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PRICING, SUNK COSTS, AND MARKET STRUCTURE ONLINE: EVIDENCE FROM BOOK RETAILING

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While online consumers are less concerned than traditional consumers about firm location, they may be more concerned about unobservable quality and, to signal this, online retailers rely more on advertising than traditional retailers. Imperfect price competition may arise because of vertical product differentiation, incomplete consumer awareness, and near-perfect information exchange between retailers. This paper evaluates alternative theories of competition and market structure in online retailing. Advertising, product development, and revenue data for the online book market reveal that consumers respond to advertising and website spending rather than low prices. As the market size expanded, during 1997–2001, these endogenous sunk costs escalated and there was no major new entry. Advertising-to-sales ratios and market-concentration ratios are much higher than for traditional bookselling. 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.

I. INTRODUCTION

Internet retailing has been prophesied to facilitate efficient markets. In this view, low consumer search costs and the absence of spatial product differentiation promote competitive pricing. The efficiency of consumer search is further enhanced by search engines, or shopbots, which find the retailer with the lowest price. 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.

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An alternative view is that these potential gains of e-commerce are 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 heavily to increase consumers' willingness to pay. Consequently, fixed costs are endogenous and sunk, and greatly exceed the minimum necessary for set-up. The high level of advertising expenditure allows only a few firms to survive, even in world-wide markets, just as happens in many traditional industries (Sutton, 1991,1998). Moreover, Internet retailers are perfectly informed about their rivals' prices, undermining the incentive for any firm to cut prices. Internet retailing is not cost minimizing, the market is concentrated, and prices exceed efficient levels.

In practice, the validity of these opposing views depends 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 cars. Here, set-up costs are high relative to market size. Others are easily delivered, such as computer parts, books, CDs, financial services, and travel. Here, set-up costs are small relative to market size. Some products are commodity items; others, such as clothes, require the consumer to rely on the retailer's merchandising skills. A final difference is that some products, such as books, are sold mainly to households while others, such as computer parts, are sold mainly to professional institutional buyers.

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 UK 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 densely populated areas. Egg, the UK 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, companies selling to the consumer market usually emphasize brand name and attempt to extend the brand to new products, e.g. Amazon.com began as a book retailer but now sells toys, tools, and hardware.

The objective of this paper is to decide which view of Internet commerce is valid for the online book-retailing market. We derive predictions of two opposing theories and assess them using data from the market.

One reason to choose the book market for study is that it might be expected to be competitive *a priori*. Books are a simple physical good that can be cheaply shipped to consumers over a large market area 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 homogeneous nature of books facilitates product comparisons across firms.

Another reason to be interested in the book market is that evidence is likely to generalize to products falling into the same class, i.e. those that are easily deliverable, comparable across retailers, and bought mainly by households. This is an important class of products and includes DVDs, CDs, toys, and tools. Indeed, the firms that sell books online often also sell these other items and apply a similar business model to them.

A practical advantage of the book market is that more data are available than is usual in e-commerce. This is not entirely down to the relatively long data run. Unlike other markets, the main online booksellers have US public listings, so that quarterly financial data are available via US Securities and Exchange Commission (SEC) records. Furthermore, because book sales information is available from bestseller lists, it is possible to gauge overall demand levels for specific products on a weekly basis.

The two biggest bricks-and-mortar booksellers in the USA are Barnes & Noble and Borders Bookstores. Together these account for over 40 per cent of books sold in the traditional US sector. Amazon.com was among the first companies to start selling books online. All of Amazon's sales are through the Internet. Since its foundation in July 1994, it has been the leading online retailer. Jeff Bezos, the CEO of Amazon.com, never envisioned Amazon.com as merely a book retailer, and book sales now only constitute part of its revenue. However, he believed the book market allowed the easiest entry into online retailing. Barnesandnoble.com (henceforth, Bn.com) has been

in operation since May 1997 and has led the most successful counterattack by the traditional retailers into the online market.[2] Fatbrain.com, formerly the Computer Literacy Bookstore, launched its online operations in February 1996. It runs some traditional bricks-and-mortar stores, but since 1999 has shifted its emphasis from traditional to online retailing. It was bought by Bn.com in November 2000, and still trades using the Fatbrain name. Buy.com entered the market in June 1997 as a general online retailer, and follows a low-price strategy. Borders was slower than its competitors to move online, setting up an online presence in May 1998. At the time of writing, Borders has a small market share and remains a fringe player. The fringe firm A1books.com has been selling books since 1995. There are now dozens of other fringe firms in the USA alone.

The two largest players, Amazon.com and Bn.com, which have been competing since 1997, dominate the online market. The book market is one of the oldest of the Internet retail sectors, and the most likely to have reached stability in pricing behaviour and market structure. Although net profits are still negative, the positive (if variable) stock-market valuations indicate expectations of positive profits as the market grows.

There are already some useful empirical studies on Internet retailing. 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 4 months, prices had equalized, indicating some price competition. Brynjolfsson and Smith (2000*a*) make the comparison with bricks-and-mortar and conclude that books and CDs cost less on the Internet, even if shipping costs are included in the price, assuming three items are bought.[3] However, their study also reveals considerable price variation across Internet retailers: book prices were an average of 33 per cent more dispersed than conventional retailers. Internet prices for CDs were 25 per cent more dispersed. This leads the authors to conclude that there is not perfectly competitive pricing on the Internet.

Brynjolfsson and Smith (2000*b*) also analyse data provided by Internet shopbot company Evenbetter.com, which performs a search of all online booksellers selling the requested title. They estimate a model of consumer choice and find that price is only one of a number of characteristics which consumers care about when buying books online. In particular, consumers are prepared to pay more to use a branded seller and will pay more for a seller they have visited previously. This suggests that there are important unobserved quality characteristics for which brand name is a signal, and that there may be important costs of switching from one seller to another. This is interesting, as shopbot users are only a small fraction of book buyers, and are likely to be the most price-sensitive.

Brown and Goolsbee (2000) look at the effect of the Internet on prices in the US life-insurance market, by examining the change in prices for groups of consumers that differ in their access to the Internet. They find that the Internet increased price competition: a 10 per cent increase in the share of individuals in a group using the Internet reduces prices by up to 5 per cent.

Ellison and Fisher Ellison (2001) look at the retailing of computer parts. In this market, unlike bookselling, a price search engine (Pricewatch) plays a dominant role. They found that retailers are able to frustrate the search process by exploiting the fact that the search engines are better at assessing prices than quality. For example, when selling memory, the firms adopt a 'bait and switch' tactic in which they lure consumers to their site by offering products at low prices. When at the site, the customer discovers that the product is of an unattractively low quality but is informed of better-quality, better-value, alternatives. As a result there is a *negative* cross-price elasticity between the low- and high-quality products, even though they are (intrinsic) substitutes. Partly as a result of these

[2] There is a slight difference between Barnes & Noble and Bn.com. The latter is a joint venture (completed on 12 November 1998) between Barnes & Noble Inc. (the bricks-and-mortar retailer) and Bertlesmann AG, each of which own 40 per cent, with Bn.com owning the remaining 20 per cent.

[3] 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.

tactics, firms are able to avoid extreme price competition on the higher quality items. The authors note that firms have low market shares, low advertising and website development expenses, and are able to cover fixed costs. As we shall see, this contrasts with online book retailing, where advertising is high. The difference is likely to stem from the different type of buyer: computer parts are mostly bought by professional institutional buyers, who respond less to advertising.

Our research proceeds in two steps, corresponding to the two stages in an oligopoly game. In section II we examine the advertising and entry behaviour of Internet retailers, and compare this with bricks-and-mortar bookselling. Our method treats traditional booksellers as a *control group*: i.e. comparisons with online booksellers identify the effect of the mode of distribution—Internet as opposed to bricks-and-mortar—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 by tracking prices of books on a weekly basis and relating these to the popularity of the book each week, and to the advertising expenses of the firms. Section IV concludes.

II. FIXED COSTS AND MARKET STRUCTURE

(i) Websites, Advertising, and the Internet Shopping Experience

We distinguish between two types of fixed costs: set-up costs and endogenous fixed costs. Set-up costs are those needed to enter the market with a basic level of product attractiveness. These costs are thought to be small for Internet firms: administration costs, the setting up and maintenance of a functional website, and the distribution warehouse. Endogenous fixed costs improve consumers' valuation of the product from its basic level. Unlike set-up costs, endogenous fixed costs are a choice variable for the firms. They include the costs of improving speed of processing, the security of transactions, the development of the website, and advertising. The importance of endogenous fixed costs in firm strategy is a crucial determinant of an industry's equilibrium market structure. The objective of this section is to assess whether endogenous fixed costs are important for online booksellers, particularly website development and advertising.

There are various reasons for firms to invest in website development. The most obvious is to enhance the attractiveness of the browsing experience, which attracts more visitors. 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. This procedure allows shoppers to purchase items without re-entering their shopping and billing information each time. Other firms have developed similar technologies. In addition to attracting new customers, this feature increases the cost to repeat consumers of visiting rival sites, and thus allows the firm to adopt a higher price strategy when it has a large customer base—which may account for the willingness of repeat customers to pay higher prices, as reported in Brynjolfsson and Smith (2000*b*). A further motivation for innovations to website design is to obtain information on consumer tastes and characteristics, allowing more efficient targeting of book promotions and other products.

Internet companies may 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 the prices of the goods. 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 Klein and Leffler, 1981; Milgrom and Roberts, 1986). Although the physical products sold (such as books) may be the same quality across retailers, the Internet retailing service has three quality characteristics

which are unknown *a priori*: the browsing experience, quality of delivery, and transaction security.[4]

The browsing experience cannot be appreciated until the firm's website is visited; advertising is required to encourage consumers to take the time and effort. Neither can consumers be sure about a firm's ability to deliver in a timely and reliable way; they can only find out about this after one or a few purchases, and advertising is needed to encourage consumers to make their first few orders. 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 evolve rapidly. Even after a few transactions the consumer is not totally sure how safe a company may be. Consumer confidence can be increased through advertising.

The importance of advertised brand names in Internet retailing supports the idea that unobserved quality is important. Internet firms use this unobserved quality in 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 service aspects of purchasing very dissimilar items online from the same retailer are so similar that a consumer disappointed with service quality for one 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 US Securities and Exchange Commission (p. 12):

> 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.

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

Having discussed the possible benefits from advertising and website expenses, we now derive three predictions that are implied if these are important. To help derive these predictions, we briefly outline some theory which relates endogenous sunk costs to market structure.

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

Sutton (1998) characterizes markets using a parameter, α, which measures the extent to which a firm can increase gross profits by outspending its rivals on fixed expenses which increase the perceived quality of its products. These expenses usually take the form of advertising or product development. Suppose a firm, outspending its highest spending rival by a factor K, can obtain a proportion A of industry revenue as gross profit. Then $\alpha = A/K$.[5]

Sutton shows that a high-α industry cannot have a low-concentration market structure in equilibrium. The intuition is simple. Imagine a very low-concentration market, where by definition each firm has a very low share of market revenue. For this to be a profitable configuration, each firm's advertising expenses must also be very low as a share of industry revenue. But if α is high, such a situation could not be an equilibrium, because it would be profitable for any firm to outspend rival advertising by *factor K*, in return for the given fraction A of industry revenue which it can obtain as gross profit. The outspending strategy is always profitable for some sufficiently low level of concentration and advertising expenses. This fact places a 'lower bound' to the level of concentration that can be sustained in equilibrium. Specifically, Sutton proves that α is the lower bound to the one-firm concentration ratio, i.e. $C1 \geq \alpha$. Note that this bound is independent of the size of the market. As the size of the market increases, the level of spending on endogenous fixed costs increases proportionately, and concentration remains high.

To examine the effect of the Internet on the level of concentration in book retailing, we examine the determinants of α. We think of the market as being

[4] 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.'

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

comprised of a large number of geographic 'sub-markets' or locations, which we identify using *i*. These markets are the 'catchment areas' of traditional retail marketing, as determined by consumer transport costs. Following Sutton's notation, we define two parameters that determine the level of α:

- β is the elasticity of fixed costs with respect to perceived quality u_i of the product at any location *i*. A high β means it is costly to increase u_i;

- σ is the extent of linkages across locations, either in demand or costs. Linkages in demand imply that consumers regard products in different locations as good substitutes for each other. Linkages in supply imply that outspending in one location reduces the cost of increasing perceived quality in another. Either way, a high σ implies high returns to increasing u_i.

α is decreasing in β, and increasing in σ. This is quite intuitive: on the one hand, if it is costly to increase u_i then the returns to outspending on advertising are low. On the other, more linkages across locations implies higher returns from outspending, as profits are obtained from consumers outside the 'home' location.

(iii) Bricks-and-Mortar and Online Bookselling: A Comparison

Using the above framework, it seems likely that α is higher for Internet retailing than bricks-and-mortar retailing.[6] To see this, we discuss the levels of σ and β in each market, classifying them as 'low', 'medium', and 'high'.

Bricks-and-mortar bookselling

- Low β**:** quality u_i in location *i* may be increased substantially via expenditure on 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 σ: there is little demand substitution across locations, owing to consumer transport costs, but there are moderate economies of scope: once a successful retail format is achieved in any location, the formula may be replicated elsewhere at lower cost.

- Medium α: the low β and medium σ suggests a medium level of α, so that the level of concentration has some positive lower bound. A *very* low-concentration structure is vulnerable to the entry of a retail chain of quality stores. However, the benefit of investment at any one location is limited by the presence of consumer transport costs.

Internet bookselling

- Low β: investment in website development improves the browsing experience; advertising can be used to enhance perception of browsing experience, delivery quality, and transaction security.

- High σ: unlike in traditional bookselling, there is no horizontal differentiation as consumer transport costs are zero.

- High α: a low β and high σ yield a high α. A low-advertising, low-concentration market structure is vulnerable to entry by a high-advertising firm with a high-quality website.

(iv) Testable Predictions

We have argued that advertising and website development are endogenous costs, that α is high for Internet bookselling, and that it is higher than α for traditional bookselling. We now derive three empirical implications of this view.

First, if advertising and website costs are endogenous they increase with the size of the market, so that the market remains concentrated as it grows. The alternative is that advertising and website development are exogenously fixed set-up costs, allowing a low-concentration market structure to emerge as the market size increases. Then, as the online book market grows, each firm's advertising costs remain constant and more firms enter. To reject this alternative, we use Prediction 1, which is only implied if the costs are endogenous.

[6] For simplicity, we treat online and traditional bookselling as two separate markets. Sutton's framework is designed flexibly to be used at alternative market definitions; this is intended to help in empirical work where there is often no 'right' level of aggregation (see Sutton, 1998, pp. 14–16).

Table 1
Revenues and Profits of Online Booksellers

	1995	1996	1997	1998	1999	2000
Revenues ($000)						
Amazon	511	15,746	147,787	609,943	1,639,839	2,762,094
Bn	—	—	6,205	53,667	88,116	324,345
Fatbrain	—	—	3,021	10,093	18,524	29,385[a]
Buy	—	—	—	96,514	596,848	787,670
Gross margin (% of sales)						
Amazon	20	22	20	22	18	24
Bn	—	—	—	23	21	18
Fatbrain	—	—	25	17	22	21[a]
Buy	—	—	—	0	–1	6
Operating profits (% of sales)						
Amazon	–59	–38	–20	–18	–37	–31
Bn	—	—	–113	–156	–61	–71
Fatbrain	—	—	–29	–52	–86	–94[a]
Buy	—	—	—	–17	–22	–17

Note: [a] First two quarters only.
Source: SEC.

Prediction 1. As the Internet book market expands, advertising and website expenditure increases.

Second, if α is higher in the online market than in the traditional market, then the advertising-to-sales ratios (and website-costs-to-sales ratios) should be higher for firms in the online market. An alternative possibility is that such expenditures are less worthwhile because prices are more competitive in the online sector. To reject this alternative we use Prediction 2.

Prediction 2. Internet retailers spend a higher proportion of revenues on advertising and website development than traditional retailers.

Third, if Internet bookselling has a high α, then $C1$ is high.[7] Furthermore, if online bookselling has a higher α than traditional retailing, then it should also have a higher $C1$, 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 UK, where bricks-and-mortar retailers have recently experienced a period of moderate consolidation, following the end of the Net 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. Prediction 3 is implied by our theory.[8]

Prediction 3. The one-firm concentration ratio is high for Internet book retailing, and higher than for traditional book retailing, for markets of similar size.

(v) Data and Evidence

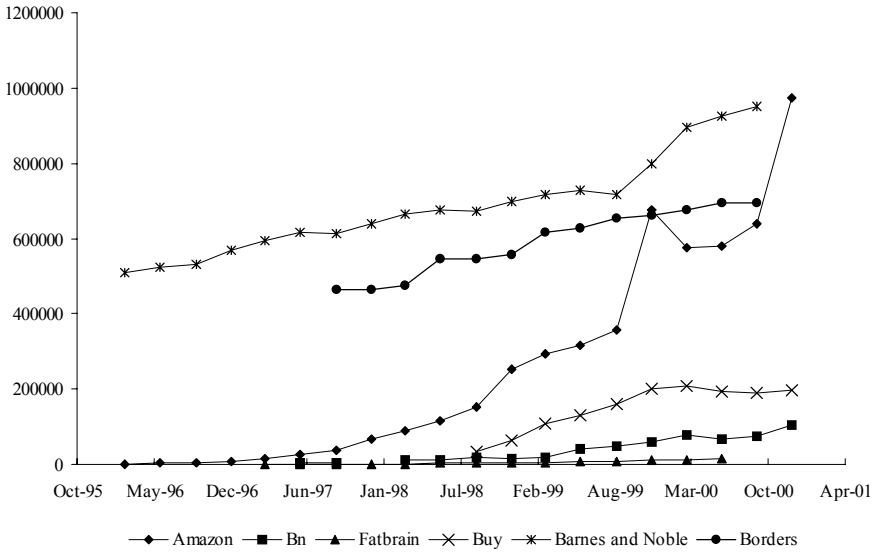
Revenues and profits

Using data from company quarterly accounts, obtained from the US SEC, Table 1 shows revenues and profits from the four largest online booksellers. Revenues are shown in the first four rows. The joint revenues of the top four firms have increased from $0.5m to over $3,500m in the period 1995–2000. The next four rows show gross margins, i.e. the difference between sales revenue and the cost of

[7] Recall that α is the lower bound to the one-firm concentration ratio, i.e. $C1 \geq \alpha$.

[8] This proposition is an implication of our theory but does not reject the alternative view, that α is low in online retailing, as α only provides a *lower bound* to concentration.

Figure 1
Revenues of Online and Bricks-and-mortar Book Retailers
(quarterly, $'000s)



buying the goods as a percentage of sales. Three of the four firms enjoy gross margins of 20–30 per cent, which is not very different from gross margins enjoyed in traditional retailing. The fourth firm, Buy.com, appears to adopt a much more competitive pricing position, as its margins are much lower. In section III we confirm that Buy.com set lower prices in this period. These considerations suggest that, with the exception of Buy.com, the firms in the market are not setting intensely competitive prices. Despite this, operating profits are negative—i.e. fixed costs exceed gross profits. We now explore the nature of the fixed costs.

Prediction 1. Escalating advertising and website development costs.

The online book market has grown rapidly. Figure 1 plots the increase in each firm's revenues over the period. These firms constitute 80–90 per cent of the world-wide online book market. The increase in revenues gives a good idea of the growth of the market—although not all revenue is derived from books as the firms have become diversified. The SEC data separately identify advertising and website development costs for online firms. Figure 2 plots advertising expenditure: it shows that the big players have escalated advertising as the market has grown, consistent with Prediction 1. Advertising expenditures are unequal: Amazon outspends rivals by as much as 300 per cent.

If advertising were an exogenous set-up cost, advertising-to-sales ratios would continuously fall as revenues grow. This has not happened. Table 2 shows that Amazon.com has spent a constant 20–30 per cent of revenues on advertising, while revenues have grown rapidly. The advertising/sales ratios of Bn.com and Buy.com have also remained high. Fatbrain.com's advertising/sales ratio has actually increased. Table 2 shows that expenditure on product and website development has also remained high, at 10–15 per cent as a share of sales for the four companies, with the exception of Buy.com.

Prediction 2. Advertising and product development costs are higher online.

We report advertising and website development costs in proportion to sales in Table 2. Some of these ratios have fallen from their initial values, but they appear to have converged to a high level. Amazon.com spends 20–30 per cent of revenues on advertising. Bn.com spends over 40 per cent. Fatbrain.com's advertising/sales ratio has increased to over 70 per cent. For each of these companies, website costs are a consistent 10–20 per cent of revenues. Adding together development and advertising costs, Amazon spends about 32 per cent of revenues on endogenous costs, and Bn and Fatbrain spend over 50 per cent. Buy follows a different strategy, spending only 13 per cent on endogenous costs. This resembles a very-high-α industry: Sutton

Figure 2
Advertising Levels of Online Book Retailers
(quarterly, $'000s)

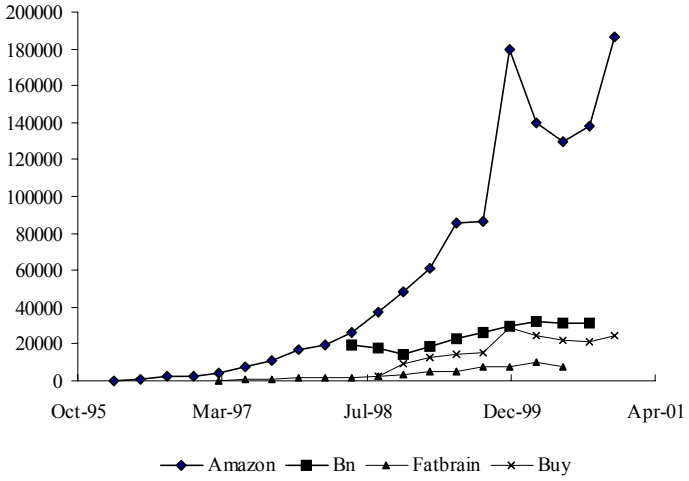


Table 2
Gross Profits, Advertising, and Website Development Costs

	1995	1996	1997	1998	1999	2000
Online retailers						
Advertising (% of sales)						
Amazon	39	39	27	22	25	22
Bn	—	—	—	171	55	43
Fatbrain	—	—	38	50	71	61
Buy	—	—	—	12	12	12
Product and website development: (% of sales)						
Amazon	41	15	9	7	10	10
Bn	—	—	—	19	10	12
Fatbrain	—	—	8	15	19	15
Buy	—	—	—	1	1	3
Bricks-and-mortar retailers						
Selling and administrative costs (% of sales)						
Barnes & Noble[a]	21	21	19	19	19	20
Borders[a]	19	19	21	21	22	25
Advertising and Development: (% of sales)						
Barnes & Noble[b]	16	16	14	14	14	15
Borders[b]	14	14	16	16	17	20

Notes: [a] Includes administrative costs; [b] assumes mean administrative costs are 5 per cent.
Source: SEC.

(1991) uses an advertising/sales ratio of 4 per cent to define a high-advertising industry. But how does it compare to bricks-and-mortar book retailing? Comparison is frustrated somewhat by the fact that, for traditional booksellers, marketing and development expenses are not reported separately, but are

combined with administrative expenses, under the category 'selling and administrative expenses'—as shown in Table 2 for Barnes & Noble and Borders Group.[9] In 1995–2000 Barnes & Noble and Borders spent about 19–22 per cent of revenues on 'selling and administrative' expenses—i.e. less than the online firms spend on endogenous costs alone.

Online firms spend on average 5 per cent of sales on general administrative expenses. Assuming this ratio is constant across the Internet and bricks-and-mortar markets, which probably errs on the high side,[10] then Barnes & Noble spends 14–16 per cent of revenues on advertising and product development. Borders spends about 14–20 per cent. These adjustments are shown in the bottom rows of Table 2. For both retailers, the ratio of advertising and development costs to sales is at most approximately one-half the costs for Amazon.com and the other online firms, with the exception of Buy.com. Prediction 2 is supported.

Prediction 3. Concentration is higher online.

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 online books only. UK revenues for the traditional sector are included because annual sales are close to those of the world-wide online markets. The table shows that the online book market is highly concentrated, and considerably more concentrated than the traditional sector, consistent with Prediction 3. The $C1$ for worldwide online books is 62 per cent; for the books, music, and video market, $C1$ is 77 per cent. These are much higher than the US and UK traditional markets, which have $C1$s of about 20 per cent. The $C4$ are also higher for the online book market than for the US and UK traditional markets. Another method of measuring online concentration is to use the level of traffic that goes through each site. According to research by Web21, the top four Internet retailers account for 99.8 per cent of all hits for online book retailers.[11] This points to a very concentrated online market.

Table 3 shows the market shares of the online booksellers. It is noteworthy that Buy.com has a small market share—only 5 per cent. As we have seen from Tables 1 and 2, Buy.com follows a different strategy to the other online retailers, involving lower advertising and lower website development costs. Section III shows that Buy.com charges lower prices than the other firms for almost all titles. If there were very low search costs on the Internet, and consumers responded only to prices, the firm with the lowest prices would attract the most customers. However, Buy.com's market share for books is much smaller than those of Amazon.com or Bn.com, consistent with endogenous sunk-cost theory.

(vi) Summing Up

As Table 1 shows, the firms are still making losses, so that the market is not yet in a long-run, stationary equilibrium. How might our results change in a stationary equilibrium when company reports return a profit? Profitability will be achieved when the firms' advertising and website development costs are less than their gross profits. This might result if there is a reduction in the number of firms,[12] or if the firms restrain the growth in their advertising costs. However, only a drastic reduction in the ratio of advertising costs to sales could reverse the findings of this section. This is unlikely. We conclude that online book selling is a high-advertising, high-concentration market.

III. PRICE BEHAVIOUR

(i) Market Power on the Internet[13]

There are two obvious reasons why Internet retailers might have less market power than traditional

[9] Note that Barnes & Noble and Bn.com are separate companies and publish separate annual reports. Borders separately reports online and traditional accounts.

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

[11] Web21 (http://www.web21.com) samples traffic to obtain estimates of total hits for each web address.

[12] There has been some movement in this direction: Bn.com bought Fatbrain.com in November 2000.

[13] For a fuller discussion of pricing on the Internet, see the article by Daripa and Kapur in this issue.

Table 3
Sales and Concentration Levels for Traditional and Online Retailers

Traditional USA (1997)[a]			Traditional UK (1998)[a]		
Books			Books		
	$m	%		£m	%
Total	12,536	100	Total	2,841	100
*C*4	5,641	45	*C*4	1,210	40
Barnes & Noble	2,758	22	Waterstones	574	20
Borders	2,256	18	WH Smith	509	18
Crown	301	2	Blackwells	68	2
Books-a-Million	326	3	Books Etc.	60	2
Online (1999)					
Books, music, video			Books		
	$m	%		$m	%
Total	1,700	100	Total	1,125	100
C4	1,589	93	C4	962	86
Amazon	1,308	77	Amazon	697	62
Bn	202	12	Bn	188	17
Borders	18	1	Borders	16	2
Fatbrain	19	1	Fatbrain	17	2
Buy	70	4	Buy	60	5

Note: [a] Excludes school books.
Sources: American Booksellers Association, UK Booksellers Association, Harris Interactive, Jupiter Communications, www.sec.com

retailers. First, there is no spatial product differentiation—many firms are brought into direct competition. Second, the cost of search on the Internet is lower than on the High Street. Sources of market power remain, however. Search is not perfect, nor costless. Consumers may be unaware of some online retailers, allowing prices to be increased above marginal cost (see Butters, 1977; Grossman and Schapiro, 1984). Vertical product differentiation may be more important on the Internet, as consumers care about website design, delivery, and transaction security (Shaked and Sutton, 1982). Finally, tacit collusion may be facilitated by the ability to detect and respond rapidly to a rival firm's price changes (see Schapiro, 1989). The presence of market power is suggested in our data because of price dispersion for a given title—across firms and over time.

(ii) Inter-firm Price Dispersion

There are two possible reasons for inter-firm price dispersion.

The first is search costs. If consumers differ in their costs of search, then price dispersion can result, where some firms set high prices and others set low prices (Salop and Stiglitz, 1977). Low-price firms end up selling to the consumers who search, and a few lucky 'no-search' consumers. High-price firms sell only to consumers with high search costs. In Butters (1977) firms try to inform consumers by advertising, but this does not eliminate price dispersion. Instead, firms differ in their advertising intensity, with high-advertising firms setting higher prices than low-advertising firms.

The second source of price dispersion is quality differences. Even if the delivered products are identical, some firms may offer a superior retail service, and therefore command a higher price (see Shaked and Sutton, 1982). High-price firms may have signalled their superior quality by advertising.

(iii) Inter-temporal Price Dispersion

One explanation for inter-temporal price variation is the desire to get rid of inventories. Another is changes in marginal cost. Four other explanations involve some degree of market power.

First, firms may vary prices over time to discriminate between customers. In Sobel (1984), firms initially sell at a high price to impatient consumers, and then cut prices when the number of patient consumers builds to the point where a lower price is worthwhile. Varian (1980) follows the Salop and Stiglitz (1977) framework of informed and uninformed customers, with randomized pricing by stores to discriminate between informed and uninformed customers.

Second, price variation may be used to take advantage of consumers' costs of changing retailer (see Klemperer, 1987). Firms may offer lower prices initially, or to 'new' cohorts of customers, to build up customer numbers, after which prices are increased to take advantage of their inelastic demand.

Third, there may be changes over time in the incentive to collude. Rotemberg and Saloner (1986) show that when demand is high, but likely to fall, the benefit to undercutting rivals is greater, and the maximum sustainable collusive price falls.

Fourth, price reductions may be used to attract customers to the site who then purchase other products, sold at higher prices. This happens in models of 'loss leading' as well as Bliss's (1988) model of multi-product retail pricing. In these models it is usually best to reduce the prices of 'hot' (or high-demand) products, rather than low-demand products. This practice is used in supermarkets, where popular product lines, such as milk and baked beans, are sold at very low profit margins. Internet book retailers are similar to supermarkets in that consumers usually purchase a basket of products at any single transaction. Unlike supermarkets, however, high-demand products change from week to week, implying inter-temporal price variation for any given title.

(iv) Data and Results

Two samples of books were taken, each including 12 titles. In the first sample, starting from 30 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 8 November 1999, the top six bestsellers from each list were chosen. Both surveys continued until 30 February 2000. There were 26 weeks of data for the first sample and 16 weeks for the second sample. Once a week, data were 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 shipping companies.

Table 4 presents the data for a selection of titles. The first column gives the week number. To save space, we group together those weeks in which no price change occurs. In column 2 the rank of the book in the *New York Times* bestseller list is given. Where several weeks are grouped together we use '<16' if the book is consistently in the top 15 and '>15' if the book is consistently out of the top 15. The position of the book in the previous week is given in parenthesis. Remaining columns report the prices of the book for each seller in the survey. Where a change in price occurs this is put in bold type.

The table shows that the two market leaders appear to follow a rule: they heavily discounted the top 15 books on the *New York Times* bestseller list. Amazon.com and Bn.com discounted these books by 50 per cent of the retail price; they discounted other books on average by about 30 per cent. In addition, note that the two leading firms charge almost equal prices. Two of the fringe firms, A1books.com and Fatbrain.com, offered a consistent 30–35 per cent discount on most titles. Buy.com was less consistent, but generally charged the lowest available price. Overall, there was considerable price dispersion among firms for any given book.

Table 4
Book Prices and Position on Bestseller List

Hannibal by Thomas Harris (30 August 1999–21 February 2000)

Week	Rank	Amazon.com	Bn.com	A1books.com	Fatbrain.com	Buy.com
1	5 (—)	$13.90	$13.97	$18.25	$19.95	*
2–8	<16 (5)	**$13.98**	$13.97	$18.25	$13.95	*
9–11	18 (12)	**$19.57**	**$19.56**	$18.25	$13.95	*
12	24 (20)	$19.57	$19.56	$18.25	**$19.55**	*
13–16	>15 (24)	$19.57	$19.56	**$19.50**	$19.55	$18.77
17–19	>15 (16)	$19.57	$19.56	**$19.00**	$19.55	$18.77
20	15 (20)	**$13.98**	**$13.97**	$19.00	$19.55	$18.77
21	23 (15)	**$19.57**	**$19.56**	$19.00	$19.55	$18.77
22–26	>15 (23)	$19.57	$19.56	**$18.25**	$19.55	$18.77

Granny Dan by Danielle Steel (30 August 1999–21 February 2000)

Week	Rank	Amazon.com	Bn.com	A1books.com	Fatbrain.com	Buy.com
1	6 (—)	$9.90	$9.97	$13.00	*	*
2–5	<16 (6)	**$9.98**	$9.97	$13.00	$13.95	*
6–12	>15 (12)	**$13.97**	**$13.96**	$13.00	$13.95	*
13–16	> 15(>15)	$13.97	$13.96	**$13.75**	$13.95	$12.97
17–21	> 15(>15)	$13.97	$13.96	**$13.50**	$13.95	$12.97
22–26	> 15(>15)	$13.97	$13.96	**$13.00**	$13.95	$12.97

Assassins by Tim LaHaye and Jerry Jenkins (30 August 1999–21 February 2000)

Week	Rank	Amazon.com	Bn.com	A1books.com	Fatbrain.com	Buy.com
1	2 (—)	$15.90	$11.49	*	*	*
2–4	<16 (2)	**$9.99**	$11.49	$13.00	$9.95	*
5	6 (5)	$9.99	**$9.98**	$13.00	$9.95	*
6–8	<16 (6)	$9.99	**$11.49**	$13.00	$9.95	*
9–11	<16 (8)	$9.99	**$9.98**	$13.00	**$11.45**	*
12–13	<16 (12)	$9.99	$9.98	**$13.75**	$11.45	*
14	15 (11)	$9.99	$9.98	$13.75	**$16.05**	$8.99
15–16	>15 (15)	**$13.98**	**$13.97**	$13.75	**$13.95**	**$13.98**
17–26	>15 (21)	$13.98	$13.97	**$15.50**	$13.95	$13.98

Notes: Figure in brackets is previous week's rank. * Indicates a missing observation. Bold type indicates a change in price.

For example, on the first day of the survey, the price of the novel *Hannibal* varied from $13.90 to $19.95, as shown in the first row of Table 4.

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* list). For example, in week 5 (27 September 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 increased to $13.97 and $13.96 respectively (see Table 4). This pattern was repeated for four out of the five qualifying titles in the first sample and for three out of three in the second sample. This can be seen for a selection of titles in Table 4. *Hannibal*, which returns to the top 15 in week 20 only, illustrates the rule nicely.

Table 4
Book Prices and Position on Bestseller List (continued)

Black Notice by Patricia Cornwell (30 August 1999–21 February 2000)

Week	Rank	Amazon.com	Bn.com	A1books.com	Fatbrain.com	Buy.com
1	1 (1)	$12.90	$12.97	$17.00	*	*
2–8	<16 (1)	**$12.98**	$12.97	$17.00	$12.95	*
9–10	>15 (9)	**$15.57**	**$18.16**	$17.00	$12.95	*
11–12	>15 (18)	$15.57	**$12.97**	$17.00	$12.95	*
13	25 (23)	$15.57	$12.97	**$18.00**	$12.95	*
14	29 (25)	**$18.17**	$12.97	$18.00	**$18.15**	$14.99
15–17	>15 (34)	$18.17	$12.97	**$17.50**	$18.15	**$15.57**
18–19	>15 (35)	**$12.98**	$12.97	$17.50	$18.15	$15.57
20–21	>15 (34)	$12.98	**$18.16**	$17.50	$18.15	$15.57
22–23	>15 (29)	$12.98	$18.16	**$17.00**	$18.15	$15.57
24–25	> 15(>15)	**$18.17**	$18.16	$17.00	$18.15	$15.57
26	> 15(>15)	$18.17	$18.16	$17.00	$18.15	**$17.17**

Pop Goes the Weasel by James Patterson (8 November 1999–21 February 2000)

Week	Rank	Amazon.com	Bn.com	A1books.com	Fatbrain.com	Buy.com
1–2	3	$13.48	$13.47	$17.75	$18.85	$12.94
3–4	<16 (3)	$13.48	$13.47	**$18.75**	$18.85	$12.94
5–11	<16 (8)	$13.48	$13.47	$18.75	$18.85	**$13.47**
12	12 (11)	$13.48	$13.47	**$17.75**	$18.85	$13.47
13–14	>15 (12)	**$18.87**	**$18.86**	$17.75	$18.85	$13.47
15	20 (19)	$18.87	$18.86	$17.75	$18.85	**$15.00**
16	29 (20)	$18.87	$18.86	$17.75	$18.85	**$18.17**

'O' is for Outlaw by Sue Grafton (8 November 1999–21 February 2000)

Week	Rank	Amazon.com	Bn.com	A1books.com	Fatbrain.com	Buy.com
1	6 (—)	$13.00	$13.00	$17.00	$15.60	$12.48
2	6 (6)	$13.00	$13.00	$17.00	$15.60	**$12.99**
3	7 (6)	$13.00	$13.00	**$18.00**	$15.60	$12.99
4–6	<16 (7)	$13.00	$13.00	$18.00	**$18.20**	$12.99
7	12 (12)	$13.00	$13.00	**$17.50**	$18.20	$12.99
8	14 (12)	$13.00	$13.00	$17.50	**$20.95**	$12.99
9–10	14 (14)	$13.00	$13.00	$17.50	**$18.20**	$12.99
11	19 (14)	**$18.20**	**$18.20**	$17.50	$18.20	$12.99
12–16	>15 (19)	$18.20	$18.20	**$17.00**	$18.20	**$17.60**

Notes: Figure in brackets is previous week's rank. * Indicates a missing observation. Bold type indicates a change in price.

The main exception to this rule was *Black Notice* (see Table 4). 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 7 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 got a new and more favourable deal. Second, this novel may

Table 5
t-Test: Two-sample Assuming Unequal Variances
(hypothesized difference = 0, standard deviations in parenthesis)

	Mean disc. top 15	Mean disc. off top 15	Rule deviation	t-stat.	$P(T \leq t)$ 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

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 per cent to 30 per cent, then to 32 per cent, and finally back to 34 per cent. This mark-down 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 5 summarizes data from the two samples. Column 1 gives the mean and standard deviation of the discounts offered for top-15 bestsellers for each company, plus some combinations of companies. Column 2 gives these statistics for books off the top 15. 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. 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 easily 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.

(v) Interpretation

Inter-firm price variation

The inter-firm price variation 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 and Bn.com. This pattern also supports the Butters (1977) model, because low-advertising firms—such as Buy and A1books—have the lowest prices, for books outside the top 15 bestsellers.

Inter-temporal price variation

A number of explanations for the observed inter-temporal price variation can be ruled out. The price reductions are for bestseller books, so an explanation based on unwanted inventories cannot be entertained. 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 UK bricks-and-mortar chain (Blackwell Bookstores), the cost of purchasing a title does not 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 books for retail sale (Cooper, 2000).

Price discrimination can also be ruled out. In Varian's (1980) model of sales, firms use mixed strategies but it is apparent that the prices set by firms are deterministic, not random. In Sobel's (1984) model of sales, and most models of durable good price discrimination, firms initially set high prices, then cut them. This behaviour 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 firm's market share increases, not merely the prices of specific titles.

This leaves us with two explanations, both of which are consistent with the data. The first is that the firms are colluding and the collusive price is changing over time as demand changes (as in Rotemberg and Saloner, 1986). Intuitively, it is more tempting to undercut prices when demand is *high and falling* than if demand is low and constant. Thus the maximum sustainable collusive price for bestsellers is lower. An examination of the data shows both market leaders cutting their prices by exactly the same amount each time (50 per cent off the list price), charging very similar (almost exact) prices for books either on or not on the bestseller list. Rather than coincidence, it seems possible there is some kind of coordination. The problem with this explanation is that it is unclear that collusion should occur book by book.

The second consistent explanation is that firms are cutting prices of high-demand products to attract customers to their sites who then simultaneously or subsequently buy other products from the same site. This behaviour is similar to the so-called loss-leading strategies of supermarkets where frequently purchased items are sold at the lowest mark-ups.

It is obvious that inter-temporal pricing patterns on the Internet are not consistent with the law of one price. We have identified two possible explanations. Although it is difficult to differentiate between these two possibilities, there is a common element: the Internet does not promote marginal cost pricing. The losses incurred by the firms during this period are a consequence of high advertising and development costs, not of average book prices being close to or lower than marginal costs.

IV. CONCLUSIONS

The experience of the online book market suggests that Internet retailing is not the competitive, efficiency-maximizing development many have prophesied. Market structure is more concentrated than in bricks-and-mortar retailing, and advertising is more intense. Firms are far from cost minimizing, spending millions of extra dollars on marketing. Cross-sectional pricing patterns suggest that consumers do not respond much to significant price differences between sellers, but do respond to advertising. Consumers are presumably concerned about price. But they also care about vertical characteristics such as reliability, security, and ease of use—and advertising can signal these. Inter-temporal pricing patterns indicate that firms are not pricing competitively for most books—they set considerably lower prices on high-demand books, for no cost-based reason.

Given the commodity nature of the delivered product, the results are interesting. We believe the results are likely to generalize to e-commerce markets for all products in the class of commodity goods which are easily delivered and which are bought mainly by households rather than professional buyers at institutions. Examples include CDs, DVDs, videos, tools, hardware, and travel tickets. Other evidence supports this claim: advertising and brand names are a common element of online competition for this class of products, while price dispersion has been found in a number of online markets, even after the advent of shopbot comparison services.

A widespread feature of Internet commerce to date is its apparent lack of profitability. The evidence from this paper suggests that this is not primarily the result of low price–cost margins on goods sold—gross margins of online firms are in fact quite similar to traditional firms. Instead, the losses arise from the high marketing expenses that firms incur to signal that they will supply a high-quality service. This explanation is supported by broad-brush evidence from company annual reports, which shows high marketing expenditure across a range of sectors. It is also consistent with Ellison and Fisher Ellison's (2000) finding that the online firms that *are* able to make a profit (selling computer parts) are those that

follow a low-price, low-advertising strategy. These firms sell to business customers who are not influenced by marketing expenditure. The future viability of online commerce for firms selling mainly to households depends on a reduction in advertising-to-sales ratios. This may come about via revenue growth, restraint on the part of the main players, or the elimination of some current firms.

There is little scope for public policy to control pricing, advertising, 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 increase again. However, there may be a case for supporting the development of shopbots, especially as these are never likely to be perfectly provided by the market. As Baye and Morgan (2001) point out, the complete eradication of price dispersion renders such services unprofitable. Regulation may be needed to stop attempts by firms to obfuscate shopbot comparisons. There may also be a case for policies aimed at reducing the need for advertising. 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 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.

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