ISSN 1471-0498



DEPARTMENT OF ECONOMICS

DISCUSSION PAPER SERIES

SINKING THE INTERNET: PRICING, SUNK COSTS, AND MARKET STRUCTURE ONLINE

Simon Latcovich and Howard Smith

Number 36

October 2000

Manor Road Building, Oxford OX1 3UQ

SINKING THE INTERNET: PRICING, SUNK COSTS, AND MARKET STRUCTURE ONLINE[1]

Simon Latcovich
Balliol College, Oxford University
Latcovich@yahoo.com

Howard Smith
Department of Economics, Oxford University
Howard.Smith@economics.ox.ac.uk

Abstract

This paper evaluates alternative strategic models of competition and market structure in online retailing, and makes comparisons with traditional retailing. Online consumers are less concerned than traditional consumers about spatial characteristics and more concerned about hidden quality characteristics. Online retailers rely more on advertising than traditional retailers do, to inform consumers and to signal hidden quality attributes. Price competition may be imperfect, because of vertical product differentiation, incomplete consumer awareness, and perfect information exchange between retailers. Advertising and revenue data for the online book market reveal that consumers respond to advertising rather than low prices. As the market increases, advertising costs escalate and there is no new entry. Advertising to sales ratios and market concentration ratios are much higher than for traditional retailers. Using price and demand information for individual books over a number of weeks, we find counter-cyclical and cross-sectional price variation inconsistent with perfect price competition.

JEL Nos: L13, L15, L81

Keywords: advertising, books, e-commerce, endogenous sunk costs, Internet, market structure, price discrimination, price dispersion, retailing.

[1] We would like to thank Tony Abrahams, Mark Armstrong, William H. G. FitzGerald, Darryl Getter, Andrew Graham, and Sandeep Kapur. First draft. Comments welcome.

I: INTRODUCTION

INTERNET RETAILING has been prophesized to facilitate efficient markets. In this view, low consumer search costs and the absence of spatial product differentiation promote competitive pricing. Low set-up costs – the web site and distribution system – promote a low-concentration, cost minimizing market structure (as, for example, in Baumol (1982)). Compared to bricks-and-mortar, Internet retailing increases efficiency.

An alternative view is that these potential gains of e-commerce are at best largely unrealized, because of traditional oligopoly interactions. In this view, consumers are not aware of the full range of retailers, or fully informed about the quality of the retail service, and firms advertise to increase consumers' willingness to pay. Consequently, fixed costs are endogenous and sunk, and greatly exceed the minimum necessary for set-up. If advertising escalates as the market expands, only a few firms can survive, even in worldwide markets, just as happens in many traditional industries (Sutton (1991,1998)). Moreover, Internet retailers are perfectly informed of rival prices and are not threatened by entry, so that price competition is imperfect. Internet retailing is not cost minimizing, the number of firms is less than optimal, and prices exceed efficient levels.

In practice, the validity of these opposing views is likely to depend on the nature of the product being sold, rather than applying across-the-board. A wide range of products can be bought on the Internet. Some are costly to deliver, and the market is *localized*, e.g. pizzas, groceries, and autos. Here, set-up costs are high relative to market size. Others are easily delivered, e.g. books, CDs, banking and travel. Here, set-up costs are small relative to market size. Some products are commodity items, others, like clothes and toys, require the consumer to place reliance on the retailer's merchandise selection.

Broad-brush evidence, from company prospectuses and annual reports, suggests a variety of competitive strategies. Tesco Online, an Internet grocery service, exploits an existing brand in U.K. retailing, and spends relatively little on advertising. Prices are the same as those available in the store, plus a delivery charge. The service is limited to large cities. By contrast, Egg, the U.K. Internet bank, is a new brand. It offers better terms than are available from traditional banking, and has large marketing expenditures. There are, however, some common elements to online strategy. In particular, successful companies emphasize brand name and extend the brand to new products, e.g. flowers (Tesco Online), mutual fund retailing (Egg), and toys (Amazon.com).

The objective of this paper is to decide which view of Internet commerce is valid. We derive predictions of the theories and test them using data from an online market.

Given the wide range of Internet retail markets, it is informative to select one that would seem likely to be competitive *a priori*. Then, if the competitive e-commerce model is rejected, it is unlikely to be typical or widespread. We select book retailing. Books are a simple physical good that can be cheaply shipped to consumers, with a minimum of consumer warranty or return difficulties from "faulty" products. Compared to other services, book retailing has low set-up costs relative to market size. The homogenous nature of books facilitates product comparisons across firms.

A further, practical, advantage of the book market is that more data is available than is usual in e-commerce. This is not entirely down to the relatively long data run. Unlike other markets, there are several online booksellers with U.S. public listings, so that quarterly financial data is available via U.S. Securities and Exchange Commission

records. Furthermore, because sales information is tabulated for bestseller lists, it is possible to gauge overall demand for specific products on a weekly basis.

The two biggest traditional U.S. book retailers are Barnes & Noble, Inc. and Borders Bookstores. Together these account for over 40% of books sold in the traditional U.S. sector. Amazon.com is the leading online retailer of books. Jeff Bezos, the CEO of Amazon.com, never envisioned Amazon.com as merely a book retailer, and book sales now only constitute part of their revenue. However, he believed the book market allowed the easiest entry into online retailing. Barnesandnoble.com (henceforth, Bn.com) was floated by Barnes & Noble Inc. in 1999, and has led the most successful counterattack by the traditional retailers into the online market. Buy.com, a general online retailer, follows a different strategy to the others, to be examined later. Fatbrain.com, which runs some traditional brick-and-mortar stores, has shifted its emphasis from traditional retail to online. Borders set up an online presence, but was slower than its competitors.

Amazon.com and Bn.com have now been competing head-to-head for five years on the Internet, much longer than firms in many other markets. Other fringe firms such as A1books.com have been selling books since 1995, and there are now dozens of others in the U.S. alone. The book market is the oldest of the Internet retail sectors, and the most likely to have reached equilibrium. Although net profits are still negative, the positive (if variable) stock market valuations indicate expectations of positive discounted profits.

There are already some useful empirical studies. Bailey (1998) examines a basket of goods from Amazon.com and Bn.com from February 1997 until January 1998. Amazon.com charged much higher prices before the entry of Bn.com at a lower price. After four months, prices had equalized, indicating some price competition. Brynjolfsson

and Smith (2000) make the comparison with bricks-and-mortar and conclude that books and CD's cost less on the Internet, even if shipping costs are included in the price, assuming three items are bought.[2] However, their study also reveals considerable price variation across Internet retailers: book prices were an average of 33% more dispersed than conventional retailers. Internet prices for CD's were 25% more dispersed. This leads the authors to conclude that there is not perfectly competitive pricing on the Internet.

We proceed in two steps, corresponding to the two stages in an oligopoly game. In section II we examine the advertising and entry behavior of Internet retailers. Internet shopping is unlikely to compare favorably to a perfectly competitive or contestable market; we make the more informative comparison with traditional retailing. Our method treats traditional booksellers as a *control group*: i.e. comparisons with online booksellers isolate the effect of the Internet on competitive strategy and market structure. We derive three propositions from the theory of endogenous sunk costs, and test them using data on market size, advertising, and concentration for Internet and traditional booksellers.

In section III we assess the competitiveness of the pricing game, taking as given the market structure. The existing pricing studies, reviewed above, were based on comparing prices *across* retailers, and relied only on price data – no demand information was used. Our study builds on these findings by tracking prices of books of on a weekly basis and relating these to the popularity of the book each week. We also relate prices to the advertising expenses of the firms. By adding demand, and examining the same products through time, we are able to develop a better picture of pricing behavior. Section IV concludes.

[2] Brynjolfsson and Smith assume the average consumer purchases three items. This results in a reduced average shipping and handling fee. This assumption was based on industry information on consumer habits.

II ADVERTISING AND MARKET STRUCTURE

(i) Advertising and the Internet Shopping Experience

Economic theory says that retailers advertise for two reasons. First, advertising may inform consumers about characteristics appreciable before purchase (see Butters (1977), Grossman and Schapiro (1984)). Internet advertising appears to provide such information, e.g. the company's existence, web address, and, sometimes, prices. Internet retailers may need this kind of advertising more than traditional retailers, who can rely on their local physical presence to remind consumers of their existence.

A second reason to advertise is to signal a quality characteristic that is not appreciable before visiting the retailer or buying the product (see Milgrom and Roberts (1986), Klein and Leffler (1978)). Although the physical products sold online (such as books) may not contain characteristics about which the consumer has incomplete information, the Internet retailing *service* has three such characteristics: the browsing experience, quality of delivery, and transaction security.[3]

The browsing experience matters because consumers care about the speed and simplicity of using a site and the provision of information on the site. For example, only some firms post online reviews of various books. Amazon.com feels so strongly that it offers a different shopping experience that it has recently taken legal action against Bn.com for allegedly copying its "1-Click" shopping procedure.[4] The consumer cannot

[3] Verdict (2000) "41% of Internet users are still worried about giving their financial details over the Internet. 25% of shoppers have a problem with the fact that many companies cannot deliver when it is convenient for the consumer"

[4] Amazon.com was able to obtain a preliminary federal injunction on December 2, 1999, which prevents Barnesandnoble.com from allegedly using its patented "1-Click" shopping procedure. This procedure

appreciate the quality of the site until it is visited; advertising is required to encourage consumers to take the time and effort.

Consumers also care about the timing and quality of product delivery; they can only find out about this after one or a few purchases, and advertising is needed to build confidence. Most important, perhaps, is transaction security. Consumers are averse to giving credit card information to unknown or unfamiliar firms. Security details such as encryption levels are difficult to understand and rapidly evolving. Even after a few transactions the consumer is not totally sure how safe a company may be. Consumer confidence can be increased via advertising.

The importance of advertised brand names in Internet retailing supports the idea that unobserved quality is important. Internet firms use a process called "brand extension" in which a firm introduces a product in a totally different category but continues to use the well-known brand name. The act of purchasing very dissimilar items online from the same retailer is so similar that a consumer disappointed with the quality of a new product will discontinue purchases of all the firm's products, as in Wernerfelt's (1988) model. For an example of brand extension, we quote from Amazon's second quarter (1999) report with the U.S. Securities and Exchange Commission (p12):

> "In March 1999, the Company launched Amazon.com Auctions, an on-line auctions service that is designed to help people find, discover, buy -- and now sell -- a large selection of products online. In April 1999, the Company launched Amazon.com Cards, a free electronic greeting card service, and in July 1999, the Company launched two new stores: Amazon.com Electronics and Amazon.com Toys & Games."

---

allows shoppers to purchase items without reentering their shopping and billing information each time. Barnesandnoble.com claims that its "express checkout" is actually an improvement on Amazon's 1-Click and is not a patent infringement.

This does not sound like a firm competing in a perfect market. Instead, it resembles a firm trying to make the most of its brand-name recognition, via brand extension.

(ii) Sunk Costs and Market Structure: The Lower Bound[5]

Sutton (1998) characterizes markets using a parameter, α, which measures the extent to which a firm can increase consumers' willingness to pay by outspending its rivals in advertising. Suppose a firm, outspending its highest spending rival by a *factor* K, can obtain a proportion A of industry revenue as gross profit. Then $\alpha = A/K$.[6] Under general conditions, Sutton shows that a high-α industry cannot have a low concentration market structure. Specifically, α is the lower bound to the one-firm concentration ratio, i.e. $C1 \geq \alpha$. The intuition is simple. If the market *were* low-concentration, then, by definition, no firm would achieve high revenue, and, in turn, no profitable firm could spend much on advertising. But then it would be inexpensive to outspend rivals' advertising by a given *factor* K in return for gross profit A, which is approximately independent of the level of concentration. An escalation strategy is always profitable for sufficiently low concentration.

Two parameters determine α, namely β and σ:

- β is the effectiveness of a unit increase in fixed costs in raising perceived quality u_i of product i (a *low* β represents high effectiveness). The fixed cost of attaining u_i is $F = F(u_i, \beta)$. If a firm spends the minimum, then $u_i = \underline{u}$ and only set-up cost is incurred.
- σ is the extent of connections between products, either on the demand-side, through demand substitution, or on the supply side. If σ is high on the supply side, investment

in perceived quality in one product reduces the cost of attaining quality in another product, e.g. via brand extension or economies of scope.

Sutton (1988) shows that α is low when β is high, and that α is increasing in σ when β is low. This is intuitive: if advertising increases perceived quality, then the more substitutable are products the more profitable is a high advertising strategy.

(iii) Traditional and Online Concentration: A Comparison

Sutton's framework may be used at alternative market definitions; this is intended to help in empirical work where there is often no "right" level of aggregation (see p14-16 of Sutton (1998)). We now compare parameters in online and bricks-and-mortar markets.

Bricks and Mortar Retailing:

- **Multiple set-up costs:** a separate set up cost is incurred in each location in the form of a minimal bricks-and-mortar shop.
- **Low** b**:** it is possible to increase quality u_i in location i by increasing store size, the product range, and the pleasantness of the store format. These, rather than advertising, are the main forms of endogenous sunk costs.
- **Medium** s**:** there is little substitution across locations, but there are moderate economies of scope: once a successful retail format is devised in any location, the formula may be used elsewhere at lower cost.
- **Medium** a**:** a low β and medium σ suggests a medium α. A *very* low-concentration structure would be vulnerable to the entry of a retail chain of quality stores.

[5] Readers familiar with Sutton's theory may skip this sub section.

Online Retailing:

- **Single set-up cost:** only one set-up cost is needed for a very large geographic area, in the form of a minimal distribution center and a web site.
- **Low** b**:** advertising can be used to enhance perception of browsing experience, delivery quality, and transaction security.
- **High** s**:** there is almost no horizontal differentiation.
- **High** a**:** the importance of vertical product differentiation, the absence of horizontal differentiation, and the effectiveness of advertising yield a high α.

(iv)Testable Predictions

If advertising costs were exogenous, then as the online book market grows, each firm's advertising level would remain constant and new firms would enter the market. Alternatively, if advertising is endogenous then Prediction 1 is implied.

Prediction 1: *As the online book market expands, we should see higher advertising expenditures and no entry of new firms*.

If Internet book retailers have a higher α than traditional retailers, Prediction 2 is implied.

[6] More specifically, alpha is the highest such ratio available by choice of K.

Prediction 2: *Online retailers should have higher advertising/sales ratios than traditional retailers.*

Recall that α is the lower bound to the one-firm concentration ratio, i.e. $C1 \geq \alpha$. If Internet retailing has a higher α than traditional retailing, then this implies that online retailing should have a higher C1 than traditional retailing, assuming that traditional retailing is on, or close to, its lower bound. This latter assumption is likely to be a good approximation, at least in the U.K. where bricks-and-mortar retailers have recently experienced a period of moderate consolidation, following the end of the Book Agreement in 1996, which prevented retail price competition. The *increase* in concentration suggests that the bricks-and-mortar market was below the new bound. The moderate *extent* of the increase indicates that the new equilibrium is not far above the new bound. Proposition 3 follows.

Prediction 3: *There should be a higher C1 for Internet book retailing than for traditional book retailing, for markets of similar size.*

(v) Evidence

Prediction 1: Advertising and Market Size

The online book market has grown rapidly. Table 1 shows that the joint revenues of the top four firms have increased from $0.5m to $2,300m in the period 1995 to 1999. Most, but not all, of this is derived from book retailing. These firms are said to constitute 80%-90% of the worldwide online book market, so the rise in joint revenues gives a good

Table 1: Revenues and Profits of Online Retailers

	Retailer	1995	1996	1997	1998	1999
Revenues	Amazon	511	15746	147,787	609,943	1,639,839
(Units: $000)	Bn	-	-	6,205	53,667	202
	Fatbrain	-	-	3,021	10,093	19
	Buy	-	-	878	96,514	596,848
Gross Profit Margin	Amazon	0.20	0.22	0.20	0.22	0.19
	Bn	-	-	-	0.23	0.21
	Fatbrain	-	-	0.30	0.21	0.19
	Buy	-	-	-	0.01	-0.01
Net Profit Rate	Amazon	-0.59	-0.39	-0.20	-0.19	-0.42
	Bn	-	-	-	-1.16	-0.50
	Fatbrain	-	-	-0.56	-0.50	-0.86
	Buy	-	-	-	-0.15	-0.21

Source: www.sec.gov.

idea of the growth of the market. Figure 1 plots the increase in each firm's revenues over the period. Figure 2 shows that the big players have escalated advertising expenditure as the market has grown, consistent with prediction 1. It is interesting to note that advertising expenditures are unequal. Amazon outspends rivals by as much as 300% (see Figure 2). The impact is clear. The rise in sales is unequally divided between the four main players, with Amazon taking the lions' share: (Figure 1).

If advertising were an exogenous set-up cost, advertising to sales ratios would fall as revenues grow. This has not happened. Table 2 shows that Amazon.com has spent a constant 20-30% of revenues on advertising while revenues have grown rapidly. The advertising/sales ratios of Bn.com and Buy.com have also remained relatively constant. Fatbrain.com's advertising/sales ratio has actually increased as online sales increase faster than their traditional sales.

The endogeneity of advertising even applies to seasonal demand variation. As Amazon.com's sales doubled in the final quarter of 1999, from the previous quarter, the largest e-Christmas to date, it more than doubled advertising over the previous quarter

Table 2: Advertising to Sales Ratios

	1995	1996	1997	1998	1999	2000
Online:						
Amazon	39.1%	35.8%	26.7%	22.2%	24.7%	23.0%
Bn				132.7%	56.1%	41.1%
Fatbrain			55.2%	50.1%	74.2%	70.0%
Buy				10.6%	11.7%	12.2%
Bricks & Mortar:						
Barnes & Noble**	20.6%	20.5%	19.6%	22.8%	21.2%	19.8%
Borders**			24.0%	25.0%	25.4%	24.1%
Barnes & Noble*	6.6%	6.5%	5.6%	8.8%	7.2%	5.8%
Borders*			10.0%	11.0%	11.4%	10.1%

Source: www.sec.gov; **includes admin costs; *assumes admin costs same as online firms (14%)

(see Figures 1 and 2). The same increase was evident for Buy.com. Finally, although revenue growth was fastest in the years 1998-2000, the existing firms remained in the market and no new entrants achieved a presence. The evidence supports Prediction 1.

Prediction 2: Comparing Advertising to Sales Ratios

Table 2 presents advertising to sales ratios for online and bricks-and-mortar retailers. Amazon.com spends 20%-30% of revenues on advertising. In 1999 Bn.com spent 41.1%. Given their established brand name in brick-and-mortar, this counters the argument that Amazon.com was only spending heavily on advertising during its initial years to build up its brand name. Fatbrain.com began in early 1997 when online sales were about 20% of total. Subsequently they concentrated on online sales, and by the end of 1999 online revenues were 80% of total. As this occurred, the advertising/sales ratio increased to over 70%.

The two biggest US Bricks-and-Mortar companies, Barnes and Noble, Inc. and Borders Group, provide a control group. In 1999 Barnes and Noble spent an average of 21.2% of revenues on "Selling and Administrative" expenses (see Table 2). In their financial statements, online retailers note marketing expenses, while in traditional

markets these expenses are grouped with administrative and other "selling" expenses. Marketing and sales are only a fraction of this total expense. For example, Amazon.com spends on average 5% of its sales on general administrative expenses alone, and another 9% on product development. Assuming this is constant across the Internet and brick-and-mortar markets, which probably errs on the high side,[7] then Barnes and Noble Inc. spends 8% of revenues on advertising. These adjustments are shown in Table 2. Similar adjustments reveal that Borders Group's advertising is about 4-8% percent of total revenues. For both retailers, the ratio of advertising costs to sales is approximately on fifth the costs for Amazon.com and the other online firms. Prediction 2 is supported.

Buy.com follows a different strategy to the other online retailers, involving lower margins and lower advertising (see Tables 1 and 2). Books are only a small fraction of its sales, which include software, electronics, and CDs. Buy.com only spends about 10% to 12% of revenues on advertising. Section III shows that Buy.com charges lower prices for almost all items. If there were very low search costs on the Internet, the firm with the lowest prices would attract the most customers. However Buy.com's market share is much smaller then Amazon.com, consistent with endogenous sunk cost theory.

Prediction 3: Comparing Concentration Ratios

Table 3 presents revenues and concentration levels. The top two panels give data for the US and UK traditional book markets. The bottom left panel gives data for online books, music, and video. The bottom right is for books only. UK data is included because

[7] This is a very conservative assumption that errs on the side of underestimating the true administrative costs of a brick-and-mortar retailer. This would imply that there are no efficiency gains to the Internet and thus it takes the same amount of administrative costs to run a large Internet business as it does a chain of

Table 3:Sales and Concentration Levels for Online and Traditional Retailers					
Traditional U.S. (1997)*			Traditional U.K. (1998)*		
Books			Books		
Total	$12, 536m	100%	Total	£2841m	100%
C4	$5,641m	45%	C4	£1210m	40%
B&N	$2,758m	22%	Waterstones	£574m	20%
Borders	$2,256m	18%	WHSmith	£509m	18%
Crown	$301m	2%	Blackwells	£68m	2%
Books-a-million	$326m	3%	Books etc.	£60m	2%
Online (1999)					
Books, Music, Video			Books		
Total	$1700m	100%	Total	$1125m	100%
C4	$1589m	93%	C4	$962m	86%
Amazon	$1308m	77%	Amazon	$697m	62%
Bn.com	$202m	12%	Bn.com	$188m	17%
Borders	$18m	1%	Borders	$16m	2%
Fatbrain	$19m	1%	Fatbrain	$17m	2%
Buy	$70m	4%	Buy	$60m	5%

Source: American Booksellers Association, UK Booksellers Assocaition, Harris Interactive, Jupiter Communications, www.sec.com

*Excludes school books

its annual sales are closer to the online markets. Online markets are more concentrated, consistent with Prediction 3. The C1 for worldwide online books is 62%; for the books, music and video market C1 is 77%. These are much higher than the traditional markets, which have C1s of about 20%. Online C4s are also higher.

Another method of measuring online concentration is through the amount of traffic that goes through each site. Although this is not a perfect proxy for sales, one would expect sales to be related to the number of people who browse the site. According to research by Web21, the top-four Internet retailers account for 99.8% of all hits for online book retailers. [8] This points to a very concentrated online market.

local retail stores. This is a very conservative assumption that errs on the side of underestimating the true administrative costs of a brick-and-mortar retailer.

Aggregate Book Market: The analysis has focussed on the two market sectors, traditional and online. What effect has the Internet on concentration in the retail book market broadly defined? The effect of the Internet is to create a new niche: substitution between online and traditional sub-markets is imperfect, partly because some consumers are not online. The ultimate effect of the Internet on α, and market concentration, for the overall book market depends on the growth of online sales. If Internet book retailing remains a "niche", overall α falls as the established leaders lose market share. If online retailing becomes the main segment of the market, then α may increase and bigger online firms dominate the overall market.

III: INTERNET RETAIL PRICING

(i) Market Power on the Internet

There are two reasons why Internet retailers might have less market power traditional retailers. First, there is no spatial product differentiation on the Internet, so that many firms are brought into direct competition. Second, although search costs are still significant, particularly for impatient consumers, the cost of finding out prices and other product details on the Internet is much lower than on the High Street.[9]

Other sources of market power remain, however. Consumers may be *unaware* of many online retailers, allowing prices to be increased above marginal cost (see Butters (1977), Grossman and Schapiro (1984)). Furthermore, as noted in section II, consumers

[8] Web21 http://www.web21.com samples traffic to obtain estimates of total hits for each web address.
[9] Some Internet applications such as "shopbots" can drop the cost of additional search further still. A shopbot is a program that browses sites for the best price for a particular item, e.g. BookBlvd.com searches twenty-five online retailers for the best price for a particular book. Some retailers are beginning to block the shopbots claiming intellectual property violations.

may perceive that some retailers offer a higher quality *service* than others, in terms of browsing experience, delivery, and transaction security. This new vertical product differentiation softens price competition (Shaked and Sutton (1987)), even where the *product* is a commodity item. Finally, even if Internet retailing has a competitive one-period pricing game, tacit collusion may be possible. Collusion is facilitated where products are close substitutes, prices can be changed rapidly, firms can detect rival's price changes, there are few firms, and barriers to entry exist (see Schapiro (1989)). If high concentration is typical, Internet retailing seems to satisfy these criteria, although competition from traditional retailing may limit the collusive price.

A perpetual feature of traditional retailing is price dispersion, both across retailers and over time for given retailers – i.e. sales and promotions. Evidence suggests these features are also prevalent for Internet retailing: Brynjolfsson and Smith (2000) find evidence of inter-firm price dispersion on the Internet, and, in this paper, we find evidence of inter-temporal price variation. Before discussing our empirical findings in detail, we discuss the theory of price dispersion.

(ii) Inter-Firm Price Dispersion

In the absence of market power, cost differences cannot explain inter-firm price dispersion: high cost firms would be eliminated if consumers are perfectly informed and shop only on price criteria.

In practice, however, consumers are not perfectly informed. Search is necessary, and consumers differ in their costs of search. In this situation, Salop and Stiglitz (1977) show that price dispersion can result. Low price firms sell to consumers who search and a

few lucky "no-search" consumers. High price firms set high prices and sell only to consumers with high search costs. In Butters (1977) firms try to inform consumers by advertising, but this need not reduce price dispersion. Butters derives an equilibrium model where firms differ in their advertising intensity and high advertising firms sell their products at higher prices than low advertising firms.

Neither do consumers shop only on price criteria. Vertical differences may matter: even if products are identical, the retail service may be perceived to be superior for some firms, which can command a higher price (see Shaked and Sutton (1987)); high price firms may have attained their superior reputation by higher advertising.

(iii) Inter-Temporal Price Dispersion

In the absence of market power, inter-temporal price variation can derive from inter-temporal cost variation, or the desire to get rid of unplanned inventories of perishable or unfashionable goods.

Firms with monopoly power may use inter-temporal price variation to discriminate between customers. In Sobel (1984) firms initially sell at a high price to impatient consumers, then cut prices when the number of patient consumers builds to the point where a lower price is profit-maximizing. Varian (1980) follows the Salop and Stiglitz (1977) model of informed and uninformed customers, but allows randomized pricing strategies by stores to discriminate between informed and uninformed customers.

In Klemperer (1987), inter-temporal price variation is used to take advantage of consumer costs of changing retailer. Firms may offer lower prices initially, or to "new"

cohorts of customers, to build up a clientele, after which prices are increased to take advantage of their inelastic demand.

Alternatively, the price variation is because market power in the product may change over time. Suppose that firms have some degree of market power, setting prices equal to the inverse of the products' price elasticities. As elasticities change, so do prices. Elasticities may change because consumer preferences change, or because the number of competing firms changes, or because consumer information changes. Consumers may be better informed about the appropriate price for a product they begin to buy more frequently. The effect of demand elasticity may be enhanced if consumers prefer to buy several items at a single retailer, either to save time, or to minimize delivery costs, cross-effects between products become relevant when setting prices. If so, retailers may use prices to lure consumers to the site with a low price hoping that he will purchase other higher-priced goods, either at the same time or on follow-up visits. Bliss (1988) shows that high elasticity products are likely to have lower markups.

A final reason for inter-temporal price variation is changing ability of firms to collude. Rotemberg and Saloner (1986) show that when demand is high, but likely to fall, the benefit to undercutting rivals becomes larger than the individual firm's share of the joint maximizing profits, and the collusive price must change to reflect the possible gains from deviation at different levels of demand.

(iv) Data and Results

Two samples of 12 books were taken. In the first sample, starting from 30th August 1999, the top five bestsellers from *The New York Times* and *The Times* were

selected along with two reference titles, *The Theory of Industrial Organization* by Jean Tirole and *The New Shorter Oxford English Dictionary*. In the second survey, starting 8th November 1999, the top six bestsellers from each list were chosen. Both surveys continued until 30th February 2000. Once a week, data was collected directly from the sites of the retailers on the hardcover price of each book. Prices do not include shipping costs; these are very similar across firms as many use the same companies.

The market leaders heavily discounted the top 15 books on *The New York Times* bestseller list. Amazon.com and Bn.com discounted these books by 50% of the retail price; they discounted other books on average about 30%. Two of the fringe firms, A1books.com and Fatbrain.com, offered a consistent 30-35% discount on most titles. Buy.com was less consistent, but generally charged the lowest available price. There was considerable price dispersion amongst firms for any given book. For example, on the first day of the survey, the price of the novel *Hannibal* varied from $13.90 to $19.95.

The most interesting results occur as demand drops. For the market leaders, prices increase as books fall off the bestseller list (the top 15 on *The New York Times*). For example, on September 27, 1999, *Granny Dan* cost $9.98 and $9.97 at Amazon.com and Bn.com, respectively. The next week, as the book dropped in the rankings from 12 to 21, the prices changed to $13.97 and $13.96 respectively (see Table 5). This pattern was repeated for four out of the five qualifying titles in the first sample and three out of three times in the second sample. This can be seen for a selection of the titles in Tables 4-9. In addition, the two firms charge almost equal prices.

The one exception to this rule was *Black Notice* (see Table 7). Both firms initially raised their prices as it dropped off the list. Bn.com then discounted the book again, but

Amazon.com did not match this for seven weeks. Eventually both firms ended up charging identical high prices. There are two possible explanations. First, when Bn.com discounted the book for the second time a different publisher published this book: Bn.com could have gotten a new and more favorable deal. Second this novel may have been selected for a special promotion. For example, Bn.com discounts "Oprah's Choices", the books recommended by talk-show host Oprah Winfrey.

In contrast to the market leaders, the other firms operated no clear pricing rule. Although discounts were lower, on average, for less popular books, the change in the discount was smaller. There were some minor changes in strategy. For example, A1books.com changed its standard discount from 34% to 30%, then to 32%, and finally back to 34%. This markdown is constant across books. Buy.com was consistently cheaper than its rivals as it follows its low-price, low-advertising strategy. Fatbrain.com showed little change across the survey.

Table 10 summarizes data from the two samples. Column 1 gives the mean and standard deviation of the discounts offered for bestsellers for each company, plus some combinations of companies. Column 2 gives these statistics for books off the bestseller list. The figures show a clear price break, for the two market leader firms. Column 3 shows that there is only a very small number of exceptions to the "top 15" discount pricing rule for the market leaders. (And these are all for the novel *Black Notice* discussed above). Columns 4 and 5 show the results of a t-test run under the hypothesis of no price change. As one can see, the hypothesis was emphatically rejected. This test was run for each individual firm. All firms show evidence of counter-cyclical pricing, but the market leaders show the greatest price range.

Table 4: Hannibal by Thomas Harris

Date	Rank	Amazon.com	Bn.com	A1 Books	Fatbrain	Buy.com
30-Aug-99	5	$13.90	$13.97	$18.25	$19.95	
06-Sep-99	5	$13.98	$13.97	$18.25	$13.95	
13-Sep-99	5	$13.98	$13.97	$18.25	$13.95	
20-Sep-99	8	$13.98	$13.97	$18.25	$13.95	
27-Sep-99	9	$13.98	$13.97	$18.25	$13.95	
04-Oct-99	12	$13.98	$13.97	$18.25	$13.95	
11-Oct-99	12	$13.98	$13.97	$18.25	$13.95	
18-Oct-99	12	$13.98	$13.97	$18.25	$13.95	
25-Oct-99	18	**$19.57**	**$19.56**	$18.25	$13.95	
01-Nov-99	20	$19.57	$19.56	$18.25	$13.95	
08-Nov-99	20	$19.57	$19.56	$18.25	$13.95	
15-Nov-99	24	$19.57	$19.56	$18.25	$19.55	
22-Nov-99	23	$19.57	$19.56	$19.50	$19.55	
29-Nov-99	25	$19.57	$19.56	$19.50	$19.55	$16.77
06-Dec-99	24	$19.57	$19.56	$19.50	$19.55	$16.77
13-Dec-99	17	$19.57	$19.56	$19.50	$19.55	$18.77
20-Dec-99	21	$19.57	$19.56	$19.00	$19.55	$18.77
27-Dec-99	22	$19.57	$19.56	$19.00	$19.55	$18.77
03-Jan-00	20	$19.57	$19.56	$19.00	$19.55	$18.77
10-Jan-00	15	**$13.98**	**$13.97**	$19.00	$19.55	$18.77
17-Jan-00	23	**$19.57**	**$19.56**	$19.00	$19.55	$18.77
24-Jan-00	32	$19.57	$19.56	$18.25	$19.55	$18.77
31-Jan-00		$19.57	$19.56	$18.25	$19.55	$18.77
07-Feb-00		$19.57	$19.56	$18.25	$19.55	$18.77
14-Feb-00		$19.57	$19.56	$18.25	$19.55	$18.77
21-Feb-00		$19.57	$19.56	$18.25	$19.55	$18.77

Table 5: Granny Dan by Danielle Steel

Date	Rank	Amazon.com	Bn.com	A1 Books	Fatbrain	Buy.com
30-Aug-99	6	$9.90	$9.97	$13.00		
06-Sep-99	8	$9.98	$9.97	$13.00		
13-Sep-99	9	$9.98	$9.97	$13.00		
20-Sep-99	10	$9.98	$9.97	$13.00	$13.95	
27-Sep-99	12	$9.98	$9.97	$13.00	$13.95	
04-Oct-99	21	**$13.97**	**$13.96**	$13.00	$13.95	
11-Oct-99	22	$13.97	$13.96	$13.00	$13.95	
18-Oct-99	24	$13.97	$13.96	$13.00	$13.95	
25-Oct-99	34	$13.97	$13.96	$13.00	$13.95	
01-Nov-99	33	$13.97	$13.96	$13.00	$13.95	
08-Nov-99	32	$13.97	$13.96	$13.00	$13.95	
15-Nov-99		$13.97	$13.96	$13.00	$13.95	
22-Nov-99		$13.97	$13.96	$13.75	$13.95	
29-Nov-99		$13.97	$13.96	$13.75	$13.95	$11.97
06-Dec-99		$13.97	$13.96	$13.75	$13.95	$11.97
13-Dec-99		$13.97	$13.96	$13.75	$13.95	$12.97
20-Dec-99		$13.97	$13.96	$13.50	$13.95	$12.97
27-Dec-99		$13.97	$13.96	$13.50	$13.95	$12.97
03-Jan-00		$13.97	$13.96	$13.50	$13.95	$12.97
10-Jan-00		$13.97	$13.96	$13.50	$13.95	$12.97
17-Jan-00		$13.97	$13.96	$13.50	$13.95	$12.97
24-Jan-00		$13.97	$13.96	$13.00	$13.95	$12.97
31-Jan-00		$13.97	$13.96	$13.00	$13.95	$12.97
07-Feb-00		$13.97	$13.96	$13.00	$13.95	$12.97
14-Feb-00		$13.97	$13.96	$13.00	$13.95	$12.97
21-Feb-00		$13.97	$13.96	$13.00	$13.95	$12.97

Table 6: Assassins by Tim LaHaye and Jerry Jenkins

Date	Rank	Amazon.com	Bn.com	A1 Books	Fatbrain	Buy.com
30-Aug-99	2	$15.90	$11.49			
06-Sep-99	3	**$9.99**	$11.49		$9.95	
13-Sep-99	4	$9.99	$11.49	$13.00	$9.95	
20-Sep-99	5	$9.99	$11.49	$13.00	$9.95	
27-Sep-99	6	$9.99	**$9.98**	$13.00	$9.95	
04-Oct-99	8	$9.99	**$11.49**	$13.00	$9.95	
11-Oct-99	7	$9.99	$11.49	$13.00	$9.95	
18-Oct-99	8	$9.99	$11.49	$13.00	$9.95	
25-Oct-99	10	$9.99	**$9.98**	$13.00	$11.45	
01-Nov-99	13	$9.99	$9.98	$13.00	$11.45	
08-Nov-99	12	$9.99	$9.98	$13.00	$11.45	
15-Nov-99	11	$9.99	$9.98	$13.75	$11.45	
22-Nov-99	11	$9.99	$9.98		$11.45	
29-Nov-99	16	$9.99	$9.98	$13.75	$16.05	$8.99
06-Dec-99	17	**$13.98**	**$13.97**	$13.75	$13.95	$13.98
13-Dec-99	21	$13.98	$13.97	$13.75	$13.95	$13.98
20-Dec-99	20	$13.98	$13.97	$15.50	$13.95	$13.98
27-Dec-99	29	$13.98	$13.97	$15.50	$13.95	$13.98
03-Jan-00	28	$13.98	$13.97	$15.50	$13.95	$13.98
10-Jan-00	24	$13.98	$13.97	$15.50	$13.95	$13.98
17-Jan-00	20	$13.98	$13.97	$15.50	$13.95	$13.98
24-Jan-00	20	$13.98	$13.97	$15.50	$13.95	$13.98
31-Jan-00	20	$13.98	$13.97	$15.50	$13.95	$13.98
07-Feb-00	17	$13.98	$13.97	$15.50	$13.95	$13.98
14-Feb-00	16	$13.98	$13.97	$15.50	$13.95	$13.98
21-Feb-00	16	$13.98	$13.97	$15.50	$13.95	$13.98

Table 7: Black Notice by Patricia Cornwell

Date	Rank	Amazon.com	Bn.com	A1 Books	Fatbrain	Buy.com
30-Aug-99	1	$12.90	$12.97	$17.00		
06-Sep-99	1	**$12.98**	$12.97	$17.00		
13-Sep-99	2	$12.98	$12.97	$17.00		
20-Sep-99	4	$12.98	$12.97	$17.00	$12.95	
27-Sep-99	5	$12.98	$12.97	$17.00	$12.95	
04-Oct-99	7	$12.98	$12.97	$17.00	$12.95	
11-Oct-99	8	$12.98	$12.97	$17.00	$12.95	
18-Oct-99	9	$12.98	$12.97	$17.00	$12.95	
25-Oct-99	16	**$15.57**	**$18.16**	$17.00	$12.95	
01-Nov-99	18	$15.57	$18.16	$17.00	$12.95	
08-Nov-99	16	$15.57	**$12.97**	$17.00	$12.95	
15-Nov-99	23	$15.57	$12.97	$17.00	$12.95	
22-Nov-99	25	$15.57	$12.97	$18.00	$12.95	
29-Nov-99	29	**$18.17**	$12.97	$18.00	$18.15	$14.99
06-Dec-99	33	$18.17	$12.97	$18.00	$18.15	$14.99
13-Dec-99	34	$18.17	$12.97	$18.00	$18.15	$14.99
20-Dec-99	35	$18.17	$12.97	$17.50	$18.15	$15.57
27-Dec-99	34	**$12.98**	$12.97	$17.50	$18.15	$15.57
03-Jan-00	34	$12.98	$12.97	$17.50	$18.15	$15.57
10-Jan-00	27	$12.98	**$18.16**	$17.50	$18.15	$15.57
17-Jan-00	29	$12.98	$18.16	$17.50	$18.15	$15.57
24-Jan-00	35	$12.98	$18.16	$17.00	$18.15	$15.57
31-Jan-00		$12.98	$18.16	$17.00	$18.15	$15.57
07-Feb-00		**$18.17**	$18.16	$17.00	$18.15	$15.57
14-Feb-00		$18.17	$18.16	$17.00	$18.15	$15.57
21-Feb-00		$18.17	$18.16	$17.00	$18.15	$17.17

Table 8: Pop Goes the Weasel by James Patterson

Date	Rank	Amazon.com	Bn.com	A1 Books	Fatbrain	Buy.com
08-Nov-99	3	$13.48	$13.47	$17.75	$18.85	
15-Nov-99	3	$13.48	$13.47	$17.75	$18.85	
22-Nov-99	4	$13.48	$13.47	$18.75	$18.85	
29-Nov-99	5	$13.48	$13.47	$18.75	$18.85	$12.94
06-Dec-99	8	$13.48	$13.47	$18.75	$18.85	$13.47
13-Dec-99	8	$13.48	$13.47	$18.75	$18.85	$13.47
20-Dec-99	8	$13.48	$13.47	$18.25	$18.85	$13.47
27-Dec-99	11	$13.48	$13.47	$18.25	$18.85	$13.47
03-Jan-00	11	$13.48	$13.47	$18.25	$18.85	$13.47
10-Jan-00	9	$13.48	$13.47	$18.25	$18.85	$13.47
17-Jan-00	11	$13.48	$13.47	$18.25	$18.85	$13.47
24-Jan-00	12	$13.48	$13.47	$17.75	$18.85	$13.47
31-Jan-00	18	**$18.87**	**$18.86**	$17.75	$18.85	$13.47
07-Feb-00	19	$18.87	$18.86	$17.75	$18.85	$13.47
14-Feb-00	20	$18.87	$18.86	$17.75	$18.85	$15.00
21-Feb-00	29	$18.87	$18.86	$17.75	$18.85	$18.17

Table 9: "O" is for Outlaw by Sue Grafton

Date	Rank	Amazon.com	Bn.com	A1 Books	Fatbrain	Buy.com
08-Nov-99	6	$13.00	$13.00	$17.00	$15.60	$12.48
15-Nov-99	6	$13.00	$13.00	$17.00	$15.60	$12.99
22-Nov-99	7	$13.00	$13.00	$18.00	$15.60	$12.99
29-Nov-99	8	$13.00	$13.00	$18.00	$18.20	$12.99
06-Dec-99	11	$13.00	$13.00	$18.00	$18.20	$12.99
13-Dec-99	12	$13.00	$13.00	$18.00	$18.20	$12.99
20-Dec-99	12	$13.00	$13.00	$17.50	$18.20	$12.99
27-Dec-99	14	$13.00	$13.00	$17.50	$20.95	$12.99
03-Jan-00	14	$13.00	$13.00	$17.50	$18.20	$12.99
10-Jan-00	14	$13.00	$13.00	$17.50	$18.20	$12.99
17-Jan-00	19	**$18.20**	**$18.20**	$17.50	$18.20	$12.99
24-Jan-00	22	$18.20	$18.20	$17.00	$18.20	$17.60
31-Jan-00	28	$18.20	$18.20	$17.00	$18.20	$17.60
07-Feb-00		$18.20	$18.20	$17.00	$18.20	$17.60
14-Feb-00		$18.20	$18.20	$17.00	$18.20	$17.60
21-Feb-00		$18.20	$18.20	$17.00	$18.20	$17.60

Table 10: t-Test: Two-Sample Assuming Unequal Variances

Hypothesized difference = 0, Standard Deviations in parenthesis

	Mean Disc. On List	Mean Disc. Off List	Rule Deviation	t-Stat.	P(T<=t) two-tail
Amazon.com	49.8 (2.48)	32.3 (5.30)	1/287	35.5	1.26E-87
Bn.com	49.6 (1.61)	31.1 (5.49)	7/287	38.5	1.09E-83
A1books.com	32.9 (1.54)	31.9 (3.16)	N/A	3.3	1.14E-03
Fatbrain.com	36.9 (8.34)	31.0 (5.41)	N/A	7.1	1.58E-11
Buy.com	51.1 (3.31)	36.9 (4.87)	N/A	22.6	1.46E-52
Market Leaders	49.7 (2.09)	31.7 (5.42)	N/A	52.1	9.08E-170
Fringe Firms	38.0 (8.64)	32.9 (5.12)	N/A	9.6	2.27E-20
Leaders and Buy	50.0 (2.42)	33.1 (5.74)	N/A	52.8	1.04E-210
Fringe Minus Buy	34.9 (6.32)	31.5 (4.40)	N/A	7.5	2.54E-13

(v) Interpretation

Inter-firm price variation

The inter-firm price variation in this pricing survey contradicts the law of one price, implied by perfect price competition. It is consistent, however, with the Salop and Stiglitz (1977) model of bargains and rip-offs, with high search consumers buying from low price firms such as Buy.com and others buying from Amazon. There is also some support for the Butters (1977) model, because low advertising firms – such as Buy and A1 books – have the lowest prices, at least for books outside the bestseller list.

Inter-temporal price variation

A number of explanations for the inter-temporal price variation can be ruled out. The costs of producing books could be changing, but this is unlikely for two reasons. First, this alleged cost phenomenon does not seem to affect Buy.com and the fringe firms nearly as much: their prices are much more stable. Second, according to an interview we conducted with an executive in charge of purchasing for a U.K. bricks-and-mortar chain (Blackwell Bookstores), the cost of purchasing a title does not usually change over the life of the book. Retailers negotiate a contract for a particular title, and additional books are purchased at the originally negotiated price. According to this source, there is "very little fluctuation" in the cost of retailers purchasing books for retail sale (Cooper (2000)).

Price discrimination can also be ruled out. In Varian's (1980) model of sales, firms use mixed strategies. However, it is apparent from the data that the prices set by firms are deterministic, not random. Sobel's (1984) model of sales, and most models of durable good price discrimination, has firms initially setting prices high while selling to impatient consumers, then cutting prices when enough patient consumers build up. This

behavior is not reconcilable with the data, as booksellers are not cutting the prices after a period of time; instead they are raising the prices. Klemperer's (1987) model of switching costs cannot explain the data either: his model predicts that a firm would raise all prices as the firms market share increases, not merely the prices of specific titles.

This leaves us with two possible explanations. First, the bestseller market may have lower non-cooperative prices, so that the price variation arises from variation in the firm's non-cooperative market power over time. This market power might derive from a number of sources. The buyers of bestsellers might be better informed than other buyers, or there may be more firms competing in this market (such as supermarkets). Alternatively, the *aggregate* elasticity of demand for individual best-selling titles could be higher than for other books. Moreover, if consumers buying bestsellers are more likely than other consumers to buy other books while visiting the site (as in Bliss (1988)), then the incentives for these inter-temporal price variations could be enhanced further.

The second explanation the collusive price could change (as in Rotemberg and Saloner (1986)). The high demand changes the incentives for cheating by making it more profitable to undercut during period of high demand, especially when demand is expected to fall in the future. This theory has empirical support as an examination of the data shows both market leaders cutting their prices by exactly the same amount each time (50% off the list price), charging very similar (almost exact) prices for books either on and not on the bestseller list. Rather than coincidence, it seems likely there is some kind of co-ordination.

It is obvious that pricing patterns on the Internet are not consistent with conventional models of perfect price competition. We have identified two possible

explanations, neither of which is fully competitive.[10] Although it is difficult to differentiate between these two possibilities, there is a common element: the Internet does not promote optimal price competition. As Table 1 confirms, the net losses incurred by the firms during this period are a consequence of advertising costs being in excess of gross profits, not of average book prices being lower than marginal costs.

IV CONCLUSIONS

The experience of the online book market suggests that that Internet retailing is not the competitive, efficiency-maximizing development many have suggested. Market structure is more concentrated than bricks and mortar retailing, and advertising is more intense. Firms are far from cost minimizing, spending millions of extra dollars on marketing. Temporal and cross-sectional pricing patterns suggest that consumers do not respond to significant price differences between sellers and that firms take advantage of this in ways that reduce economic efficiency.

Given the commodity nature of the underlying product, the results are likely to be of some generality. Other research – as well as broad-brush evidence from annual reports – shows that advertising and brand names are a common element of online competition. Price dispersion has been found in a number of online markets.

There is little scope for public policy to control pricing or market structure directly. Obviously, high-α markets cannot be de-concentrated to any point below the "lower bound" as the industry then would not be in equilibrium, and concentration would

[10] The practice of greater discounts for books on the bestseller list is also found among some firms in bricks and mortar retailing, and the same market power factors can be used to explain the variation. This indicates that the Internet is not so competitive that these factors are eradicated.

increase again. However, policies aimed at reducing the need for advertising may reduce the lower bound to concentration. The effectiveness of advertising derives in part from consumer concerns about transaction security. These worries may decline over time. The industry itself may develop new methods of assuring their quality to consumers, such as third-party accreditation systems. Alternatively, the government may intervene to ensure such a system develops. Otherwise, a price-competitive, cost-minimizing, market structure may elude us into the future.

REFERENCES

Baumol, W. J. "Contestable Markets: An Uprising in the Theory of Industry Structure", *American Economic Review* 72 (1982): 1-15.

Bailey, Joseph P. "Intermediation and Electronic Markets: Aggregation and Pricing in Internet Commerce." PhD Thesis (1998) for Technology, Management, and Policy. *Massachusetts Institute of Technology*, Cambridge, MA.

Bliss, Christopher. "A Theory of Retail Pricing." *The Journal of Industrial Economics* 36 (June 1998): 375-391.

Brynjolfsson, Erik and Smith, Michael D. "Frictionless Commerce? A Comparison of Internet and Conventional Retailers." MIT Sloan School of Management (2000),

Butters, G. R., "Equilibrium Distribution of Sales and Advertising Prices", *Review of Economic Studies*, 44 (1977), 465-491.

Cooper, Tony. *Blackwell Retail Books.* Phone Interview on 02 February 2000, 1345.

Grossman, G. M. and Schapiro, C. "Informative Advertising with Differentiated Products"" *Review of Economic Studies* 51 (1984), p63-81.

Klein, B. and Leffler K. B., "The Role of Market Performance in Assuring Contractual Performance", *Journal of Political Economy*, 89 (1981) 615-641.

Klemperer, Paul. "Markets With Consumer Switching Costs." *Quarterly Journal of Economics* 102 (1987): 375-394.

Milgrom, Paul and Roberts, John. "Price and Advertising Signals of Product Quality." *Journal of Political Economy* 94 (August 1986): 796-821.

Rotemberg, Julio J. and Saloner, Garth. "A Supergame-Theoretic Model of Price Wars during Booms." *The American Economic Review* 76, Issue 3 (June, 1986): 390-407.

Salop, Steven and Stiglitz, Joseph. "Bargains and Ripoffs: A Model of Monopolistically Competitive Price Dispersion." *Review of Economic Studies* 45 (1977): 493-510.

Shaked, A. and J. Sutton, "Relaxing Price Competition through Product Differentiation", *Review of Economic Studies,* 49 (1982), 3-13.

Shapiro, Carl. "Theories of Oligopoly Behavior." *Handbook of Industrial Economics*, Volume I, Elsevier Science Publishers B.V., 1989.

Sobel, Jœl. "The Timing of Sales." *The Review of Economic Studies* 51, Issue 3 (July, 1984): 353-368.

Sutton, John. *Sunk Costs and Market Structure*. United States: Massachusetts Institute of Technology Press, 1991.

Sutton, John. *Technology and Market Structure*. United States: Massachusetts Institute of Technology Press, 1998.

Varian, Hal R. "A Model of Sales." *The American Economic Review*, 70, Issue 4 (Sep., 1980): 651-659.

Verdict *Electronic Shopping* June 2000

Wernerfelt, B. "Umbrellas Branding as a Signal of New Product Quality: An Example of Signaling by Posting a Bond." *Rand Journal of Economics* 19 (1988): 458-466.

Figure 1: Revenues of Online and Bricks and Mortar Book Retailers: Quarterly ($)
(Note: revenues include non-book sales)

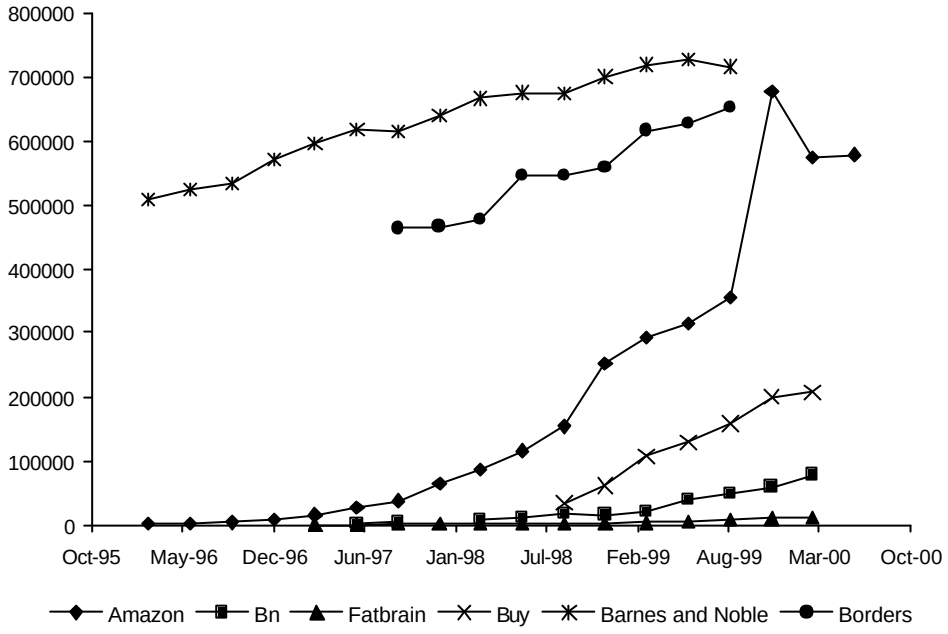

Figure 2: Advertising Levels of Online Book Retailers
Quarterly ($)
(Note: figures include non-book advertising)

