Did First-Mover Advantage

Survive the Dot-Com Crash?*

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ABSTRACT

Strong expectations of first-mover advantages led to a rush of market entrants during the early growth phase of the Internet sector. More recently, the sharp decline in the value of Internet companies has led many to question these early beliefs. This study assesses the magnitude and sources of first-mover advantages in 46 Internet markets, based on data for more than 200 publicly traded entrants. The findings show a large premium in stock market capitalization for early entrants in markets with network effects, and for pioneers with patented innovations. Absent these factors, however, first-mover advantages appear minimal. The first-mover premium has been persistent in that pioneers have maintained high market valuations relative to peers, even though the value of the Internet sector has fallen. Similar results apply when performance is measured in terms of revenues or company survival.

1. Introduction

Internet commerce in the late 1990s was widely characterized as a "land grab" where firms rushed to acquire market positions before competitors had an opportunity to do so. Some pioneering entrants—such as Amazon, Yahoo and eBay—gained enormous stock market capitalization as investors anticipated that early entry would translate into large financial returns. High market valuations and widespread belief in first-mover advantages sustained a gold rush mentality among Internet entrants. Once the bubble burst in mid-2000, however, serious doubts arose about the validity of such views.

Was the perception of first-mover advantages an illusion, as Michael Porter (2001) has claimed? Others have asserted that Internet first-mover advantages exist, but managers vastly overestimated their importance (Adner and Rangan, 2001). Typically, such assessments have been impressionistic rather than rooted in systematic empirical analysis. The aim of the present study is to provide a more comprehensive appraisal of the extent of first-mover advantages in Internet markets. The study draws upon a broad sample of Internet entrants and tests for specific conditions under which first-mover advantages might be expected to arise. The results show advantages for early entrants in markets with network effects, and for pioneers with patented innovations. Absent these factors, first-mover advantages appear minimal.

The sudden rise of Internet commerce can be viewed as a natural experiment that offers a unique research opportunity. Many new "market spaces"[1] were created almost simultaneously by a common technology shock. A large proportion of Internet entrants became publicly traded, often within a year or two of founding, leading to the availability of extensive information

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[1] In this study, the term "market space" refers to an Internet market or sub-market that is reasonably well defined in terms of the product or service and the competitor set. Methods for identifying the competitor set are described Section 3.

on stock market value, revenue, and other factors. Thus, the rise of Internet commerce provides a unique laboratory for studying the effects of entry timing on firm performance.

This paper proceeds as follows. The next section outlines potential sources of first-mover advantage in Internet-related markets. It gives special consideration to the role of "network effects," which are commonly believed to play an important role in the Internet sector. Section 3 describes the study's methodology and data sample, covering more than 200 entrants in 46 market spaces. Section 4 presents the statistical tests, which consider whether pioneering firms maintained higher market capitalization or revenue than their peers, controlling for various factors. The tests show a large premium in stock market capitalization for early entrants in markets with network effects, and for firms with patented innovations. Section 5 concludes with an assessment of the study's findings and limitations.

2. Potential Sources Of First-Mover Advantages in Internet Markets

First-mover advantages accrue to a firm that gains a first-mover opportunity (through proficiency or luck) and is able to maintain an edge despite subsequent entry. In their conceptual survey, Lieberman and Montgomery (1988, 1998) refer to four types of mechanisms that can sustain a first-mover advantage: (1) proprietary technology, (2) preemption of scarce resources, (3) customer switching costs, and (4) network effects. The discussion below considers these four potential sources of first-mover advantage in the Internet sector, with particular attention given to network effects.

Proprietary Technology

Many observers have noted that the transparency of most Internet business methods makes imitation by competitors relatively easy. Thus, the Internet would appear to offer relatively limited opportunities to support first-mover advantages through proprietary technology.

Secrecy, the most common method for keeping technological advantage proprietary (Levin et al, 1987), is virtually impossible in many parts of the Internet environment. Some Internet pioneers have developed superior technology and sustained a temporary lead by racing down the learning curve ahead of competitors, as firms such as Amazon have done. But in the absence of patents and other means of intellectual property protection, the ability to sustain such a lead for an extended period is open to question.

Patent activity by Internet companies remains well below the rates observed in most other technology sectors. One notable exception is in the area of "business process" patents (e.g., Amazon's patent on "one click" ordering, and Priceline's patent for reverse auctions). Such patents remain controversial, and some have questioned whether they can withstand future challenges. In this study we consider the degree to which patents by Internet start-ups may contribute to the sustainability of first-mover advantages.

Preemption of Superior Resources

Prior studies of first-mover advantages have shown that early market entrants may be able to preempt superior resources of various types: physical assets, geographic positions, and positions in customer perceptual space. In the Internet sector, however, resource preemption is likely to be less important than in other industries. Physical assets are inconsequential for most Internet companies, and human resources, while valuable, are highly mobile. Preemption of superior positions in geographic space, an effective strategy for many brick and mortar companies, is obviously irrelevant for Internet firms.[2]

Preemption of attractive positions in customer perceptual space may, however, be sustainable and important for some Internet companies. Early entrants such as Yahoo, eBay and Amazon invested heavily to nurture consumer recognition of their brands. These firms have also

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[2] One might, however, consider preemption of "domain names" on the Internet to be roughly equivalent to geographic preemption in more traditional industries. Even so, the market prices of superior domain names (which were often captured by early speculators) have fallen precipitously.

broadened their product lines to expand and defend their initial position. Subsequent entrants to Internet markets in the late 1990s mounted huge advertising campaigns in an effort to develop name recognition. By most accounts, though, these funds were largely wasted, even when firms entered as pioneers in their market segments. One example is the Internet retailer eToys, which established huge name recognition but nevertheless failed. Clearly, the ability of Internet pioneers to capture strong customer perception has not been sufficient by itself to ensure success or survival.

Customer Switching Costs

Early entrants may enjoy greater opportunities than followers to capture customers through switching costs (also known as "lock-in" or "stickiness"). Switching costs arise in several ways. For software products that require large initial investments by the buyer (e.g., e-commerce transaction platforms) switching costs arise from the fixed cost nature of the basic investment and incentives to maintain compatibility over time. Switching costs can also develop more gradually as buyers gain experience with the seller's product, and as the seller customizes the product to conform to the buyer's tastes. One example is the loyalty of many buyers to Amazon.com: users grow accustomed to features of Amazon's site, which evolve to suit the individual user's preferences. These factors allow experienced buyers to search more efficiently on Amazon than on the web sites of competitors. The resulting lock-in may be compounded by a third source of switching costs, arising from the desire of buyers to avoid risk and uncertainty. For example, as Amazon's reputation for reliability has grown, many consumers are now willing to pay the firm a premium to avoid the risk of loss or delay associated with purchases from an unknown, but lower price vendor.

Network Effects

Network effects, the fourth category of mechanisms that support first-mover advantage, tend to be more important in technology and communications-related industries than in the economy as

whole. The potential for network effects was a main reason why many expected substantial first-mover advantages in Internet markets. Yet many entrants failed to think carefully about the specific structural conditions under which network effects are likely to be important, and where they are not.

Network effects (also known as network externalities, or demand side economies of scale) arise when the value of a product or service to a given user increases with the number of other users (Shapiro and Varian, 1999). The positive feedback that is generated causes the market to tip in favor of the firm that emerges as the standard, potentially leading to a winner-take-all market structure.   Thus, in markets with network effects, the leading firm is likely to capture disproportionate returns. Depending upon the magnitude of the feedback effect, the leading firm may be able to drive out smaller rivals; and potential rivals may choose not to enter once a strong bandwagon builds in favor of the leader. Thus, one might expect higher profits, and perhaps fewer competitors, for the firm that emerges as the leader in a market with substantial network effects.

While the first entrant into the market has the initial *opportunity* to exploit the network effect, in many cases later entrants prove more successful. For example, Netscape introduced the first commercial Internet browser, but Microsoft entered aggressively and emerged as dominant. Thus, the presence of network effects gives the first-mover an opportunity but not a birthright for success. To prevail, the pioneer must recognize and exploit the network opportunity, and avoid challenges by later entrants who may try to leverage other strengths to build a dominant network position.

Several different types of network effects can be observed in Internet markets.   (This variety among network effects seems to have been overlooked in the literature.) First, network effects arise in environments where one firm serves as a "market maker," coordinating among numerous buyers and sellers who seek to transact in a common forum. Buyers seek a forum that maximizes the number of sellers, and sellers seek to maximize the number of buyers. A single

forum is likely to emerge as the dominant meeting place (unless groups of buyers and sellers have highly differentiated needs, leading to a more fragmented market). Internet examples include eBay, the successful coordinator of consumer auctions; the Monster Board, which serves a similar matching function in the job market; and DoubleClick, which coordinates between advertisers and the owners of Web pages on which the ads are displayed. Findings presented later in this paper suggest that Internet markets with this type of network externality offer the potential for substantial first-mover advantages.

A second type of network effect arises from what is often called the "virtuous cycle." A web site or product with more visitors or customers than rivals becomes perceived as more successful and is able to attract higher quality alliance partners. These alliances contribute to further growth in the site's customer base, leading to more alliances, and so on.[3] Such feedback loops have benefited Amazon, Yahoo, and other early Internet entrants. They were also a factor in the browser wars, leading to the ascendancy of Microsoft's Internet Explorer over Netscape—once Explorer attained the majority of users, outside software developers cut back their support of Netscape in favor of Explorer. Such effects often arise in software markets, where buyers are influenced to purchase the dominant product in order to maximize compatibility.

A third type of network effect arises on the World Wide Web, given its nature as a medium for channeling users among sites. Hyperlinks serve as a primary means of web navigation and can easily be drawn from independent Web sites to a given company's site.[4] Firms may provide incentives for the creation of these inbound links; for example, Amazon's "Affiliates Program" makes cash payments to owners of sites that lead customers to Amazon. Other things equal, a commercial Web site with more inbound links (or more such links coming from influential sites)

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[3] A similar virtuous cycle operates in the case of "market makers" described above. The difference is largely one of degree: feedback is likely to be stronger when the site serves an explicit matching function where buyers and sellers both seek a broad choice set.
[4] In addition to such inbound links, firms make outbound links from their Web site to others. The most prominent examples are Web portals such as Yahoo.

is likely to enjoy more traffic and potentially greater sales. We classify this as a type of network effect, given that it arises from the network properties of the World Wide Web. It is important to note, however, that this effect fails the standard test for network externalities. (A web site does not become more valuable *to customers* as the number of inbound links grows.)

First-mover Disadvantages

The potential advantages of pioneering entry, discussed above, are counterbalanced by various disadvantages.[5] Later entrants may be able to "free ride" on the first-mover's investments, and followers may benefit by waiting until key technological and market uncertainties have been resolved. A more basic failure arises when the pioneer's market proves not to be commercially viable. Many Internet entrants discovered that the market spaces that they hoped to develop were not economically attractive. For example, Webvan and others found that the home grocery delivery market was not attractive enough to sustain even a single stand-alone company. To enjoy a first-mover advantage, not only must the pioneering firm be successful relative to subsequent entrants; the market space must be viable enough to profitably support at least one firm.

Measurement Issues Relating to First-mover Advantages

This discussion raises the question of how first-mover advantages can be identified and evaluated by researchers. Lieberman and Montgomery (1988) define first-mover advantage in terms of the ability of the pioneer to earn economic profits (i.e., profits that exceed the cost of capital). Given that the Internet sector remains at an early stage of development, such a metric based on current accounting profits is inappropriate. Successful startup businesses take nearly a decade, on average, to reach profitability (Biggadike, 1976). Presently, relatively few Internet ventures are profitable, and the survival of many Internet business categories remains open to question.

To assess potential first-mover advantages at this early stage of industry development, one must draw upon forward-looking measures such as stock market capitalization, which incorporates investor expectations of future profitability. Market capitalization, measured quarterly from 1999 to 2002, serves as the primary dependent variable in this study. We compare market capitalization across firms that compete directly within Internet sub-markets. We also consider quarterly revenues as a dependent variable, capturing relative firm size. A further metric of success, company survival, is considered briefly.

These performance measures are clearly imperfect proxies for a firm's net economic profits over an extended time period, which if available would be the most suitable performance measure. Many studies of first-mover advantages have the luxury of a retrospective view and a long historical series of data. In the case of Internet commerce, only limited information is yet available on the long-term viability of specific firms and markets. Thus, only guarded conclusions can be drawn about the ultimate extent of first-mover advantages in the Internet sector.

3. Data and Methods

The sample for this study includes 206 publicly-traded Internet entrants, classified into 46 sub-markets or "market spaces," as described below. Two measures of firm performance, market capitalization and revenue, were recorded quarterly from early 1999 through September 2002.[6] The most general tests for first-mover advantage use dummy variable regression to assess whether pioneering entrants had higher market value (or revenue) than later entrants within their

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[5] See Lieberman and Montgomery (1988, 1998) for more detailed discussion of first-mover disadvantages.

[6] To supplement the financial data, this study also considers whether early entry enhanced the probability of firm survival. Survival is perhaps the most fundamental measure of firm performance, and it has been used in other first-mover studies. The failure of many Internet companies starting in mid-2000 makes it possible to apply hazard analysis to distinguish the influence of entry timing and other factors. The hazard analysis will be included in a later draft of this paper.

market space. If first-movers enjoyed higher market capitalization (or revenue) on average, the estimated coefficient of the first-mover dummy should appear positive and significant in the regressions. More specific tests consider whether the magnitude of advantage was related to market or firm characteristics, such as network effects or patents. Tests to distinguish these mechanisms were carried out by adding interaction terms to the first-mover dummy (or in some cases adding new measures directly).

Internet company stock prices rose and fell dramatically over the period of the sample, as illustrated in Figure 1. This market "bubble" affected the stock prices of virtually all Internet companies. Hence the anticipated future returns of first-movers, as well as those of follower firms, shifted markedly over the period of the sample. The regression approach of this study compares each firm's market value to that of competitors within their market space; i.e., net of the average level of Internet stock prices in each period. Consequently, the study identifies first-mover advantages in a relative sense: the premium enjoyed by first-movers relative to later entrants. It is conceivable that despite such a premium, the average long-run financial returns to Internet pioneers will ultimately prove to be negative. Thus, this study isolates the effect of early entry on relative performance but cannot give definitive answers on the absolute magnitude of first-mover advantages.

With quarterly financial data, one can observe whether the relative advantage of early entrants—as anticipated by investors and reflected in stock prices—has been changing over time. Shifts in the impact of firm and market characteristics on the first-mover premium can also be identified. The results of the study show that most effects remained fairly stable despite large movements in the average level of Internet stock prices.

Data Sample

The sample is limited to public firms traded on the NASDAQ or other U.S. exchange. All firms had their initial public offering (IPO) by the end of 2001. Candidates for inclusion were

identified from lists of Internet public companies[7] and lists of IPOs issued from 1995 to 2000. Of the firms included in the sample, about half sold primarily to other businesses (B2B), and half to consumers (B2C). More than 40% of the companies had exited by late 2002.[8] Given entry and exit from the sample, the number of companies, and the exact identity of the firms, varies by quarter. An Appendix provides detailed information on the sample firms.

The sample is restricted to firms whose primary business involved the provision of Internet-related services or software. Three major categories of Internet companies have been excluded: Internet service providers (ISPs), telecommunications companies, and hardware vendors. We exclude ISPs because of their tendency to serve regional markets, which are hard to identify.[9] We exclude Internet hardware and telecommunications companies because their product categories tend to overlap with pre-existing markets. In addition, many of these firms predate the commercial Internet.

Sample selection biases can be problematic in investigations of first-mover advantages (see, for example, Golder and Tellis (1993) and Vanderwerf and Mahon (1997)), and this study is no exception. Limitation of a sample to publicly traded companies introduces a potential bias in markets where the pioneering entrant remained private or failed without issuing an IPO. Under these circumstances the true first-mover would be omitted from the sample and a follower firm potentially misclassified as the pioneer. In many industries this is a serious consideration. In the Internet markets of the late 1990s, however, there was enormous impetus for early entrants to go public in order to raise capital to sustain their growth. In all of the market spaces in this study, the firm identified as the first entrant ultimately issued an IPO.[10] Moreover, the sample is homogeneous in the sense that all firms, pioneers and followers alike, have passed the threshold

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[7] In particular, we used the *Internet Stock List*, http://www.wsrn.com/apps/internetstocks/.

[8] Of the 206 firms in the sample, 87 (42%) exited prior to October 2002. Of the exiting firms, 21 declared Chapter 11 bankruptcy, 50 were acquired without entering bankruptcy, and 17 disappeared or shifted business operations to a new focus outside the market space. There were several mergers…

[9] We include one category of ISP, the free segment, whose entrants served the US national market.

[10] No case is known where a private firm preceded the public entrants identified in the study. It was, however, necessary to exclude many market spaces because of lack of publicly traded firms.

of initial growth and success represented by the IPO. Thus, limitation of the sample to public companies seems unlikely to induce a bias that would overstate the extent of first-mover advantages within the markets included in the study.

More serious, though, is the bias of the sample toward successful market spaces. To be included in the sample, at least two public firms must have been active in the market space. Many Internet entrants attempted to pioneer novel markets but failed. Most of these firms never filed an IPO; in a few instances only a single firm went public in the market space. Exclusion of such cases from this study creates a bias in favor of successful markets, and hence a likely overstatement of the overall extent of Internet first-mover advantages.[11] In effect, our analysis gauges the performance of pioneers relative to followers, contingent on some minimum viability of the market space. One might expect to find superior performance by pioneers under these conditions, even if pioneering was an inferior strategy for Internet start-ups on average.

Classification of "Market Spaces"

An important issue in any empirical study of first-mover advantage is the classification of markets. The identity of initial entrants depends upon how narrowly or broadly the markets are defined. In this study, a two-step procedure was used to define the "market spaces." (The terms, "market space," "market," and "industry" are used interchangeably throughout the remainder of this paper.) First, classifications were developed based upon the author's judgments, given business descriptions found on companies' web sites and profiles listed on *Yahoo Finance*[12]. These classifications were then refined using information on each firm's top three competitors, as denoted by *Hoover's Online*.[13]

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[11] This is similar to the survivor bias discussed in the literature on first-mover advantages.

[12] <http://finance.yahoo.com/>

[13] These competitor listings, which are based on assessments made by the *Hoover's* staff, are available at http://www.hoovers.com/ .

Table 1 gives an illustration of the method for refining the industry classifications, using the *Hoover's Online* data.[14] More than two-dozen public firms were initially identified within the Internet Advertising/Marketing sector, broadly defined. It proved difficult to group these companies into meaningful sub-markets on the basis of their business descriptions alone. Using competitor information from *Hoover's Online*, however, a set of meaningful and objective classifications could be made. Consider, for example, the firms that compete with DoubleClick, the pioneer and category leader in the "advertising network" sub-market. The primary business of DoubleClick and its rivals involves the coordination of online advertisements among three parties: the company placing the ad, the owner of the web site that displays the ad, and the consumer who ultimately views the ad. As shown in Table 1, the competitor listings from *Hoover's* imply that six public companies competed with each other in this market. DoubleClick and 24/7 Media, the largest firms, were listed by *Hoover's* as principal competitors faced by each of their four smaller rivals. By comparison, DoubleClick and 24/7 Media were not generally ranked as top competitors for the other advertising/ marketing firms identified in the study. Thus, the *Hoover's Online* information allows competitors within the "advertising network" market to be distinguished from firms within the broader advertising/marketing category.

As indicated by this example, the *Hoover's Online* competitor information provides a reasonably objective method for identifying companies that compete closely in a specific market. Firms that did not have a clear classification based upon the *Hoover's* data were generally excluded from the study. The result of this process was the identification of 46 market spaces containing at least two public competitors during some or all of the period from 1999 to mid-2002. The names of the market spaces, and the identity of the first-mover(s) within each market space, are shown in Table 2.

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[14] The method is easy to apply and may be applicable in other studies where it is necessary to identify a coherent set of market competitors.

The market spaces were grouped into categories reflecting common Internet business models (Eisenmann, 2002). These categories are as follows: market maker, broker, portal, retailer, content provider, software, infrastructure, and other. These groupings play an important role in the tests for first-mover advantages. In addition, markets were classified as either "B2B" (business to business) or "B2C" (business to consumer), a common distinction in the Internet sector.

Identification of the First-Mover Firms

Typically, one of the first actions of a new Internet-related company was to officially register its domain name. Such registration or "web entry" dates correspond closely to the founding dates indicated on many company Web sites. Given this correspondence and the availability of registry information for nearly all firms in the sample, the date of domain registration was taken as the firm's date of entry.[15] In cases where a large discrepancy was found between the domain registration date and the founding date indicated by the company, the latter was selected as the entry date.[16]

With firms sequenced by entry date, "first-movers" were defined in three alternative ways. In the first approach, the firm with the earliest date of entry in the market space was identified as the unique first-mover.[17] In the second approach, the first one-third of market entrants were denoted as first-movers. The third approach (which provides the preferred method for this study) is intermediate between the first two: if all firms entered after 1995, the earliest entrant

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[15] These registration dates were obtained by querying the "WhoIs" function on the Network Solutions web site (http://www.netsol.com/cgi-bin/whois/whois) in mid-2000. (This method is no longer a reliable source of initial entry dates, as many firms' domain registrations have been changed or renewed, and registration has lapsed for some exiting firms.)

[16] One exception is for firms with "bricks and mortar" origins. For such firms we used the date of first entry on the web, as denoted by the date of domain registration or historical information provided on the firm's web site.

[17] In two market spaces, dual first-movers were assigned as the entry dates were within a few days of each other. In one additional market space, the entries were at similar times, but precise dates were unavailable.

was taken as the sole first-mover;[18] otherwise, firms entering prior to the end of 1995 were classified as first-movers up to the first 30% of entrants. Based on this definition, ten of the 47 market spaces in the sample have two first-movers, one market space has three (e-business software suites/platforms) and one has eight (Internet consulting). All others have a unique first-mover firm.

Dummy variables were defined with their value set equal to 1 if the firm was classified as a first-mover, and zero otherwise. Thus, three alternative dummy variables for first-movers were tested in the analysis: FM1 (a single first-mover within each market space), FM33 (the first third of entrants selected as first-movers), and FM, the preferred, intermediate measure.

All three definitions gave similar results in the regression analysis. However, the third definition has the advantage that it allows for multiple first-movers in markets with a large number of early entrants. Hence it is robust to possible error in the recorded entry dates, which are known less precisely for entrants in the early 1990s. In several cases the second entrant in our sample (who was still quite early in the entry queue) is the firm that is widely perceived as the market pioneer. While identification of a unique market pioneer might seem attractive, more inclusive definitions are common in the empirical literature.

Performance Measures

The main performance measure in this study is stock market capitalization. A secondary measure is quarterly revenue. These serve as dependent variables in regressions that were run quarterly from 1999 through 3rd quarter 2002. The market capitalization and revenue data were obtained from Compustat.

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[18] If the entry dates of the first two entrants differed by two weeks or less, both were classified as first-movers.

Explanatory Factors Relating to First-mover Advantage

Section 2 described four types of mechanisms that can sustain a first-mover advantage. These mechanisms are not directly observable and thus must be represented by proxies in the empirical analysis. The measures described below, although highly imperfect, serve as indicators of the mechanisms that potentially support first-mover advantages.

Proprietary Technology and Patents. For reasons discussed in Section 2, proprietary technology is likely to be less important as a source of sustainable advantage for Internet companies than for many other technology businesses. Even so, the ready availability of patent data makes objective measures of intellectual property feasible. The annual count of US patents awarded to each firm in the sample was obtained from the *Delphion* database.[19] Typically, these patents pertain to business processes or software.[20]

Table 3 lists the patent holders in the sample. Comparatively few Internet companies have sought patents, but patents appear to be important for some early entrants. First-movers were about twice as likely as others to patent: 40% of first-movers had at least one patent issued by mid-2002, as compared with 23% of followers.[21] The high patent rates of early entrants relative to followers suggests that patents have provided a means for pioneers to protect their innovations.

The patent statistics summarized in Table 3 can be transformed in a variety of ways to yield testable measures. The most obvious approach is to take the cumulative count of patents by each firm (i.e., the values shown in Table 3). The distribution of patents among firms is highly skewed, so a simple count of this sort puts very strong weight on just a few firms. Moreover, wide variation in firms' propensity to patent and in the quality of patents makes the raw counts

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[19] The counts in this study include patents awarded prior to May, 2002, when the data were collected from the Delphion web site, http://www.delphion.com/.

[20] A future version of this paper will categorize the patents by class.

[21] This classification uses the intermediate definition of first-movers (FM).

extremely noisy. The top patent holder in the sample, E-Stamp Corp., was forced to exit its main business despite a quantitatively strong patent position. While the cumulative patent counts were tested in the regression model, the results presented in the next section take patenting as a dummy variable, distinguishing firms that filed and received patents from those that did not. This approach ignores potential information in the patent count but reduces the noise level. The patents>0 dummy proved highly significant in the regression model, whereas the raw patent counts were not.

The timing of patent applications raises an additional issue. Applications filed many years after the firm's founding may be indicative of company success but unrelated to first-mover advantage. Hence, we distinguished between early and late patents by defining a separate dummy variable for firms that filed patent applications within two years of the date of entry.

Preemption of Resources. As discussed in Section 2, some sustainability mechanisms are more important than others in the Internet environment. Resource preemption seems particularly unlikely to be a major source of first-mover advantages for Internet companies. The sole exception is in markets where pioneers may be able to preempt customers' "perceptual space" to some degree. Unfortunately, we lack objective criteria to identify such markets, so it is necessary to omit resource preemption from the analysis.

Switching Costs. It was argued in Section 2 that switching costs are likely to be important in some Internet markets, contributing to first-mover advantage. But here again, objective empirical measures are unavailable. One might anticipate, however, that switching costs are greater in certain market categories (e.g., software) than in others (e.g., retailing of products that are purchased infrequently). To explore such possibilities, dummy variables were tested in the regressions for various product or business model types: e.g., software, broker, retailer, portal, etc.[22] Such groupings were also used in the tests for network effects, discussed below.

Network Effects. Section 2 argued the potential importance of three types of network effects in Internet markets. Empirical work on network effects has been limited, and unfortunately, no standard measures have been developed that apply across industries. Therefore, an effort was made to estimate the magnitude of network effects using rudimentary proxies.

The first type of network effect arises when opportunities exist for a "market maker" to bring together relatively dispersed sets of buyers and sellers. Such environments, where the market maker plays a coordinating role, correspond to some of the great success stories of Internet commerce such as eBay. The following market spaces were assigned to the market maker category: consumer auctions, advertising network, employment search, real estate, and vertical marketplace. Other Internet markets where firms perform a brokerage function exhibit similar characteristics, although some lack the feature that consumer benefits increase with the number of sellers linked to the site. The brokerage markets in the sample include: stockbroker, auto broker, mortgage broker, insurance quote aggregator, tickets (entertainment), and travel.

Tests for such network effects were implemented by defining dummy variables corresponding to first-movers within the market maker and brokerage categories. Positive regression coefficients for first-movers in one or both of these categories, controlling for general first-mover effects, potentially denotes the existence of network effects in support of first-mover advantage.

While the first type of network effect arises in markets where the firm serves as a nexus between buyers and sellers, the second type of network effect is more general: a "virtuous cycle," of positive feedback allows a firm with initial success to attract more and better alliance partners (and/or customers), which contributes in turn to further success, and so on. It is not clear, however, how this second, more general type of network effect can be effectively measured. Possibilities include counting the number of alliance partners, assessing their quality, or measuring the size of the firm's customer base. Such measures, to the extent that they can be collected, are all endogenous with firm performance. This raises questions of cause and effect

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[22] See Eisenmann (2002) for a discussion of Internet business models.

that are hard to resolve, both conceptually and empirically. Given these difficulties, no explicit measure of this second type of network effect was included in this study. However, firms in some of the brokerage markets in the sample may benefit from this type of network effect.

The third type of network effect is represented by the magnitude of inbound links to the firm's Web site. Estimates of the number of inbound links can be readily obtained from Web search engines, and such a measure was collected in the course of this study.[23] The interpretation of these counts is problematic, however, given that inbound links grow endogenously in much the same way as the alliances described above. (Other things equal, more successful firms will have more inbound links, which may further contribute to the firm's success, and so on.) It is not clear whether a count of inbound links should be regarded as a type of performance measure, or as a factor that helps to explain the firm's performance. Given this complexity, the inbound links measures will be assessed in a separate study that explicitly considers the endogeneity of web links.

Control variable

A further measure was included in the regressions to control for the fact that many Internet companies have origins that predate the commercial Web. Such firms include spin-offs from established companies (e.g., DLJ Direct, FTD.com, Expedia, Travelocity) and brick and mortar firms that were reorganized as Internet-oriented companies (e.g., Charles Schwab, Ticketmaster, Hotel Reservation Network). Since these two categories did not appear to have significantly different effects in the regression analysis, they were combined in a single dummy denoting firms with "brick and mortar" origins. Many of these firms have continuing "brick and mortar" operations.

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[23] A count of inbound links was collected from AltaVista by typing "link:www.name.com" in the AltaVista search box to get the number of inbound links that AltaVista detected for "name.com." Note that because any search engine indexes only a small fraction of the web, these counts must be treated as relative measures.

4. Results

Market Value Regressions

Tables 4 and 5 report regression results using the logarithm of market capitalization as the dependent variable. Both tables include separate constant terms (fixed effects) for each market space in the sample, plus a dummy variable controlling for "brick and mortar" origins. Table 4 includes the FM dummy to gauge the average net magnitude of the first-mover premium within market spaces. Table 5 adds to this basic specification the patent dummy and several interactions with the FM dummy. These measures allow the first-mover premium to be disaggregated into components relating to network effects and patents.

The tables give estimates for the first and third calendar quarters from 1999 to 2002. (Intermediate quarters were similar.) By comparing the value of coefficients across quarters, it is possible to assess whether the effects (as anticipated by investors and incorporated in stock prices) were changing over time. The number of observations changes by quarter, rising with net entry into the sample through the middle of 2000, and falling with net exit after that time.

The estimates in Table 4 show that the average premium of first-mover companies, measured in terms of stock market capitalization, was positive and reasonably constant over time. The first-mover dummy is statistically significant in each of the quarterly regressions. Its coefficient, which ranges in magnitude from about 0.7 to 1.1, implies that the average first-mover had a market value roughly two to three times that of follower firms. Thus, the market value regressions demonstrate that the advantages early entrants were statistically significant and substantial in magnitude when assessed within the market spaces of the sample. The dummy for companies with "bricks and mortar" origins is not significantly different from zero, indicating that these companies had market values comparable to others.

Table 5 gives results of the expanded regressions, which include the measures representing network effects and patents. The addition of these measures causes the coefficient of the basic (non-interacted) first-mover dummy to fall to zero and become statistically insignificant. This suggests that first-mover advantages have been minimal for pioneers that do not benefit from network effects or patents.

The FM*MarketMaker and FM*Broker interactions capture the market premium of pioneers in market spaces with potential network effects. The FM*MarketMaker coefficients appear positive, and they are highly significant in most periods of the sample.[24] The coefficient of FM*Broker increases over time and is highly significant in the final period. The values of 3.69 and 3.63 shown for these coefficients in the third quarter of 2002 imply that pioneers in network markets had average capitalization roughly fifteen times greater than that of later entrants.[25] One conclusion is that the general market premium shown for first-movers in Table 4 is largely concentrated within this group of network market pioneers.

The dummy variable for firms with patents also appears highly significant in Table 5. The estimated coefficients are close to unity in most years, implying that firms with patents had average market capitalization roughly two to three times greater than other companies in the sample. (Note that this is a general premium for all patent holders, not limited to first-mover companies.) The premium appears larger than what might be anticipated in a sector where patents have been relatively unimportant. Presumably, the premium reflects the economic value of the patents as well as (unobserved) differences in firms' underlying innovative capabilities.

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[24] There is, however, great variation among the market maker pioneers. For example, the employment network (job boards) market space has two first-movers: TMP Worldwide (which owns the 'Monster Board') and Dice (which has remained focused on engineering employment in Silicon Valley). Both firms entered at about the same time, but TMP actively exploited the network effect and now has a market value more than one hundred times that of Dice.

[25] This multiple is computed by adding the coefficients for the basic first-mover dummy and the "FM*NetworkMarket" dummy, and exponentiating the result.

To determine if the patent premium differs between market pioneers and later entrants, an interaction between the first-mover and patent dummies was tested in the regressions.[26] Table 5 shows that this interaction term is not statistically significant. Thus, the market value premium associated with patents is indistinguishable between first-movers and other patent holders. Nevertheless, first-movers were about twice as likely as other firms to patent, suggesting that patents served as a means for pioneering firms to defend against imitation.

The patent measure in Table 5 is a simple dummy variable set equal to 1 for firms with at least one patent. Other patent measures were also evaluated. As mentioned previously, the cumulative count of patents awarded to each firm was tested in the model, but the results were substantially weaker than those shown for the patent dummy. Other experiments, with the threshold for the dummy variable set at higher patent counts, were similarly unsuccessful. This suggests that it is the existence of patents, rather than the number of patents, that is important.

In general, the results in Tables 4 and 5 show that first-mover advantages have been substantial when market capitalization is gauged relative to later entrants within each market space. However, the advantages of early entry appear to be largely confined to pioneers in markets with strong network effects, and those with patented innovations. Table 6 assesses the robustness of these findings by considering alternative definitions of first-movers, and by relaxing the focus on relative performance among surviving firms. Data for the regressions in Table 6 cover the most recent period of the sample (third quarter, 2002).

The first three regressions in Table 6 show the effects of changing the definition of first-mover. The first regression uses the preferred definition, FM; the second regression assumes a unique first-mover in each market space (FM1); and the third regression assigns the earliest 1/3 of entrants in each market space as first-movers (FM33). The fit is slightly worse with these

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[26] The dummy for patent applications filed within two years of entry was used for this interaction, but the results are similar if the more general patent dummy is employed.

alternative definitions, and significance levels fall slightly, but in general the results appear robust across the three definitions.

A deficiency of the regression approach in Tables 4 and 5 is that the number of observations diminishes in recent periods, due to exits. Exits by weaker firms have the perverse effect reducing the relative premium of surviving first-movers, which are compared with surviving firms within the market space. Moreover, exit of (all) first-movers in a given market space removes that space from the sample for the purpose of computing the first-mover premium. In an effort to overcome such problems, the middle regressions in Table 6 add the exiting firms back into the sample, at an (arbitrarily) assumed market value of $1 million. Table 6 shows that this procedure augments the FM*MarketMaker and FM*Broker coefficients, leaving the basic FM coefficient unchanged (slightly negative but insignificant). Thus, adjustment for exits raises the estimated magnitude of the network effect but not the magnitude of other first-mover advantages.

Such adjustment for exits also causes the patent coefficient to fall and lose statistical significance. The drop in the patents coefficient in these regressions reflects the fact that many firms with patents failed. (The exit rates of patent holders were virtually identical to those of other firms in the sample, as discussed below.) Thus, the strong positive patent coefficients in Table 5 may reflect a selection effect; firms with valuable patents tended to survive, whereas those with weak patents often did not.

The final columns of Table 6 give the market value regressions based on OLS estimation, omitting the industry fixed effects. In these regressions, market values are gauged relative to the mean of the sample rather than the mean of the market space. Results are similar to those with industry fixed effects, except that the FM*MarketMaker coefficients drop substantially and become insignificantly different from zero. Thus, on average, the market maker pioneers enjoyed a large premium relative to followers in their market space, but not relative to firms in

the sample as a whole. Indeed, many of the market spaces in this category are now regarded as failures, despite their initial promise.[27]

Revenue Regressions

Table 7 reports the regression estimates when quarterly revenues are used as the dependent variable. The explanatory variables are identical to those in Table 5. The results of the revenue regressions are similar to those described previously for market capitalization, but several differences are notable.

The dummy variable for brick and mortar origin, intended largely as a control measure, appears positive and significant in the revenue regressions. Thus, entrants with brick and mortar origins had substantially higher revenue than the average firm in their market space. This premium did not, however, carry over to market value (Table 5). Investors appear to have discounted the future earnings prospects of firms with brick and mortar origins, relative to independent startups.

An opposite pattern holds for pioneers in network markets, for whom the estimated premium is much larger in terms of market value (Table 5) than in terms of revenues (Table 7). One explanation is that investors anticipated higher growth, and hence greater future returns, for companies with potential network economies. For patent holders, on the other hand, the estimated coefficients are similar for both revenue and market value. In general, despite some differences in magnitude of effects, the revenue regressions tend to corroborate the findings obtained when market capitalization is used as the dependent variable.

Supplemental Analysis of Industry Effects

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[27] This is particularly true for vertical marketplaces, real estate, and perhaps advertising network. The average market value of follower firms in the "market maker" categories lies significantly below the sample mean.

The regression results in this paper demonstrate that first-movers in market spaces corresponding to the broker and market maker business models, identified as having strong potential network economies, attained high average market capitalization and revenue. Additional regressions were estimated to explore whether market values (for first-movers, followers or both) may have varied systematically with generic business models other than broker and market maker. Such patterns would be observed if network effects, switching costs, or other factors favoring first-movers are concentrated within business model categories.

To explore these possibilities, first-mover interaction terms such as those defined for the market maker and broker categories were defined for the following additional product or business model types: retailer, broker, software, portal, consultant, and B2B. These interaction terms were tested in the regression model (in the same manner as the FM*NetworkMarket dummy) to determine if first-movers enjoyed significantly higher returns in any of these environments. Results proved negative, except for a temporary market premium enjoyed by first-movers in the portal category in the early periods of the sample. These supplementary tests confirmed the concentration of first-mover advantages within the market maker and broker segments of the sample.

Analysis of Entrant Survival

A final analysis was performed to investigate firm survival. Table 8 gives exit rates for various subgroups in the sample. For the sample as a whole, 42% of entrants had exited (including bankruptcies, acquisitions, disappearances, and reorganization outside the Internet sector) by the last quarter of sample coverage. Table 8 shows that early entry (regardless of definition) and patent awards had virtually no effect on the probability of exit. Exit rates for brick and mortar firms (27%) and first-movers that applied for patents soon after entry (29%) are slightly below the sample mean, but the differences are not statistically significant.

The bottom portion of Table 8 gives exit rates of first-movers and followers categorized by type of business model. None of the pioneers in the market maker segments, and only one of the first-mover brokers, had exited by the end of the sample period. Hence the net exit rate of first-movers from these markets was a mere 6%, as compared with a rate of 45% for followers. These differences are highly significant statistically, and they suggest that first-movers in network markets enjoyed survival advantages comparable to those relating to market capitalization and revenue, documented previously.

5. Conclusions

This study has considered the specific conditions under which first-mover advantages would be expected to arise in Internet-related markets. The empirical analysis shows advantages for pioneers in environments with network effects, and firms with patented innovations. Absent these factors, Internet first-mover advantages appear minimal at best.

Thus, first-mover advantages seem to have arisen under roughly the conditions predicted. Even so, Internet first-mover advantages appear much less extensive than what many early entrants anticipated. In the euphoria of the early growth of Internet commerce, many entrepreneurs failed to perform adequate market analysis prior to entry and were disappointed. The view that first-mover advantages are pervasive throughout the Internet sector is clearly incorrect.

These findings are subject to many caveats. The measures developed in the study are crude proxies, which correspond only imperfectly to the factors that they are designed to represent. Moreover, it proved impossible to develop measures for some potentially important mechanisms, such as switching costs. In addition to these deficiencies of the empirical measures, sample selection biases may influence the results. The sample is clearly biased towards relatively successful Internet markets (and hence a finding of successful first-movers); it omits many pioneering entrants whose markets turned out to be non-viable. The main

performance measure in this study, stock market capitalization, reflects investor expectations, which may add a further unknown bias. In addition, the performance of pioneers has been compared with that of followers within each market space, so first-mover advantages have been assessed in relative terms, and not in terms of absolute long run profits.

In general, the study suggests that Internet first-mover advantages have arisen under specific and limited conditions, consistent with underlying theory.   Nevertheless, Internet commerce remains in its infancy, and it is too early to know for certain if these conclusions will hold over the long term. Years from now the answers may be clear, but the questions are likely to be less interesting.

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Fig 1. Average Market Capitalization of Internet Companies
(27 companies in sample with market prices in all periods)
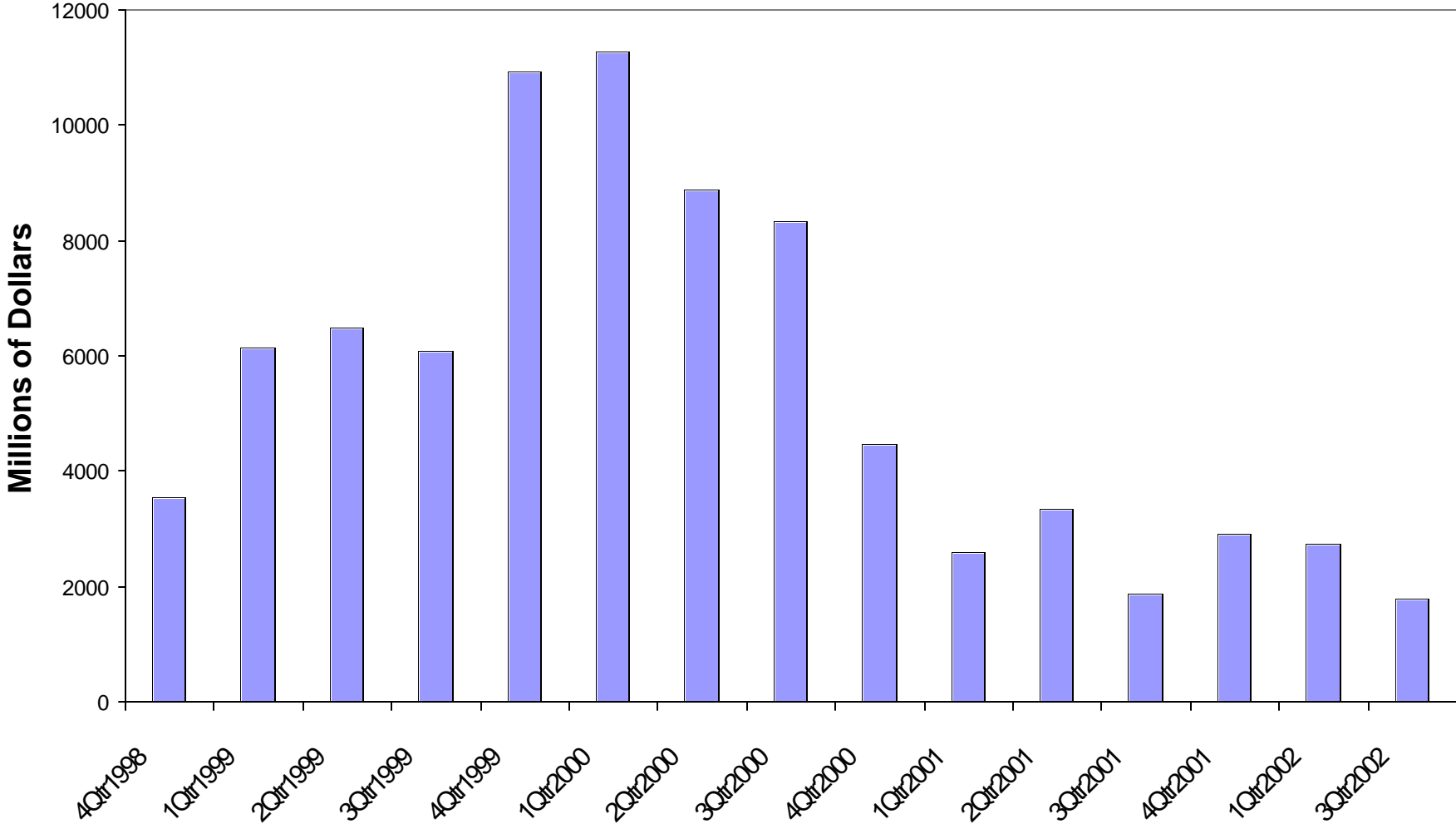
Table 1. Identification of Submarkets within the Internet Advertising/Marketing Sector

Company Name	Ticker	Hoover's Top Three Competitors			Market Space Assignment
DoubleClick Inc	DCLK	24/7 Media	Engage	NPD	Advertising Network
24/7 Media, Inc.@	TFSM	Adforce	Doubleclick	Engage	Advertising Network
Engage Media	ENGA	24/7 Media	Doubleclick	Jupiter Media Metrix	Advertising Network
ValueClick	VCLK	24/7 Media	Doubleclick	Engage	Advertising Network
L90 Inc	LNTY	24/7 Media	Doubleclick	Engage	Advertising Network
Mediaplex Inc	MPLX	24/7 Media	Avenue A	Doubleclick	Advertising Network
Be Free Inc	BFRE	Linkshare	Promotions.com	yesmail.com	E-Mail/promotion Marketing
FreeShop.com Inc	APTM	coolsavings.com	MyPoints.com	yesmail.com	E-Mail/promotion Marketing
Aptimus	APTM	coolsavings.com	MyPoints.com	yesmail.com	E-Mail/promotion Marketing
MyPoints.com Inc	MYPT	coolsavings.com	Netcentives	Promotions.com	E-Mail/promotion Marketing
Netcentives Inc	NCNT	beenz.com	MyPoints.com	Promotions.com	E-Mail/promotion Marketing
Coolsavings.com	CSAV	e-centives	MyPoints.com		E-Mail/promotion Marketing
Promotions.com	PRMO	Agency.com	MyPoints.com	yesmail.com	E-Mail/promotion Marketing
LifeMinders.com	LFMN	MyPoints.com	NetCreations	yesmail.com	E-Mail/promotion Marketing
Net Creations	NTCR	*	*	*	E-Mail/promotion Marketing
Exactis.com Inc	XACT	*	*	*	E-Mail/promotion Marketing
Cybergold	CGLD	*	*	*	E-Mail/promotion Marketing
Digital Impact	DIGI	Flonetwork	Messagemedia	Responsys	poor match: omitted from smpl
Harris Interactive Inc	HPOL	ACNeilsen	Gallup	Information Resources	poor match: omitted from smpl
GenesisIntermedia.co	GENI	e4l	Guthy-Renker	QXL	poor match: omitted from smpl
Avenue A	AVEA	DoubleClick	Modem Media	WPP Group	poor match: omitted from smpl
Mod.Media/PoppeTys	MMPT	iXL Enterprises	marchFIRST	Sapient	poor match: omitted from smpl
Message Media	MESG	24/7 Media	NetCreations	Rainmaker Systems	poor match: omitted from smpl

*Firm was acquired; no Hoover listing available.

Table 2. Market Spaces Included in the Sample

Bus. Model	B2C	Business Area	Submarket	# Firms	First-Mover(s)
mkt. maker		Advertising/Marketing	Advertising Network	6	DoubleClick Inc
mkt. maker		B2B	Vertical marketplace	6	FreeMarkets / Vertical Net
mkt. maker	x	Consumer Auctions		4	Ebay
mkt. maker	x	Real Estate		3	Homestore.com / HomeSeekers
mkt. maker	x	Tickets		2	Ticketmaster
mkt. maker		Employment Search		7	Dice / TMP Worldwide
broker	x	Autos	Broker/referral	2	Autoweb
broker	x	Financial Services	Insurance-quote aggregato	2	Quotesmith.com Inc
broker	x	Financial Services	Mortage	4	E-Loan Inc
broker	x	Financial Services	Stockbroker	7	E*Trade / Schwab
broker	x	Travel		6	Expedia / Hotel Res. Network
content	x	Women Networks		2	Women.com Networks
content		Health and Medicine	Content/other	3	HealthGate Data Corp
portal	x	Portals (horizontal)	Chinese Portal	3	China.com Corp
portal	x	Portals (horizontal)	General Portal	6	Yahoo
portal	x	Portals (horizontal)	Spanish Portal	4	StarMedia
portal	x	Financial Services	Content/portal	3	Multex.com Inc
portal	x	Music	Portal	6	ARTISTdirect Inc
retail	x	B2C Consumer Markets	Books	3	Amazon
retail	x	B2C Consumer Markets	Electronics	5	Value America Inc
retail	x	B2C Consumer Markets	Flowers	2	1-800-Flowers.com
retail	x	B2C Consumer Markets	Groceries	4	Peapod
retail	x	B2C Consumer Markets	Online Fashion Mall	3	Fashionmall.com
retail	x	B2C Consumer Markets	Sporting Goods	2	FogDog
retail	x	B2C Consumer Markets	Toys	3	Etoys/ Smarterkids.com
retail	x	Health and Medicine	Drugstores	2	drugstore.com
retail	x	Health and Medicine	Health Stores	2	Mothernature.com
software		B2B	Transaction platforms	2	Ariba
software		Software	e-business suites/platforms	9	Allaire / Broadvision / OpenMkt
software		Software	eCRM: E-Services	7	Kana / Delano
software		Software	eCRM: intelligence	5	WebTrends Corporation
software		Software	Infrastucture (EAI)	6	NEON / See Beyond
software		Software	Interactive TV	2	Spyglass Inc
infrastruct.		Internet Infrastructure	Content Delivery	4	Digital Island / Sandpiper
infrastruct.		Internet Services	Domain Name	2	Network Solutions (Verisign)
infrastruct.		Internet Services	E-Mail	5	CommTouch / Software.com
infrastruct.		Internet Services	Hosting	4	Exodus
infrastruct.		Internet Services	Telephony	7	NetSpeak / Net2Phone
other		Advertising/Marketing	E-Mail/promotion Marketing	10	Netcentives / Promotions.com
other		Advertising/Marketing	Web Information	3	Media Metrix
other		Consulting Services		23	CTP/Sapient/Lante/Organic
other		e-learning		6	Digitalthink Inc
other	x	Financial Services	Banking	3	Digital Insight Corp
other		Health and Medicine	Rx Management	2	Allscripts
other	x	ISP	Free	2	Juno Online Services
other		Postage		2	Stamps.com Inc
				206	TOTAL

Table 3: Firms in the Sample with Patents

First-Movers (FM):

Company Name	No. of Patents	Filed < 2yr	Exited
Amazon	18	1	0
Open Market Inc	12	1	1
Juno Online Services	8	1	1
Yahoo	7	1	0
NetSpeak Corp	7	1	1
FreeMarkets	5	0	0
Stamps.com Inc	4	1	0
Digital Island/Sandpiper	3	0	1
Kana	3	1	0
FogDog	2	1	1
WebTrends Corporation	2	0	1
Net2Phone	2	1	0
Ariba Inc.	1	1	0
Ebay	1	0	0
Charles Schwab	1	0	0
Multex.com Inc	1	1	0
Network Solutions (Verisign)	1	1	0
Software.com	1	0	1
Exodus	1	1	1
Media Metrix Inc	1	1	0
BroadVision Inc	1	1	0
Spyglass Inc	1	0	1
Sapient	1	0	0
TMP Worldwide	1	1	0
E*Trade Group Inc	1	0	0
NEON	1	1	0

Followers:

Company Name	No. of Patents	Filed < 2yr	Exited
E-Stamp Corp	29	1	1
Liberate Technologies	13	1	0
BEA Systems	9	1	0
Priceline.com Inc	9	1	0
Inktomi	6	1	0
About.Com	5	1	1
Lycos Inc(CMG@Ventures)	5	1	1
SilverStream Software	4	1	1
ITXC Corp.	4	1	0
Netzero Inc	3	1	0
E.piphany Inc	3	1	0
Exactis.com Inc	2	1	1
Cybergold	2	1	1
Netcentives Inc	2	1	1
Commerce One Inc	2	1	0
Net Perceptions	2	1	0
Vignette	2	0	0
Crossworlds	2	1	1
24/7 Media, Inc.	1	1	0
Be Free Inc	1	1	1
Ventro	1	1	1
Saba Software	1	1	0
Docent	1	1	0
Webvan	1	1	1
GoTo.Com	1	1	1
InfoSpace.com Inc	1	1	0
Careerbuilder.com	1	0	1
LendingTree Inc	1	1	0
Critical Path	1	1	0
Vitria	1	0	0
WorldQuest Networks Inc	1	1	0
Travelocity	1	1	1

Table 4. Market Value Regressions

Dependent Variable: log (market capitalization)

	3Q/2002	1Q/2002	3Q/2001	1Q/2001	3Q/2000	1Q/2000	3Q/1999
Constant	industry dummies	industry dummies	industry dummies	industry dummies	industry dummies	industry dummies	industry dummies
Brick & Mortar	-0.10	-0.05	0.16	0.27	0.02	-0.10	0.30
	(0.1)	(0.1)	(0.2)	(0.5)	(0.0)	(0.2)	(0.6)
First Mover (FM)	1.05 *	1.07 **	0.67 *	0.68 *	0.75 **	0.65 **	0.81 **
	(2.1)	(2.7)	(2.1)	(2.4)	(3.0)	(3.2)	(3.0)
R-sq	0.40	0.43	0.46	0.44	0.48	0.53	0.44
# observations	112	125	149	174	198	193	132

Numbers in parentheses are t-statistics.

**P<.01; *P<.05

Table 5. Market Value Regressions with Interaction Effects

Dependent Variable: log (market capitalization)

	3Q/2002	1Q/2002	3Q/2001	1Q/2001	3Q/2000	1Q/2000	3Q/1999
Constant	industry dummies	industry dummies	industry dummies	industry dummies	industry dummies	industry dummies	industry dummies
Brick & Mortar	0.37	0.21	0.44	0.41	0.08	-0.15	0.14
	(0.4)	(0.3)	(0.6)	(0.8)	(0.2)	(0.4)	(0.3)
First Mover (FM)	-0.76	-0.13	-0.06	-0.03	-0.03	-0.13	0.27
	(1.1)	(0.3)	(0.1)	(0.1)	(0.1)	(0.5)	(0.7)
FM*MarketMaker	3.69 **	3.26 **	1.85 *	1.85 *	2.08 **	2.08 **	1.35
	(3.1)	(3.3)	(2.2)	(2.4)	(2.8)	(3.7)	(1.8)
FM*Broker	3.33 **	2.03 *	1.46	1.31	1.62 *	1.30 *	0.38
	(2.7)	(2.0)	(1.6)	(1.6)	(2.2)	(2.3)	(0.4)
Patents > 0	1.28 *	1.06 *	1.07 **	0.98 **	1.06 **	0.83 **	1.08 **
	(2.4)	(2.4)	(2.6)	(2.7)	(3.3)	(3.3)	(3.0)
FM*Patents	0.56	0.36	-0.13	0.22	0.45	0.62	0.19
	(0.5)	(0.4)	(0.2)	(0.3)	(0.8)	(1.4)	(0.3)
R-sq	0.55	0.55	0.54	0.51	0.56	0.62	0.52
# observations	112	125	149	174	198	193	132

Numbers in parentheses are t-statistics.

**P<.01; *P<.05

Table 6. Market Value Regressions Based on Alternative Methods

Dependent Variable: log of market capitalization (3Q/2002)

Regression type:	Industry Fixed Effects			Fixed Effects, Exits Included^			OLS (no fixed effects)		
Definition of first-mover :	FM	FM1	FM33	FM	FM1	FM33	FM	FM1	FM33
Constant	industry dummies	industry dummies	industry dummies	industry dummies	industry dummies	industry dummies	3.35 ** (13.5)	3.36 ** (13.4)	3.40 ** (13.2)
Brick & Mortar	0.44 (0.5)	0.80 (0.9)	0.58 (0.7)	0.44 (0.7)	0.86 (1.2)	0.50 (0.8)	0.85 (1.4)	1.08 (1.8)	0.98 (1.6)
First Mover (FM)	-0.54 (1.0)	-0.46 (0.7)	-0.40 (0.7)	-0.44 (1.1)	-0.40 (0.8)	-0.36 (1.0)	0.01 (0.0)	0.13 (0.2)	-0.22 (0.5)
FM*MarketMaker	3.50 ** (3.1)	3.00 * (2.3)	2.93 * (2.5)	4.38 ** (4.1)	3.93 ** (3.3)	4.13 ** (4.2)	0.66 (0.8)	0.45 (0.5)	0.66 (1.0)
FM*Broker	3.12 ** (2.7)	2.60 * (2.0)	2.97 * (2.5)	4.30 ** (4.0)	3.22 ** (2.6)	4.37 ** (4.2)	2.60 ** (3.1)	2.15 * (2.1)	2.52 ** (3.2)
Patents > 0	1.40 ** (2.9)	1.49 ** (3.1)	1.28 * (2.5)	0.69 (1.6)	0.82 (1.8)	0.51 (1.2)	1.55 ** (3.8)	1.61 ** (3.9)	1.53 ** (3.7)
R-sq	0.55	0.51	0.53	0.44	0.39	0.45	0.23	0.16	0.23
# observations	112	112	112	206	206	206	112	112	112

Numbers in parentheses are t-statistics.

**P<.01; *P<.05

^Exiting firms assigned arbitrary market value of $1 million.

Table 7. Revenue Regressions

Dependent Variable: log (market capitalization)

	3Q/2001	1Q/2001	3Q/2000	1Q/2000	3Q/1999	1Q/1999
Constant	industry dummies	industry dummies	industry dummies	industry dummies	industry dummies	industry dummies
Brick & Mortar	1.32 *	1.27 **	0.72 *	0.93 **	1.10 **	1.48 **
	(2.6)	(2.9)	(2.1)	(2.7)	(2.8)	(3.3)
First Mover (FM)	-0.36	-0.02	0.13	0.21	0.39	0.55 *
	(1.2)	(0.1)	(0.6)	(1.0)	(1.7)	(2.0)
FM*MarketMaker	2.30 **	1.33 *	1.15 *	0.88	0.55	0.56
	(3.5)	(2.0)	(2.2)	(1.6)	(0.9)	(0.8)
FM*Broker	0.95	0.76	0.65	1.12 *	0.64	0.30
	(1.3)	(1.1)	(1.2)	(2.1)	(1.1)	(0.4)
Patents > 0	0.84 **	0.85 **	0.78 **	0.69 **	0.71 **	0.70 *
	(2.9)	(3.0)	(3.5)	(3.2)	(2.9)	(2.4)
R-sq	0.63	0.52	0.57	0.57	0.56	0.59
# observations	141	168	187	202	202	192

Numbers in parentheses are t-statistics.

**P<.01; *P<.05

Table 8. Exit Rates by Subgroup

	# Entrants	# Exits	Percent Exiting
Full Sample	206	87	42%
Bricks & Mortar Origin	22	6	27%
First-Mover Definition			
FM	65	24	37%
FM1	49	18	37%
FM33	80	32	40%
Patents			
Patents>0	58	23	40%
Patents>3	16	7	44%
Patent(2yr)>0	46	18	39%
FM*Patents>0	26	9	35%
FM*Patent(2yr)>0	17	5	29%

Exit Rates by Business Model Type:

	# Entrants	# Exits	Percent Exiting
Market Maker			
FM	8	0	0%
Followers	18	9	50%
Broker			
FM	8	1	13%
Followers	15	6	40%
Portal			
FM	5	1	20%
Followers	16	10	63%
Software			
FM	11	5	45%
Followers	23	6	26%
Retail			
FM	9	5	56%
Followers	17	10	59%

Appendix

Industry	Sub-Industry	Company Name	MCAP 3Q/02	FM1	FM	FM33	EXITED	ACQUIRI	CHAP11
Advertising/Marketing	Advertising Network	DoubleClick Inc	698.7	1	1	1	0	0	0
Advertising/Marketing	Advertising Network	ValueClick	197.2	0	0	1	0	0	0
Advertising/Marketing	Advertising Network	24/7 Media, Inc.@	19.1	0	0	1	0	0	0
Advertising/Marketing	Advertising Network	Mediaplex Inc	NA	0	0	0	1	0	0
Advertising/Marketing	Advertising Network	Engage Media	3.6	0	0	0	0	0	0
Advertising/Marketing	Advertising Network	L90 Inc	NA	0	0	0	1	1	0
Advertising/Marketing	E-Mail/promotion Marketing	Promotions.com	NA	1	1	1	1	1	0
Advertising/Marketing	E-Mail/promotion Marketing	Netcentives Inc	NA	0	0	1	1	0	1
Advertising/Marketing	E-Mail/promotion Marketing	Coolsavings.com	3.3	0	0	1	0	0	0
Advertising/Marketing	E-Mail/promotion Marketing	Be Free Inc	NA	0	0	1	1	1	0
Advertising/Marketing	E-Mail/promotion Marketing	MyPoints.com Inc	NA	0	0	0	1	1	0
Advertising/Marketing	E-Mail/promotion Marketing	Cybergold	NA	0	0	0	1	1	0
Advertising/Marketing	E-Mail/promotion Marketing	Net Creations	NA	0	0	0	1	1	0
Advertising/Marketing	E-Mail/promotion Marketing	FreeShop.com Inc	3	0	0	0	0	0	0
Advertising/Marketing	E-Mail/promotion Marketing	LifeMinders.com	NA	0	0	0	1	0	0
Advertising/Marketing	E-Mail/promotion Marketing	Exactis.com Inc	NA	0	0	0	1	1	0
Autos	Broker/referral	Autoweb	NA	1	1	1	1	1	0
Autos	Broker/referral	Autobytel	74.8	0	0	0	0	0	0
B2B	e-commerce platform	Ariba Inc.	358.5	1	1	1	0	0	0
B2B	e-commerce platform	Commerce One Inc	86.6	0	0	0	0	0	0
B2B	vertical marketplace	FreeMarkets	207.5	1	1	1	0	0	0
B2B	vertical marketplace	Vertical Net	12	1	1	1	0	0	0
B2B	vertical marketplace	Purchasepro.com Inc	0.668	0	0	0	0	0	0
B2B	vertical marketplace	Sciquest.com	18.7	0	0	0	0	0	0
B2B	vertical marketplace	Bid	NA	0	0	0	1	0	0
B2B	vertical marketplace	Ventro	NA	0	0	0	1	0	0
B2B	e-learning	Healthstream Inc	18.4	1	1	1	0	0	0
B2B	e-learning	Click2Learn	15.3	1	1	1	0	0	0
B2B	e-learning	Digitalthink Inc	45.6	0	0	0	0	0	0
B2B	e-learning	Docent	32.7	0	0	0	0	0	0
B2B	e-learning	Saba Software	101.8	0	0	0	0	0	0
B2B	e-learning	Riverdeep Interactive Le	236.8	0	0	0	0	0	0
B2C Consumer Markets	Books	Amazon	6061	1	1	1	0	0	0
B2C Consumer Markets	Books	Barnes and Noble	79.8	0	0	0	0	0	0
B2C Consumer Markets	Books	Books A Million	54.3	0	0	0	0	0	0
B2C Consumer Markets	Electronics	Value America Inc	NA	1	1	1	1	0	1
B2C Consumer Markets	Electronics	Egghead.com	NA	0	0	1	1	0	1
B2C Consumer Markets	Electronics	Cyberian Outpost, Inc	NA	0	0	0	1	0	0
B2C Consumer Markets	Electronics	Buy.Com Inc	NA	0	0	0	1	1	0
B2C Consumer Markets	Electronics	Onvia.com Inc	15.8	0	0	0	0	0	0
B2C Consumer Markets	Entertainment-Tickets	Ticketmaster	2196	1	1	1	0	0	0
B2C Consumer Markets	Entertainment-Tickets	Tixx.com	5.9	0	0	0	0	0	0
B2C Consumer Markets	Flowers	1-800-Flowers.com Inc	455.4	1	1	1	0	0	0
B2C Consumer Markets	Flowers	FTD.com	230	0	0	0	0	0	0
B2C Consumer Markets	Groceries	Peapod	NA	1	1	1	1	1	0
B2C Consumer Markets	Groceries	Streamline	NA	0	0	1	1	0	0
B2C Consumer Markets	Groceries	Homegrocer	NA	0	0	1	1	1	0
B2C Consumer Markets	Groceries	Webvan	NA	0	0	0	1	0	1
B2C Consumer Markets	Online Fashion Mall	Fashionmall.com	3.7	1	1	1	0	0	0
B2C Consumer Markets	Online Fashion Mall	Bluefly.com	8.8	0	0	0	0	0	0
B2C Consumer Markets	Online Fashion Mall	Ashford.Com Inc	NA	0	0	0	1	1	1
B2C Consumer Markets	Sporting Goods	FogDog	NA	1	1	1	1	1	0
B2C Consumer Markets	Sporting Goods	Global Sports	200.4	0	0	0	0	0	0
B2C Consumer Markets	Toys	Etoys	NA	1	1	1	1	0	1
B2C Consumer Markets	Toys	Rightstart	NA	0	0	0	0	0	0
B2C Consumer Markets	Toys	smarterkids.com	NA	0	0	0	1	0	0

Category	Subcategory	Company	Value						
Consulting Services		Cambridge Technology Part	NA	1	1	1	1	1	0
Consulting Services		Sapient	129.1	0	1	1	0	0	0
Consulting Services		Lante Corp	NA	0	1	1	1	1	0
Consulting Services		Organic	NA	0	1	1	1	1	0
Consulting Services		Diamond Technology Partne	101.9	0	1	1	0	0	0
Consulting Services		Agency.com	NA	0	1	1	1	1	0
Consulting Services		iXL Enterprises	NA	0	1	0	1	0	0
Consulting Services		Razorfish Inc	6.2	0	1	0	0	0	0
Consulting Services		PEC Solutions	589.1	0	0	0	0	0	0
Consulting Services		US Interactive Inc	NA	0	0	1	1	0	1
Consulting Services		Marchfirst	NA	0	0	0	1	0	1
Consulting Services		Mainspring Communications	NA	0	0	0	1	1	0
Consulting Services		Proxicom	NA	0	0	0	1	1	0
Consulting Services		C-Bridge Internet	NA	0	0	0	1	0	0
Consulting Services		Inforte Corp	59.3	0	0	0	0	0	0
Consulting Services		Viant	78.7	0	0	0	0	0	0
Consulting Services		Perficient	6.8	0	0	0	0	0	0
Consulting Services		Scient	NA	0	0	0	1	1	1
Consulting Services		AnswerThink Consulting	68.7	0	0	0	0	0	0
Consulting Services		Circle.Com	NA	0	0	0	1	1	0
Consulting Services		Xpedior	NA	0	0	0	1	0	1
Consulting Services		Digitas Inc	138.7	0	0	0	0	0	0
Consulting Services		Luminant Worldwide Corp	NA	0	0	0	1	1	1
Consumer Auctions		Ebay	14883	1	1	1	0	0	0
Consumer Auctions		FairMarket	30.7	0	0	1	0	0	0
Consumer Auctions		Qxl	6.1	0	0	0	0	0	0
Consumer Auctions		Ubid	NA	0	0	0	1	1	0
C&C - Portals	Portal - General	Yahoo	5747	1	1	1	0	0	0
C&C - Portals	Portal - General	Lycos Inc(CMG@Ventures)	NA	0	0	1	1	1	0
C&C - Portals	Portal - General	InfoSpace.com Inc	142.3	0	0	0	0	0	0
C&C - Portals	Portal - General	Looksmart.com	95	0	0	0	0	0	0
C&C - Portals	Portal - General	About.Com	NA	0	0	0	1	1	0
C&C - Portals	Portal - General	GoTo.Com	NA	0	0	0	1	0	0
C&C - Portals	Portal - Chinese	China.com Corp	208.5	1	1	1	0	0	0
C&C - Portals	Portal - Chinese	Sohu.com (Chinese)	69.6	0	0	0	0	0	0
C&C - Portals	Portal - Chinese	Sina.Com Corp	99.1	0	0	0	0	0	0
C&C - Portals	Spanish Portal	StarMedia Network Inc	NA	1	1	1	1	0	0
C&C - Portals	Spanish Portal	El Sitio International C	NA	0	0	1	1	0	0
C&C - Portals	Spanish Portal	Quepasa.com Inc	NA	0	0	0	1	0	0
C&C - Portals	Spanish Portal	Terra Networks(Telefonic	NA	0	0	0	0	0	0
Employment		Dice	11.5	1	1	1	0	0	0
Employment		TMP Worldwide	1005	0	1	1	0	0	0
Employment		Careerbuilder.com	NA	0	0	0	1	0	1
Employment		Webhire.com	2.8	0	0	0	0	0	0
Employment		HotJobs.com Ltd	NA	0	0	0	1	0	0
Employment		E-Cruiter.com Inc	NA	0	0	0	0	0	0
Employment		HeadHunter Inc	NA	0	0	0	1	0	0
Financial Services	Banking	Digital Insight Corp	505.6	1	1	1	0	0	0
Financial Services	Banking	Net.B@nk Inc	518.2	0	0	0	0	0	0
Financial Services	Banking	Netzee Inc	1.1	0	0	0	0	0	0
Financial Services	Stockbroker	Charles Schwab	11874	1	1	1	0	0	0
Financial Services	Stockbroker	E*Trade Group Inc	1626	0	1	1	0	0	0
Financial Services	Stockbroker	Ameritrade	806.9	0	0	0	0	0	0
Financial Services	Stockbroker	DLJdirect (now CSFB direct	NA	0	0	0	1	1	0
Financial Services	Stockbroker	AB Watley	1.3	0	0	0	0	0	0
Financial Services	Stockbroker	Web Street Inc	NA	0	0	0	1	1	0
Financial Services	Stockbroker	TD Waterhouse Group Inc	NA	0	0	0	0	0	0
Financial Services	Mortage	E-Loan Inc	81.4	1	1	1	0	0	0
Financial Services	Mortage	LendingTree Inc	326.9	0	0	1	0	0	0

Sector	Category	Company	Value						
Financial Services	Mortage	American Home Mrtg Hldgs	175.2	0	0	0	0	0	0
Financial Services	Mortage	Mortgage.com Inc	NA	0	0	0	1	0	1
Financial Services	Insurance-quote aggregator	Quotesmith.com Inc	12.3	1	1	1	0	0	0
Financial Services	Insurance-quote aggregator	Insweb Corp	12.5	0	0	0	0	0	0
Financial Services	content/portal	Multex.com Inc	101.4	1	1	1	0	0	0
Financial Services	content/portal	Marketwatch	72.2	0	0	0	0	0	0
Financial Services	content/portal	TheStreet.com	53	0	0	0	0	0	0
Health and Medicine	Drugstores	drugstore.com	113.8	1	1	1	0	0	0
Health and Medicine	Drugstores	Planetrx	NA	0	0	0	1	0	0
Health and Medicine	Health Stores	Mothernature.com	NA	1	1	1	1	0	1
Health and Medicine	Health Stores	Vitaminshoppe.com	NA	0	0	0	1	0	0
Health and Medicine	Rx management	Allscripts Inc	109.9	1	1	1	0	0	0
Health and Medicine	Rx management	Medscape Inc	NA	0	0	0	1	1	1
Health and Medicine	Content/other	HealthGate Data Corp	0.361	1	1	1	0	0	0
Health and Medicine	Content/other	Healtheon Corp	1500	0	0	0	0	0	0
Health and Medicine	Content/other	Healthcentral.com Inc	NA	0	0	0	1	1	1
Internet Infrastructure	Content Delivery Network	Digital Island/Sandpiper	NA	1	1	1	1	1	0
Internet Infrastructure	Content Delivery Network	Inktomi Corp	36.6	0	0	1	0	0	0
Internet Infrastructure	Content Delivery Network	iBeam	NA	0	0	0	1	0	1
Internet Infrastructure	Content Delivery Network	Akamai Technologies Inc	96.6	0	0	0	0	0	0
Internet Services	Domain Name	Network Solutions (verisign)	NA	1	1	1	0	0	0
Internet Services	Domain Name	Register.com	121.3	0	0	0	0	0	0
Internet Services	E-Mail	Software.com	NA	1	1	1	1	1	0
Internet Services	E-Mail	CommTouch Software Ltd	NA	0	1	1	0	0	0
Internet Services	E-Mail	Mail.com	NA	0	0	0	1	0	0
Internet Services	E-Mail	Easy Link	24.4	0	0	0	0	0	0
Internet Services	E-Mail	Critical Path	50.2	0	0	0	0	0	0
Internet Services	Hosting	Exodus	NA	1	1	1	1	0	1
Internet Services	Hosting	Digex Inc	11	0	0	1	0	0	0
Internet Services	Hosting	Data Return Corp	NA	0	0	0	1	1	0
Internet Services	Hosting	Interliant	NA	0	0	0	1	0	1
Internet Services	Web Information	Media Metrix Inc	5.9	1	1	1	0	0	0
Internet Services	Web Information	NetRatings Inc	194.7	0	0	0	0	0	0
Internet Services	Web Information	@plan.inc	NA	0	0	0	0	1	0
ISP	Free	Juno Online Services	NA	1	1	1	1	1	0
ISP	Free	Netzero Inc	NA	0	0	0	0	0	0
Music	Portal	ARTISTdirect Inc	19.7	1	1	1	0	0	0
Music	Portal	Musicmaker.com Inc	NA	0	0	1	1	0	0
Music	Portal	Audiohighway.com	NA	0	0	0	1	0	1
Music	Portal	E-Music.com Inc	NA	0	0	0	1	1	0
Music	Portal	MP3.COM Inc	NA	0	0	0	1	1	1
Music	Portal	Launch Media Inc	NA	0	0	0	1	1	0
Postage		Stamps.com Inc	218	1	1	1	0	0	0
Postage		E-Stamp Corp	NA	0	0	0	1	0	0
Real Estate		HomeSeekers.com	2.2	1	1	1	0	0	0
Real Estate		Homestore.com Inc	35.4	1	1	1	0	0	0
Real Estate		Homeservices Com Inc	NA	0	0	0	1	1	0
Software - ebusiness	eCRM: E-Services	Delano Technology Corp	NA	1	1	1	1	1	0
Software - ebusiness	eCRM: E-Services	Kana	18.3	0	1	1	0	0	0
Software - ebusiness	eCRM: E-Services	Primus Knowledge Solutions	6.1	0	0	1	0	0	0
Software - ebusiness	eCRM: E-Services	eshare	NA	0	0	0	1	1	0
Software - ebusiness	eCRM: E-Services	E.piphany Inc	259.9	0	0	0	0	0	0
Software - ebusiness	eCRM: E-Services	Exchange Applications	0.265	0	0	0	0	0	0
Software - ebusiness	eCRM: E-Services	eGain Communications	4.7	0	0	0	0	0	0
Software - ebusiness	eCRM: intelligence	WebTrends Corporation	NA	1	1	1	1	1	0
Software - ebusiness	eCRM: intelligence	Broadbase Software Inc	NA	0	0	0	1	0	0
Software - ebusiness	eCRM: intelligence	Net Perceptions	24.6	0	0	0	0	0	0
Software - ebusiness	eCRM: intelligence	net.Genesis	NA	0	0	0	1	1	0
Software - ebusiness	eCRM: intelligence	Accrue Software Inc	2	0	0	0	0	0	0

Software - ebusiness	e-business suites/platforms	BroadVision Inc	39.6	1	1	1	0	0	0
Software - ebusiness	e-business suites/platforms	Open Market Inc	NA	0	1	1	1	1	0
Software - ebusiness	e-business suites/platforms	Allaire Corp	NA	0	1	1	1	1	0
Software - ebusiness	e-business suites/platforms	InterWoven	213	0	0	0	0	0	0
Software - ebusiness	e-business suites/platforms	BEA Systems	2122	0	0	0	0	0	0
Software - ebusiness	e-business suites/platforms	Vignette	200.5	0	0	0	0	0	0
Software - ebusiness	e-business suites/platforms	Art Technology Group Inc (A	67.1	0	0	0	0	0	0
Software - ebusiness	e-business suites/platforms	SilverStream Software In	NA	0	0	0	1	1	0
Software - ebusiness	e-business suites/platforms	Blue Martini	38.7	0	0	0	0	0	0
Software	infrastucture	SeeBeyond	116.9	1	1	1	0	0	0
Software	infrastucture	NEON	NA	0	1	1	0	0	0
Software	infrastucture	Vitria	101.8	0	0	0	0	0	0
Software	infrastucture	webMethods	245.9	0	0	0	0	0	0
Software	infrastucture	TIBCO Software Inc	781.2	0	0	0	0	0	0
Software	infrastucture	Crossworlds	NA	0	0	0	1	1	0
Software	interactive tv	Spyglass Inc	NA	1	1	1	1	1	0
Software	interactive tv	Liberate Technologies	167.9	0	0	0	0	0	0
Telephony		NetSpeak Corp	NA	1	1	1	1	0	0
Telephony		Net2Phone	149.6	0	1	1	0	0	0
Telephony		WorldQuest Networks Inc	11.9	0	0	0	0	0	0
Telephony		Deltathree	13.9	0	0	0	0	0	0
Telephony		Ibasis	11.4	0	0	0	0	0	0
Telephony		ITXC Corp	115.4	0	0	0	0	0	0
Telephony		Universal Access Inc	18.9	0	0	0	0	0	0
Travel		Expedia Inc	2896	1	1	1	0	0	0
Travel		Hotel Reservation Network	2920	0	1	1	0	0	0
Travel		Travelocity	NA	0	0	0	1	0	0
Travel		Priceline.com Inc	335.5	0	0	0	0	0	0
Travel		Getthere.Com Inc	NA	0	0	0	1	1	0
Travel		Netcruise.com	NA	0	0	0	1	0	0
Women Networks		Women.com Networks	NA	1	1	1	1	1	0
Women Networks		iVillage Inc	32	0	0	0	0	0	0