently has been in business-to-consumer (B2C) markets, the biggest economic changes are likely to be in the business-to-business (B2B) part of the value chain. B2B electronic commerce has been around longer than B2C commerce with the introduction of technologies such as electronic data interchange (EDI). However, now that the B2C part of the value chain is becoming digital, it is increasingly easy to integrate the whole value chain so that consumers become an important player in all steps of value creation. The most immediate impact of this change will be in logistics and supply chain management.

Logistics and supply chain management practices are changing to include consumers in the value chain. Traditional logistics issues address the moving of physical items along the value chain so that a product is available at a retailer when a consumer wants to purchase it. Supply chain management incorporates logistics, but examines how information can be used to change how and when products are moved to increase efficiency. Furthermore, by exchanging richer and more timely information between trading partners, they can avoid the double marginalization

problem of sub-optimizing the supply chain.¹⁶ However, both logistics and supply chain management practices often fall short of incorporating the B2C link.

With the B2C link becoming electronic, consumers are able to give information beyond the retailer they transact with and send this information deeper in the value chain. This can affect product offerings such as cars. Ford and many other automobile companies are starting to use the Internet to share information about product offerings that are still years away from the dealer showroom. By soliciting information from the consumer, Ford can now change the design of a product before it becomes too costly to do so.

4.4 Information Markets

The ability of the Internet to deliver a good, and not just create a transaction that requires fulfillment via some other channel, may be the most important development to watch. Information goods have unique properties including marginal reproduction costs that are close to, if not exactly, zero. Therefore, the pricing strategies must change as well to reflect the new economics. For instance, some of the financial information is freely made available on the web today by companies like Etrade was sold through proprietary networks for hundreds of dollars per month just a few years ago. Software, another information good, is also enjoying a new economic model of “open source” where the source code that comprises the good is made freely available to use and improve on the design.

Information goods may be most affected by integrating consumers in the value chain. Instead of an information product being created ex ante for consumers to purchase, information products can be dynamically rendered based upon the wishes of the consumer. Not only will this help Internet retailers price discriminate as discussed earlier, it can also help change the number of product offerings to an almost infinite set of products. While there may be mass customization of physical products once the consumer is included in the value chain, information products can be personalized to individual consumers at almost no additional cost.

Digital information goods also raise interesting pricing opportunities. Clearly the traditional rules of thumb such as “price equal to marginal cost” or using a standard markup over cost are not

¹⁶ For a discussion of the double marginalization problem, see Milgrom and Roberts (1992), p. 550.

very useful in this environment. Instead, value-oriented pricing strategies are likely to be more effective (Varian, 1995, 1997). At the same time, the special characteristics of digital goods combined with the Internet open up new opportunities including disaggregation of previously aggregated content such as newspaper or journal articles and/or massive aggregation items, such those sold by America Online (Bakos and Brynjolfsson 1999a, 1999b).

Finally, there are a variety of important policy questions relating to the sale of information goods. Since digital markets do not rely on physical presence, the jurisdictional issues become very difficult to sort out. When a digital market transaction relies on a physical channel for order fulfillment, jurisdiction does not necessarily have to be resolved on the Internet since it can be resolved in the physical channel. However, information goods that are delivered via the electronic channel do not rely on a physical distribution channel so there may not be a way to resolve jurisdiction. This can become a policy maker's headache if they are trying to prevent fraudulent business activity on the Internet or they are trying to impose taxes or regulations based on jurisdiction.

5. Conclusions

The stakes of the emerging digital economy are very large, yet of necessity, most business decisions have not been able to draw on a significant research foundation in this area. While intuition, trial and error, and venture capital can sometimes substitute for genuine understanding, few areas, if any, could benefit more from well-designed research. In particular, the synergies between rigor and relevance, academia and business, theory and practice, are exceptionally great. The emerging digital economy, with its set of vanishing costs and increasingly universal reach, constitutes an grand experiment which will put many of our theories about what happens at “zero” and “infinity” to the test. At the same time, the managers who best understand the changes taking place will be in the best position to shape those changes. In chaos lies opportunity.

In the coming years, electronic markets may dramatically change the way products are bought and sold. Early research suggests that electronic markets are more efficient than conventional markets with respect to price levels, menu costs, and price elasticity. At the same time, several

studies find significant price dispersion in Internet markets. This price dispersion may be explained by heterogeneity in retailer-specific factors such as branding and trust, retailer efforts to build consumer lock-in, and various retailer price discrimination strategies.

However, at this early stage of an emerging revolution in technology and business, important questions remain in the analysis of electronic markets. How will the development of infomediaries and shopbots effect competition on the Internet? Will the importance of brand decrease with the development of third party rating sites? Will established retailer be able to leverage existing their physical assets when competing with pure-play Internet sites? How will the structure of firms adapt to the new digital economy? Questions such as these deserve more attention and this exploration promises to make the Internet a fertile ground for research and experimentation for years to come.

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Appendix A: Internet Retailer Web Page Examples

Figure A.1: Books.com Price Before Price Comparison

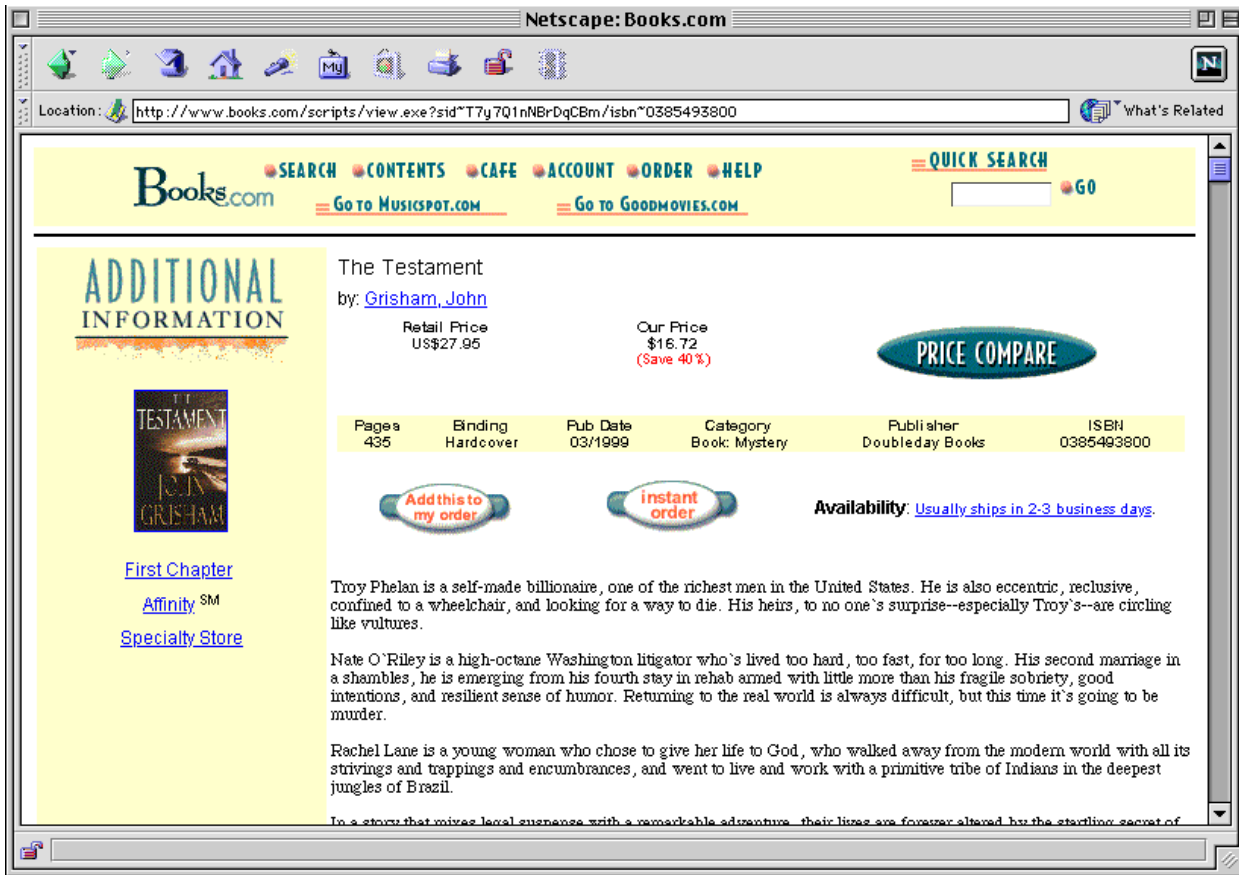


Figure A.2: Books.com Price After Price Comparison

The screenshot shows a Netscape browser window with the address bar containing the URL: `http://www.books.com/scripts/view.exe?sid*T7y7Q1nNBrDqCBm/isbn*0385493800`. The page header includes navigation links: SEARCH, CONTENTS, CAFE, ACCOUNT, ORDER, HELP, and a QUICK SEARCH box. Below the header, the book title "The Testament" by Grisham, John is displayed. A table compares the current price to retail and other retailers:

Retail Price	Our New Price	Amazon	B&N	Borders
US\$27.95	\$13.65 (Save 51%)	\$13.98	\$13.97	\$13.98

Below the table, a table provides book details:

Pages	Binding	Pub Date	Category	Publisher	ISBN
436	Hardcover	03/1999	Book: Mystery	Doubleday Books	0385493800

Buttons for "Add this to my order" and "instant order" are visible, along with an availability note: "Availability: Usually ships in 2-3 business days." The page also includes a synopsis of the book and links for "First Chapter", "Affinity SM", and "Specialty Store".

Figure A.3: Auction price versus regular Shopping.com price for Palm V Organizer

Netscape: Shopping.com, Top Brands Auction

Location: <http://www.shopping.com/store/auction/item.asp?r=UDCTCYSYL&ID=%2FLiveExchange%3Fs%3Dd644aa3982bbf67ebb%26t%3D18> What's Related

AltaVista Connections [AltaVista.com](#) [Shopping.com](#) [Zip2.com](#)

Shopping.com
an AltaVista® company

The Ultra Satisfying Place to Shop, **125% Guaranteed.**


Site Wide Search: [Advanced Search](#) [Search Help](#)

Home Page Computers & Office Books, Music & Movies Home Electronics Toys & Baby Home Improvement Sports & Fitness Gifts & Home **Auction!**

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Maximum Bid	Quantity	Time Remaining	Bidder
\$322.00	1	1 day, 9 hr, 23 min.	LordSchaut
\$322.00	1	1 day, 9 hr, 23 min.	rdd

Figure A.4: DealPilot.com Price Comparison Table

Netscape: DealPilot.com, the Ultimate Comparison Shopping Engine: Price Comparison Results

Location: http://dealpilot5.dealpilot.com/dealpilotbin/nph-dealpilot8.cgi?type=1&aces_item=1558513027&list_price=39.95&idcode=8216968 What's Related

Click on one offer (1st column) to proceed to the respective shop!

Displaying Top Ten offers:

Total Price	Shop	Item Price	Discount	US Sales Tax	Shipping Costs	Shipping Time	Shipping Service	Delivery Time
US\$ 32.06	Kingbooks.com, USA, WA	US\$ 29.56	26%	US\$ 0.00	US\$ 2.50	14 days	USPS Book Rate	16 days
US\$ 33.51	Kingbooks.com, USA, WA	US\$ 29.56	26%	US\$ 0.00	US\$ 3.95	3-7 days	Standard Shipping	5-9 days
US\$ 35.96	1Bookstreet.com, USA, CA	US\$ 35.96	10%	US\$ 0.00	US\$ 0.00	3-14 days	USPS Parcel Post	6-21 days
US\$ 37.19	barnesandnoble.com, USA, NJ/NY/VA	US\$ 31.96	20%	US\$ 1.28	US\$ 3.95	3-6 days	U.S. Postal Service	5-9 days
US\$ 37.51	Kingbooks.com, USA, WA	US\$ 29.56	26%	US\$ 0.00	US\$ 7.95	2 days	2nd Day Air	4 days
US\$ 41.19	barnesandnoble.com, USA, NJ/NY/VA	US\$ 31.96	20%	US\$ 1.28	US\$ 7.95	2-3 days	FedEx Second Day	4-6 days
US\$ 41.91	1Bookstreet.com, USA, CA	US\$ 35.96	10%	US\$ 0.00	US\$ 5.95	4-6 days	UPS Ground	7-13 days
US\$ 42.91	1Bookstreet.com, USA, CA	US\$ 35.96	10%	US\$ 0.00	US\$ 6.95	2-3 days	Priority Mail	5-10 days
US\$ 43.75	Books.com, USA, OH	US\$ 39.90	0%	US\$ 0.00	US\$ 3.85	14-42 days	USPS Book Rate	16-45 days
US\$ 43.85	Borders.com, USA, MI/TN	US\$ 39.95	0%	US\$ 0.00	US\$ 3.90	3-7 days	Standard	5-10 days

Displaying offers 11 - 44:

Total Price	Shop	Item Price	Discount	US Sales Tax	Shipping Costs	Shipping Time	Shipping Service	Delivery Time
US\$ 43.85	Shopping.com, USA, CA	US\$ 39.95	0%	US\$ 0.00	US\$ 3.90	3-5 days	Economy	6-10 days
US\$ 43.85	Books.com, USA, OH	US\$ 39.90	0%	US\$ 0.00	US\$ 3.95	2-10 days	UPS	4-13 days
US\$ 43.90	Fatbrain.com, USA, CA	US\$ 39.95	0%	US\$ 0.00	US\$ 3.95	3-7 days	UPS Ground	6-11 days
US\$ 43.90	Amazon.com, USA, WA/NV	US\$ 39.95	0%	US\$ 0.00	US\$ 3.95	3-7 days	USPS Priority Mail	5-10 days

Appendix B: Annotated Bibliography of Selected Electronic Commerce Research Papers

1. Competition in Electronic Markets

1.1 Theoretical Analysis of Competition in Electronic Markets

Bakos, J. Yannis. 1997. Reducing Buyer Search Costs: Implications for Electronic Marketplaces. *Management Science*, Volume 43, Number 12, December.

Uses Salop's circle model to show that if electronic markets have lower search costs than conventional markets, prices in the electronic markets will be lower and more homogeneous.

Bakos, J. Yannis. 1998. "The Emerging Role of Electronic Marketplaces on the Internet." *Communications of the ACM*, 41(8):35-42, August.

Discusses the effect of the Internet on electronic markets. Hypothesizes that the Internet will (1) increase product offerings, (2) increase customization, (3) increase the ability of consumers to discover prices, and (4) increase the ability of retailers to discover information about consumers and price discriminate.

Odlyzko, Andrew. 1996. "The bumpy road of electronic commerce." in *WebNet 96 World Conference Web Soc. Proc.*; H. Maurer, ed., AACE, pp. 378-389.

Presents many examples of retailers using multiple prices to price discriminate. Argues that the characteristics of electronic markets may give retailers many opportunities to price discriminate.

Ogus, Ayla; de la Maza, Michael; Yuret, Deniz. 1999. "The Economics of Internet Companies." *Proceedings of Computing in Economics and Finance 1999*, Meetings of the Society for Computational Economics, June 24-26.

Use a simulation environment to show that the presence of *both* brand loyalty and network effects leads to highly concentrated Internet markets. The presence of either factor alone leads to significantly less concentrated markets.

Shaffer, Greg; Zettlemeyer, Florian. 1999. "The Internet as a Medium for Marketing Communications: Channel Conflict over the Provision of Information." Working Paper, June.

The authors model demonstrates that if the Internet allows manufacturers to provide technical/idiosyncratic information directly to customers (without having to use retailers as intermediaries), manufacturers will gain power in the channel. They conclude that the Internet "can potentially harm retailers even if it is not used as a direct sales channel."

Zettlemeyer, Florian. 1996. *The Strategic Use of Consumer Search Cost*, Ph.D. Thesis, Sloan School of Management, Massachusetts Institute of Technology, June.

Notes that the simple hypothesis that the Internet will lead to lower prices and more information ignores the fact that hybrid firm's maximize over conventional and Internet operations. With this factor included in the model, the author finds that the amount of information provided by Internet retailers is tied to the reach of the channel.

1.2 Empirical Studies of Competition in Electronic Markets

Adamic, Lada A.; Huberman, Bernardo A. 1999. "The Nature of Markets in the World Wide Web." Proceedings of *Computing in Economics and Finance 1999*, Meetings of the Society for Computational Economics, June 24-26.

Uses log files from AOL recording the number of visits to various web sites to show that hits to web sites are highly concentrated among a few sites. The authors suggest that this may be due to brand loyalty and network effects in Internet markets.

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.

Tests Internet market efficiency for books, software, and CDs using three statistics: price levels, price dispersion, and menu costs. Finds higher prices, more dispersion, and lower menu costs for Internet outlets. Uses data from 1996 (exploratory study) and 1997.

Brynjolfsson, Erik; Smith, Michael. 2000. "Frictionless Commerce? A Comparison of Internet and Conventional Retailers." *Management Science*, April.

Extension of Bailey (1998) analyzing Internet market efficiency for books and CDs. Finds lower prices, more dispersion, and lower menu costs for Internet outlets. Uses data from February 1998 through May 1999.

Clemons, Eric K.; Hann, Il-Horn; Hitt, Lorin M. 1998. "The Nature of Competition in Electronic Markets: An Empirical Investigation of Online Travel Agent Offerings." Working Paper, The Wharton School of the University of Pennsylvania, June.

Find high price dispersion in online markets for airline tickets: prices for tickets offered by online travel agents can vary by as much as 20%. Also find evidence of the use of separate storefronts with different "ease-of-use" to facilitate price discrimination by sorting customers by their value of time.

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.

Analyzes prices for online grocery sales and conventional grocery sales. The authors find that price sensitivity can be lower online than in conventional channels. This difference could be due to a lack of product information in the online channel, which would lead to higher brand loyalty (where brand is used by customers as a signal of quality).

Easley, Robert F.; Tenorio, Rafael. 1999. Proceedings of Computing in Economics and Finance 1999, Meetings of the Society for Computational Economics, June 24-26.

“Jump bidding” strategies (placing bids that are higher than the amount needed to win the auction) are regularly observed in Internet auctions. Jump bidding can be an equilibrium strategy if consumers face (1) positive costs associated with monitoring auctions and placing bids and (2) uncertainty in the auction’s outcome.

Goolsbee, Austan. 2000. “In A World Without Borders: The Impact of Taxes on Internet Commerce.” *Quarterly Journal of Economics*, Forthcoming.

Uses survey data from online shoppers to impute elasticity with respect to local sales tax rates. Finds that consumers in states with higher local taxes are more likely to purchase online (and thus presumably avoid paying local taxes) than consumers in states with lower local tax rates.

Lee, Ho Geun. 1997. Do Electronic Marketplaces Lower the Price of Goods. *Communications of the ACM*. Volume 41, Number 12 January.

Observes high prices in electronic markets for used cars than in conventional markets for used car markets in Japan. This could reflect the relative efficiency of the two channels or it could reflect product heterogeneity (cars sold through the electronic channel were newer in general than those sold through the conventional channel).

2. The Value of Information, Brand, and Trust in Electronic Markets

Kollock, Peter. 1999. “The Production of Trust in Online Markets.” to appear in *Advances in Group Processes* (Vol. 16), Lawler, Macy, Thyne, Walker eds. JAI Press, Greenwich CT.

The author discusses the role of community in conveying trust and facilitating the smooth operation of electronic markets. The discussion focuses on communities fostered by eBay and other electronic auctions.

Lynch, John G., Jr.; 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.

The authors use laboratory experiments to simulate the sale of wine through electronic channels. These experiments show that providing product information can soften price competition, increase customer loyalty, and increase customer satisfaction.

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.

The authors use survey data for travelers to show that prior positive experience with a brand in the physical world can decrease price sensitivity in online markets where it may be difficult to evaluate retailer quality.

Urban, Glen L.; Sultan, Fareena; Qualls, William. 1998. "Trust-based Marketing on the Internet." MIT Sloan School of Management Working Paper #4035-98.

Use a simulated community called "Truck-Town" to analyze the effect of "trusted advisors" on the operation of electronic markets. Argue that online retailers can build trust among consumers by providing accurate information and unbiased advice. Validate these claims using an online environment for evaluating light trucks for consumer purchase.

Ward, Michael R.; Lee, Michael J. 1999. "Internet Shopping, Consumer Search, and Product Branding. Working Paper, University of Illinois, April.

Observes that recent adopters of the Internet will rely more on brand in their shopping choices, but that this reliance will decrease over time as they gather more experience with the Internet.

3. The Value of Convenience and Web Content in Electronic Markets

Alba, Joseph, John Lynch, Barton Weitz, Chris Janiszewski, Richard Lutz, Alan Sawyer, and Stacy Wood (1997), "Interactive Home Shopping: Consumer, Retailer, and Manufacturer Incentives to Participate in Electronic Marketplaces," *Journal of Marketing*, 61 (July), 38-53.

Discusses the implications of electronic shopping for consumers and retailers. Technological advancements offer consumers unmatched opportunities to locate and compare product offerings. However, pure price competition may be mitigated by the ability to search for more differentiated products to better fit a customer's needs.

Dellaert, Benedict G. C.; Kahn, Barbara E. 1999. "How Tolerable is Delay? Consumers' Evaluations of Internet Web Sites after Waiting." Working Paper, CentER for Economic Research, Tilburg University.

Use experiments simulating consumer waiting time to show that "waiting can but does not always negatively affect evaluations of Web sites." Argues that the "negative effects of waiting can be neutralized by managing waiting experiences effectively."

Mandel, Naomi; Johnson, Eric. 1998. "Constructing Preferences Online: Can Web Pages Change What You Want?" Working Paper, University of Pennsylvania.

Site design characteristics, such as background wallpaper, can influence customer perceptions of product attributes. Consumer attribute weights and ultimately product choices can be influenced by web site design.

Menon, Satya; Kahn, Barbara E. 1997. "Cross-Category Effects of stimulation on the shopping experience: An application to Internet shopping." The Wharton School, University of Pennsylvania, Department of Marketing, Working Paper 97-006

The characteristics of products that are encountered early in a shopping visit influence shopping behavior during the rest of the trip. Consumers who encounter highly novel products early in their shopping trip will "engage in less arousing activities" during the rest of the shopping event (e.g., less exploration, fewer novel products, less response to promotional incentives, fewer unplanned purchases).

Novak, Thomas P.; Hoffman, Donna L.; Yung, Yiu-Fai. 1998. "Measuring the Flow Construct in Online Environments: A Structural Modeling Approach." Working Paper, May.

Systematize the *flow construct* as a way to measure what makes for a "compelling consumer experience" online and then test their theory using survey data. Show that their operationalization of the flow construct is a useful way to measure web content.

4. Bundling and Competition in Information Goods Markets

Bakos, Yannis; Brynjolfsson, Erik. 1997. "Aggregation and Disaggregation of Information Goods: Implications for Bundling, Site Licenses, and Micropayment Systems." In *Internet Publishing and Beyond: The Economics of Digital Information and Intellectual Property*, Hurley, Kahin, and Varian eds, MIT Press.

Examines where firms will find bundling/aggregation and disaggregation of products optimal. Lower marginal costs of production (e.g., digitized format) favors aggregation. Reductions in transaction and distribution costs (e.g., digital networks) favors disaggregation. Both costs must be taken into account.

Bakos, Yannis; Brynjolfsson, Erik. 1999. "Bundling and Competition on the Internet." Working Paper, April.

Examine the implications of "economies of aggregation" on competition in markets for information goods. Find that (1) larger bundles are able to outbid smaller bundles for upstream content, (2) bundling makes retailers "tougher" in downstream markets, (3) bundling enhances entry into markets where incumbents aren't bundling, and (4) bundling increases incentives to innovate compared to firms that don't bundle.

5. Agents, Collaborative Filtering, and Intermediaries

Avery, Christopher; Resnick, Paul; Zeckhauser, Richard. 1999. "The Market for Evaluations." Forthcoming in *The American Economic Review*.

Introduces a mechanism to provide correct incentives for provision of evaluations in an electronic market with a collaborative filtering engine. Mechanism solves (1) the under provision of evaluations as a public good, (2) inefficient ordering of evaluations, (3) sub-optimal quantity of evaluation given a lack of *a priori* information on quality.

Chavez, Anthony; Maes, Pattie. 1996. "Kasbah: An Agent Marketplace for Buying and Selling Goods." Proceedings of the First International Conference on the Practical Application of Intelligent Agents and Multi-Agent Technology, London, UK, April.

Discusses of the role of agents in creating and mediating electronic markets. Introduces Kasbah as a prototype system for the use of consumer controlled agents to negotiate deals.

Greenwald, Amy R.; Kephart, Jeffrey O. 1999. "Shopbots and Pricebots." The Proceedings of International Joint Conference on Artificial Intelligence 1999.

Develop a model similar to Varian (1980) where some consumers have access to shopbots (through knowledge of the existence) and some don't. Retailers respond by randomizing over prices: retailers have sales some of the time to capture "informed" consumers and regular prices at other times to capture their share of the "uninformed" consumers.

Sarkar, M., Butler, B., Steinfield, C. (1995), "Intermediaries and Cybermediaries: A Continuing Role for Mediating Players in the Electronic Marketplace," *Journal of Computer-Mediated Communication*, 1(3).

Electronic markets will reinforce the position of traditional intermediaries, increase their numbers, and lead to the formation of a new generation of intermediaries called cybermediaries.

Shardanand, Upendra; Maes, Pattie. 1995. "Social Information Filtering: Algorithms for Automating 'Word of Mouth.'" *Proceedings of Chi '95 Mosaic of Creativity*, pp. 210-217.

Discusses the application and design of collaborative filtering algorithms. These algorithms can make personalized recommendations based on observed similarities between the preferences of various users. Introduces *Ringo*, an early collaborative filtering tool, as a case example.