University of Navarra

Working Paper

U.S. PUBLIC AND PRIVATE VENTURE CAPITAL MARKETS, 1998-2001: A FUNDAMENTAL INFORMATION ANALYSIS

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Abstract

Systematic analysis of U.S. capital markets reveals important empirical facts that analytical modeling or empirical research seeking to explain the 1998-2001 movements needs to recognize. There is no single "bubble point" at which U.S. capital markets had an epiphany that valuations required a sharp downward re-evaluation. Rather, different sectors had different points after which ex post sustained declines occurred. For the NASDAQ/NYSE/AMEX public capital markets, the sustained ex post declines occurred starting in March 2000 for the computer software industry and in September 2000 for the computer hardware industry. Private venture capital investment in new ventures peaked in the March 2000 quarter for software and in the September 2000 quarter for hardware and communications. Four sectors exhibiting extreme price movements are identified – computer hardware, computer software, telecommunications, and biotech/pharmaceuticals. These sectors had observable characteristics prior to 1998 that implied higher risk – they had higher relative risk (CAPM beta), higher standard deviation of security returns, more extreme revenue growth increases (decreases) in the upper (lower) tails, and a higher propensity for negative net income. During the 1998-2001 period, companies in these sectors had abnormally high revenue growth rates. An Internet sample of companies exhibits even higher abnormal revenue growth rates relative to either prior periods or other companies in the 1998-2001 period. The large relative increases and decreases in the market capitalization of U.S. capital markets in 1998-2001 may well have more grounding in risk-reward asset pricing theory than many commentators have recognized.

Keywords: capital markets, stock prices, Internet stocks, stock market bubble

**U.S. PUBLIC AND PRIVATE VENTURE CAPITAL MARKETS, 1998-2001:
A FUNDAMENTAL INFORMATION ANALYSIS[1]**

Many colorful and emotive expressions have been used to describe the movements of stock prices in U.S. capital markets in the period 1998-2000. Phrases that appear with regularity include "bubble", "bursting of the bubble", "crash", "Internet", "boom and bust", "dot-com bubble", "spectacular rise and fall of NASDAQ", and "technology bubble on NASDAQ."[2] Likewise, the explanations/rationalizations that have been proposed to explain the phenomena have used similar terminology, such as "irrational exuberance," "hedge funds riding the technology bubble, not attacking it", "short term institutional trend-chasing", and "herding by institutional investors."[3]

This paper examines the behavior of U.S capital markets during 1998-2001 through the lens of underlying company financial fundamentals. We examine the ability of company fundamentals to directionally explain changes in stock price levels. We analyze both U.S. public equity markets and U.S. private venture capital markets because many of the relatively young companies that reached $10 billion-plus market capitalizations in 1998-2001 originated in the venture capital market.

I. Overview of Existing Research

The behavior of capital markets in the U.S. and other countries in the period 1998-2001 has attracted a great deal of attention. To try to explain the general notion of a sizable rise and then relatively sharp fall in stock price levels, a diverse set of hypotheses have been put forward:

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[2] These phrases appear with frequency. One source where each of these terms are used is: "Internet bubble and crash" in Sharma, Easterwood, and Kumar [2005, p. 1]; "the technology bubble on NASDAQ" in Brunermeier and Nagel [2003, Abstract]; "April [2000] saw the 'bursting' of the Internet bubble" in Battalio and Schultz [2004, p. 10]; "spectacular rise and fall of NASDAQ from September 99-2001" in Griffin, Harris, and Topaloglu [2003, Abstract]; "the dot com bubble" in Ljungqvist and Wilhelm [2003, p. 723]; "boom and bust" and "the Internet stock bubble" in Liu and Song [2001, p. 3].

[3] Sources for phrases include: "irrational exuberance" in Shiller [2005] and Greenspan, A. [1996]; "hedge funds riding the technology bubble, not attacking it" in Brunermeier and Nagel [2004, p.2014]; "short term institutional trend-chasing" in Griffin, Harris, and Topaloglu [2003, Abstract]; "herding by institutional investors" in Sharma, Easterwood, and Kumar [2005, Abstract].

- **Investor-related explanations.** Griffin, Harris, and Topaloglu [2003, p. 4] argue that "institutions contributed more than individuals to the NASDAQ rise and fall…our evidence is most consistent with models where smart money follows past stock price movements leading to larger stock price bubbles than would exist in their absence." Sharma, Easterwood, and Kumar [2005, p. 50] probe the hypothesis that "Institutional investors as a group herded into Internet stocks during the overall bubble period (Jan. 98 – Mar. 00) and herded out of these stocks during the overall crash period (Apr. 00 – Dec. 01)." Brunnermeier and Nagel [2003, p. 2] ascribe a significant role to "hedge funds" who were "riding the technology bubble… [they] skillfully anticipated price peaks in individual technology stocks."

- **Market trading mechanism explanations.** Ofek and Richardson [2003, Abstract] probe the role of short sale restrictions using a model where investors have heterogeneous beliefs. In a study of 400 Internet stocks, they document "substantial short sale restrictions" and report a "link between heterogeneity and price effects." Battalio and Schultz [2004, p. 4] examine whether short sale restrictions prevent rational investors from driving Internet stock prices to "reasonable levels." They conclude that "As a whole, short-sale constraints were not responsible for the high prices of Internet stocks at the peak of the bubble."

- **Security analyst excess optimism.** Liu and Song [2001, Abstract] argue that "financial analysts as a whole were too optimistic about Internet stocks before the market crash in April 2000… Analysts did indeed share some blame in the formation of the Internet stock bubble."

- **Company ownership structure/IPO restrictions on lockups.** Ljungqvist and Wilhelm [2003, Abstract] discuss the pre-IPO ownership structure of "dot-coms" and conclude that "it was firm characteristics that were unique during the 'dot-com bubble' and that pricing behavior followed from incentives created by these characteristics." Schultz and Zaman [2001] examine manager share ownership and subsequent selling behavior to probe "overvaluation" of Internet companies going IPO.

- **Corporate financial reporting induced.** Coronado and Sharpe [2003, p. 2] examine whether pension plan accounting contributed to a "pension-induced bubble in equity prices." They conclude that any pension-based misvaluation explains little of the runup on stock prices over the 1990s and 2000.

- **Company growth prospects.** Pastor and Veronesi [2004a, p. 31] examine how stock valuation models are affected by uncertainty about average profitability. They argue that "NASDAQ valuations were not necessarily irrational ex ante because uncertainty about average profitability, which increases the fundamental value of a firm, was unusually high in the late 1990s." Using expectations data from I/B/E/S for selected Internet stocks, they demonstrate for twelve high technology firms how above average profitability can lead to sizable upward revaluations in stock price levels.

Underlying many of the above hypotheses are statements or assertions about what actually occurred in U.S. capital markets in the period 1998-2001. There is often little detailed empirical analysis offered for the phenomena that the authors use to motivate their modeling or attempt to explain with their empirics. This paper systematically examines the period 1998-2001 using multiple data sets covering U.S. public and private markets. We observe positive associations between shifts in key public market/private venture capital market variables and fundamental company information. These associations warrant further investigation to see how much of the observed upward revisions and downward revisions in

equity valuation can be explained by fundamental information about company risk and company expected growth and profitability.

II. Key Themes

Our analyses highlight that there are five important themes that need to be taken into account by analytical modeling or empirical research that seeks to explain stock price movements in 1998-2001:

1. There was no single "bubble point" at which U.S. capital markets had an epiphany that valuations required a sharp downward re-evaluation. Descriptions of U.S. capital markets in the 1998-2001 period often use a single index (NASDAQ) and highlight March 10, 2000 as the "high-point." Analysis or observation using a single index inevitably ends up with the unsurprising conclusion that there was a single high point. We examine alternative ways to identify groups of companies that experienced sizable market capitalization shifts during 1998-2001. Using three-digit SIC codes, we identified four industry groups that had both (1) large relative increases and decreases in market capitalization and (2) large absolute market capitalizations—computer hardware, computer software, telecommunications, and biotech/pharmaceuticals. We demonstrate that in aggregate market capitalization computer software peaks on March 10, 2000, computer hardware and telecommunications on March 27, 2000, and biotech/pharma on December 28, 2000. Also telling against the single "bubble point" conclusion is the finding that on September 30, 2000, computer hardware companies were at 100% of their March 30, 2000 levels whereas computer software companies were only at 75%. Computer hardware had a six-month later sustained downward revision in its public market stock price levels vis-à-vis computer software. There was not a common peak followed by simultaneous drops in the market capitalizations of different public market sectors. Similarly, the private venture capital market did not operate in the homogeneous way that an analysis of a single aggregate new funds invested series might imply. Rather, we find that aggregate private venture capital funding for new software ventures peaked in the March 2000 quarter while new communications and hardware ventures peaked in the September 2000 quarter. Our findings of different market capitalization peak points for sectors with identifiable differences in fundamental product/business characteristics suggest that an information-based explanation for stock price paths warrants serious consideration.

2. The sizable increases and decreases in market capitalization during 1998-2001 were not simply a NASDAQ-only phenomenon. We show that NYSE/AMEX and NASDAQ companies alike experienced increases and decreases in the hardware, software, telecommunications and biotech/pharma industries. One explanation for why observers mistakenly label the increases and decreases in market capitalization during 1998-2001 as a "NASDAQ bubble" is that companies from industries such as computer software and hardware make up a much higher percentage of total exchange market capitalization on NASDAQ than on the NYSE/AMEX, so that comparable dollar movements in the market capitalization of such industries show up as larger relative movements for the NASDAQ index than for the NYSE/AMEX index. Analysis of aggregate market-wide indexes is unlikely to be an effective way to identify sector-specific trends on stock exchanges like the NYSE and AMEX where other sectors such as banking/financial services, consumer products, oil and gas, and retail have large weightings.

3. The large shifts in market capitalizations during the 1998-2001 period were not restricted to Internet companies. We examine a sample of 512 Internet companies that is

built from a merger of Internet identifications of Thompson Financial Securities Data, Dealogic and IPOMonitor.com.[4] Such firms are almost exclusively listed on NASDAQ. On March 10, 2000, 96.2% of all Internet companies were on NASDAQ (97.8% weighting by market value of equity). The aggregate market capitalization of the Internet companies vis-à-vis NASDAQ/NYSE/AMEX companies, partitioned into our "Selected SIC Industry group" of hardware/software/telecommunications/biotech-pharma and "All Other Companies" group, are:

	Aggregate Market Capitalization		Change in Aggregate Market Capitalization	Number of Companies on 3/10/2000
	3/10/2000	12/31/2000		
Internet Companies	$1,630	$279	↓ $1,351	367
NASDAQ/NYSE/AMEX Companies				
• Four Selected SIC Industries	$9,262	$4,593	↓ $4,669	1,932
• All Other Companies	$9,135	$9,619	↑ $484	6,469

The Internet company aggregate market capitalization decline, while larger as a percentage drop from its March 10, 2000 value than for our four SIC Industry groups (83% vis-à-vis 50%), is lower in aggregate dollar amount of the decline ($1,351 billion decline for Internet vis-à-vis $4,669 billion decline for the four Selected SIC Industry group).

4. Key sectors such as our Selected SIC Industry sample that were impacted in the 1998-2001 period had a higher than average potential for large capital market appreciation and depreciation. For example, two major capital market risk measures are (CAPM) beta and standard deviation of returns. In a capital asset pricing world, higher beta stocks have both higher risk and higher expected return. In an option pricing world, higher standard deviation of returns translates into both higher upside and higher downside returns. The Selected SIC Industry sample had long exhibited higher capital market risk even *prior* to 1998-2001. The 90th and 50th percentiles on the distribution for the Selected SIC Industries vis-à-vis All Other Companies is reported below.

	Beta				Standard Deviation of Returns			
	Selected SIC Industries		All Other Companies		Selected SIC Industries		All Other Companies	
Year	90th	50th	90th	50th	90th	50th	90th	50th
1980	1.867	1.084	1.539	0.704	0.044	0.029	0.042	0.024
1985	2.147	0.872	1.416	0.552	0.041	0.022	0.036	0.018
1990	1.768	0.677	1.362	0.423	0.072	0.029	0.055	0.021
1995	2.090	0.746	1.333	0.353	0.053	0.024	0.037	0.016
1996	1.990	0.965	1.167	0.354	0.047	0.024	0.035	0.016
1997	1.643	0.728	1.039	0.365	0.050	0.027	0.034	0.018

The explosive upside of successful companies in industries such as computer hardware and software is illustrated by Cisco Systems and Microsoft. Cisco listed in 1990 and by January 1, 1998 had a market capitalization of $61 billion and a market capitalization of $446 billion on March 10, 2000. Microsoft listed in 1986 and achieved the largest market capitalization status during the 1990s; on January 1, 1998 it had a market

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[4] The sample is on Jay Ritter's website: http://bear.cba.ufl.edu/ritter/.

capitalization of $156 billion and on March 10, 2000 its market capitalization was $521 billion.

Accounting-based risk measures point to the same conclusion as beta and standard deviation of returns. For example, in 1980 there was less than a 10% chance that a publicly traded company would report negative net income. By 1997 this had grown to nearly 25% and in our Selected SIC Industries the shifts have been even more marked. In terms of revenue growth, for many years prior to 1998, the revenue growth distribution of the Selected SIC Industries exhibits fatter tails at both ends of the distribution vis-à-vis All Other Companies. The past track record would predict the Selected SIC Industries had the propensity in the 1998-2001 period for above average revenue growth potential at the 90th percentile and above average revenue declines at the 10th percentile.

Some of these results have antecedents in the accounting and finance literatures. For example, Hayn [1995], Collins, Pincus, and Xie [1999], and Joos and Plesko [2004] note the increasing left skewing of the net income distribution in that a larger percentage of the sample Compustat companies report negative net income. Fama and French [2004] examine the changing characteristics of companies going IPO over the 1990-2001 period. They report that the profitability of IPO firms has become "progressively more left skewed…toward lower profitability" (pp. 229-230). They also note that the total asset growth of IPO companies has become "more right skewed… high growth" (p. 230). They then conclude that this drift toward lower profitability and higher growth has meant lower survival rates for newly listed companies over time.

5. The period 1998-2001 saw marked increases in both revenue growth and net income growth at the top end of the distribution for the Selected SIC Industries vis-à-vis All Other Companies. At the bottom end of the distribution, the Selected SIC Industries had higher revenue declines and higher net income declines vis-à-vis All Other Companies. The Selected SIC Industries sector therefore exhibited characteristics of a "winner-take-most" outcome in what were well above historical average increases in market size.

The actual revenue growth rates during 1998-2001 for the Internet sample of companies at the top end were on a scale not observed before for either the All Other Companies sample or the Selected SIC Industries sample (which was itself above the All Other Companies sample).

Annual Revenue Growth Rates						
	All Internet Companies		Selected SIC Industries		All Other Companies	
Year	90th	50th	90th	50th	90th	50th
1996	200%	4%	119%	14%	72%	4%
1997	324%	-1%	132%	15%	75%	4%
1998	401%	28%	136%	17%	69%	2%
1999	469%	15%	180%	13%	65%	1%
2000	729%	129%	278%	22%	78%	4%
2001	120%	4.3%	87%	5%	78%	12%

The 100%+ (1996), 200%+ (1997), 300%+ (1998), and 400%+ (1999) Internet company revenue growth rates at the 90th percentile for companies that went IPO post-1996 are strong indicators that the upside to these companies had a potential rarely seen before.

Finally, subsequent to 2000 there was a dramatic reduction in annual revenue growth rates for Internet companies and the Selected SIC Industry sample vis-à-vis (a) their own prior 1996-2000 rates, and (b) their prior above-average rates as compared to the All Other Companies sample. From a company fundamentals perspective, such reductions in revenue growth translate into lower company valuations, all else held equal. Skinner and Sloan (2002) highlight the sensitivities of stock price levels of companies having downward revisions when growth expectations are not met.

III. Samples of Companies Examined

Multiple samples of companies are examined in this paper. The aim is to examine both U.S. public capital markets and U.S. private venture capital markets. There is not one source that combines capital market and company fundamental information for both public and private markets.

III-A. Sample One: Publicly Traded Companies in Selected SIC Industries on NASDAQ and NYSE/AMEX

Two commonly held views of U.S. capital markets in the period 1998-2001 is that (a) the rise and fall of stock prices was solely a NASDAQ related phenomenon, and (b) there was an extended rise followed by a sharp fall in March 2000. For example, Griffin, Harris, and Topaloglu [2003] refer to the "spectacular rise and fall of NASDAQ." Pastor and Veronesi [2004a], after noting that the NASDAQ composite index closed at its all time high on March 10, 2000, comment that:

> "The unusual rise and fall in the prices of technology stocks has led many academics and practitioners to describe the event as a stock price 'bubble'. This label seems appropriate as an ex post description of an extended rise in prices followed by a sharp fall." (p. 1)

Sample One enables us to probe whether the stock price rise/fall was specific only to NASDAQ or whether it was also present on other exchanges, and whether a small subset of industries accounted for an unduly large percentage of the high/low movement in market-wide capitalization.

Sample One comprises all publicly traded firms on the NYSE, AMEX and NASDAQ exchanges. The focal set of companies are those in six three-digit SIC industry groups. Our sample selection procedure was designed to capture key industry groups that had both sizable increases and decreases in market capitalization during the 1998-2001 period, and sizable market capitalizations at their peak (i.e., they were viewed as an economically significant sector by the capital markets).

We first calculated the sequence of end-of-month aggregate market capitalizations from January 1998 to December 2001 of all companies in every three-digit SIC code. For each three-digit SIC industry, we then found the:

(1) High value of that three-digit SIC industry group's market capitalization,
(2) Low value before the date of the high value but after January 1998, and
(3) Low value after the date of the high value but before December 2001.

From these, we calculated the ratio of high-to-low market capitalizations before the peak (from (1) and (2)) and after the peak (from (2) and (3)). The average of these two ratios measures the relative increase and decrease in aggregate value of the three-digit SIC industry group during the 1998-2001 period. We next ranked all SIC industries using the average ratio and chose the top six industries with a peak individual aggregate market capitalization of at least $1 trillion. These six SIC industries we put into four industry groups—computer hardware (SIC codes 357, 366 and 367), computer software (737), telecommunications (481), and biotechnology/pharmaceutical (283).

Table 1 (Sample One) reports the aggregate market capitalization information (as of 1/1/1998, 3/10/2000, and 12/31/2001) and the number of companies (as of 3/10/2000) for the following groups:

    I. All Companies

   II. Pooled Selected SIC Industries (II.A + II.B + II.C + II.D)

       II.A. Computer Hardware (357, 366, 367)[5]
       II.B. Computer Software (737)[6]
       II.C. Telecommunications (481)7
       II.D. Biotechnology/Pharmaceuticals (283)[8]

  III. All Other Companies (in I. but not in II.)

At the March 10, 2000 peak, our four industry groups comprised approximately 50% of the total market capitalization of the NASDAQ/NYSE/AMEX. NASDAQ firms made up 57.6% of the total market capitalization of NASDAQ and NYSE/AMEX firms made up 42.4% of NYSE/AMEX total market capitalization. For the four SIC groups, the percentages of NASDAQ market capitalization to the total industry market capitalization on NASDAQ/NYSE/AMEX on 3/10/2000 are computer software (88.0%), computer hardware (57.6%), telecommunications (32.4%), and biotechnology/pharmaceuticals (24.9%).

III-B. Sample Two: Publicly Traded Internet Companies

The phrase "Internet boom" is often used to describe U.S. capital markets during the late 1990s. We examine Internet stocks using a database on Jay Ritter's website (used in Loughran and Ritter [2004]). The database is built from a merging of "Internet identifications of Thompson Financial Securities Data, Dealogic, and IPOMonitor.com" (p.1).[9] To facilitate comparisons with our SIC industry analysis, we cross-classified the

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[5] The top five computer hardware companies according to market capitalization on March 10, 2000 are Cisco ($446.1 billion), Intel Corp. ($401.5 billion), Lucent Technologies Inc. ($189.7 billion), IBM Corp. ($189.7 billion), and Northern Electric Ltd. ($168.9).

[6] The top five computer software companies according to market capitalization on March 10, 2000 are Microsoft Corp. ($521.1), Oracle Systems Corp. ($231.7 billion), Yahoo Inc. ($96.1 billion), Veritas Software Corp. ($66.1 billion), and Compaq Computer Corp. ($48.6 billion).

[7] The top five telecommunication companies according to market capitalization on March 10, 2000 are AT&T Co. ($173.1 billion), Southwestern Bell Corp. ($143.3), MCI Worldcom, Inc. ($132.5), Bell Atlantic Corp. ($89.0 billion), and Bell Tel Co. CDA ($78.6).

[8] The top five biotech/pharmaceuticals companies according to market capitalization on March 10, 2000 are Merck & Co. Inc. ($139.2 billion), Pfizer Chas & Co. Inc. ($135.5 billion), Bristol Myers Co. ($103.9 billion), Johnson & Johnson ($98.6 billion), and Warner Hudnut Inc. ($79.3 billion).

[9] There is no universally agreed upon definition of an Internet company. The finance literature approach appears to be to identify which new IPOs have an Internet connection. The Ritter database has this approach as

Internet sample with our SIC based groupings. The overlap is strongest for computer software, computer hardware, and telecommunications industries. However, one other three digit SIC industry (738 – Miscellaneous Business Services) with 52 companies accounted for over 10% of the Internet sample.

Table 1 (Panel B) lists the number of companies (as of March 10, 2000) and aggregate market capitalizations (as of March 10, 2000 and December 31, 2001) for three sets of Internet companies:

      I. All Internet Companies

     II. Pooled Selected Internet-SIC Industries (II.A + II.B + II.C + II.D)

          II.A. Internet-Computer Hardware[10]
          II.B. Internet-Computer Software[11]
          II.C. Internet-Telecommunications[12]
          II.D. Internet-Business Services[13]

     III. All Other Internet Companies (in I. but not in II.)[14]

The "All Other Internet Companies" group (III) consists of firms from many SIC industry groupings. However, no SIC industry group in (III) has more than 4% of the All Internet Companies group (I).

The Internet sample is dominated by companies that went public after 1995.[15] In contrast, Sample One includes companies of many different IPO and age vintages. For example, Sample One includes Microsoft (IPO in 1986) and Yahoo! (IPO in 1996) while Sample Two includes Yahoo!, but not Microsoft.

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does Schultz and Zaman [2001], Ljungqvist and Wilhem [2003], Ofek and Richardson [2003]. The samples in these papers ranged from 393 to 538. The accounting literature has relied heavily on InternetStockList™ (ISL), reported on www.internet.com. The ISL was billed by www.internet.com as a complete list of all publicly traded Internet stocks. An Internet stock was operationally defined as a stock that existed because of the Internet – that is, had there been no Internet, the stock would not be in existence. Papers that use the ISL include Trueman, Wong and Zhang (2000), Demers and Lev (2001), Hand (2001), Bartov, Mohanram and Seethamraju (2002), Davis (2002), Demers and Lewellen (2003), Hand, (2003), and Keating, Lys and Magee (2003). Depending on whether the authors were targeting all Internet firms or just a subset (e.g., only B2C firms), the sample sizes these papers analyzed range between 55 and 261.

[10] The top five Internet-Computer Hardware companies according to market capitalization on March 10, 2000 are Cisco Systems Inc. ($446.1 billion), Juniper Networks Inc. ($43.9 billion), Sycamore Networks Inc. ($40.1 billion), Broadcom Corp. ($28.3 billion), and Foundry Networks Inc. ($22.4 billion).

[11] The top five Internet-Computer Software companies according to market capitalization on March 10, 2000 are Yahoo Inc. ($96.1 billion), Exodus Communications Inc. ($30.3 billion), Ariba Inc. ($29.6 billion), Verisign Inc. ($27.5 billion), and Akamai Technologies ($27.1 billion).

[12] The top five Internet-Telecommunications companies according to market capitalization on March 10, 2000 are Nextlink Communications Inc. ($9.3 billion), Covad Communications Group Inc. ($8.6 billion), Flag Technologies Holdings Ltd. ($4.1 billion), Northpoint Communications Group Inc. ($3.8 billion), and ITXC Corp. ($3.0 billion).

[13] The top five Internet-Miscellaneous Business Services companies according to market capitalization on March 10, 2000 are eBay Inc. ($25.2 billion), Freemarkets Inc. ($6.9 billion), Critical Path Inc. ($4.9 billion), Digital Island Inc. (3.9 billion), and Purchasepro.com Inc. ($3.9 billion).

[14] The top five Other Internet Companies according to market capitalization on March 10, 2000 are Priceline.com ($16.1 billion), Doubleclick Inc. ($10.6 billion), Verticalnet Inc. ($9.7 billion), Allegiance Telecom Inc. ($9.6 billion), and T.D. Waterhouse Group Inc. ($7.5 billion).

[15] The Internet list includes 4.1% that went IPO prior to 1996. One notable company included in the list is Cisco Systems (IPO in 1990).

The Internet sample is almost exclusively traded on NASDAQ. On March 10, 2000, 96.2% of the companies in Sample Two were listed on NASDAQ. They also made up 97.8% of the total NASDAQ/NYSE/AMEX Internet market capitalization on that date.

III-C. Sample Three: VentureOne Sample of Privately-Held Venture-Backed Companies

VentureOne is a commercial organization that collects and sells information about venture-backed companies and their investors. For each company included in its database, VentureOne reports information on financing rounds (such as dates of funding rounds, amounts raised, and pre-money valuations) as well as details about the company's management and investors. Financial statement-based numbers (revenue and net income) are included in the database for a subset of these companies. VentureOne's database is at its most comprehensive starting in the early 1990s. Data are provided to VentureOne by companies and their investors on a voluntary basis. Where possible, VentureOne uses additional sources to verify the reported numbers (such as obtaining pre-money valuation numbers from the company itself, from individual investors, tracking business press reports on the company's financing, and publicly available regulatory reports such as S1 filings with the SEC). VentureOne generously provided us with access to their comprehensive data file.

VentureOne provides its own industry classifications (16 in total) for the companies in its database. The top eight industry classifications cover 86.5% of the 13,765 companies in the database. We use these eight industries as our Sample Three, grouping them into five broader industries:

> I. All VentureOne Companies in Sample Three
>
>> I.A   Software
>> I.B   Consumer-Business Services
>> I.C   Communications
>> I.D   Biopharmaceuticals
>> I.E   Hardware/Equipment

Table 2 summarizes the composition of these VentureOne industry groups. Of the 11,910 companies in Table 2, 1,262 had gone IPO by March 2005. Table 2 also reports the number of these IPO companies that were also classified as Internet companies using the Sample Two Internet company listing (from Jay Ritter's website). Approximately 20% of these 1,262 are Internet companies, with most (92.8%) of these having their IPO between 1996 and 2000.[16]

IV. Publicly Traded Companies in Selected Industries on NASDAQ and NYSE/AMEX

This section examines capital market and accounting information for publicly traded companies.

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[16] The valuation of privately held, venture-backed companies is explored in Armstrong, Dávila, and Foster [2005].

IV-A. Peak (High to Pre-Low and High to Post-Low) Market Capitalization Analysis

Figure 1 plots the aggregate daily market capitalization of all stocks listed on the NASDAQ, NYSE and AMEX exchanges. The time period is January 1, 1990 to December 31, 2004. Focusing on the 1/1/1998 to 12/31/2001 period, it is apparent that the NASDAQ stocks have the most marked increase in market capitalization followed by a dramatic decrease. Aggregate market capitalizations for selected times in the 1/1/1998 to 12/31/2001 period are (in $000,000's):

	Start	Pre-low Value	High Value	Post-low Value	End
NASDAQ	$1,683 (1/1/1998)	$1,576 (10/8/1998)	$6,667 (3/10/2000)	$2,026 (9/21/2001)	$2,830 (12/31/2001)
NYSE/AMEX	$9,368 (1/1/1998)	$8,700 (10/8/1998)	$13,045 (9/1/2000)	$9,685 (9/21/2001)	$11,382 (12/31/2001)

The ratio of the high value to the lowest value prior to the high in this period is 4.23 for NASDAQ and 1.50 for NYSE/AMEX. The ratio of the high value to lowest value after the high in this period is 3.29 for NASDAQ and 1.35 for NYSE/AMEX.

However, aggregate market ratios of High/Pre-low and High/Post-low mask several important industry-related differences. Table 3 (Panel A) presents summary statistics that show for our Sample One the I, II, II.A to II.D, and III groups:

(a)   Ratio of High market capitalization to Pre-Low market capitalizations,
(b)   Ratio of High market capitalization to Post-Low market capitalization;
(c)   Market capitalization change (in $ billions) from Pre-Low to High, and
(d)   Market capitalization change (in $ billions) from High to Post-Low.

Panel B of Table 3 presents data that gives a more granular picture than Panel A.

There are several noteworthy patterns in Table 3. First, NASDAQ always has higher ratios than NYSE/AMEX for both High to Pre-Low, and High to Post-Low. Second, there is strong evidence of a NYSE impact during the 1998-2001 period. Both the High to Pre-Low and High to Post-Low ratios on the NYSE/AMEX are higher for Selected SIC Industry groups than for the All Other Companies group. Third, the dollar magnitude of the aggregate increase and decrease in market capitalization is highest for computer hardware. This increase and decrease for computer hardware is over $3 trillion each way for NASDAQ/NYSE/AMEX. The dollar magnitude of the aggregate increase/decrease is higher on NASDAQ than NYSE/AMEX for computer hardware and computer software. It is higher on NYSE/AMEX than NASDAQ for telecommunications and biotechnology/ pharmaceuticals.

Figure 2 plots the aggregate market capitalization of each of our four Selected SIC Industry groups (Groups II.A to II.D in Table 1—computer hardware, computer software, telecommunications, and biotech/pharma). These figures reinforce the inferences drawn from Table 3. The increase/decrease occurs on the NYSE/AMEX for selected industries as well as for the NASDAQ. The Selected SIC Industries dominate the NASDAQ market capitalization, with approximately 80.0% on 3/10/2000 (66.9% on 12/31/2001). The consequence is that any sizable movements in these industries translate into sizable movements in the total NASDAQ index. In contrast, the Selected SIC Industries comprise only 31.3% of the NYSE/AMEX market capitalization on 3/10/2000 (23.7% on

12/31/2001). Even large movements in the Selected SIC Industries for NYSE/AMEX stocks result in less marked movements in the aggregate NYSE/AMEX indexes.

Stories about capital market bubbles often include references to sharp falls in stock prices from a "peak level." In contrast, informationally driven revaluations of stock prices are likely to be manifested through rolling changes as new information appears in a non-synchronous fashion for individual companies or individual industries. Figure 3 and Table 4 show what we term a Peak Market Capitalization Analysis. Figure 3 centers each of the Sample One groups on March 2000, which is the peak month for the NASDAQ index in the 1/1/1998 to 12/31/2001 period.[17] The aggregate market capitalization at the close of March 2000 is set at a value of 100. All other month-end aggregate capitalizations are expressed relative to the March 2000 value of 100. Table 4 shows end-of-month relative market capitalizations for all companies (I), the pooled Selected SIC Industries (II), the individual SIC industries (II.A to II.D), and the All Other Companies group (III).

In the pre-March 2000 period, computer hardware and computer software show the most similarity in the "run-up" to their March 2000 level. Even for these two groups, however, differences are marked. For example, December 1999 relative values are 64.1% for the NASDAQ computer hardware and 81.9% for the NASDAQ computer software groups. Post March 2000, there are wide differences across the industry groups in their market capitalization declines. Six months after March 2000, computer hardware groups have relative values of 101.7% for NASDAQ and 97.5% for NYSE/AMEX. The computer software group has the most rapid decline in market capitalization following March 2000. By June 2000, this group had relative values of 71.6% for NASDAQ companies and 91.8% for NYSE/AMEX companies. We view this non-synchronous stock price movement across different industry groups as more consistent with a fundamental information driven re-evaluation than a market epiphany that the "bubble has burst."

IV-B. Capital Market Risk Measures

Risk-return notions are central to most asset pricing models in finance. The higher an asset's risk, the higher its expected return. Two frequently used measures of a company's capital market risk that are readily available in CRSP are the CAPM beta and the standard deviation of returns.

Figure 4 plots the .9 (90th), .7 (70th), and .5 (50th) deciles each year for each risk measure for our Selected SIC Industries group (II) and All Other Companies group (III). Combined, Groups II and III are all companies on NASDAQ/NYSE/AMEX. The Selected SIC Industries group had higher relative market risk and higher total market risk than the All Other Companies group for an extended time period from the 1980s through 2004:

| | Beta | | | | Standard Deviation of Returns | | | |
| | Selected SIC Industries | | All Other Companies | | Selected SIC Industries | | All Other Companies | |
Year	90th	50th	90th	50th	90th	50th	90th	50th
1980	1.87	1.08	1.54	0.70	0.044	0.029	0.042	0.024
1985	2.15	0.87	1.42	0.55	0.041	0.022	0.036	0.018
1990	1.77	0.68	1.36	0.42	0.072	0.029	0.055	0.021
1995	2.09	0.75	1.33	0.35	0.053	0.024	0.037	0.016
2000	1.71	0.86	1.08	0.24	0.086	0.040	0.054	0.025
2004	2.14	1.17	1.63	0.71	0.049	0.023	0.031	0.014

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[17] As of Spring 2005, the closing value on March 10, 2000 still represents the all-time high value for the NASDAQ composite index.

These data highlight that before, during, and after the 1998-2001 period, our Selected SIC Industry group had sizably higher market relative risk and higher market total risk than all other companies. With this higher risk came the potential for very large increases in market capitalization and very large decreases in market capitalization. This is exactly what occurred in the 1998-2001 period.

IV-C. Negative Net Income

A fundamental indicator of company risk is the likelihood of reporting a loss. All else held equal, a firm with negative net income is less likely to generate funds for investing in new growth opportunities or to make distributions to its shareholders. The Selected SIC Industry group differs markedly from the "other sectors" in terms of its propensity for losses. Figure 5 presents the percentage of companies with negative net income (Compustat Data Item 172) each year from 1980 to 2003. Since 1980 there has been an increase in the percentage of companies reporting negative net income:

Year	All Companies	Pooled Selected SIC Industries	All Other Industries
1980	8.3%	7.8%	8.4%
1985	19.7%	29.9%	17.9%
1990	25.6%	36.9%	23.2%
1995	22.6%	38.8%	18.3%
2000	31.5%	56.7%	22.6%
2001	37.7%	67.7%	27.2%

The results for the All Companies column have been noted before by Hayn [1995], Collins, Pincus, and Xie [1999], and Joos and Plesko [2004]. Over time, the likelihood that a publicly-traded U.S. listed company will report a loss has increased. In 1980, there was less than a 10% chance in any one year, while by 2000 there was more than a 30% chance.[18]

Companies on NASDAQ have higher loss percentages than companies on the NYSE/AMEX. Selected percentages over the 1980 to 2000 period are:

Year	NASDAQ Companies	NYSE/AMEX Companies	All Companies
1980	10.1%	7.8%	8.3%
1985	24.3%	16.8%	19.7%
1990	30.4%	22.1%	25.6%
1995	28.0%	15.9%	22.6%
2000	40.7%	18.7%	31.5%
2001	46.4%	25.9%	37.7%

NASDAQ companies are, on average, smaller and younger than companies on the NYSE/AMEX. Size and age have been found to be useful predictors of financial distress [Altman, 2000].

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[18] The proposition that the percentage of losses has increased over time is supported by a univariate regression of the percentage loss on a time trend. The trend term is positive and significant.

A key result in Figure 5 is that between 1982 and 2003, the average loss percentage for our Selected SIC Industries (Group II) consistently exceeded the average for the All Other Companies group (Group III). This holds for every year since 1980 for NASDAQ companies and for every year since 1985 for NYSE/AMEX companies. It is consistent with the Selected SIC Industry group having above-average company risk. In 2000, over 56.7% of the Selected SIC Industry Group reported negative net income compared to 22.6% for all other industry sectors. The biotechnology/pharmaceutical group has the highest individual loss percentage across our four industry groups. The differences between the higher loss percentages of each SIC industry group and the Other industry group are systematically higher in the post-1990 period than in the pre-1990 period. This is consistent with our Selected SIC Industry groups becoming relatively higher risk in the post-1990 period.

IV-D. Revenue and Net Income Growth Distribution

A company's growth potential is of high interest to security analysts and other market observers. Revenue growth is one metric used to classify companies into different growth/non-growth categories. In this section we compare the distribution of revenue growth rates for our Selected SIC Industries with those of All Other Companies on NASDAQ/NYSE/AMEX. In particular, we ask whether the Selected SIC industries had above average revenue growth. For each group in Sample One (see Table 1), we computed annual revenue growth rates. Figure 6 plots the 90th, 70th, 50th, 30th, and 10th percentiles of the revenue growth rate distributions for the 1980 to 2003 period. Several patterns are seen.

First, both ends of the distribution plots are more extreme for the Selected SIC Industries. The Selected SIC Industries have higher positive growth rates at the 90th percentile, and higher negative growth rates at the 10th percentile. This is a systematic pattern that emerges well before 1998-2001.

Second, there is a dramatic increase in revenue growth rates in the 1996-2000 period at the upper end of the distribution:

	Pooled Selected SIC Industries		All Other Companies	
	90th	70th	90th	70th
1980-1989 Average	67.0%	25.6%	45.1%	17.8%
1990-1994 Average	70.6%	26.7%	48.4%	15.7%
1995-1996 Average	115.5%	37.0%	64.9%	23.8%
1997-1998 Average	134.1%	40.1%	72.2%	24.1%
1999	179.5%	41.2%	65.3%	20.6%
2000	278.5%	63.5%	77.8%	24.6%
2001	86.7%	21.1%	45.5%	14.3%

The 179.5% and 278.5% 90th percentile growth rates are well above those in prior time periods and well above those of other companies in the same time period.

Analysis of profitability of the Selected SIC Industry group is affected by the large percentage of negative net income observations. One approach is to compute the year to year change in net income. This measure will be positive if (a) net income in the current year exceeds net income in the prior year, or (b) if the loss in the current year is less than the loss in the prior year. Figure 5 and Table 7 present distribution data pertaining to annual net income growth rates (deflated by market capitalization at the beginning of the period). There is less difference between the Selected SIC Industry group (II) and the All Other

Companies group (III) for net income growth rates than for revenue growth rates. For the 90th percentile group, the relevant comparisons during 1980-2001 are:

Year	Pooled Selected SIC Industries (II)	All Other Companies (III)
1998	0.18	0.08
1999	0.24	0.16
2000	0.10	0.15
2001	0.22	0.14

The Selected SIC Industries have higher income growth rates in 1998, 1999, and 2001.

IV-E. Security Analysts

Security analysts are often uncertain about a firm's future income/earnings. One measure of this uncertainty is the standard deviation of the net income forecasts made by all security analysts submitting their forecast to I/B/E/S. The higher this measure, the greater the variation across analysts. Figure 8 plots key percentiles of the consensus dispersion measure (standard deviation scaled by beginning security price).[19] Figure 8 reports for Sample One the .9, .7, and .5 for the Selected SIC Industry group (II) and the All Other Companies group (III). The Selected SIC Industry group exhibits higher uncertainty among security analysts when forecasting next year's net income.

V. Publicly Traded Internet Companies

V-A. Peak (High to Pre-Low and High to Post-Low) Market Capitalization Analysis

Figure 9 and Table 6 show the aggregate market capitalizations of our Internet sample (Sample Two in Table 1) over the period 1/1/1998 to 12/31/2001. The pooled Internet sample has a High-to-Pre-low ratio of 23.0 and a High-to-Post-low ratio of 10.1. These ratios are substantially larger than the equivalent ratios reported in Table 3 for Sample One (i.e., the Selected SIC Industry group). Three of the Selected SIC Industry subgroups have a reasonable number of observations in the Internet sample. The table below reports the ratios for the Sample Two companies in the SIC hardware, software, and telecommunications industries. We also report (from Table 3) the Sample One ratios for all companies in the designated industries. The ratios and dollar amounts of the Internet stock sample for the High-to-Pre-low and High-to-Post-low swings vis-à-vis the SIC Industry groups from Sample One are:

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[19] The standard deviation of one-year-ahead earnings is measured four months after the end of the prior fiscal year. This ensures that the prior years' earnings have been announced and incorporated in analysts' forecasts of the next year's earnings. This methodology is consistent with the analyst forecast dispersion literature.

	High to Pre-Low		High to Post-Low	
	Sample Two Internet/SIC Sample	Sample One SIC Sample	Sample Two Internet/SIC Sample	Sample One SIC Sample
A. Ratios				
Computer Hardware	13.49	4.84	7.75	3.84
Computer Software	46.20	4.76	16.80	3.99
Telecommunications	54.10	2.73	47.91	2.22
B. Market Capitalization Swings				
Computer Hardware	$687	$3,450	$647	$3,215
Computer Software	$710	$1,978	$682	$1,813
Telecommunications	$45	$893	$46	$813

The above Sample Two Internet companies are a perfect subsample within each of the SIC Sample One industry groups. The Internet companies have far higher High to Pre-Low, and High to Post-Low ratios. However, the dollar amounts of the market capitalization increases and decreases are lower for the Internet companies than for the "non-Internet" companies included in the SIC industry groups.

Figure 10 and Table 7 present the Peak Market Capitalization Analysis, with March 2000 set as the benchmark (100) for each Internet series. Note the differential behavior of the two dominant (in market capitalization) Internet sectors, namely computer hardware and computer software. This is especially apparent in the post March 2000 period. In September 2000, the computer hardware Internet companies have a benchmark value of 103.8 compared to 62.8% for the computer software-Internet companies. The decline in market capitalization for Internet hardware stocks was delayed by over six months more than for Internet software stocks. By December 2000 (2001), Internet computer hardware companies were at 76.7% (26.8%) of their March 2000 levels. In contrast, by December 2000 (2001) Internet software companies were at 30.2% (10.3%) of their March 2000 levels. This pattern of non-synchronous market capitalization declines across different industry sectors was also observed within the four Selected SIC Industries with Sample One.

IV-B. Negative Net Income

The Selected SIC Industry group in Sample One has a loss percentage above that of all other NASDAQ/NYSE/AMEX companies. The Internet companies in Sample Two have, on average, even higher loss percentages than our Selected SIC Industries group. Figure 11 reports loss percentages for the 1996 to 2003 period for All Internet Companies (I) and for the two subsamples described in Table 1 (Panel B) – the Internet SIC subsample (II) and the All Other Internet Companies subsample (III). Table 8 reports a comparison of negative net income percentages across Sample Two and Sample One.

The number of Internet companies ranges from a low of 69 in 1996 to a high of 405 in 1999. There are multiple potential explanations for the higher negative net income percentages for the Internet companies. One is that Internet companies are "investing" heavily to build a platform for future growth and profitability. Such investing could involve many costs that financial reporting rules will not allow companies to capitalize such as customer acquisition costs and brand-building costs. Another explanation is that the managers of Internet companies are relatively inexperienced and have not installed appropriate management control systems to ensure efficient and effective spending.

IV-C. Revenue Growth Distribution Analysis

The Selected SIC Industry group in Sample One exhibited revenue growth rates significantly above all other companies on NASDAQ/NYSE/AMEX over the 1980 to 2000 period. This growth rate increased substantially during 1999-2000. Our Internet sample of companies (Sample Two) has even higher actual revenue growth rates in each of the .7 and .9 deciles for two sub-samples of all NASDAQ/NYSE/AMEX companies in Sample One – the Selected Pooled SIC group (II) and the All Other Companies group (III). Figure 12 highlights this result by comparing the magnitude of the .9, .7, .5, .3, and .1 points of the revenue growth distribution for the Internet stock sample vis-à-vis several of the Sample One groups. The .9 decile and .1 decile blocks in Figure 12 highlight the high upside and high downside associated with the Internet companies in Sample Two, and the Selected SIC Industries vis-à-vis the All Other Companies in Sample One. There is a high level of variation in both the Internet companies and the Selected SIC Industries between the higher performers and the strugglers. There are revenue growth rates in the +100% and above range for the 90th percentile and revenue decline rates in the -50% range at the 10th percentile.

In the late-to-mid 1990s this high growth rate of revenue for many Internet companies was often justified by scenarios in which growth was projected over an extended period. In Appendix A we present four illustrative case studies in this regard. The case studies leverage off of the:

- Internet facilitating a rapidly expanding online trading platform for commercial transactions in a highly efficient manner. eBay illustrates this scenario.

- Internet playing the role of a disruptive intermediary that would transfer customer purchases from established companies to new technology-centric, web-enabled startups. Amazon and Webvan illustrate this scenario.

- Internet creating the need for connectivity and security products for its individual and business users. Juniper Networks illustrates this scenario.

All four companies mentioned above had rapid revenue growth, with differences in the timing of positive net income. eBay had positive net income at an early stage in its revenue ramp-up. Amazon incurred considerable losses in its early years as it attempted to build a sustainable revenue stream that was profitable. Webvan had a rapid revenue ramp-up in its short time as a publicly traded company. However, it never reported positive income in its 1999-2001 public market era and was delisted in July 2001. Juniper Networks had tremendous revenue growth up to March 10, 2001 and then struggled when industry-wide demand for their products decreased substantially; it achieved positive net income for six quarters up to March 2001 and then experienced large quarterly losses up to September 2002.

The four companies in Appendix A are illustrative of the diverse types of businesses labeled as "Internet" and the widely varying outcomes that emerged in this sector with regard to:

(a) How quickly the revenue ramp-up occurred,
(b) How quickly positive net income was achieved (if at all), and
(c) How long the company survived.

These revenue/net income plots are all drawn looking backwards. For a security analyst looking forward in, say, September 1999, there was much uncertainty with respect

to (a), (b), and (c). The high growth rates of revenue by multiple Internet companies in the Figure 12 plots provided one important ground for differentiating Internet stocks from companies in many other more established industries and assigning the Internet stocks higher market capitalizations.

VI. Privately-Held Venture-Backed Companies

Venture capital is a pivotal part of U.S. capital markets. A large number of now major publicly traded U.S. companies were funded with venture capital. In this section we examine changes in the venture capital market in the pre-1998, 1998-2001, and post-2001 periods. We first report data on funding trends. Then, for those firms that had an IPO, we examine fundamental information on the investee companies,[20] both in their private state and as public companies.

Summary information on venture capital investments is regularly reported by both VentureOne and PWC MoneyTree. VentureOne generously provided us with access to their comprehensive database. We therefore examine aggregate quarterly funding data using both sources. Figure 13 plots aggregate quarterly venture capital investments from the March 1992 quarter to the December 2004 quarter for companies tracked by VentureOne and PWC MoneyTree. Both VentureOne and PWC MoneyTree show similar trends, and the high degree of overlap in Figure 13 indicates that VentureOne strongly captures important venture capital financing trends in the 1992-2004 period.

Figure 14 presents summary venture capital statistics on a per-venture-round basis. We report mean statistics for venture rounds A to G. Although all companies in the database received a Series A financing round (although not all companies may report that to VentureOne), a declining number of firms receive subsequent rounds of funding. There are many reasons for this "exiting" of firms from VentureOne's database. One exit is an IPO, which happens for approximately 11% of firms. Another exit is the trade sale of a venture-backed company. In some cases, this can occur even though there may be an attractive IPO opportunity (and in some cases it occurs after a S-1 registration statement for an IPO has been filed with the SEC). In other cases, the trade sale can be for a company with little prospect of an IPO. Another "exit" is that the company does not raise another round of private financing. This may be because the company has turned cash flow positive and does not require more equity financing. Alternatively, it may be that the venture company has gone out of business.

Figure 14 shows that the surge in venture capital funds invested in 1999 and 2000 was employed via both (a) an increase in the number of deals (Panel A), and (b) an increase in the dollar amount invested per deal (Panel B). The median pre-money valuation of the investee companies at each round in 1999 and 2000 was above pre-1999 deals and above post-2000 deals (Panel C).

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[20] An investee company is a company in which the venture capital firms (the investor) invests. Venture-backed private companies raise financing via a negotiation between the management/board of the early stage (investee) company and one or more venture capital (investor) companies. Two key issues in this negotiation are the valuation of the investee company at the time new financing is arranged (termed pre-money valuation) and the amount of financing to be provided by the investor. The first (second, third,…) round of private funding is (are) referred to as Series A (B,C,…). The pre-money valuation plus the amount of new financing is known as the post-money valuation of the investee company.

VI-A. High to Pre-Low and High to Post-Low Venture Funding

The private equity market does not provide frequent daily and intra-day revaluations of company market capitalizations as do the public equity markets. The mean (median) time between successive rounds of private financing (and therefore revaluations) for our VentureOne sample is 466 (358) days.

One indicator of private investor interest in different sectors is the dollar amount of new venture capital investment in that sector. Figure 15 and Table 8 use the Peak Venture Capital Funding Analysis, akin to Table 4 and Figures 3 and 10, to express each quarter's new venture capital investment relative to the 2000 Quarter 1 investment level. 2000 Quarter 1 is the high point of aggregate venture investment in the VentureOne database (and the PriceWaterhouse database). This Peak Venture Capital Funding Analysis highlights that venture capital interest had a sector-by-sector re-evaluation in 2000, rather than an across–the-board drop due to a "bubble bursting" in March 2000. The Software (I.A) and Consumer Business Services (I.B) sectors have large declines in new investments in the June and September quarters of 2000. In contrast, the communications, biopharmaceutical and hardware/equipment sectors have a higher level of new investments in the September 2000 quarter vis-à-vis the March 2000 quarter.

VI-B. Revenue Growth Distribution

Venture capitalists typically expect early stage companies to achieve one or more milestones before they agree to reinvest in subsequent financing rounds. Among milestones, revenue growth is one of the most important (often *the* most important). The VentureOne database includes revenue and net income information for companies going IPO. We now examine this fundamental company information. Our goal is to shed light on whether the venture backed companies in the 1998-2001 period were different as regards revenue growth relative to venture-backed companies in other periods. We first use a calendar time analysis to analyze revenue growth at successive financing rounds (A, B, C, etc.). We then use an event time analysis for venture-capital backed companies that had an IPO.

VI-B-1. Calendar Time Analysis

One approach to examining revenue growth in private equity investments is to compare revenue growth rates for companies at comparable financing rounds. We examine the first four financing rounds (A, B, C and D). As noted previously, there is a decline in the number of companies in successive rounds of financing. Figure 16 presents the .1, .3, .5, .7 and .9 revenue growth distribution percentiles for each round examined. The data pertain to venture-backed companies' revenue growth prior to their going public. We report separate data for three time periods: companies with an IPO in 1990-1994, an IPO in 1995-1997, and an IPO in 1998-2000. The general trend in the .9 and .7 deciles over the three sub-periods is an increase in the annual revenue growth over successive financing rounds. The magnitude of the revenue growth rates for 1998-2000 IPOs are much higher than those reported in Figure 12 for the publicly traded Sample One companies. The .9 decile revenue growth rates are 339% (Series A), 448% (Series B), 716% (Series C), and 696% (Series D).

VI-B-2. Event Time Analysis

In this analysis we define each firm's IPO year as Year 0 and compute the firm's revenue growth rates in the three prior years (as a private company) and the first four years

as a public company. Thus, Year 0 is the IPO year. Figure 17 plots the revenue growth rates. One general pattern unrelated to 1998-2001 is that Year 0 is most likely to have the highest revenue growth rate. Figure 17 also highlights that companies going IPO in the 1998-2000 period had a faster ramp-up in revenue growth rates for the .9 and .7 deciles. The scales on the .9 percentile block (0% to 1000%) and the .7 percentile (0% to 500%) are well above those achieved by a random cross-section of publicly traded companies. Figure 17 also highlights that the companies going IPO in the 1998-2000 period were demonstrably stronger as regards annual revenue growth rates in their pre-IPO private capital market years vis-à-vis those going public in the 1990-1994 and 1995-1997 periods.

The Internet sample of companies analyzed previously in this paper also exhibit marked differences in their early-stage public market fundamentals. The largest sample of Internet IPOs occurs in the period 1996-2000. Figure 18 presents the event time analysis in Figure 17 for two perfect subsamples of the VentureOne set of companies with an IPO in the 1996-2000 period—an Internet IPO sample and an IPO sample where companies were not classified as being Internet-related. The results reinforce the prior evidence that Internet companies experienced much higher annual revenue increases in their pre-IPO capital market era than observed for non-Internet companies for the same time period or in prior time periods.

Many venture capital firms have a very high weighting of their portfolio of investments in the four industry sectors we independently identified as the focus of Sample One. We documented in Section IV the higher capital market risk of our Selected SIC Industries. Venture capital arose in large part to invest in ventures for which traditional debt-based financing was unavailable (or minimally available). Venture capital returns typically have a highly (right) skewed distribution – a small percentage of investments return a very high percentage of total venture fund portfolio return. The results in Section VI illustrate this higher variability of returns using fundamental revenue growth data.

VII. Conclusions

In this paper we have scrutinized the behavior of U.S capital markets during 1998-2001 through the previously ignored lens of underlying company financial fundamentals. Specifically, we have examined the ability of company fundamentals to directionally explain changes in stock price levels, both in U.S. public equity markets and in U.S. private venture capital markets. Our analyses highlighted key empirical findings that need to be taken into account by analytical modeling or empirical research that seeks to explain stock price movements in 1998-2001.

1. Industry groups such as computer software, computer hardware, telecommunications, and biotech/pharma differ in the timing and magnitude of the upward and downward re-evaluations of their stock prices in U.S. public capital markets in the period 1998-2001. U.S. private venture capital markets likewise exhibit variations across sectors in new investment funding peak levels. Such differential behavior makes it more likely that an information-based explanation is deserving of deeper investigation. Information about the future growth and profitability of companies frequently comes at different points in time. At the industry level, key analyst reports, government releases, etc. rarely occur simultaneously for all industries. One challenge in pursuing this information-based explanation is to identify the key information events that led to revaluations. Many of these information releases may be at the individual company or the individual security analyst level.

2. One proposed hypothesis for the NASDAQ decline in early 2000 is that investors finally realized (had an epiphany) that a large number of publicly traded companies had little substance (the "emperor had no clothes" discovery). This hypothesis does not explain why the sustained decline in computer software stocks started in March 2000 while the computer hardware sector had sustained declines starting in September 2000. Attempts to rehabilitate this explanation by positing multiple bubbles (and their discovery at different times) raise questionable issues of investor segmentation. How and why are investors who detect a "computer software" bubble in March 2000 segmented from those who detect a "computer hardware" bubble six months later in September 2000?

   The analysis across our three samples highlights the diversity in how the capital market rose and fell between 1998 and 2001 in the sense that for a designated set of industries we showed that:

   - It occurred across the NYSE/AMEX as well as the NASDAQ,
   - It occurred for established companies as well as recent IPO companies, and
   - It occurred for Internet companies and for non-Internet companies.

   This diversity has implications for several proposed explanations that assume the rise/fall behavior was far narrower than we document. For example, IPO-related explanations such as lockup constraints with recent IPOs will need to explain the rise/fall pattern observed for many companies listed well before 1998. Explanations focusing on Internet/dot.com companies need to explain why the rise/fall patterns were observed for a large number of companies that were not characterized as "Internet/dot.com."

3. Some critiques of 1998-2001 capital markets have a strong ex post bias or hindsight tone to them. Capital markets price assets looking forward with varying degrees of visibility as to future revenue, profitability, and growth. The selected SIC Industry sample and the Internet sample exhibited revenue growth rates in the 1998-2000 period that were abnormally high by historical standards. Thus, there were contemporaneous grounds for supra-normal growth prospects of a select set of companies. Finding that after the fact many of these companies did not sustain their abnormally high growth rates does not invalidate the reasonableness of above normal growth expectations in the 1998-2000 period.

4. The risk-reward notion is a lynchpin of much asset pricing and valuation. The Selected SIC Industries by sample design had the largest relative increase/decrease in market capitalization in the 1998-2001 period. For many years up to and including 1998, these industries had well above average relative market risk (beta) and well above average absolute market risk (standard deviation). Moreover, at a company fundamentals level, these industries had extreme behavior as regards revenue growth increases and revenue growth decreases prior to 1998. This profile would predict that any capital market movements in 1998-2001 would be higher than those of many other companies on the rise and more severe than many other companies on the decline. The large relative increases and decreases in the market capitalization of U.S. capital markets in 1998-2001may well have more grounding in risk-reward asset pricing theory than many commentators have recognized.

Appendix A

Illustrative Internet-Related Company Revenue and Net Income Growth Profiles

This Appendix profiles four companies that illustrate different revenue and net income growth profiles of Internet companies.

eBay: eBay (short for Echo Bay Technologies) was founded by Pierre Omidyar and Jeff Skoll in Silicon Valley in May 1996 as a place for "practically anybody to sell practically anything on earth." It was a trading platform that used the Internet to facilitate transactions between buyers and sellers. Every quarter since 1997 it has experienced revenue growth. eBay operates with a business model which has multiple revenue sources (listing fees and transaction fees are two of the major ones) and has acquired a transaction financing capability (Paypal) that adds another revenue stream. It has expanded its trading platform to facilitate transactions by business and individual consumers and across multiple geographies. It went IPO on September 9, 1998 after two rounds of venture capital financing. The Series A raised $3 million at a pre-money value of $27 million, while the Series B raised $2 million. The pre-money valuation at the IPO date was $740 million.

Amazon.com: Founded in 1994 by Jeff Bezos, in Seattle, as the "Earth's Biggest Bookstore." Its stated mission initially was to be the leading online bookseller. Using its own warehouse, it shipped books around the globe to its customers, who ordered online. It subsequently expanded its product offerings to include a broader selection – such as music, toys, computers, video games, and electronic goods. It went IPO on May 15, 1997 after one round of venture capital financing. The Series A raised $8 million. The pre-money valuation at the IPO date was $450 million.

Webvan: Founded in Silicon Valley in December 1996 by Louis Borders and Kevin Czinger to enable on-line purchase and home delivery of grocery products. It subsequently expanded its product offering to include other products such as flowers. It established its own physical infrastructure – both high technology-based warehouses to store and pick products, and delivery vans. By 2001 it was delivering in Chicago; Los Angeles; Orange County, California; Portland, Oregon; San Diego; San Francisco; and Seattle. It went IPO on November 5, 1999 after four rounds of venture capital financing – Series A (raised $10.7 million), B ($35.3 million), C ($120 million), and D ($275 million). The pre-money valuation at the IPO date was $6,051 million. It closed operations in July 2001 after a cash-burn rate of over $200 million per year and never making positive net income in any quarter.

Juniper Networks: Founded in February 1996, the company develops and manufactures integrated silicon- and software-based wide area network (WAN) switching systems. The company has expanded its network infrastructure offerings to also include network security products and applications. Juniper had rapid sales growth in its early years and posted positive (quarterly) net income by the end of its fourth year. The company completed four rounds of venture capital financing prior to its public offering – Series A (raised $2 and pre-money valuation of $7 million), Series B (raised $9.2 million and pre-money valuation of $23.6 million), Series C (raised $46 million and pre-money valuation of $32.8 million), and Series D (raised $34 million and pre-money valuation of $500 million). The company completed a $163.2 million IPO on June 24, 1999 and had a pre-money valuation of $1,653 million.

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Figure 1

**Publicly Traded Aggregate Market Capitalizations of All Companies on NASDAQ/NYSE/AMEX:
1/1/1990 to 12/31/2004**

Panel A: 1/1/1990 to 12/31/2004

Aggregate Value of NYSE/AMEX and NASDAQ Exchanges: 1/1/1990 - 12/31/2004
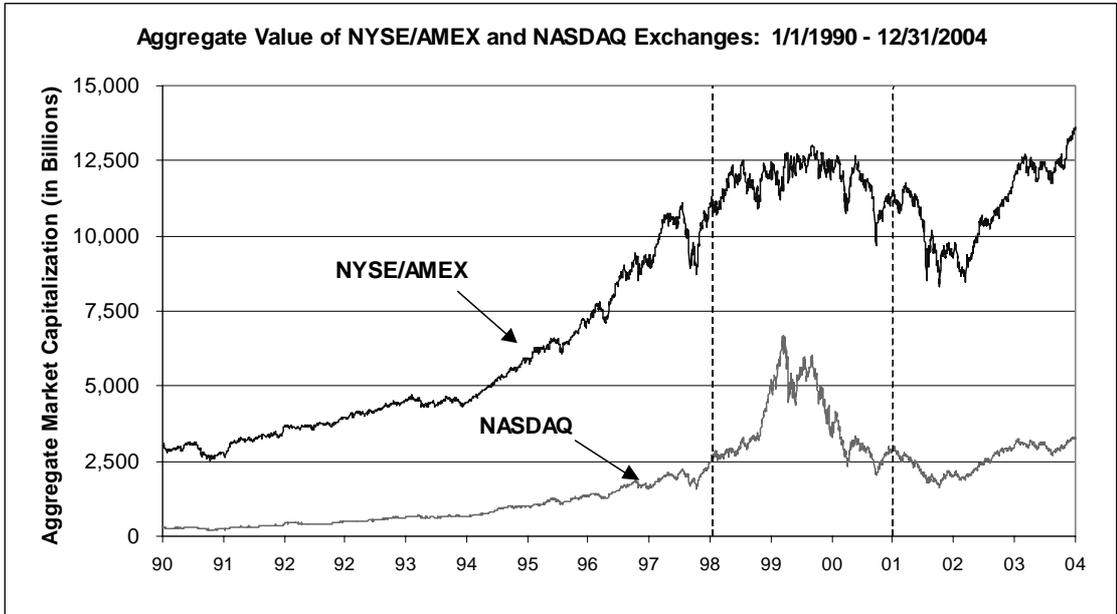
Panel B: 1/1/1998 to 12/31/2001

Aggregate Value of NYSE/AMEX and NASDAQ Exchanges: 1/1/1998 - 12/31/2001
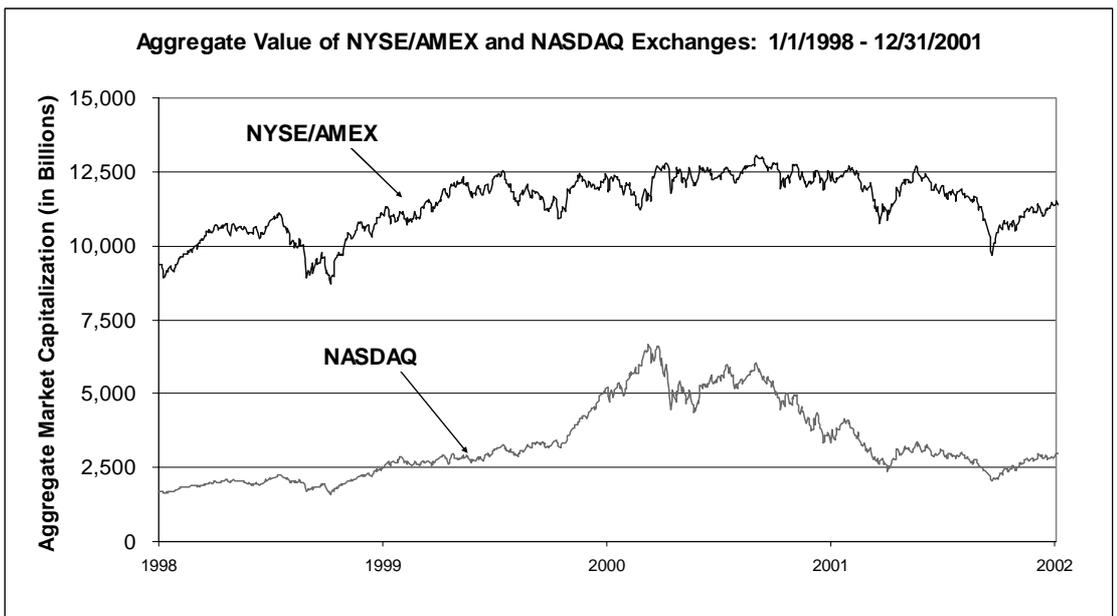
Figure 2

**Publicly Traded Aggregate Market Capitalizations of Selected SIC Industries
(Computer Hardware; Computer Software; Telecommunications; Biotech/Pharma)
on NASDAQ/NYSE/AMEX: 1/1/1998 to 12/31/2001**

Panel A: NASDAQ/NYSE/AMEX
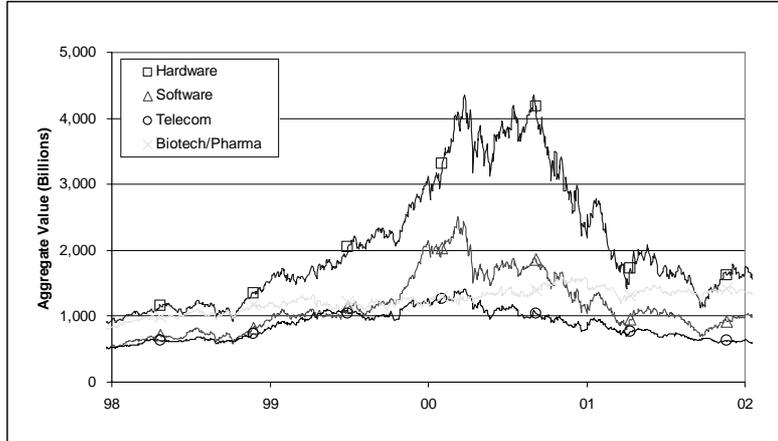
Panel B: NASDAQ
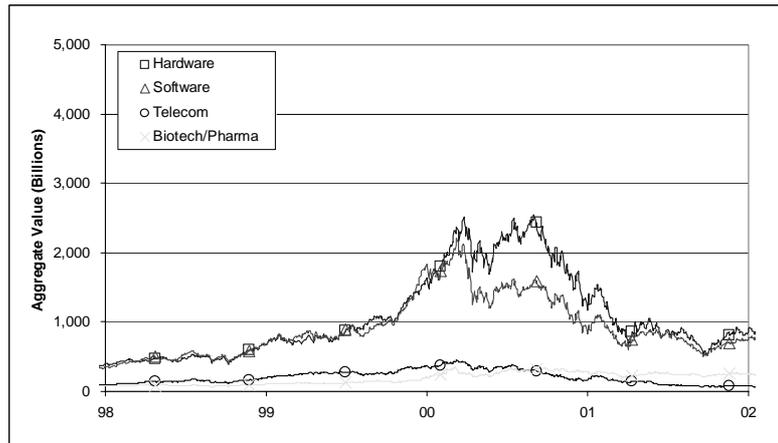
Panel C: NYSE/AMEX
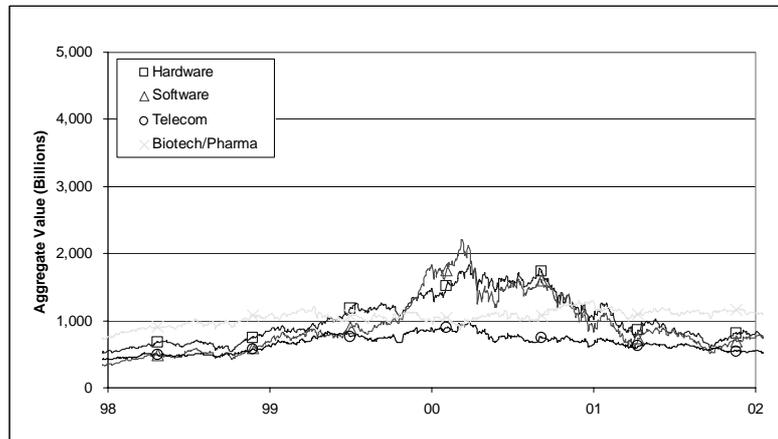
Figure 3A

**Peak Market Capitalization Analysis: Aggregate Market Capitalizations for
All Companies (I), Selected SIC Industries Pooled (II), and All Other Companies
Benchmarked Relative to March 2000 Market Capitalization: 1/1/1998 to 12/31/2001**

Panel A: NASDAQ/NYSE/AMEX
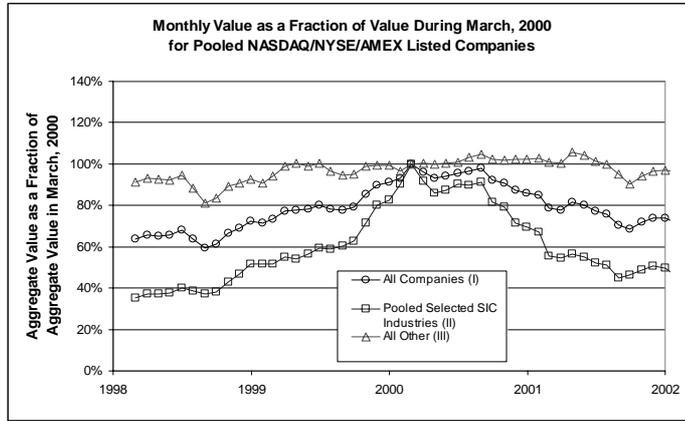
Panel B: NASDAQ
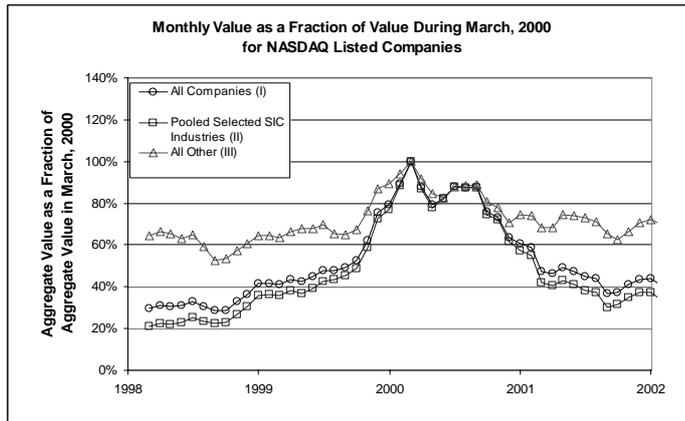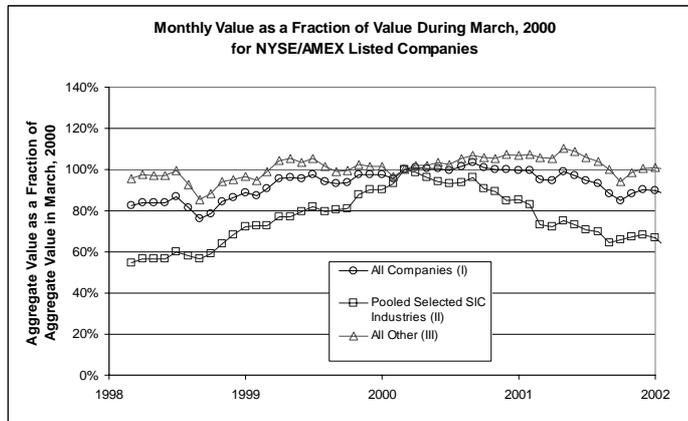
Panel C: NYSE/AMEX

Figure 3B

**Peak Market Capitalization Analysis: Aggregate Market Capitalizations for
Selected SIC Industry Groups (II.A to II.D)
Benchmarked Relative to March 2000 Market Capitalization: 1/1/1998 to 12/31/2001**

Panel A: NYSE/AMEX/NASDAQ
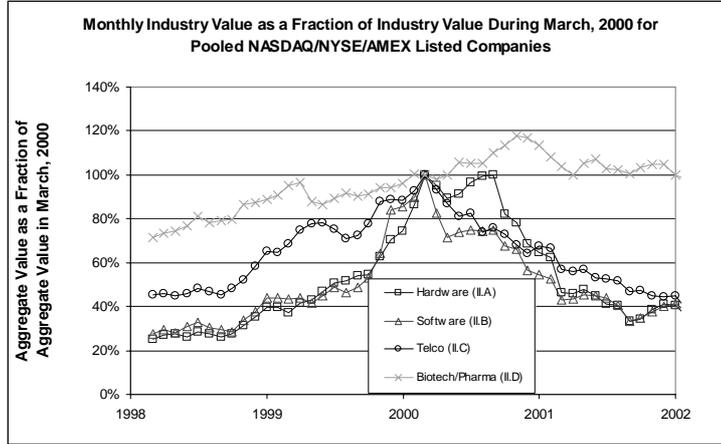
Panel B: NASDAQ
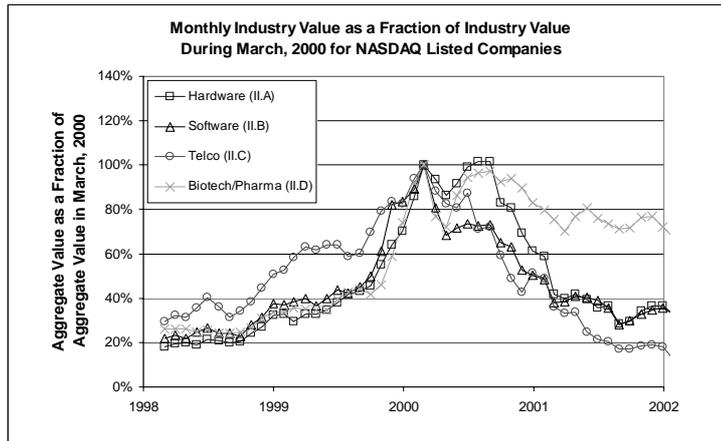
Panel C: NYSE/AMEX
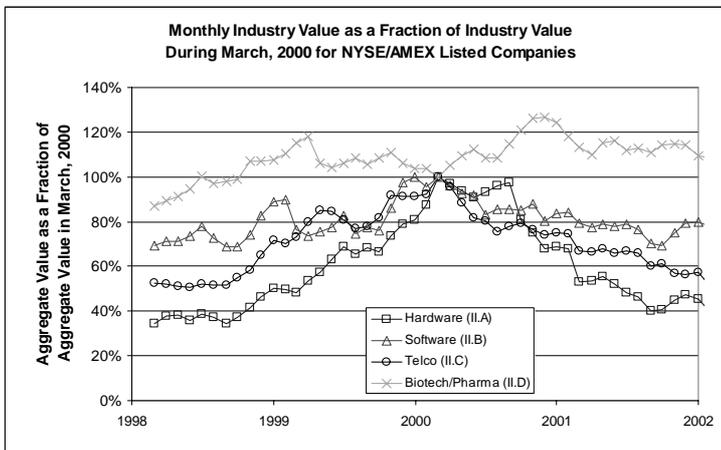
Figure 4

**Capital Market Risk Measures for Publicly Traded Companies:
Select Percentiles of Annual Beta and Standard Deviation of Daily Returns
for Selected SIC Industries and Other Companies for 1980 to 2004**
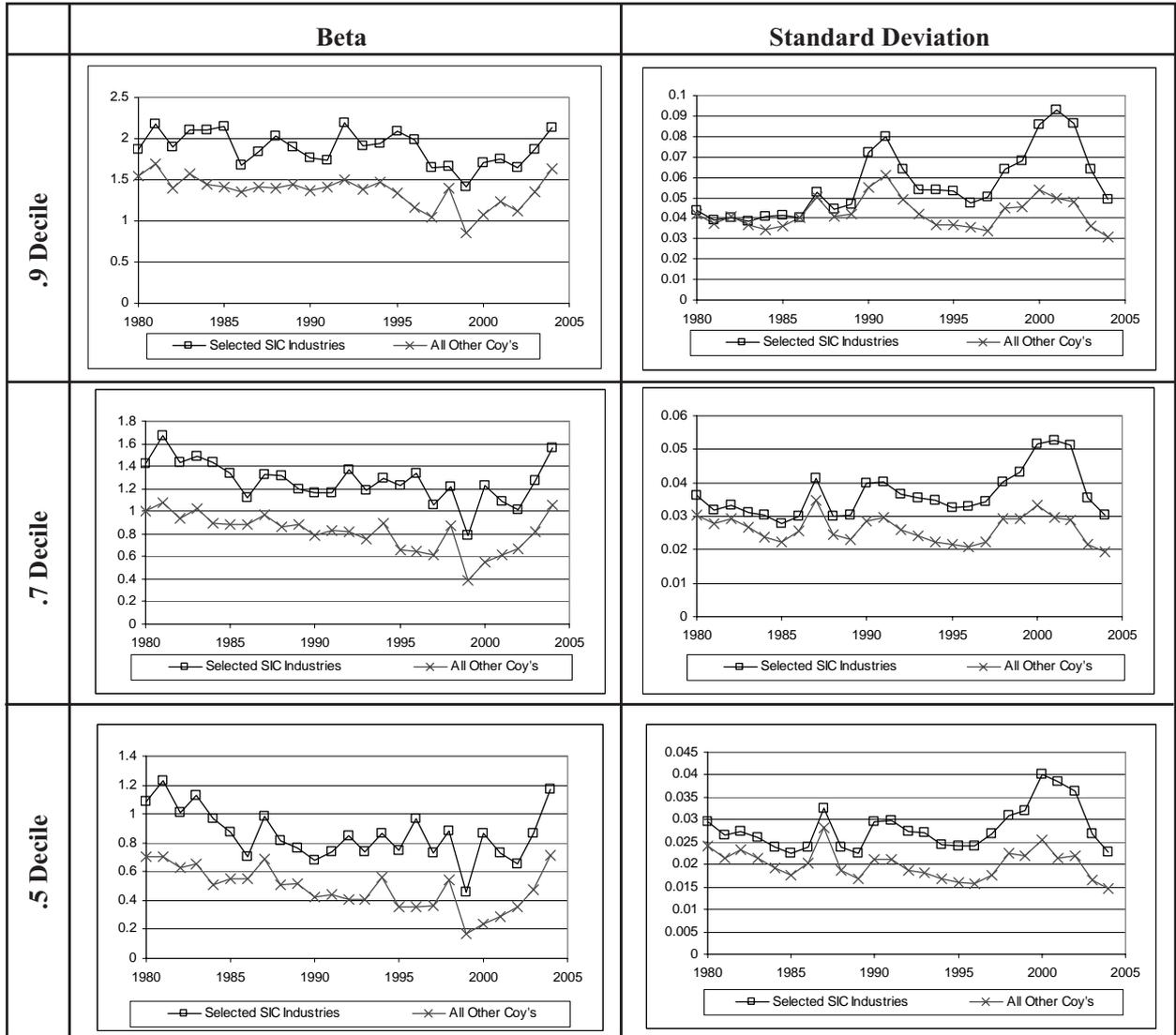
Figure 5

Percentage of Firm-Years with Negative Net Income:
Publicly Traded Companies on NASDAQ/NYSE/AMEX: 1980 – 2003

Panel A: NASDAQ/NYSE/AMEX
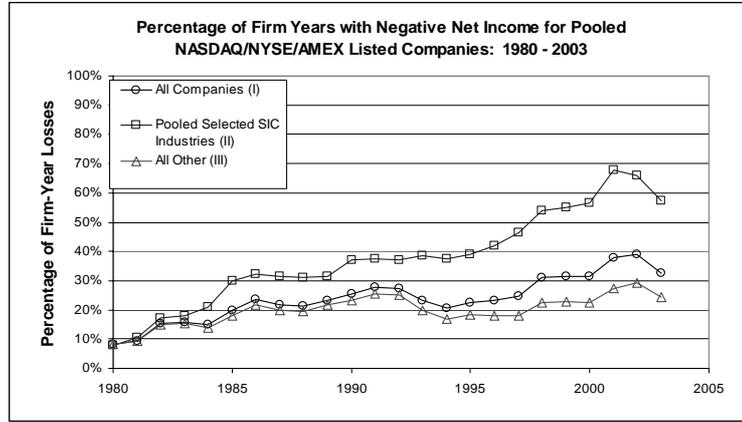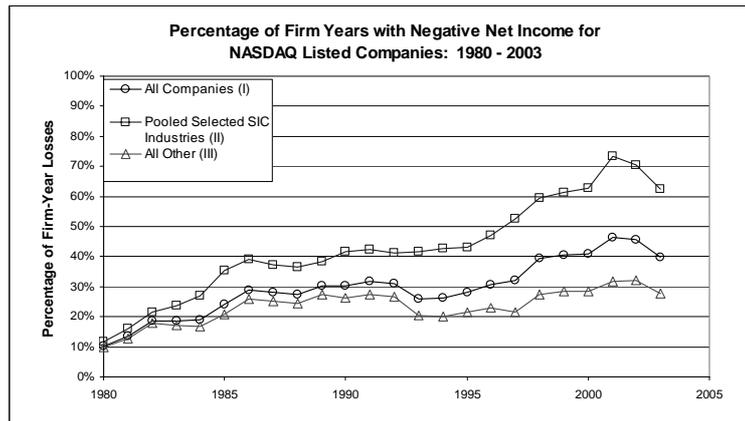
Panel B: NASDAQ
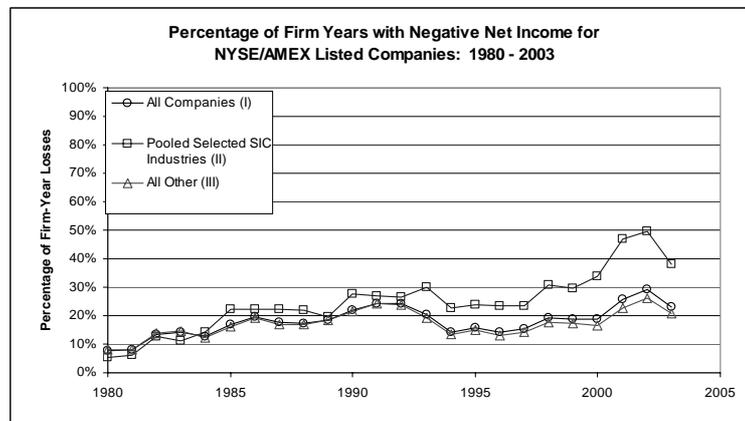
Panel C: NYSE/AMEX

Figure 6A

Annual Revenue Growth Percentiles (10th, 30th, 50th, 70th, and 90th):
Publicly Traded Companies on NASDAQ/NYSE/AMEX: 1980 to 2003

Panel A: All Companies
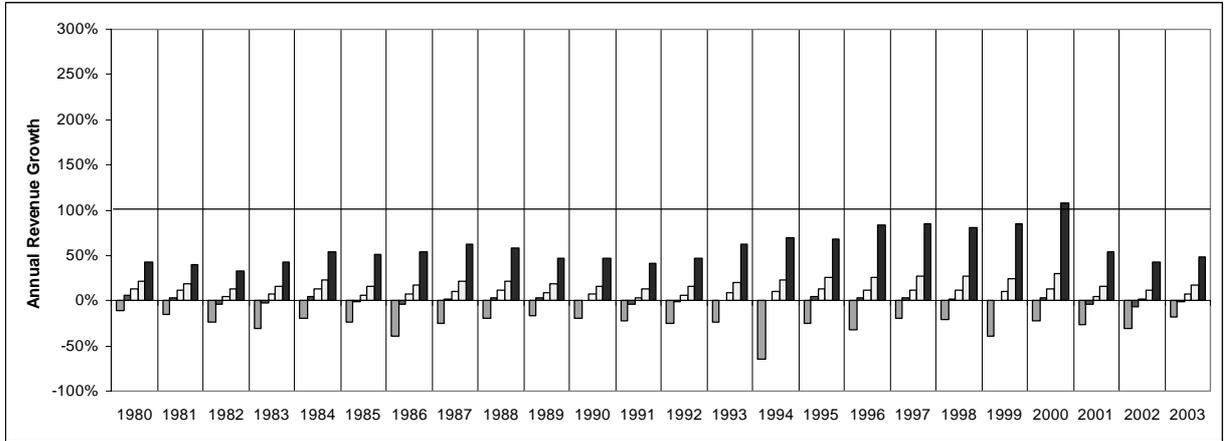
Panel B: Selected SIC Industries (Hardware, Software, Telecom, Biotech/Pharma)
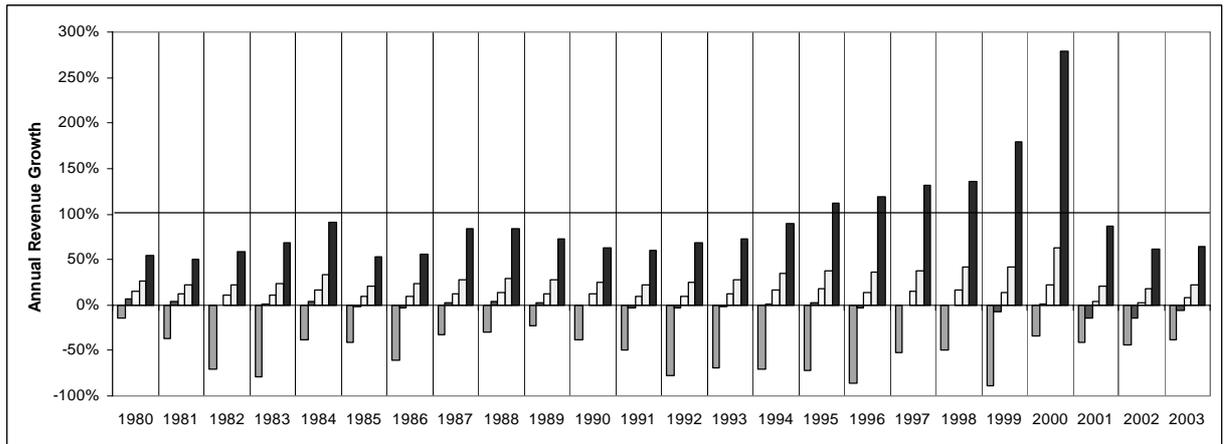
Panel C: All Other Companies
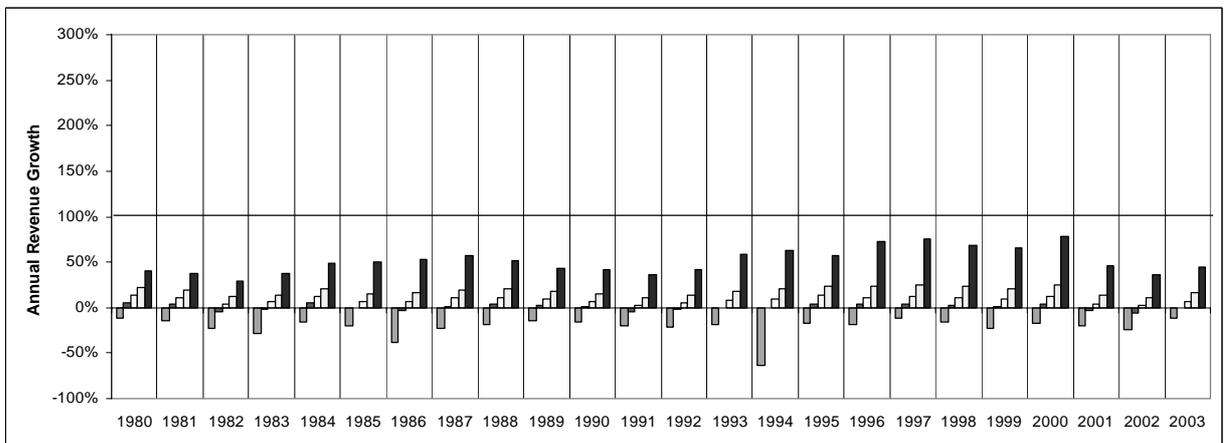
Figure 6B

Annual Revenue Growth Percentiles (10th, 30th, 50th, 70th, and 90th) for Publicly Traded Companies on NASDAQ/NYSE/AMEX in Selected SIC Industry Groups: 1980 to 2003

Panel A: Computer Hardware
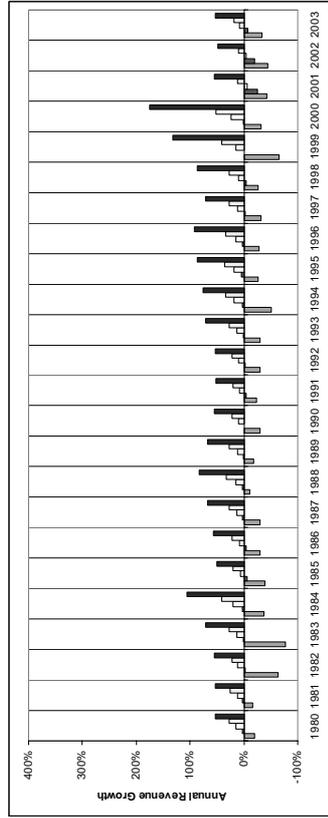
Panel B: Computer Software
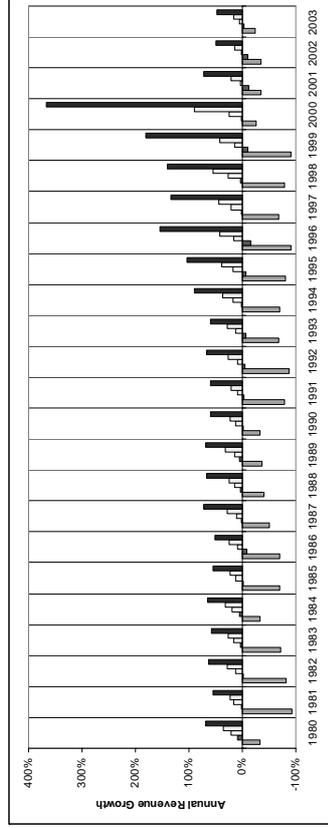
Panel C: Telecommunications
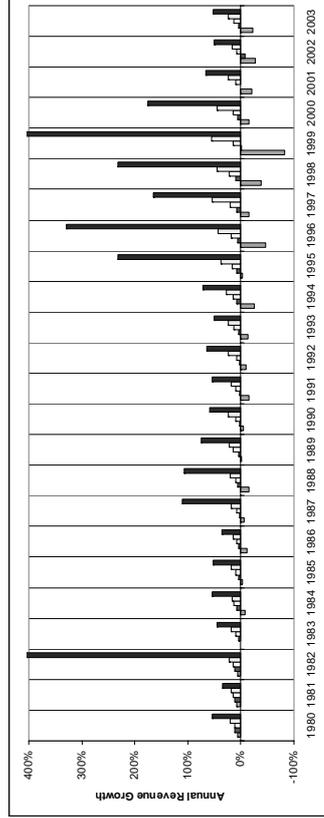
Panel D: Biotech/Pharma
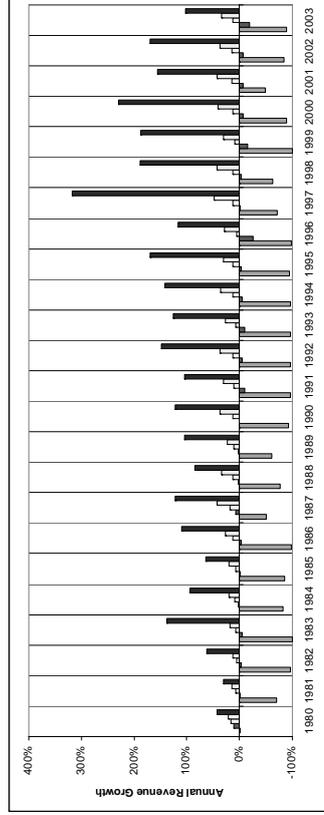
Figure 7A

Change in Annual Net Income Scaled by Beginning of Period Market Capitalization Percentile (10th, 30th, 50th, 70th, and 90th) for All Exchanges: 1980 to 2003

Panel A: All Companies
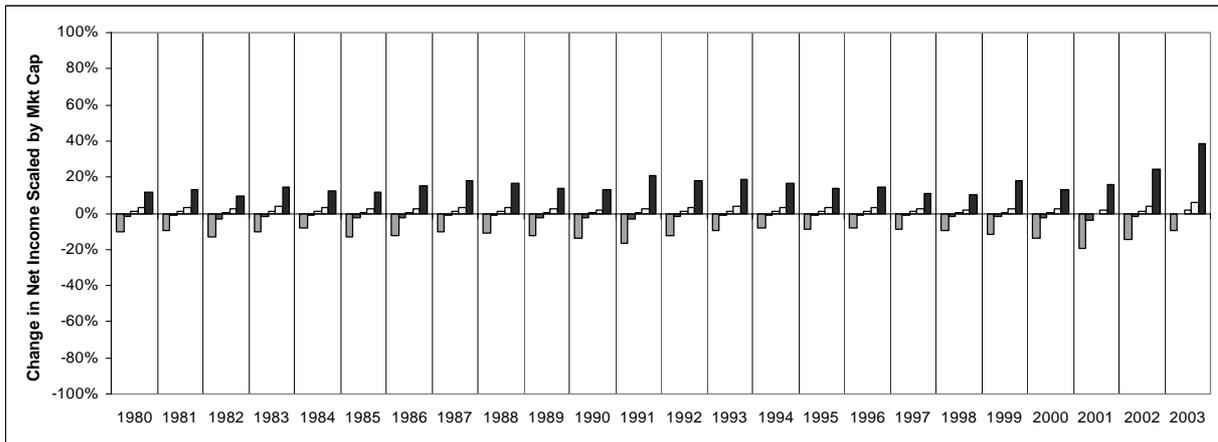
Panel B: Selected SIC Industries (Hardware, Software, Telecom, Biotech/Pharma)
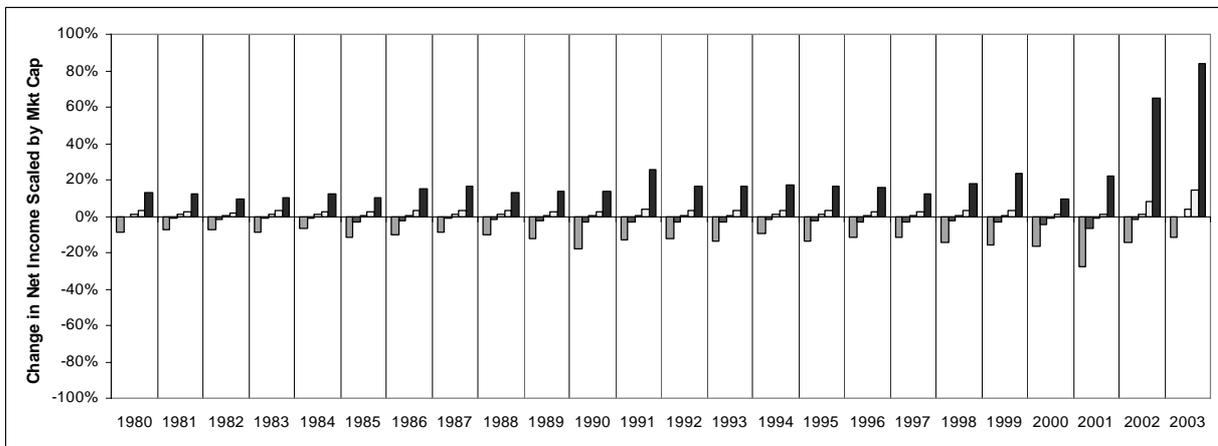
Panel C: All Other
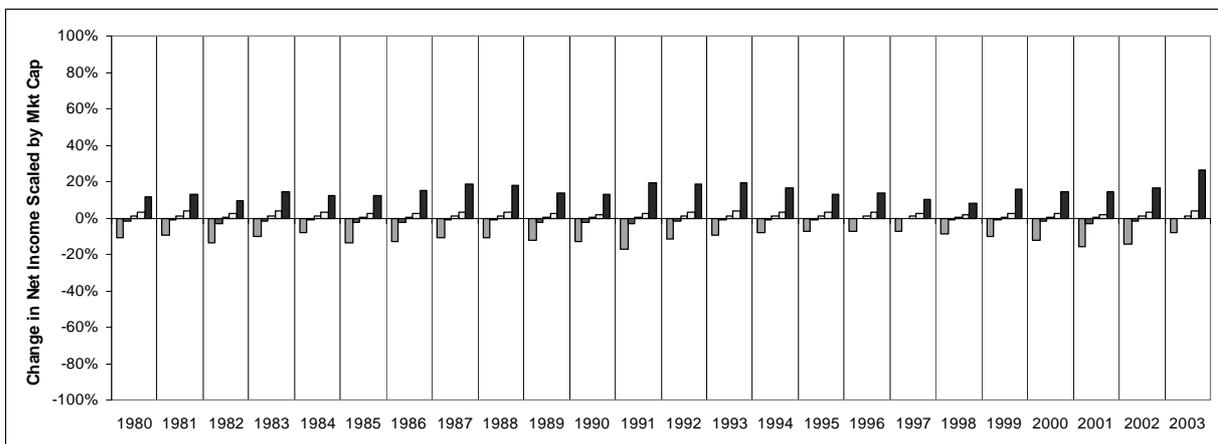
Figure 7B

Change in Annual Net Income Scaled by Beginning of Period Market Capitalization
Percentile (10th, 30th, 50th, 70th, and 90th) for All Exchanges for Four Industry Groups: 1980 to 2003

Panel A: Computer Hardware
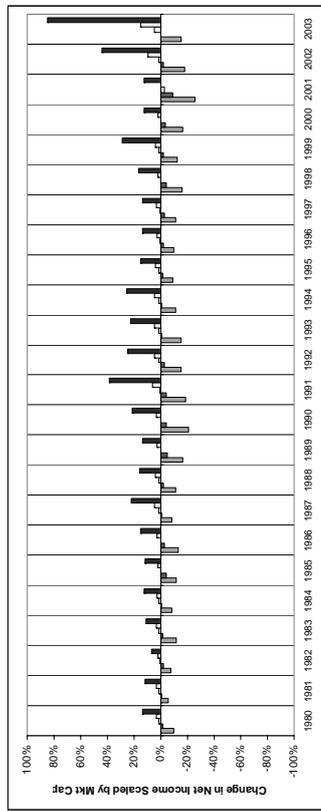
Panel B: Computer Software
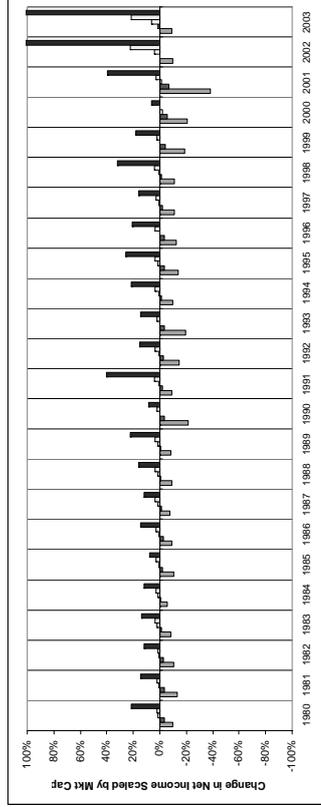
Panel C: Telecommunications
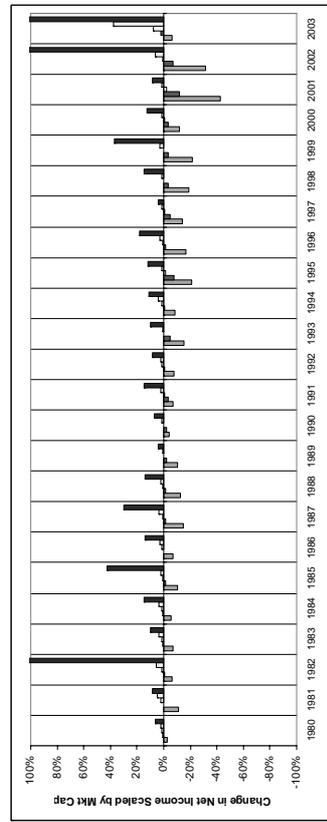
Panel D: Biotech/Pharma
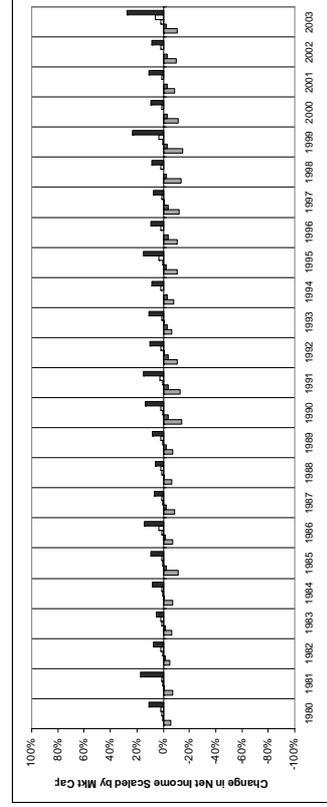
Figure 8

**Select Percentiles of Standard Deviation of Analysts' Earnings Per Share
Forecasts (Scaled by Price): 1980 to 2004**
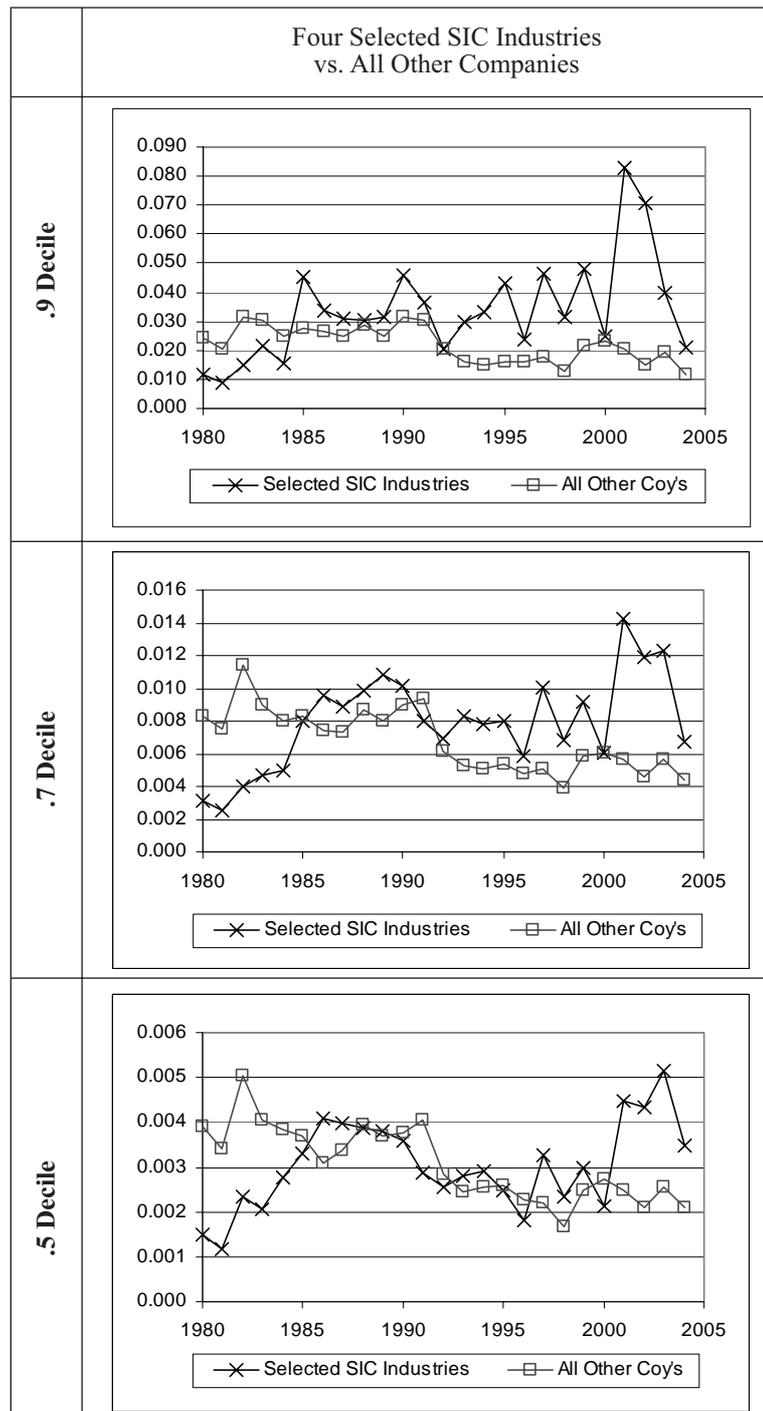
Figure 9

**Publicly Traded Aggregate Market Capitalization of
Internet Sample: 1/1/1998 to 12/31/2001**

Panel A: Aggregate Market Capitalization
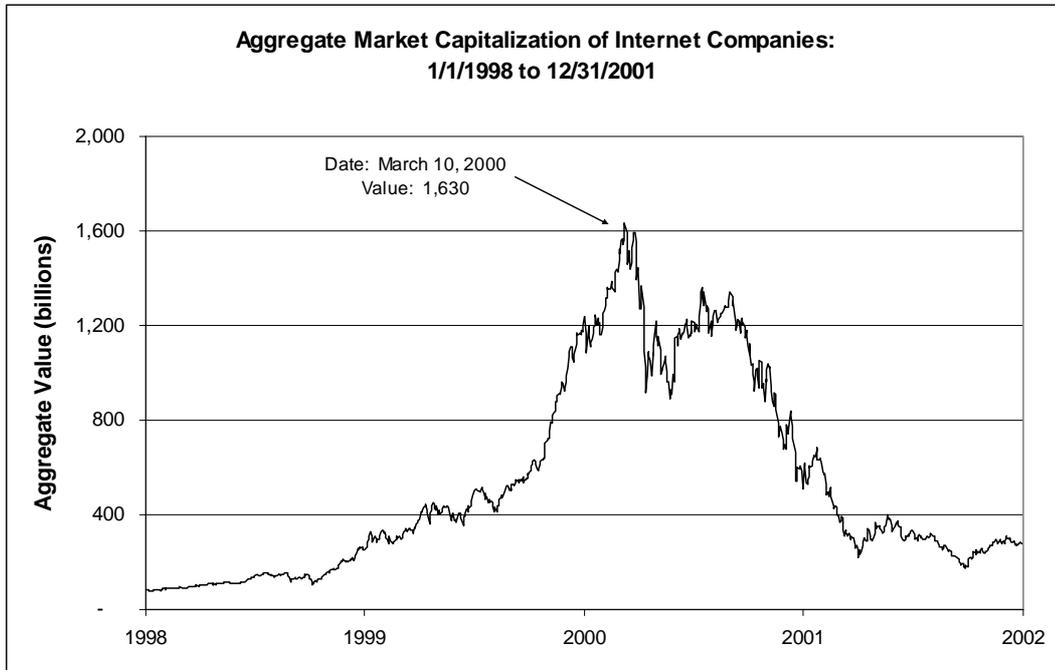
Panel B: Market Capitalization of Selected SIC Industries
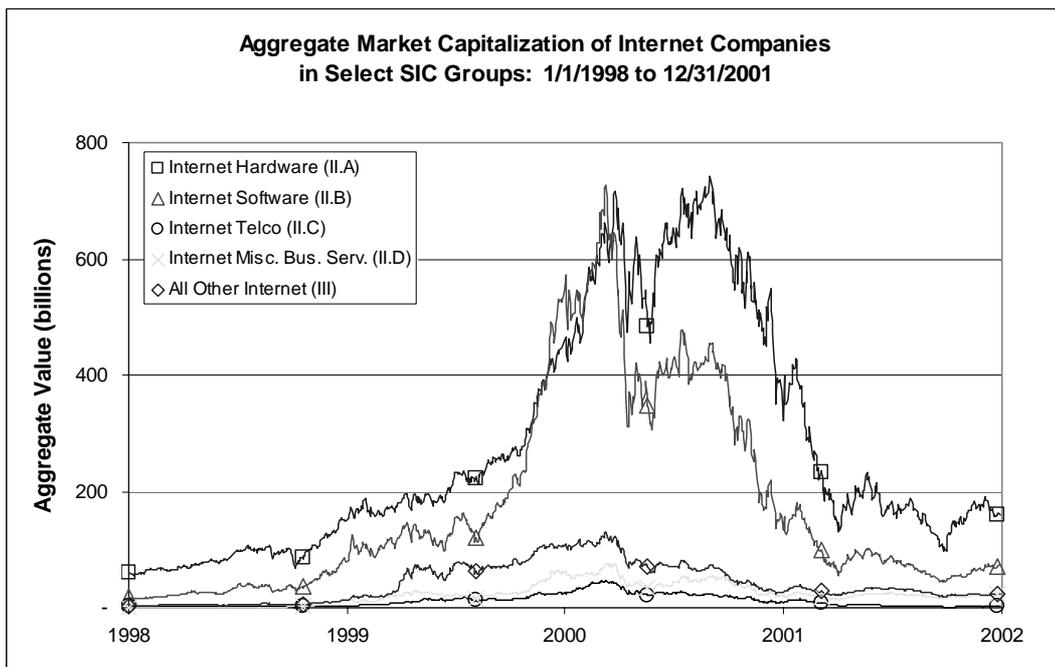
Figure 10

Peak Market Capitalization Analysis: Aggregate Market Capitalizations for Selected SIC Internet Industries (II.A to II.D) and All Other Internet Companies (III) Benchmarked Relative to March 2000 Market Capitalization: 1/1/1998 to 12/31/2001
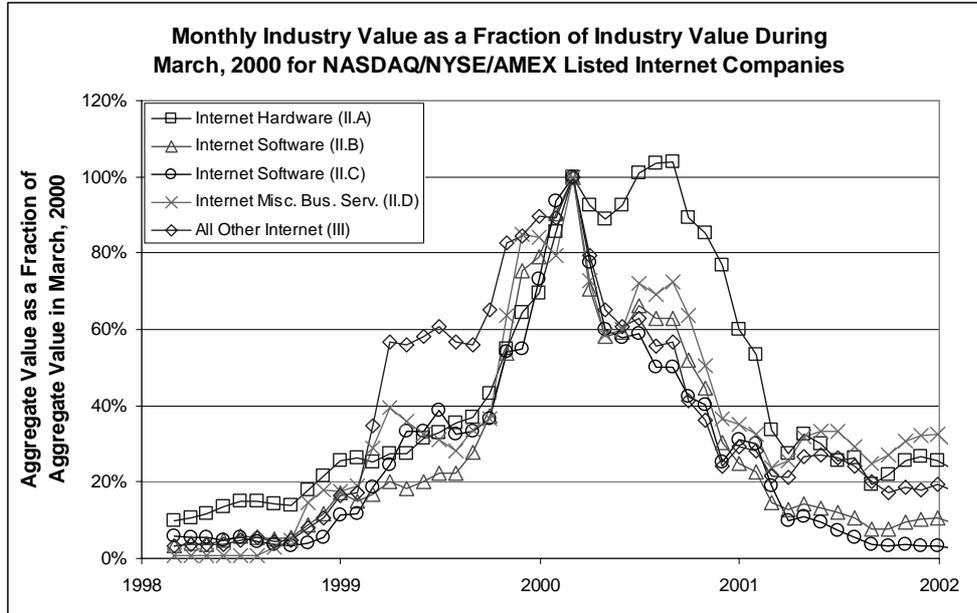
Figure 11

Percentage of Firm-Years with Negative Net Income for Publicly Traded Internet Companies: 1996-2003
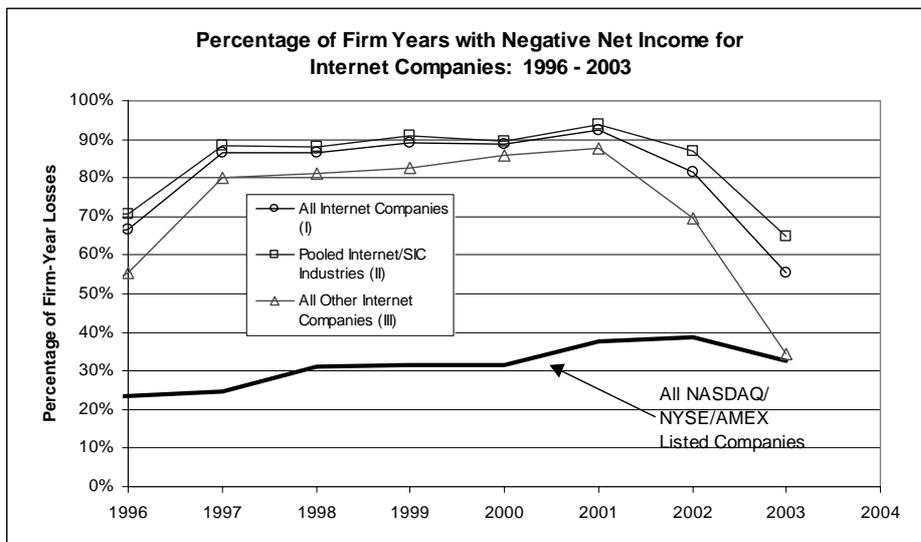
Figure 12

Annual Revenue Growth Rates: 1996-2003
Internet Companies vs. Selected SIC Industries vs. All Other Companies
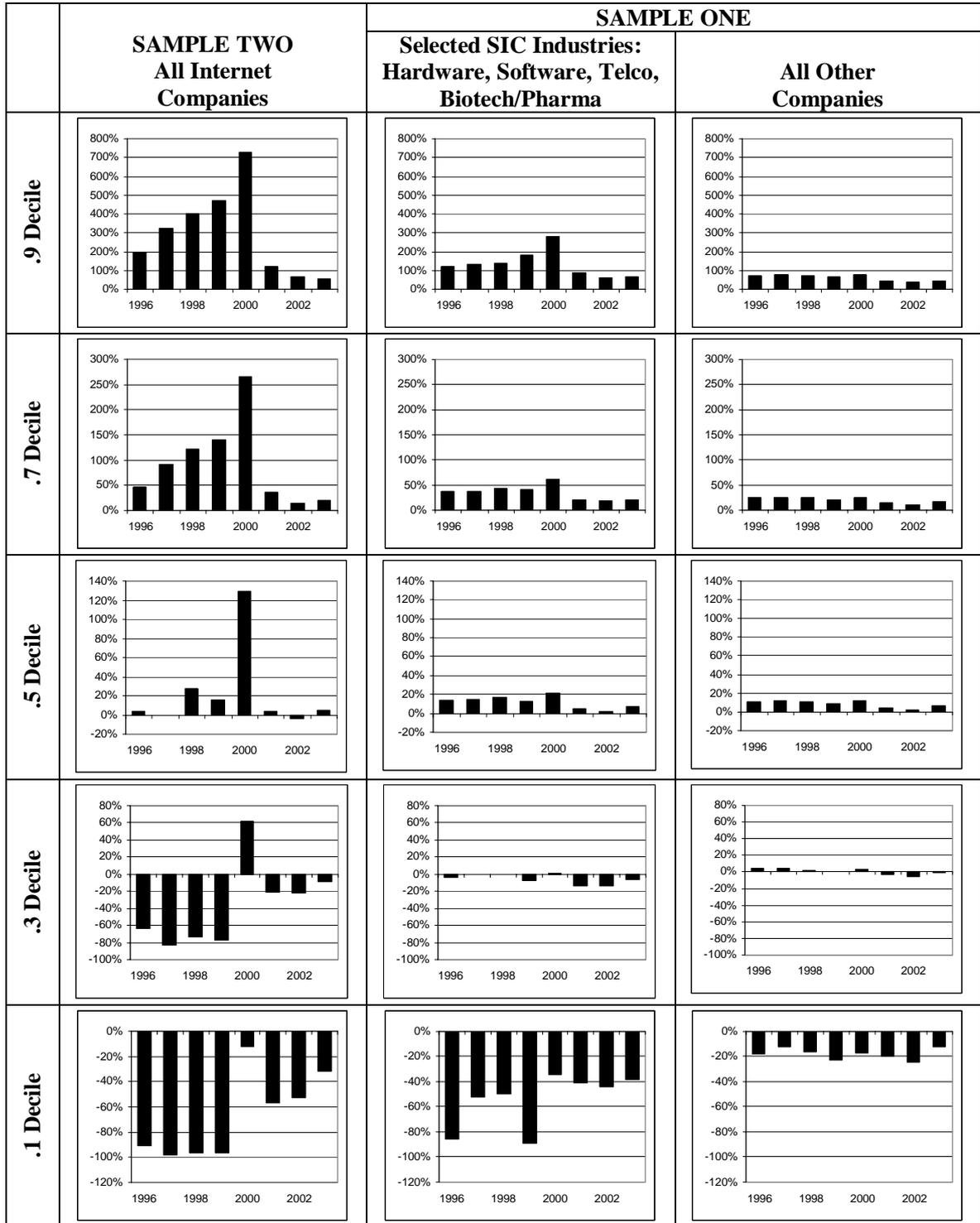
Figure 13

Private Venture Capital Quarterly Investments – 1992, Quarter 1 to 2004, Quarter 4: VentureOne and PWC Moneytree Quarterly Reported Amounts

Panel A:

Comparison of Aggregate Funding by Year and Quarter Between VentureOne and PWC MoneyTree: 1992Q1 - 2004Q4

Panel B:

Funding by Quarter for Top Five VentureOne Industry Groupings: 1992Q1 - 2004Q4
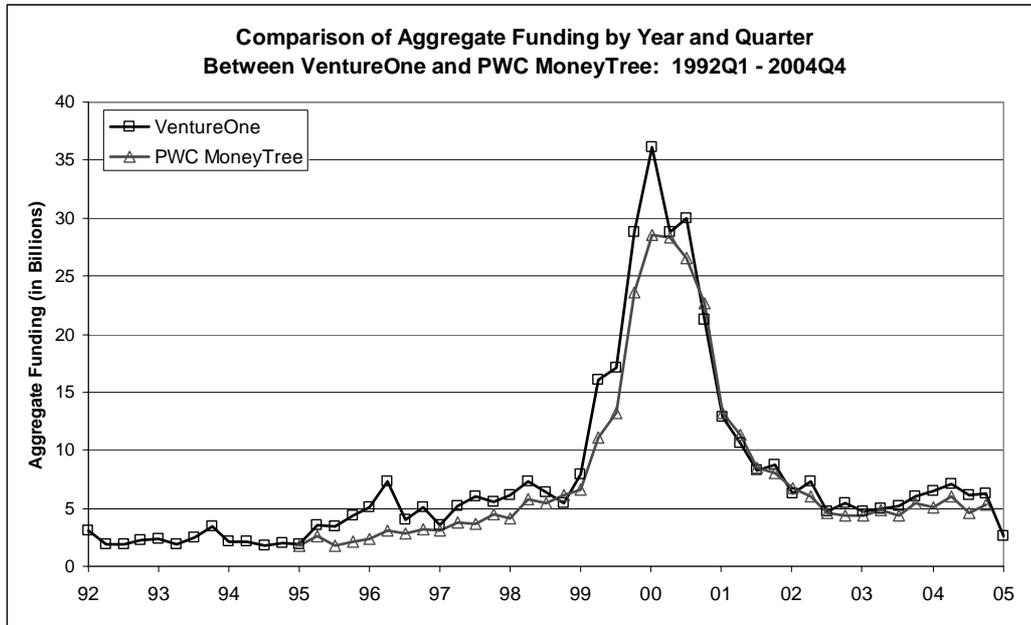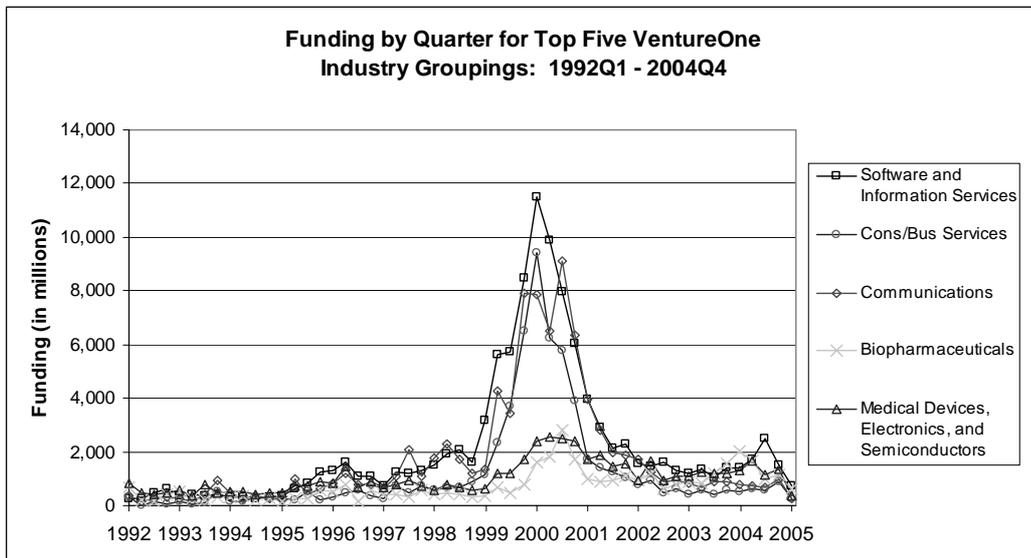
Figure 14

U.S. Private Venture Capital Market Trends: 1992 – 2004

Panel A: Number of Deals By Round (A – G)

Number of Deals by Round (A-G) from 1992 - 2004
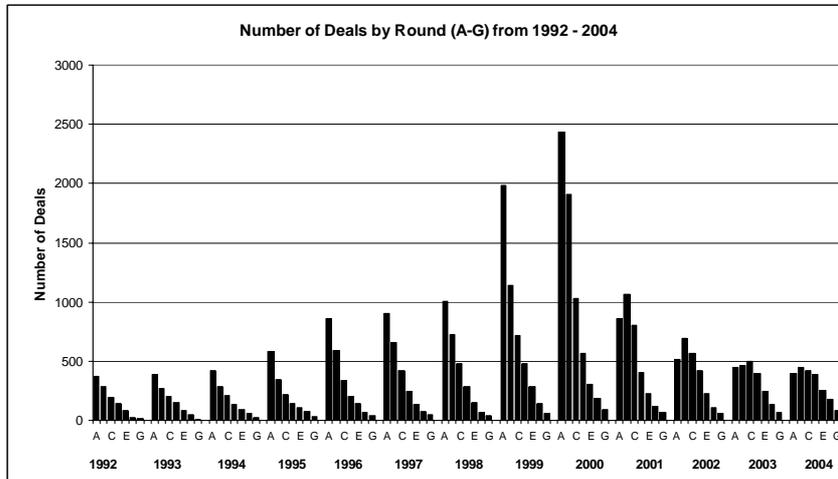
Panel B: Median Amount Raised By Round (A – G)

Median Amount Raised by Round (A-G) from 1992 - 2004
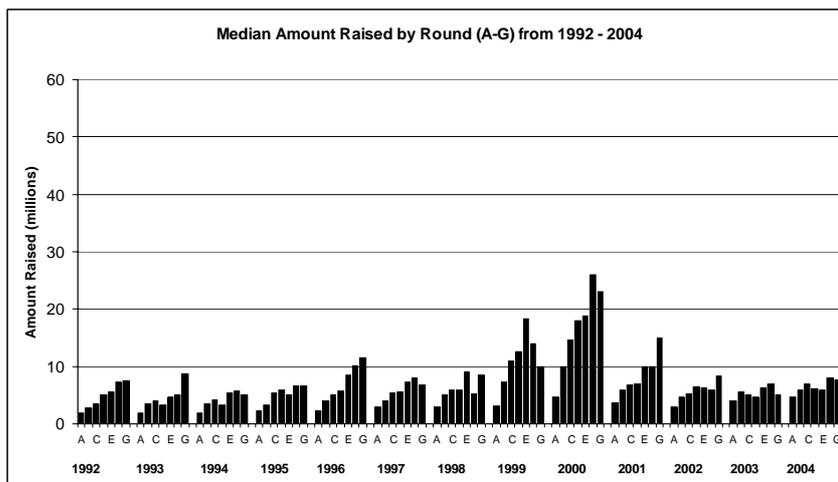
Panel C: Median Pre-Money Valuation By Round (A – *G)*

Median Pre-Money Valuation by Round (A-G) from 1992 - 2004
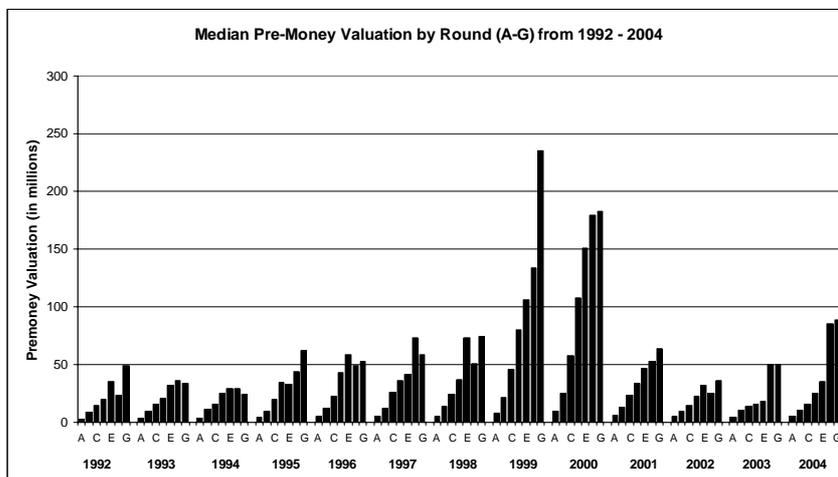
Figure 15

**Private Venture Capital Market Funding for Top Five VentureOne Industry Groupings
Relative to Funding for the Quarter Ended March 31, 2000: 1992Q1 to 2004Q4**
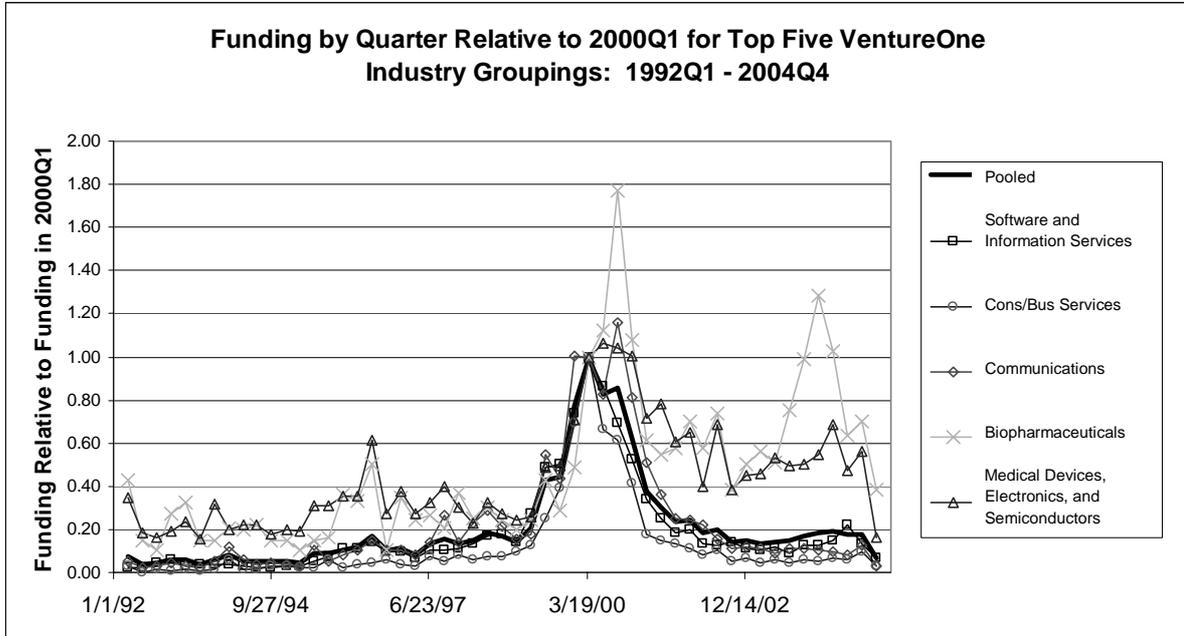
Figure 16

Annual Revenue Growth Percentiles for Private Venture Backed Companies – Calendar (Financing Round) Time Analysis for 1990-1994, 1995-1997, and 1998-2000
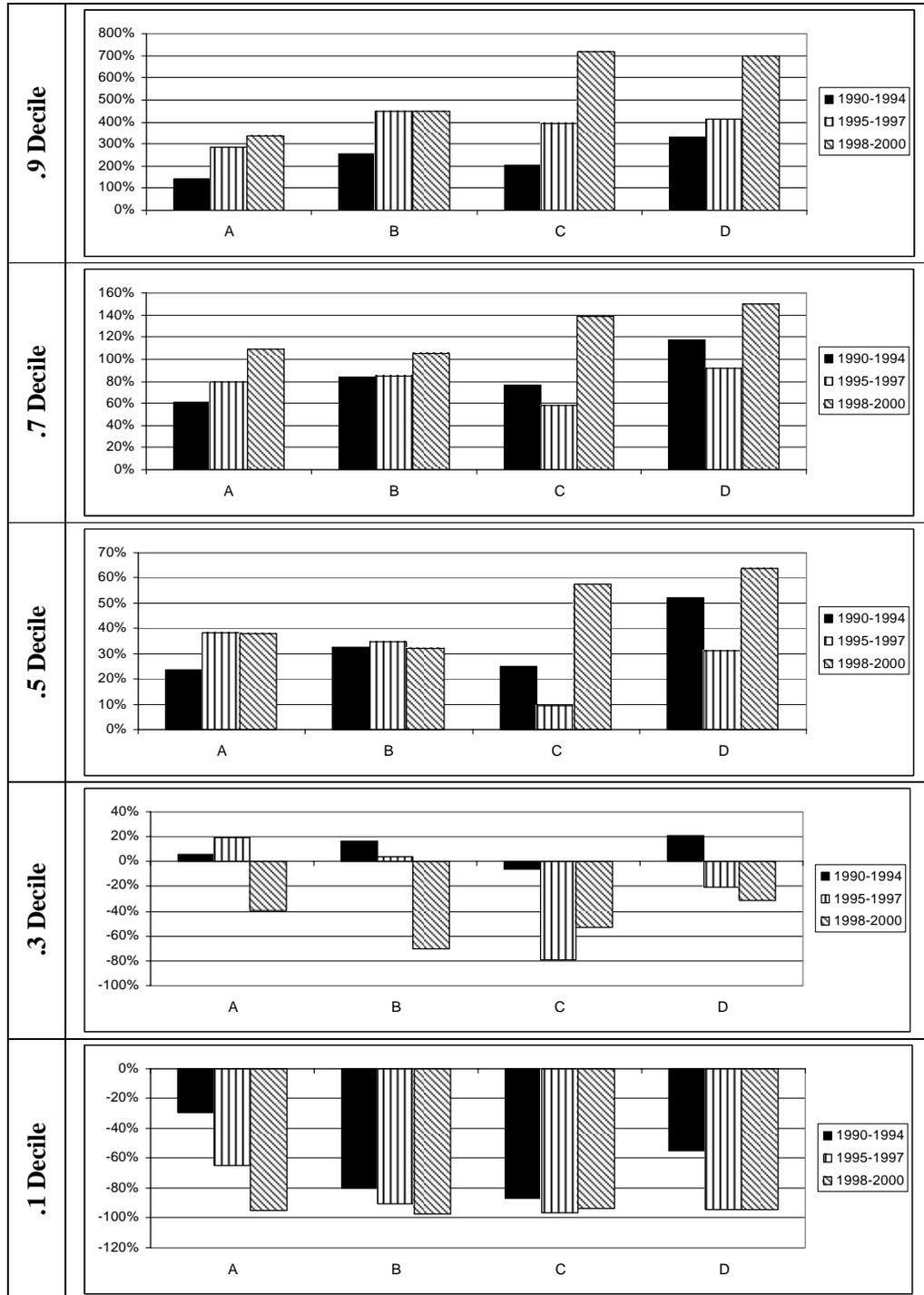
Figure 17

Annual Revenue Growth Percentiles for Private Venture Backed Companies – Event Time (Centered on IPO in Year 0) Time Analysis for 1990-1994, 1995-1997, and 1998-2000
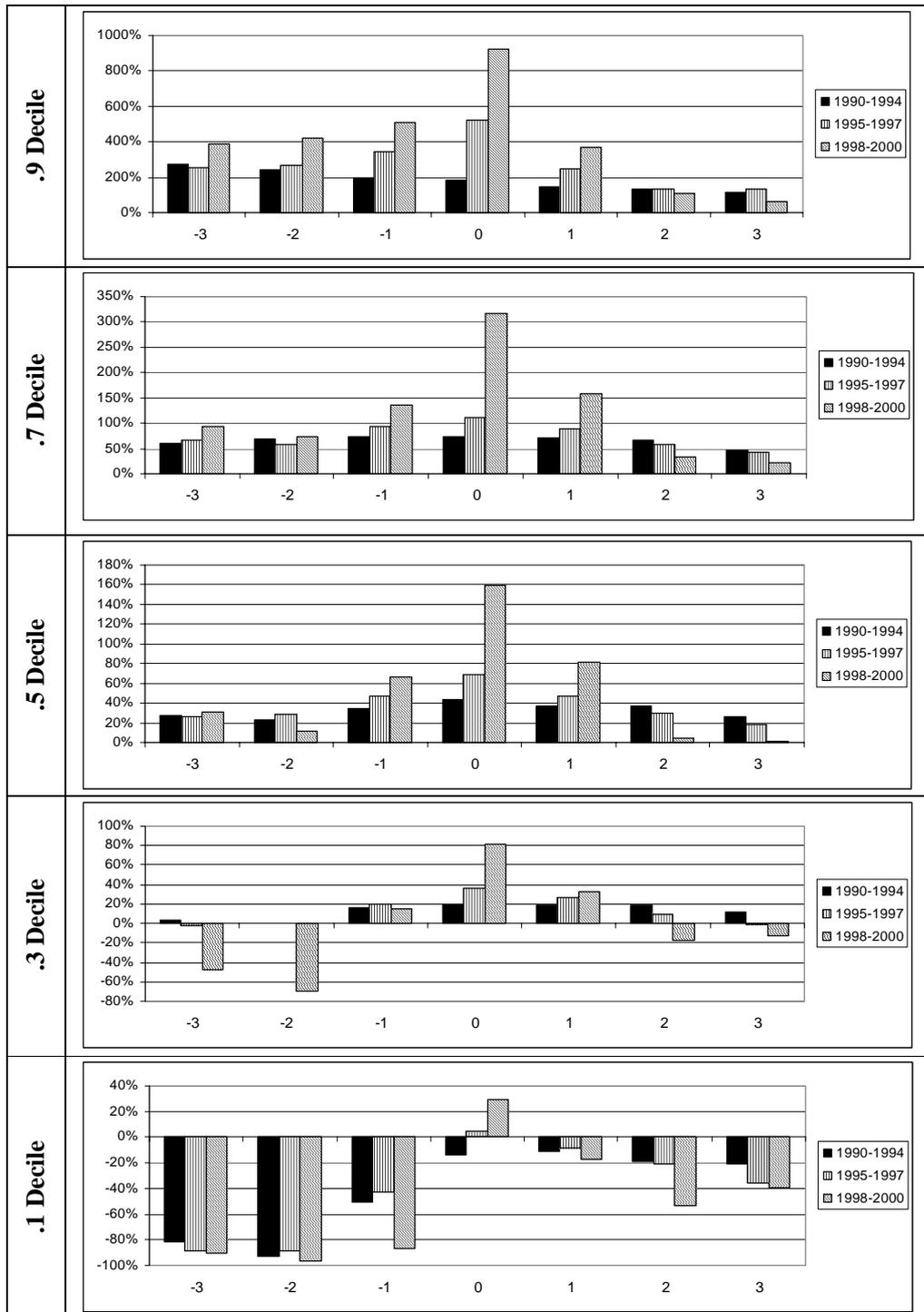
Figure 18

**Annual Revenue Growth Percentiles for Private Venture Backed Companies –
Event Time Analysis (IPO in Year 0) for VentureOne Internet Companies
and VentureOne All Other Companies: 1996-2000**
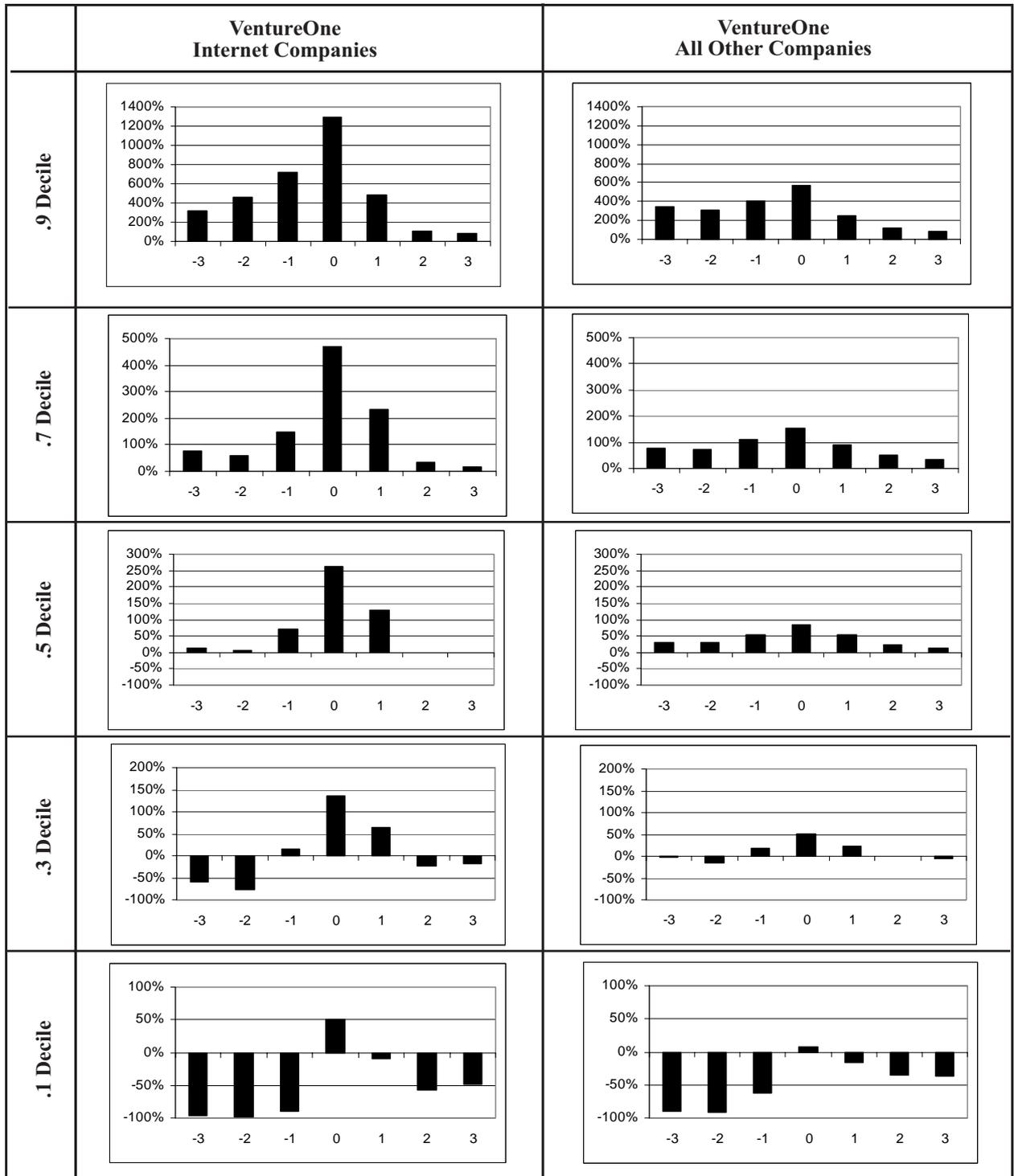
Figure 19

Alternative Revenue and Income Paths for Four Illustrative Internet Companies
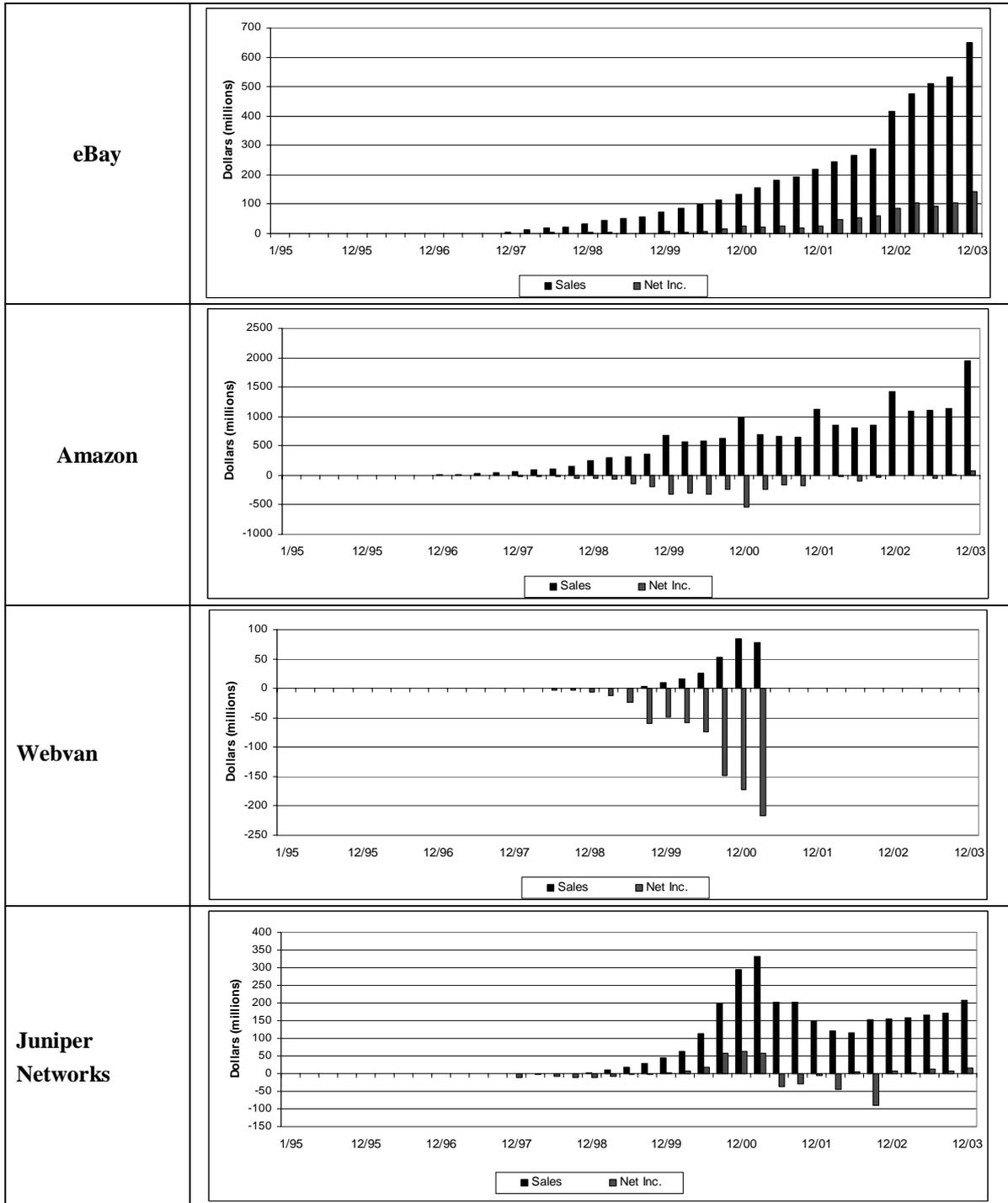
Table 1
Description of Publicly Traded Company Samples

Panel A: Sample One – Publicly Listed Companies on NYSE/AMEX/NASDAQ

| | Market Capitalization | | | | | | Number of Companies | |
| | 1/1/1998 | | 3/10/2000 | | 12/31/2001 | | | |
	Total (in Billions)	NASDAQ/ NYSE-AMEX	Total (in Billions)	NASDAQ/ NYSE-AMEX	Total (in Billions)	NASDAQ/ NYSE-AMEX	Total (in Billions)	NASDAQ/ NYSE-AMEX
I. All Companies	11,051	15.2%/84.8%	18,398	36.2%/63.8%	14,212	19.9%/80.1%	8,401	56.4%/43.6%
II. Pooled Selected SIC Industries (357, 366, 367, 737, 481, 283)	2,849	32.5%/67.5%	9,262	57.6%/42.4%	4,593	41.2%/58.8%	1,932	81.4%/18.6%
II.A. Computer Hardware (357, 366, 367)	933	41.5%/58.5%	4,098	57.6%/42.4%	1,612	50.9%/49.1%	615	79.0%/21.0%
II.B. Computer Software (737)	550	64.8%/35.2%	2,504	88.0%/12.0%	979	75.2%/24.8%	792	89.4%/10.6%
II.C. Telecommunications (481)	528	18.4%/81.6%	1,387	32.4%/67.6%	625	12.5%/87.5%	190	64.7%/35.3%
II.D. Biotech/Pharma (283)	839	10.0%/90.0%	1,273	24.9%/75.1%	1,377	18.7%/81.3%	335	76.1%/23.9%
III. All Other Companies	8,202	9.2%/90.8%	9,135	14.6%/85.4%	9,619	9.7%/90.3%	6,469	49.0%/51.0%

Panel B: Sample Two – Publicly Listed Internet Companies on NYSE/AMEX/NASDAQ

| | Market Capitalization | | | | | | Number of Companies | |
| | 1/1/1998 | | 3/10/2000 | | 12/31/2001 | | | |
	Total (in Billions)	NASDAQ/ NYSE-AMEX	Total (in Billions)	NASDAQ/ NYSE-AMEX	Total (in Billions)	NASDAQ/ NYSE-AMEX	Total (in Billions)	NASDAQ/ NYSE-AMEX
I. All Internet Companies	80	92.7%/7.3%	1,630	97.8%/2.2%	279	97.2%/2.8%	367	96.2%/3.8%
II. Pooled Selected Internet SIC Industries	77	95.5%/4.5%	1,500	98.9%/1.1%	256	99.2%/0.8%	260	97.3%/2.7%
II.A. Internet - Computer Hardware	57	100.0%/0.0%	653	100.0%/0.0%	158	100.0%/0.0%	21	100.0%/0.0%
II.B. Internet - Computer Software	17	80.3%/19.7%	726	97.9%/2.1%	72	97.5%/2.5%	178	98.3%/1.7%
II.C. Internet - Telecommunications	2	100.0%/0.0%	47	95.9%/4.1%	2	86.9%/13.1%	23	82.6%/17.4%
II.D. Internet - Business Services	1	100.0%/0.0%	75	100.0%/0.0%	24	100.0%/0.0%	38	100.0%/0.0%
III. All Other Internet Companies	3	25.0%/75.0%	130	85.4%/14.6%	23	75.4%/24.6%	107	93.5%/6.5%

Table 2

Description of Privately Held Company Sample
Sample Three: VentureOne Venture Capital Backed Companies

	Number of Companies	Number With IPO	Internet Companies With IPO (c)
I. All Venture One Companies (in Sample Three)	11,910	1,262	239
I.A. Software (a)	4,811	388	134
I.B. Consumer-Business Services	2,272	127	48
I.C. Communications	1,604	195	53
I.D. Biopharmaceuticals	1,008	231	0
I.E. Hardware / Equipment (b)	2,215	321	4
	11,910	1,262	239

(a) Comprises the "Software" and "Information Services" Industry Segments of VentureOne.
(b) Comprises the "Medical Devices," "Electronics," and "Semiconductors" Industry Segments of VentureOne.
(c) The Internet company list (taken from Jay Ritter's website) is combined with the VentureOne listing to identify the VentureOne Internet companies with an IPO.

Table 3

NASDAQ/NYSE/AMEX Aggregate Market Capitalization (in $ Billions) and

High-to-Pre-Low/High-to-Post-Low Analysis: 1/1/1998 to 12/31/2001

Panel A: Summary

Exchange / Industry	Ratio of High to pre-low	Ratio of High to post-low	Market Capitalization Changes	
			Pre-low to High	High to Post-low
NASDAQ/NYSE/AMEX				
I. All Companies	1.88	1.65	9,060	(7,626)
II. Pooled Selected SIC Industries	3.40	2.55	6,623	(5,899)
II.A. Computer Hardware (357, 366, 367)	4.64	3.84	3,450	(3,215)
II.B. Computer Software (737)	4.76	3.62	1,978	(1,813)
II.C. Telecommunications (481)	2.73	2.35	893	(813)
II.D. Biotech/Pharma (283)	1.93	1.32	766	(969)
III. All Other Companies	1.47	1.32	3,390	(2,548)
NASDAQ				
I. All Companies	4.23	3.29	5,091	(4,641)
II. Pooled Selected SIC Industries	5.97	4.05	4,439	(4,016)
II.A. Computer Hardware (357, 366, 367)	6.76	4.85	2,179	(2,029)
II.B. Computer Software (737)	6.48	4.32	1,863	(1,693)
II.C. Telecommunications (481)	4.73	6.63	355	(862)
II.D. Biotech/Pharma (283)	5.29	1.79	286	(155)
III. All Other Companies	2.30	1.88	753	(626)
NYSE/AMEX				
I. All Companies	1.50	1.35	4,346	(3,361)
II. Pooled Selected SIC Industries	2.19	1.72	2,214	(1,713)
II.A. Computer Hardware (357, 366, 367)	3.52	3.07	1,313	(1,237)
II.B. Computer Software (737)	1.82	1.72	141	(130)
II.C. Telecommunications (481)	2.33	1.87	558	(455)
II.D. Biotech/Pharma (283)	1.75	1.30	557	(297)
III. All Other Companies	1.45	1.31	2,979	(2,255)

Panel A: Summary

Exchange / Industry	Value 1/1/1998	Number of Firms	Pre-Low Value	Date of Pre-Low	Number of Firms	High Value	Date of High Value	Number of Firms	Post-Low Value	Date of Post-Low	Number of Firms	Value 12/31/2001	Number of Firms
NASDAQ/NYSE/AMEX													
I. All Companies	$ 11,051	9,175	$ 10,276	10/8/98	8,934	$ 19,336	3/24/00	8,406	$ 11,710	9/21/01	7,647	$ 14,212	9,271
II. Pooled Selected SIC Industries	2,849	1,880	2,761	1/5/98	1,876	9,383	3/27/00	1,947	3,685	9/21/01	1,819	4,593	1,757
II.A. Computer Hardware (357, 366, 367)	933	667	897	1/5/98	686	4,347	3/27/00	616	1,132	9/21/01	601	1,612	586
II.B. Computer Software (737)	550	667	526	1/5/98	664	2,504	3/10/00	792	691	9/21/01	706	979	668
II.C. Telecommunications (481)	528	156	516	1/5/98	156	1,409	3/27/00	192	597	10/30/01	174	625	166
II.D. Biotech/Pharma (283)	839	370	821	10/8/98	370	1,587	12/23/00	347	1,198	3/22/01	350	1,377	337
III. All Other Companies	8,202	7,295	7,184	10/8/98	7,077	10,574	5/21/01	5,983	8,026	9/21/01	5,828	9,619	5,757
NASDAQ													
I. All Companies	$ 1,683	5,258	$ 1,576	10/8/98	5,053	$ 6,667	3/10/00	4,740	$ 2,026	9/21/01	4,169	$ 2,830	5,449
II. Pooled Selected SIC Industries	925	1,518	884	1/5/98	1,514	5,332	3/10/00	1,572	1,317	9/21/01	1,457	1,893	1,405
II.A. Computer Hardware (357, 366, 367)	387	542	377	1/5/98	541	2,555	9/1/00	516	526	10/2/01	473	820	465
II.B. Computer Software (737)	356	593	340	1/5/98	590	2,203	3/10/00	708	510	9/21/01	613	736	580
II.C. Telecommunications (481)	97	101	95	1/5/98	101	450	3/10/00	123	68	9/21/01	107	78	99
II.D. Biotech/Pharma (283)	84	282	67	8/31/98	285	353	3/6/00	254	197	4/4/01	273	258	261
III. All Other Companies	758	3,740	691	10/8/98	3,552	1,335	3/10/00	3,168	709	9/21/01	2,712	937	2,639
NYSE/AMEX													
I. All Companies	$ 9,368	3,917	$ 8,700	10/8/98	3,881	$ 13,045	9/1/00	3,625	$ 9,685	9/21/01	3,478	$ 11,362	3,822
II. Pooled Selected SIC Industries	1,924	362	1,867	1/5/98	362	4,081	3/27/00	362	2,368	9/21/01	362	2,700	362
II.A. Computer Hardware (357, 366, 367)	545	145	521	1/5/98	145	1,834	3/27/00	131	597	9/21/01	126	791	121
II.B. Computer Software (737)	194	74	171	10/8/98	79	312	3/24/00	85	182	9/21/01	93	243	88
II.C. Telecommunications (481)	431	55	421	1/5/98	55	979	3/27/00	67	525	10/31/01	68	547	57
II.D. Biotech/Pharma (283)	755	88	739	1/5/98	88	1,296	12/23/00	76	999	3/21/01	77	1,119	76
III. All Other Companies	7,444	3,555	6,802	10/8/98	3,515	9,531	5/21/01	3,136	7,316	9/21/01	3,116	8,682	3,118

Table 4

Benchmarked Market Capitalization of End-of-Month Values Relative to March 2000
Market Capitalization: All Companies and Selected SIC Industry Groups

	NASDAQ							NYSE/AMEX						
	All Companies I.	Pooled Selected SIC Industries II.	Computer Hardware II.A.	Computer Software II.B.	Telecommunications II.C.	Biotech/Pharma II.D.	All Other Companies III.	All Companies I.	Pooled Selected SIC Industries II.	Computer Hardware II.A.	Computer Software II.B.	Telecommunications II.C.	Biotech/Pharma II.D.	All Other Companies III.
6/1998	31%	23%	19%	25%	36%	25%	63%	84%	57%	36%	74%	51%	95%	97%
12/1998	36%	30%	27%	31%	44%	31%	61%	87%	68%	46%	83%	65%	107%	95%
6/1999	45%	39%	35%	40%	64%	35%	68%	96%	79%	63%	77%	85%	104%	104%
7/1999	48%	43%	38%	44%	64%	40%	70%	98%	82%	69%	83%	81%	106%	105%
8/1999	48%	43%	42%	42%	59%	43%	66%	94%	79%	65%	75%	77%	108%	102%
9/1999	49%	45%	43%	45%	61%	44%	65%	93%	81%	69%	78%	78%	106%	99%
10/1999	53%	49%	45%	50%	70%	42%	68%	94%	81%	67%	76%	82%	108%	99%
11/1999	62%	59%	55%	61%	79%	46%	77%	98%	88%	74%	86%	92%	111%	102%
12/1999	75%	72%	64%	82%	84%	59%	87%	98%	90%	79%	98%	92%	106%	101%
1/2000	79%	77%	70%	84%	83%	74%	90%	98%	90%	81%	100%	91%	104%	101%
2/2000	89%	88%	86%	89%	94%	92%	94%	96%	93%	87%	96%	92%	104%	97%
3/2000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
4/2000	88%	87%	93%	81%	88%	77%	92%	101%	99%	97%	96%	95%	105%	102%
5/2000	79%	78%	86%	68%	83%	72%	84%	100%	96%	94%	93%	89%	110%	102%
6/2000	82%	82%	91%	72%	81%	87%	83%	100%	94%	91%	92%	82%	112%	103%
7/2000	88%	88%	99%	74%	88%	95%	88%	100%	93%	93%	83%	80%	109%	103%
8/2000	88%	87%	102%	73%	71%	97%	89%	102%	94%	96%	85%	75%	108%	106%
9/2000	88%	88%	102%	73%	72%	97%	89%	104%	96%	98%	86%	78%	115%	107%
10/2000	76%	75%	83%	65%	60%	93%	81%	101%	91%	81%	85%	79%	121%	106%
11/2000	73%	72%	81%	63%	49%	94%	78%	100%	89%	75%	88%	77%	126%	106%
12/2000	64%	62%	69%	53%	43%	90%	71%	100%	85%	68%	80%	74%	126%	107%
6/2001	48%	41%	39%	40%	25%	81%	74%	97%	73%	52%	78%	66%	116%	109%
12/2001	44%	37%	37%	35%	19%	77%	71%	90%	68%	47%	79%	56%	114%	101%
3/2000 Value[1]	6,853	5,518	2,513	2,203	450	353	1,335	12,833	4,150	1,834	312	979	1,025	8,683

[1] Denotes the aggregate market capitalization (in billions of dollars) at the end of March 2000.

Table 5

Selected SIC Industry Group Net Income Growth Rates

| | 50th Percentile | | | | | | | 90th Percentile | | | | | | |
Year	All Companies I.	Pooled Selected SIC Industries II.	Computer Hardware II.A.	Computer Software II.B.	Telecommunications II.C.	Biotech/Pharma II.D.	All Other Companies III.	All Companies I.	Pooled Selected SIC Industries II.	Computer Hardware II.A.	Computer Software II.B.	Telecommunications II.C.	Biotech/Pharma II.D.	All Other Companies III.
1980	1.2%	1.4%	1.4%	1.3%	1.5%	1.2%	1.1%	12.0%	12.9%	13.7%	21.7%	6.2%	10.9%	11.5%
1981	1.3%	1.0%	1.1%	0.5%	2.3%	0.7%	1.4%	12.9%	12.2%	11.9%	14.5%	8.7%	17.0%	13.0%
1982	0.3%	0.6%	0.5%	0.6%	1.2%	0.3%	0.2%	9.4%	9.2%	7.0%	12.1%	310.2%	7.3%	9.4%
1983	1.3%	1.2%	1.2%	1.8%	1.5%	0.9%	1.3%	14.2%	10.1%	10.7%	14.2%	9.7%	5.0%	14.7%
1984	1.2%	1.0%	1.3%	1.1%	1.5%	0.6%	1.3%	12.2%	12.2%	12.7%	11.8%	14.8%	8.0%	12.2%
1985	0.5%	0.2%	-0.2%	0.6%	0.9%	0.3%	0.5%	11.8%	10.4%	11.6%	7.9%	42.7%	9.6%	12.2%
1986	0.7%	0.6%	0.3%	0.9%	1.4%	0.8%	0.7%	15.2%	14.8%	15.4%	14.8%	13.8%	14.5%	15.2%
1987	1.0%	0.9%	1.4%	1.3%	0.8%	0.2%	1.1%	18.0%	16.4%	21.8%	11.9%	30.1%	6.6%	18.4%
1988	1.1%	1.1%	1.4%	1.5%	0.6%	0.7%	1.1%	16.9%	13.2%	15.7%	15.8%	13.9%	5.8%	17.9%
1989	0.6%	0.5%	0.0%	1.6%	0.0%	0.5%	0.6%	13.5%	13.5%	13.8%	22.1%	3.9%	8.2%	13.5%
1990	0.2%	0.1%	0.0%	0.2%	0.1%	0.3%	0.2%	13.3%	13.6%	21.2%	8.1%	7.1%	13.7%	12.8%
1991	0.4%	0.6%	0.8%	0.9%	-0.4%	0.0%	0.4%	20.7%	26.0%	38.8%	40.3%	14.9%	15.0%	19.1%
1992	0.9%	0.6%	1.5%	0.8%	1.1%	-0.7%	0.9%	18.2%	16.6%	24.7%	15.1%	8.2%	9.9%	18.3%
1993	1.1%	0.3%	1.7%	0.3%	-0.3%	-0.8%	1.2%	18.8%	16.6%	23.0%	14.2%	9.9%	11.1%	19.4%
1994	1.0%	1.0%	1.6%	1.0%	1.2%	-0.4%	0.9%	16.6%	17.4%	25.5%	21.7%	11.1%	8.5%	16.4%
1995	1.0%	0.9%	1.4%	1.0%	-1.1%	0.2%	1.0%	13.7%	16.5%	15.4%	25.4%	12.0%	14.9%	13.3%
1996	1.0%	0.3%	0.9%	0.2%	0.8%	-0.4%	1.1%	14.2%	16.0%	13.5%	20.8%	17.9%	9.2%	13.5%
1997	0.9%	0.3%	0.7%	0.7%	-1.0%	-1.1%	1.0%	10.8%	12.4%	13.7%	15.8%	4.3%	7.1%	10.3%
1998	0.5%	0.5%	0.1%	1.0%	0.2%	-0.2%	0.5%	10.1%	17.6%	16.9%	32.0%	14.9%	8.9%	8.3%
1999	0.6%	0.3%	1.1%	-0.2%	0.1%	0.2%	0.6%	18.0%	23.7%	28.9%	17.9%	37.1%	23.7%	16.0%
2000	0.4%	-0.8%	0.0%	-2.0%	-0.8%	-0.2%	0.6%	13.3%	9.8%	12.6%	6.1%	12.6%	9.5%	14.7%
2001	-0.2%	-1.3%	-3.1%	-1.1%	-2.1%	-0.4%	0.0%	15.7%	22.3%	12.7%	39.3%	8.4%	10.6%	14.3%
2002	0.9%	1.3%	1.6%	3.8%	0.4%	-0.3%	0.9%	24.7%	64.7%	44.3%	117.2%	137.9%	8.6%	16.2%
2003	1.4%	3.8%	4.6%	6.3%	7.5%	1.5%	1.1%	38.4%	84.1%	84.6%	106.7%	304.3%	27.5%	26.4%

Table 6

**NASDAQ/NYSE/AMEX Aggregate Market Capitalization (in $ Billions) and
High-to-Pre-Low/High-to-Post-Low Analysis for Sample Two (Internet Companies): 1/1/1998 to 12/31/2001**

Panel A: Summary

Exchange / Industry	Ratio of High to pre-low	Ratio of High to post-low	Market Capitalization Changes Pre-low to High	High to Post-low
NASDAQ/NYSE/AMEX				
I. All Internet Companies	23.02	10.07	1,646	(1,550)
II. Four Internet Industries	22.12	10.44	1,519	(1,438)
III. Other Internet Companies	45.77	7.03	127	(111)
IV. Computer Hardware - Internet	13.49	7.75	688	(647)
V. Computer Software - Internet	46.20	16.80	710	(682)
VI. Telecommunications - Internet	54.10	47.91	46	(46)
VII. Misc. Business Services - Internet	262.49	5.11	76	(63)
NASDAQ				
I. All Internet Companies	22.44	5.87	1,523	(1,427)
II. Four Internet Industries	21.09	5.65	1,413	(1,329)
III. Other Internet Companies	164.28	6.29	110	(98)
IV. Computer Hardware - Internet	13.49	4.69	688	(647)
V. Computer Software - Internet	56.63	10.13	688	(669)
VI. Telecommunications - Internet	53.22	33.88	44	(44)
VII. Misc. Business Services - Internet	262.49	3.16	76	(63)
NYSE/AMEX				
I. All Internet Companies	9.09	4.73	33	(30)
II. Four Internet Industries	10.63	9.49	17	(18)
III. Other Internet Companies	0.08	0.32	-21	3
IV. Computer Hardware - Internet				
V. Computer Software - Internet	10.25	9.64	16	(17)
VI. Telecommunications - Internet	92.33	10.04	2	(2)
VII. Misc. Business Services - Internet	1.38	8.24	0	(0)

Panel B: Supporting Detail

Exchange / Industry	Value 1/1/1998	Number of Firms	Pre-Low Value	Date of Pre-Low	Number of Firms	High Value	Date of High Value	Number of Firms	Post-Low Value	Date of Post-Low	Number of Firms	Value 12/31/2001	Number of Firms
NASDAQ/NYSE/AMEX													
I. All Internet Companies	79.73	52	74.76	1/9/98	52	1,720.64	3/10/00	367	173.92	9/27/01	338	279.16	315
II. Four Internet Industries	76.55	50	71.92	1/9/98	39	1,590.72	3/9/00	258	152.43	9/27/01	257	255.79	241
III. Other Internet Companies	3.17	2	2.84	1/27/98	13	129.91	3/10/00	107	18.49	9/27/01	81	23.38	74
IV. Computer Hardware - Internet	55.60	30	55.06	1/9/98	2	742.62	9/1/00	30	36.87	9/27/01	31	158.36	30
V. Computer Software - Internet	17.44	4	15.71	1/9/98	30	725.55	3/10/00	178	43.18	9/26/01	169	71.93	157
VI. Telecommunications - Internet	1.90	3	0.86	10/8/98	5	46.73	3/10/00	23	0.93	10/8/01	22	1.52	20
VII. Misc. Business Services - Internet	0.62	13	0.29	8/31/98	2	75.83	3/17/00	39	12.41	4/4/01	44	23.97	34
NASDAQ													
I. All Internet Companies	73.90	47	71.04	1/9/98	47	1,594.37	3/10/00	353	165.92	9/27/01	324	271.43	302
II. Four Internet Industries	73.11	37	70.32	1/9/98	37	1,483.44	3/10/00	253	154.34	9/27/01	247	253.79	231
III. Other Internet Companies	0.79	10	0.68	1/15/98	10	110.93	3/10/00	100	12.58	9/27/01	77	17.64	71
IV. Computer Hardware - Internet	55.60	2	55.06	1/9/98	2	742.62	9/1/00	30	36.87	9/27/01	31	158.36	30
V. Computer Software - Internet	13.99	28	12.55	1/9/98	28	710.59	3/10/00	175	41.84	9/26/01	164	70.14	152
VI. Telecommunications - Internet	1.90	4	0.84	10/8/98	4	44.81	3/10/00	19	0.87	10/8/01	18	1.32	16
VII. Misc. Business Services - Internet	0.62	3	0.29	8/31/98	2	75.83	3/17/00	39	12.40	4/4/01	43	23.96	33
NYSE/AMEX													
I. All Internet Companies	5.83	5	4.02	10/8/98	6	36.60	3/1/00	14	6.39	11/28/01	13	7.74	13
II. Four Internet Industries	3.45	2	1.78	9/28/99	5	18.91	2/28/00	7	0.55	4/5/01	9	1.99	10
III. Other Internet Companies	2.38	3	23.07	7/15/99	6	1.85	8/31/98	3	4.59	11/28/01	3	5.74	3
IV. Computer Hardware - Internet													
V. Computer Software - Internet	3.45	2	1.68	9/28/99	2	17.20	2/28/00	3	0.14	4/5/01	3	1.78	5
VI. Telecommunications - Internet			0.02	10/8/98	1	2.01	2/17/00	1	0.10	10/9/01	4	0.20	4
VII. Misc. Business Services - Internet			0.05	6/28/00	1	0.06	7/28/00	1	0.00	8/9/01	1	0.01	1

Table 7

**Benchmarked Market Capitalization of End-of-Month Values Relative to March 2000
Market Capitalization: All Internet Companies and Selected Internet SIC Industry Groups**

	NASDAQ/NYSE						
	All Internet Companies I.	Pooled Selected Internet SIC Industries II.	Internet-Computer Hardware II.A.	Internet-Computer Software II.B.	Internet-Telecomm-unications II.C.	Internet-Biotech/ Pharma II.D.	All Other Internet Companies III.
6/1998	8%	9%	13%	5%	5%	1%	4%
12/1998	16%	16%	22%	12%	5%	18%	11%
6/1999	29%	26%	32%	20%	33%	33%	58%
7/1999	31%	28%	33%	22%	39%	31%	61%
8/1999	31%	29%	35%	22%	33%	28%	57%
9/1999	34%	33%	37%	28%	33%	34%	56%
10/1999	42%	40%	43%	37%	37%	37%	65%
11/1999	57%	55%	55%	54%	54%	64%	83%
12/1999	71%	70%	64%	75%	55%	85%	85%
1/2000	76%	75%	70%	79%	73%	84%	90%
2/2000	88%	88%	86%	90%	94%	79%	89%
3/2000	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
4/2000	81%	81%	93%	71%	78%	73%	79%
5/2000	72%	72%	89%	58%	60%	59%	65%
6/2000	73%	74%	93%	59%	58%	60%	61%
7/2000	81%	82%	101%	66%	59%	72%	63%
8/2000	79%	81%	104%	63%	50%	69%	56%
9/2000	80%	82%	104%	63%	50%	72%	57%
10/2000	67%	69%	89%	52%	43%	64%	42%
11/2000	61%	64%	85%	45%	40%	51%	36%
12/2000	50%	52%	77%	30%	25%	37%	24%
6/2001	22%	22%	30%	13%	9%	33%	27%
12/2001	19%	19%	27%	10%	3%	32%	18%
3/2000 Value*	1,563	715	726	47	76	130	1,693

* Denotes the aggregate market capitalization (in billions of dollars) at the end of March 2000.

Table 8

Percentage of Companies with Negative Net Income: 1996 to 2003
Sample Two (Internet) vs. Sample One Companies

	Sample Two: All Internet Companies (I)	Sample One: All Companies (I)	Sample One: Pooled Selected SIC Industries (II)	Computer Hardware		Computer Software		Telecommunications	
				Sample Two: Internet Companies (II.A.)	Sample Two: Internet Companies (II.B.)	Sample Two: Internet Companies (II.B.)	Sample One: Selected SIC Industries (II.B.)	Sample Two: Internet Companies (II.C.)	Sample One: Selected SIC Industries (II.C.)
1996	66.7%	23.4%	42.0%	40.0%	76.7%	76.7%	39.9%	33.3%	35.4%
1997	86.5%	24.6%	46.4%	70.0%	89.5%	89.5%	48.1%	100.0%	43.0%
1998	86.6%	31.0%	53.8%	83.9%	88.8%	88.8%	54.9%	84.2%	45.8%
1999	89.0%	31.6%	55.1%	76.5%	92.6%	92.6%	60.3%	86.4%	41.5%
2000	88.7%	31.5%	56.7%	71.0%	90.8%	90.8%	65.5%	100.0%	44.2%
2001	92.6%	37.7%	67.7%	96.3%	93.8%	93.8%	72.0%	93.8%	53.0%
2002	81.6%	38.8%	65.8%	90.9%	86.9%	86.9%	64.5%	87.5%	52.0%
2003	55.4%	32.7%	57.2%	85.0%	62.2%	62.2%	52.0%	69.2%	31.4%

Table 9

**Peak Venture Funding Benchmark Analysis of Quarterly Venture Capital Funding for Five Select
VentureOne Industry Groups Relative to 2000,Q1 Funding: 1998,Q1 to 2001,Q4**

	Pooled I.	Software I.A.	Consumer- Bus. Serv. I.B.	Commu- unications I.C.	Biotech/ Pharma I.D.	Hardware/ Equipment I.E.
1998,Q1	0.15	0.13	0.06	0.23	0.25	0.23
1998,Q2	0.19	0.17	0.07	0.29	0.30	0.33
1998,Q3	0.17	0.18	0.07	0.22	0.25	0.27
1998,Q4	0.14	0.14	0.09	0.15	0.20	0.25
1999,Q1	0.20	0.27	0.12	0.17	0.24	0.26
1999,Q2	0.43	0.49	0.25	0.55	0.43	0.49
1999,Q3	0.44	0.50	0.39	0.43	0.29	0.49
1999,Q4	0.77	0.74	0.69	1.01	0.49	0.71
2000,Q1	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
2000,Q2	0.82	0.86	0.66	0.83	1.13	1.07
2000,Q3	0.86	0.69	0.61	1.16	1.77	1.04
2000,Q4	0.62	0.52	0.41	0.81	1.08	1.01
2001,Q1	0.38	0.34	0.18	0.51	0.61	0.71
2001,Q2	0.30	0.25	0.15	0.36	0.54	0.79
2001,Q3	0.24	0.19	0.13	0.25	0.57	0.60
2001,Q4	0.24	0.20	0.11	0.24	0.70	0.65
2000,Q1*	$32.77	$11.52	$9.41	$7.84	$1.60	$2.40

* Denotes amount of funding in 2000, Quarter 1 in billions of dollars.

Table 10

Select Financial Statement Information for Internet Companies ($ mil.)

Qtr. Ended	eBay		Amazon		Webvan		Juniper Networks	
	Sales	Net Inc.	Sales	Net Inc.	Sales	Net Inc.	Sales	Net Inc.
12/95			0.51	-0.30				
3/96			0.88	-0.33				
6/96			2.23	-0.77				
9/96			4.17	-2.38				
12/96	0.37	0.15	8.47	-2.30				
3/97	0.60	0.19	16.00	-3.04				
6/97	1.05	0.29	27.85	-7.53				
9/97	1.46	0.20	37.89	-9.65				
12/97	2.63	0.19	66.04	-10.81			0.00	-10.36
3/98	13.99	1.44	87.36	-10.37			0.00	-3.90
6/98	19.48	2.73	115.98	-22.58	0.00	-3.30	0.00	-7.20
9/98	21.73	0.46	153.65	-45.17	0.00	-3.23	0.00	-10.58
12/98	30.93	2.64	252.89	-46.43	0.00	-5.46	3.81	-9.28
3/99	42.80	3.76	293.64	-61.67	0.01	-11.69	10.04	-6.67
6/99	49.48	0.82	314.38	-138.01	0.38	-23.44	17.56	-3.85
9/99	58.52	0.17	355.78	-197.08	3.84	-60.44	29.56	-1.59
12/99	73.92	4.81	676.04	-323.21	9.07	-49.00	45.44	3.08
3/00	85.89	1.76	573.89	-308.42	16.27	-57.81	63.89	8.07
6/00	98.15	7.46	577.88	-317.18	25.94	-74.36	113.03	19.62
9/00	113.38	15.21	637.86	-240.52	52.06	-147.97	201.20	58.07
12/00	134.01	23.86	972.36	-545.14	84.19	-173.13	295.39	62.16
3/01	154.09	21.07	700.36	-234.13	77.23	-216.97	332.10	58.57
6/01	180.90	24.61	667.63	-168.36			202.18	-37.13
9/01	194.42	18.84	639.28	-169.87			201.70	-29.73
12/01	219.40	25.93	1115.17	5.09			151.03	-5.13
3/02	245.11	47.58	847.42	-23.15			122.22	-46.00
6/02	266.29	54.31	805.60	-93.55			117.04	6.23
9/02	288.78	61.00	851.30	-35.08			152.03	-88.33
12/02	413.93	87.00	1428.61	2.65			155.27	8.45
3/03	476.49	104.19	1083.56	-10.12			157.21	3.68
6/03	509.27	91.87	1099.91	-43.31			165.10	13.58
9/03	530.94	103.25	1134.46	15.56			172.13	7.20
12/03	648.39	142.46	1945.77	73.15			206.95	14.73