



The Internet: Still Wide Open and Competitive?

Eli Noam
Professor of Finance and Economics, Director
Columbia Institute for Tele-Information
Columbia Business School

Introduction

For many years now, the Internet seemed to be open, free, and competitive. Internet entrepreneurialism was high, financing easy, entry barriers low. But now, in the wake of the Internet's bursting bubble, the reality of that competitiveness deserves a second look: Is the Internet still as open and competitive as it used to be, or is it becoming concentrated and dominated by a few firms with market power? To even ask this question raises emotional responses, so deeply held is the Internet's self-image of openness and competitiveness, in contrast to the stodginess of the telecom, print, and TV industries.

Many people even have difficulty with the very concept of looking at the Internet as an industry. The early phases of the medium were indeed dominated by government, universities, and non-profit entities, all operating outside of private markets. But even when the Internet became commercialized, it was frequently asserted that the new 'bit economy' operated on fundamentally different principles than the traditional 'atom economy'.

Today, a more balanced perspective has become possible and necessary. This starts with the recognition that the Internet is a set of interacting activities provided by a variety of business firms, operating in interacting sub-markets. The structure of those markets affect, in the classic paradigm of industrial economics, the behavior and hence the performance of these firms. A prime measure for market structure is the extent of market concentration; it is an indicator and predictor of competitive behavior. Since the Internet has been arguably the major force for economic, societal, and cultural innovation in society in recent years, the extent of the competitive forces driving it is significant far beyond the sector itself.

The study of Internet market concentration

This Issue Brief summarizes part of a larger study on media concentration that we are presently undertaking at the Columbia Business School. We measure market concentration in the Internet sector, trace it over time, and compare it with trends in other information industries. I am not aware of any previous empirical effort to examine the market concentration of the Internet sector.

What is the Internet sector?

Before looking at the study and its findings, the term 'Internet sector' needs to be clearly defined. The Internet is today part of most organizations' activities. To encompass all of them as part of the Internet industry would equate this sector with almost the entire economy, thereby making an analysis over-broad. Hence, we define the Internet sector much more narrowly: as the core industries that provide instrumentalities and infrastructure components underlying the Internet's basic functioning.

Our definition of the Internet sector therefore excludes applications, content, computer hardware, and generic telecom/cable conduits. It includes the basic infrastructure components and instrumentalities of the Internet through eight sub-industries: Internet backbones; Internet service providers (ISPs); broadband providers; portals; browser software; search engines; media-player software; and Internet Protocol (IP) telephony. IP telephony straddles applications and infrastructure, and becomes increasingly part of the

latter. Portals, browsers, search engines, and media players enable generic navigation on the Internet.

The nature of market concentration

We analyzed the market concentration trends for these eight Internet-sector industries in America. For each, we tracked revenue and calculated individual firms' market shares in the particular industry sector for a period of twenty years. The resultant database is unprecedented in its scope. These market shares were then used to calculate 'concentration indices' and to track them over time.

The major concentration index employed was the Herfindahl-Hirschman Index (HHI), which is used by the US Department of Justice:¹

$$HHI = \sum_{i=1}^f S_i^2$$

where f = number of firms participating in an industry and S_i = each firm's market share.

The US government's Antitrust Enforcement Guidelines classify market concentrations according to their HHI score:

- Unconcentrated Market: $HHI < 1,000$
- Moderately Concentrated Market: $HHI > 1,000$; and
- Highly Concentrated Market: $HHI > 1,800$.

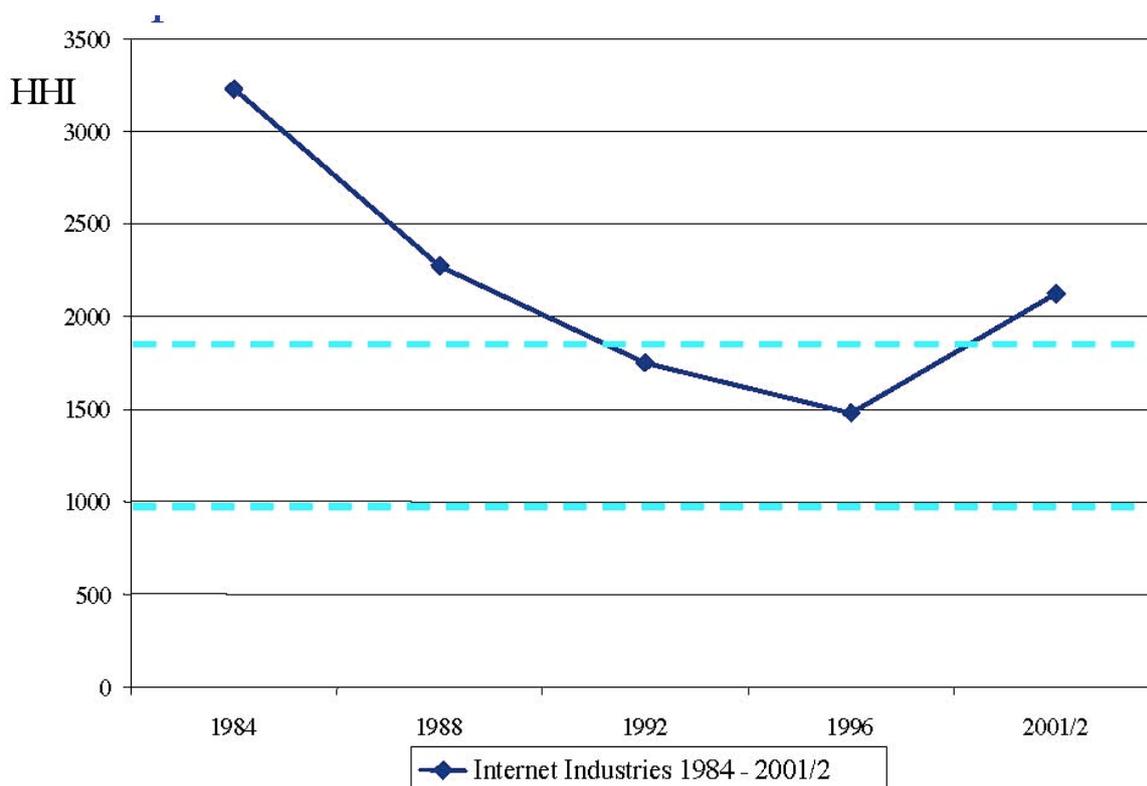
The study tracked these indices of concentration over time starting in 1983 and 1984, from just before and just after the Divestiture of AT&T telecoms in the US. Where industries do not go back for twenty years, a shorter time series is used. As the next step, we create weighted averages of the concentration index of the various Internet industries² and the weighted aggregate HHI³.

Findings

The findings from the study are illustrated in the 'u'-shaped curve in Graph 1, whose recent tendency is distinctly up. This shows that:

1. the Internet sector's overall concentration has never been low;
2. concentration declined in the 1980s and into the mid-1990s, but in the mid-1990s it increased again; and
3. concentration is today in the highly-concentrated range.

Graph 1: Concentration of Internet Industries

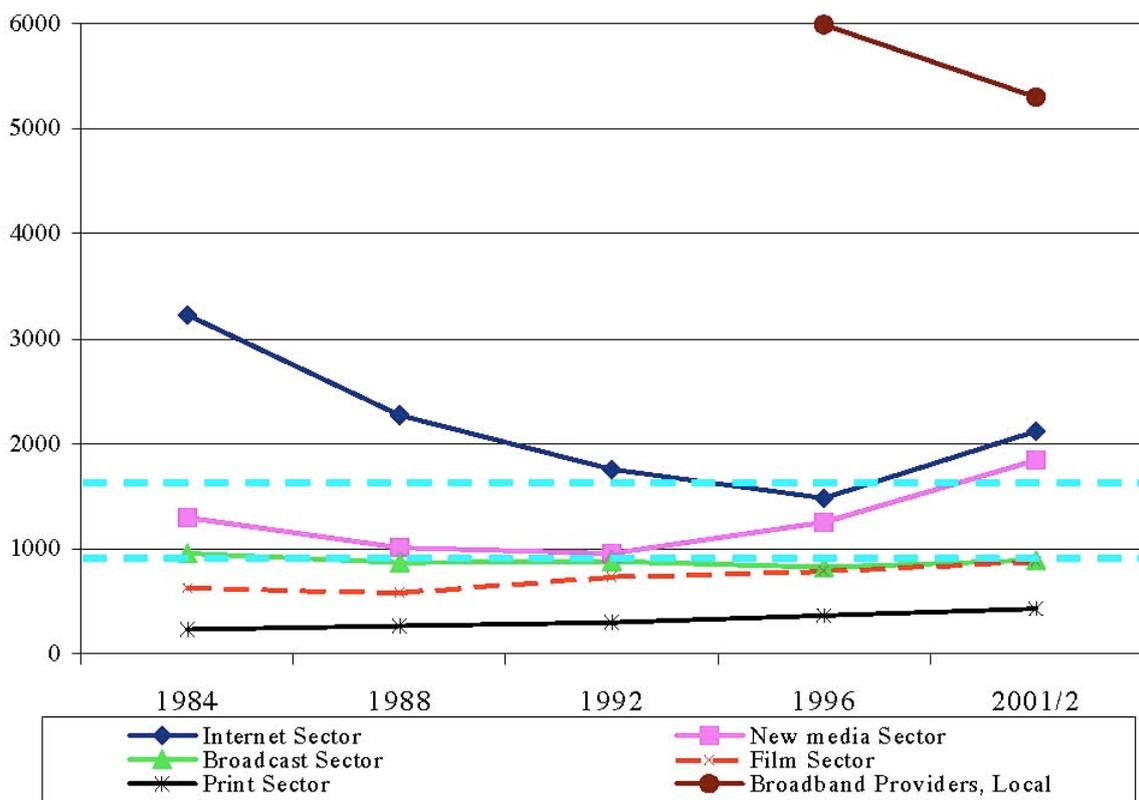


Comparing Internet concentration with other media and information sectors

The findings of Graph 1 run counter to the accepted wisdom of a fragmented and competitive Internet. To put these Internet concentration trends further into perspective, we conducted similar empirical analyses for related media and for other sub-sectors of the information sector.

Graph 2 shows concentration trends for several categories of other media: Print; Film; Broadcasting; 'New Media'; the Internet; and the Broadband Internet⁴. Concentration is increased on a national rather than local level. The main overall finding is highly interesting: *the newer the medium, the more concentrated it is*, and (often) the more has its concentration risen in recent years.

Graph 2: Form Old to New: Concentration Trends of Various Media



Thus, print media are relatively unconcentrated, and rising only slowly in concentration. Film, Broadcasting, and New Media, the next entrants, are more concentrated in the order of chronology. Most concentrated are the Internet media, especially Broadband, the newest of delivery media. What are the reasons for this differential concentration? Most likely it is the large capital requirement, which increases from one media generation to the next and is associated with economies of scale and with network effects. This leads to increasing riskiness, as well as instability for newer media, especially of Internet media, and the consequent attempt to stabilize them by concentration and oligopoly.

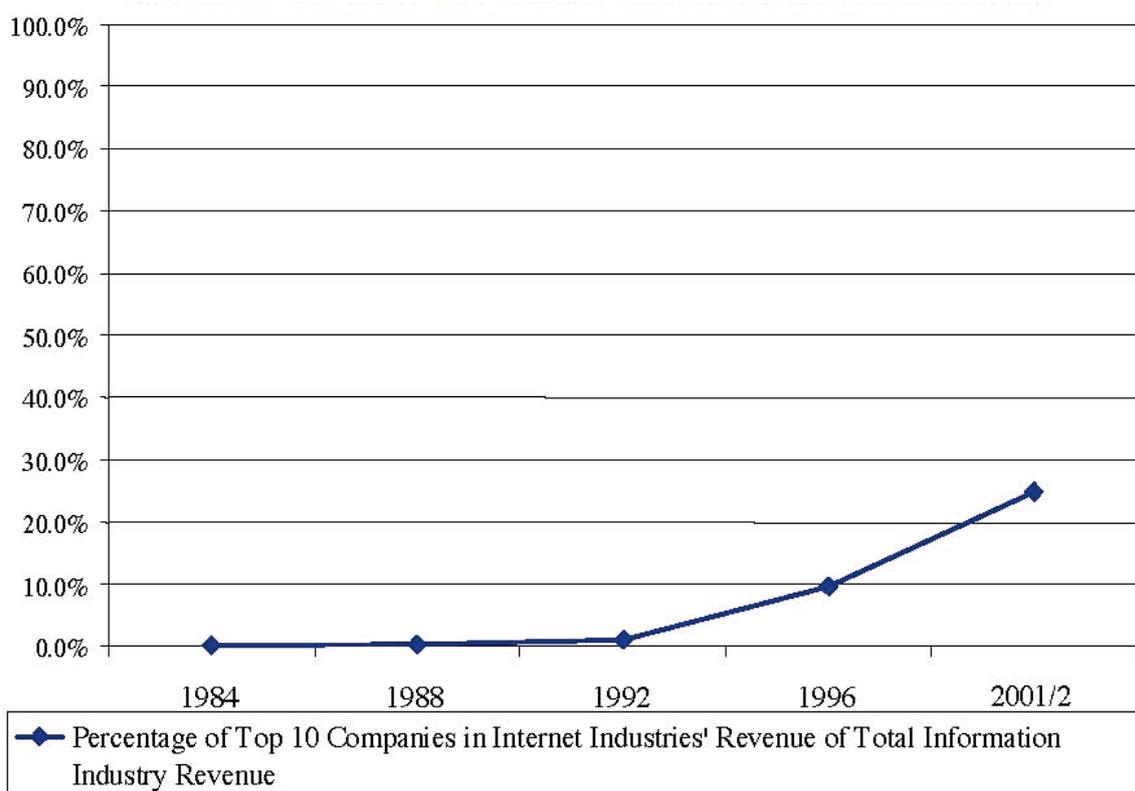
Vertical concentration trends

Even if a firm does not dominate any specific market, its presence in several markets might, in combination, become powerful. To look at the trends of such concentration, we use a number of indicators of vertical integration.

Market share of the major Internet companies

Graph 3 shows one dimension of vertical trends: the share of the entire information sector – Internet, mass media, telecom, and IT– that is accounted for by the ten largest firms in the Internet sector. Their revenues include those of their non-Internet activities.

Graph 3: Share of Top 10 Companies in the Internet Sector in the Overall Information Sector



The results in the above graph show a pronounced recent increase in the share, to over 20 per cent of the information sector. Underlying this trend is the major entry of loose information into Internet activities, and the merger of major Internet firms with other major media sector firms (in particular AOL with Time Warner).

The Power Index

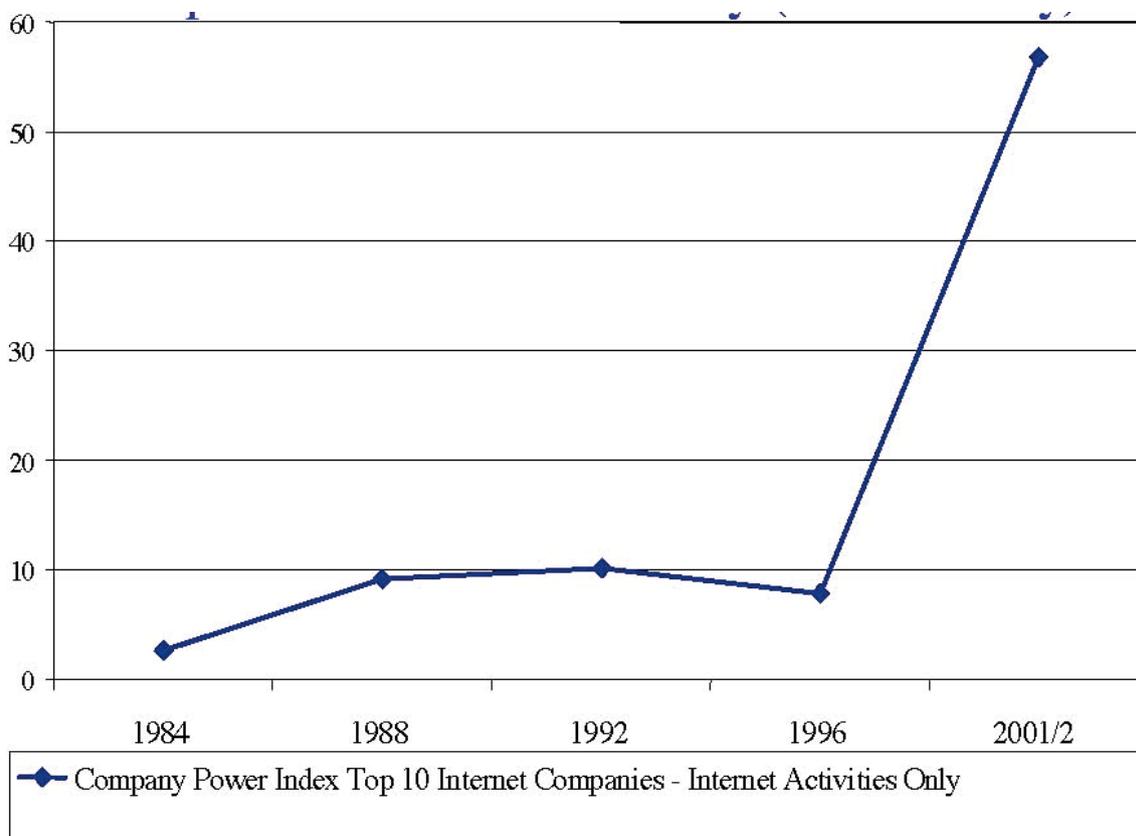
A second measure of vertical concentration is what I call a 'Power Index' (PI), which aggregates the top Internet companies' HHI scores across the several Internet industries⁵. For example, if a firm held 10 per cent in the ISP market and 20 per cent in the backbone market, and if the two markets were of equal size, its PI would be $1/2(100+400) = 250$. The results of the sectoral PI aggregate across the top 10 Internet firms, provided in Graph 4, show a strong upward rise in such an index, indicating increases in firms' shares and in their participation in multiple Internet industries.

What are some of the factors leading to higher concentration in the Internet's industries? Each of the sub-industries has a different story. But the common elements are high economies of scale (scalability) based on the high fixed costs and low marginal costs, and the way they are often complemented on the demand side by network effects (which economists call 'positive externalities').

These characteristics encouraged rapid expansions and created a period of intense competition in which prices were driven to levels that could not sustain total costs. The eventual result was failure of some market participants, and efforts at consolidation by the survivors, with the aim of reducing competition and creating a market structure that could

sustain higher prices. Such firms can also maintain access to financial markets, which have shut down for most entrants in the competitive segments. The Internet sector's present downturn will, therefore, accelerate concentration trends that are part of the boom–bust process.

Graph 4: Company Power Index of Top 10 Companies in Internet Industry (Internet only)



Factors leading to high market concentration

Similar concentration trends can be observed for industries closely related to the Internet's core: e-commerce applications (e.g. online book retailing, auctions, travel services); operating system software; microprocessors; microcomputers and workstations; and telecommunications. Thus, a broader definition of the Internet sector does not change the results qualitatively.

Implications for the Internet industry

We have found pronounced horizontal and vertical trends of concentration in the Internet sector that challenge the view of the Internet as a highly competitive medium. What are the implications?

It would take a lengthy essay to fully analyze this question, but some effects can be anticipated:

- 1 Higher user prices

- 2 A consequently higher profitability of the major Internet firms, which will stabilize their financial condition.
- 3 A slowing of innovation and of upgrade.
- 4 Increased power of the major Internet firms over:
 - (a) its governance, standards, and protocols;
 - (b) access by content and applications providers; and
 - (c) hardware providers.
- 5 Cross-subsidies, within major integrated Internet firms, from segments with oligopolistic pricing to more competitive segments, distorting competition in those segments.
- 6 The emergence of regulation to deal with such power.

Given the Internet's centrality to commerce, culture, and politics, it is not likely to be left alone if it becomes dominated by a few firms. Debates over the opening of cable-provided Internet access are an early example of a similar situation. Others are likely to follow.

In the long term, therefore, the Internet might move from an entrepreneurial and libertarian model to one of market power, and of regulation resembling or even exceeding that of several other electronic media. These findings and conclusions may not fit the Internet's self-image of being wide-open and competitive, but business strategies and public policies will benefit from a realistic rather than wishful assessment.

Notes

¹ A second index is also used primarily to cross-check the HHI. This 'C4' index is the combined share of the top four firms in a market:

$$C4_j = \sum_i^4 s_{ij}$$

where: S_i = firm's i market share of a given industry j , with firms ordered by size of market share.

² The formula for the C4 aggregation is

$$WC4_k = \sum_{j=1}^n \frac{m_j}{\sum m_j} \sum_{i=1}^4 s_{ij}$$

where j = an industry j within a larger segment; m_j = total revenue of an industry j ; i = firm in an industry; S_i = market share of firm in a given industry; k = segment of industries; n = number of industries.

³ The weighted aggregate HHI is

$$WAHHI = \sum_{j=1}^n \frac{m_j}{\sum m_j} \sum_{i=1}^f s_{ij}^2$$

where j = an industry; m_j = total revenue of an industry; S_i = each firm's market share of a sub-industry; n = number of Internet sub-industries; f = number of firms in a sub-industry.

⁴ 'Print' includes: daily newspapers, trade and paperback books, educational books, other books, book retailing, magazines, academic journals, printing services. 'Film' includes: TV prime time, movie production/distribution, movie theaters. 'Broadcasting' includes: TV prime time production, TV stations, TV networks, TV syndication, radio stations, radio networks. 'New media' includes: home video, video rental, DBS providers, Cable TV operators, Cable TV channels, Cable TV set top converters. Broadband Internet involves local broadband providers.

⁵ The formula for the Power Index is:

$$CPI_{industry} = \sum_i CPI_{firm} = \sum_i \sum_j \frac{S_j^2 m_j}{M}$$

where: S_j = firm's share in market j ; m_j = total revenue of sub-market j ; j = sub-industries, ranging from 1 to 95 (consisting of the 95 sub-industries); M = revenues of total information sector; i = firm i of main Internet firms.

About the Author



Eli Noam has been Professor of Economics and Finance at the Columbia Business School since 1976. He served for three years as Commissioner with the New York State Public Service Commission, and is a member of the President's Advisory Committee on Information Technology. He is the Director of the Columbia Institute for Tele-Information, a university-based research centre focusing on strategy, management, and policy issues in telecommunications, computing, and electronic mass media. Noam also chairs the MBA concentration in the Management of Media, Communications, and Information at the Business School. Besides over 300 articles in economic, legal, communications, and other journals, Professor Noam has also authored, and edited, more than 20 books.

Key issues for a research agenda on industrial structure in Internet markets

Comment 1 on *The Internet: Still Wide Open and Competitive?*

(Eli Noam, OII Internet Issue Brief No. 1, August 2003)

Donald Hay
Head of the Division of Social Sciences
Department of Economics
University of Oxford

A rich agenda for further research

Professor Eli Noam's excellent OII Internet Issue Brief No. 1 has injected much needed empirical realism into the analysis of competition in the Internet industries. He shows not only that the structure of these industries in North America does not look competitive currently, as measured by standard indices such as the Herfindahl-Hirschman Index (HHI), but his data also indicate that it was never competitive, contrary to popular beliefs. His findings suggest a rich agenda for further research on the evolution of industrial structure in these industries and related sectors. Here, I would like to highlight two such research issues. One is the determinants of the long-term equilibrium market. A second is the processes of entry, competition and exit that have shaped the evolution of the industry to this point. Both these issues need to be understood to enable us to frame appropriate regulatory or competition policies for the Internet.

Determinants of the long-term equilibrium market

On the first research issue, the current consensus in the industrial organisation fraternity is that long-term industrial structure is determined by the interaction of technology (affecting both process and product characteristics) and the nature of competition (price, quantity, product quality). This interaction has been explored most notably in two books by John Sutton (1991, 1998).

First, Sutton makes a key distinction between exogenous and endogenous sunk (fixed) costs. Exogenous sunk costs are (primarily) those that come from minimum economic scale of plants. Larger markets can, in principle, support more (single plant) firms and hence concentration is lower. Endogenous fixed costs are expenditures on the product: a paradigm case is expenditures that increase the real or perceived quality of the product. If a firm's market share is heavily dependent on its product quality, then as the market grows it is worthwhile for the firm to invest heavily in product quality. This becomes an endogenous sunk cost that increases with market size, and hence the market structure remains concentrated. It is entirely plausible to think that this scenario may have been the case for Internet industries, with the sunk costs in the form of expenditures on product improvements and of advertising to maintain market shares of leading brands. For example, Latcovich and Smith (2001) have shown that the online retail book market is highly concentrated because of the very high level of expenditure on marketing.

A further element in Sutton's analysis is the nature of competition in the market. We can make an extreme and somewhat theoretical comparison in the case of a market with a homogeneous product, full information available to consumers, and economies of scale arising from exogenous fixed costs. If the firms compete on price, then only one firm can survive in the market. If the firms compete in quantities or collude either tacitly or overtly, then more firms can survive in the market. Professor Noam (2003: 7-8) notes a switch in market behaviour in the sector, with initial intense price competition replaced by less aggressive pricing strategies, suggesting at least tacit collusion.

Processes shaping Internet markets

The second research agenda concerns the evolution of Internet markets over time. In part, this was driven by the elements discussed above. But there also seems to be a fascinating story about the dynamics of the process.

For example, imagine an industry with rapid technological innovation spawning a range of market opportunities for potential entrants. *Ex ante*, none of these entrants can know, with any precision, which other entrepreneurial firms will enter and, crucially, which will turn out to have the best products. However, the potential profits to be earned are large, and either with a rational estimation of the probability of success, or out of sheer entrepreneurial hubris, a number of firms enter. The market game then begins: almost certainly there is excess capacity (especially if demand needs to be grown), which encourages price cutting in a situation where all the entrants have effectively sunk their costs. As different products are evaluated by consumers, low-quality offerings will lose market share and exit the market. Remaining firms will continue to invest in product quality and capacity until a long-term equilibrium is reached. Something like this story appears to capture the essential elements of what happened in the Internet industry. So far, so good. But it raises the question of whether the process of competition contains any element of path dependency, whereby potentially superior technologies and products have been discarded too early, and have no real prospect of being reintroduced.

Finally, Professor Noam's section on implications notes the emerging need for regulation. This is almost certainly right, but begs the question of what form regulation might take. One view is that it should be possible to provide regulation within the normal framework of antitrust (competition) policy, and that there should be no need for a special regulatory regime. A further policy question is who should regulate. Given the global scope of the Internet, and therefore of the major players, a national antitrust jurisdiction may not be able to provide the scope of regulation required.

References

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Competition in Internet industries: evidence from e-retailing

Comment 2 on *The Internet: Still Wide Open and Competitive?*

(Eli Noam, OII Issue Brief No. 1, August 2003)

Michael R. Baye

Bert Elwert Professor of Business Economics and Public Policy
Kelley School of Business
Indiana University

John Morgan

Professor of Business and Economics
Haas School of Business and the Department of Economics
University of California, Berkeley

Introduction

In OII Internet Issue Brief No. 1, Professor Noam (2003) provides a thoughtful look at concentration within Internet industries. He documents that, even in its entrepreneurial heyday, the Internet sector was more concentrated than was commonly thought. Moreover, he shows that, using a variety of measures, concentration in the Internet sector increased substantially between 1996 and 2002.

Here, we offer some context to help explain the patterns present in Professor Noam's data. We also share some of our own data from the e-retailing sector, and show that it is consistent with Professor Noam's findings for the pre-2002 period. However, our data – which also covers the more recent period from January 2002 to November 2003 – suggests that, at least for the e-retail sector, the upward trend has been reversed, and there is currently a downward trend in concentration levels.

Reasons for increased concentration since 1996

The most striking aspect of Professor Noam's analysis is the clear upward trend in concentration in the Internet sector since 1996, as shown in his Graph 1. Much of the post-1996 increase in concentration may be attributable to consolidation in Internet-related sectors in the U.S. during the late 1990s.

As a case in point, consider WorldCom, which acquired over 60 companies. In 1995, WorldCom paid \$2.5 billion for William's Communications' network service operations, including 11,000 miles of fibre-optic cable. In 1996, WorldCom acquired MFC Communications for \$12.5 billion. This deal permitted it to gain control of the world's largest Internet backbone provider, UUnet (which MFS itself had acquired earlier in 1996). In a sequence of similar acquisitions, WorldCom acquired Brooks Fiber Properties, Compuserve, ANS Communications, GridNet, Unicom-Pipex, InNet, NL Net, Metrix-Interlink and Embratel. Consolidation by WorldCom culminated in 1998, when it acquired MCI Communications. Indeed, levels of concentration in the industry rose to such high levels that, on 26 June, 2000, the U.S. Department of Justice (2000) initiated a civil action to enjoin WorldCom from acquiring Sprint Communications.

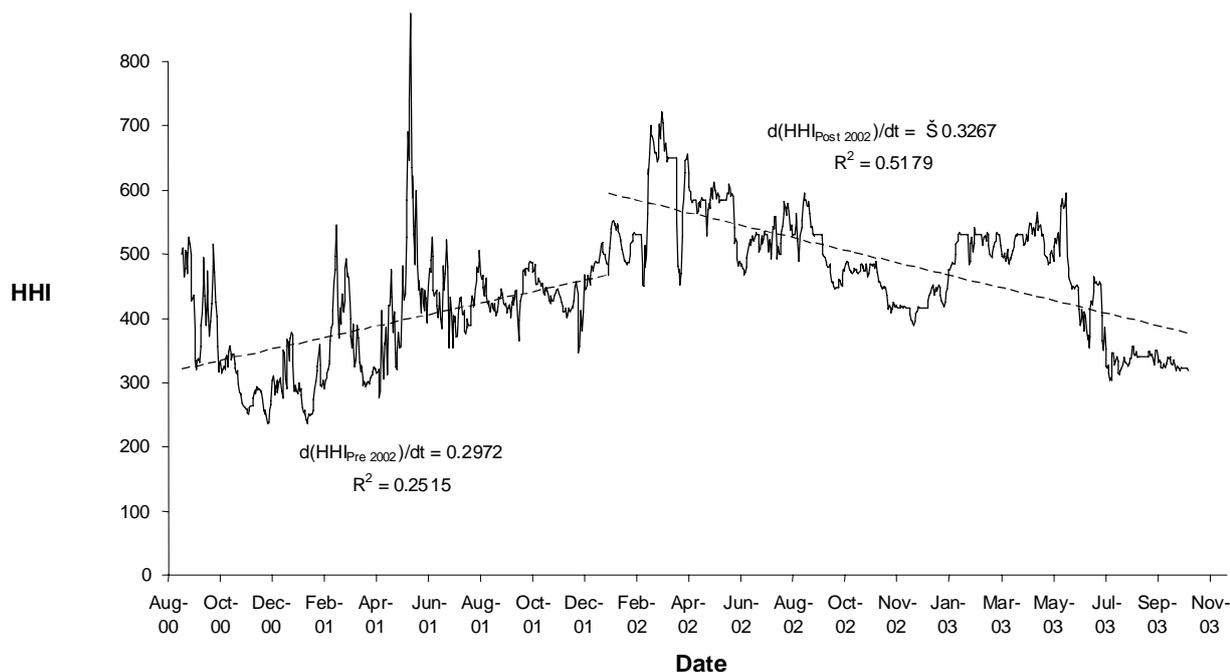
There were similar movements toward vertical consolidation in Internet services provider and content segments of the Internet sector. For example, one of the main concerns raised by the U.S. Federal Trade Commission (2000) in the AOL-Time Warner merger was that the consolidation of AOL's content with Time Warner's distribution network via cable broadband would stifle competition. This ultimately resulted in divestiture of certain cable broadband assets before the merger was approved.

E-retail markets

We have been measuring day-to-day fluctuations in the competitiveness of a variety of e-retail markets since the late 1990s. These statistics are updated weekly at our website, www.nash-equilibrium.com. Figure 1 below uses our data to chart the average Herfindahl-Hirschman Index (HHI) in e-retail markets (averaged over 5000 different products sold online since 2000). One needs to be cautious in drawing inferences from the HHI measure in that it is a poor predictor of market power in e-retail markets where firms compete in prices rather than quantities.

Several aspects of Figure 1 are worth noting. First, the level of concentration is quite low, averaging about 500 over the period. The levels are similar to those reported by Professor Noam for the Print Sector and the Film Sector. Second, between August 2000 and December 2001, the general trend in concentration is increasing. Why is this? In our view, the main reason for increasing concentration was not consolidation but rather exit by many e-retailers in a climate where capital suddenly became scarce due largely to the burst in the Internet bubble. Indeed, between 2000 and 2002, concentration was increasing at a rate of 100 HHI points per year – comparable to that implied in Professor Noam’s Chart 1.

Figure 1: Concentration (HHI) of E-Retail Sector, 2000-2003



Data Source: *Nash-equilibrium.com*

The third, and perhaps most important, feature of Figure 1 is that the trend toward increasing concentration has reversed itself since 2002. Since 2002, the general trend in concentration is once again decreasing, at a rate of almost 120 HHI points per year.

What are the broader implications on the Internet sector more generally of the reversal of the trend toward increasing concentration seen in Figure 1? As noted in Professor Noam’s Graph 2, concentration varies widely among different sectors of the Internet economy, with distinctly more concentration among local broadband providers compared with much lower levels of concentration for the Internet sector as a whole. The message here is clear: One must be careful not to lump different sectors of the new economy into the same pot.

Conclusions

Our data from the e-retail sector suggests that the trend toward increasing concentration in the Internet sector may be slowing or even reversing – which would appear to be a hopeful sign. However, care must be taken in extrapolating the trend reversal we observe in the e-retail sector to the Internet sector as a whole owing to the diverse nature of competition in the Internet sector.

A second caveat in interpreting our results is one that antitrust regulators routinely grapple with: How does one define 'the market' over which firms are competing? Market definition – both product market definition and geographic market definition – is important in any measure of concentration.

Consider first the issue of product definition. If one defines the relevant market to be the market for Internet access, the number of competitors in any given town is quite large (including cable, DSL, the multitude of dial-up providers, and so on). Based on this market definition, HHIs would be considerably less than 1000. Alternatively, if one defines the market to consist solely of broadband providers, the HHI for most cities in the U.S. (and indeed the world) would be in the range of 5,000. Similarly, if one considers the number of broadband providers worldwide, HHIs would be much smaller than if one considered the number of broadband providers in a given city or region. Thus, different methods of aggregating across products and/or across countries will lead to quite different measures of concentration.

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