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Market-to-Revenue Multiples in Public and Private Capital Markets

Abstract

The behavior and determinants of market-to-revenue ratios in public and private capital markets is examined. Three samples are analysed: (1) all publicly traded stocks listed at some time on the New York Stock Exchange/American Stock Exchange/National Association of Securities Dealers Automated Quotation System in the 1980—2004 period; (2) sample of over 300 so-called ‘internet companies’ in the 1996—2004 period; and (3) over 5500 privately held venture capital-backed companies in the 1992—2004 period. Both company size and the most recent revenue growth rate are found to explain significant variation across companies in their market-to-revenue multiples — smaller companies and companies with higher recent revenue growth rates have higher multiples. We also document how the capital market appears to use a broad-based information set when setting market-to-revenue multiples for companies with negative revenue growth rates — transitory revenue growth components appear to be identified (in a probabilistic sense) by the capital market. Contrary to much anecdotal comment, we present evidence that the capital market behaved directionally along the lines predicted by capital market theory in the pricing of internet stocks in the 1996—2004 period.

Keywords

internet companies, market-to-revenue multiple, price/sales ratio, private companies, public companies, transitory revenue, venture capital

Disciplines

Accounting | Business Administration, Management, and Operations | Finance and Financial Management

**MARKET-TO-REVENUE MULTIPLES
IN PUBLIC AND PRIVATE CAPITAL MARKETS***

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ABSTRACT

The behavior and determinants of market to revenue ratios in public and private capital markets is examined. Three samples are analyzed : (1) all publicly traded stocks listed at some time on the NYSE/AMEX/NASDAQ in the 1980 to 2004 period, (2) sample of over 300 so-called “internet companies” in the 1996 to 2004 period, and (3) over 5,500 privately held venture capital backed companies in the 1992 to 2004 period. Both company size and the most recent revenue growth rate are found to explain significant variation across companies in their market to revenue multiples—smaller companies have higher multiples and companies with higher recent revenue growth rates have higher multiples. We also document how the capital market appears to use a broad based information set when setting market to revenue multiples for companies with negative revenue growth rates—transitory revenue growth components appear to be identified (in a probabilistic sense) by the capital market. Contrary to much anecdotal comment, we present evidence that the capital market behaved directionally along the lines predicted by capital market theory in the pricing of internet stocks in the 1996 to 2004 period.

KEY WORDS: MARKET TO REVENUE MULTIPLE, PRICE/SALES RATIO, PUBLIC COMPANIES, PRIVATE COMPANIES, VENTURE CAPITAL, INTERNET COMPANIES, TRANSITORY REVENUE

I. Introduction

The market capitalization to revenue ratio (sometimes called price/sales ratio) is of central interest in many areas of capital market investment analysis and research. These areas include fundamental analysis, acquisition analysis, and examination of returns from quantitative investment trading strategies.¹ Revenue forecasts now are part of most security analyst reports.² This paper provides an extensive analysis of market capitalization to revenue multiples (hereafter MKT_t/REV_t) and their drivers. We examine MKT_t/REV_t multiples for three samples, each of which is of much interest in its own right. Sample One includes all publicly-traded stocks listed at some time on the NYSE, AMEX or NASDAQ over the 1980 to 2004 period. Sample Two comprises roughly 300 publicly-traded “Internet companies;” the sample has most of its observations in the 1996-2004 period. Sample Three comprises over 5,500 privately-held, venture-backed companies from primarily the 1992-2004 period. Comparisons across the three samples strengthens the reliability of the inferences we draw about the behavior and determinants of MKT_t/REV_t multiples.

Key findings in this paper include: (1) Company size is a significant predictor of MKT_t/REV_t ratios with smaller companies having higher MKT_t/REV_t ratios; (2) Past revenue growth is a significant predictor of the level of the MKT_t/REV_t ratio; and (3) the capital market takes into account transitory components of revenue when setting MKT_t/REV_t ratios. Underlying factors explaining these findings are examined. The use of data pre, during, and post the 1998 to 2000 period also enables us to explore factors associated with the so-called “internet bubble” period. Our results are consistent with the capital market behaving in this period more rationally along the predictions of capital market theory than many observers are willing to recognize.

¹ See, for instance, O’Hara and Lowry (2009).

² IBES started reporting security analyst revenue forecasts approximately 20 years after it started reporting EPS forecasts. It started reporting one-year ahead and two-year ahead revenue (EPS) forecasts in 1996 (1976). It started reporting long term revenue (EPS) growth forecasts in 1999 (1981). By 2004, 85.18%/83.68% of companies in the IBES sample of companies had one-year ahead/two-year ahead security analyst revenue forecasts; the comparable percentages for one-year ahead/two-year ahead EPS forecasts were 90.87%/89.50%. Ertimur, Mayew, and Stubben [2011] probe explanations for the issuance of revenue and expense forecasts by security analysts.

II. Importance of Research and Literature Review

The findings in this paper have relevance for multiple research areas, including capital market valuation research, management of reported financial numbers research, capital market 1998-2001 “bubble” research, and early-stage company research.

Capital Market Valuation Research

Much valuation research using market multiples has emphasized market (price) to earnings or market to book value. MKT_t/REV_t analysis is also important in valuation research. Analysis of market-to-revenue multiples can be motivated by both the revenue variable itself being an informative signal about future value-relevant parameters and by revenues being a “substitute” variable for situations in which negative earnings or book value are encountered.

A growing number of studies have documented the differential or incremental information content of revenue vis-à-vis other variables. Ertimur, Livnat, and Martikainen [2003] report that a dollar of surprise in revenues has higher capital market information content than a dollar of surprise in expenses. Hypothesized explanations include a persistence explanation, a homogeneity explanation, and an earnings management explanation. Berger [2003] argues that the persistence explanation – “investors react more strongly to a [revenue] surprise because these are less transitory than expense surprises” (p. 213) – is the most credible explanation of the three proposed. Ghosh, Gu, and Jain [2005], using an earnings response coefficient (ERC) methodology, report that “relative to the cost reduction firms, earnings for the revenue-growth firms are more persistent... revenue-supported earnings growth is likely to be more sustainable because revenue is the key value driver and its growth often reflects the underlying product differentiation strategy” (p. 19). Keung [2010] reports incremental information content to analyst revenue forecasts when they simultaneously make changes to their earnings and revenue forecasts. The research in this paper provides systematic evidence to support the revenue persistence / momentum argument. We also document across multiple samples that companies with higher positive revenue growth in the most recent year have higher MKT_t/REV_t multiples.

Many valuation studies on market multiples, by their choice of variable(s) to examine, exclude sizable numbers of interesting and important observations. For example, research on market (price) to earnings multiples invariably deletes observations with non-positive earnings. This deletion can have sizable impacts on the generalizability of the results. Appendix A of this paper reports the percentages of NYSE, AMEX, and NASDAQ companies with negative net income. The following percentages relate to the “high-technology” subsample (covering the computer hardware, software, telecom, and biotech/pharmaceuticals industries) and the “all other” subsample of companies listed on these exchanges:

	1985	1990	1995	2000	2004
High-Tech Companies	30.3%	37.2%	39.1%	56.8%	50.3%
All Other Companies	16.3%	23.1%	17.2%	22.3%	22.7%

Companies listed on NASDAQ (on average, smaller and younger) have a higher percentage of negative net income than companies listed on the NYSE and AMEX. Core, Guay, and Van Buskirk [2003], in a study of market to book value multiples, report losing 5,355 observations (4.7%) from their sample when requiring companies to have positive book value. They note that “deleting firms with negative book value of equity removes a greater percentage of young (7.5%) and high-technology (5.6%) firms” (p. 51).

Research that compares the relative “performance” of MKT_t/REV_t vis-à-vis other market multiples highlights the potentially severe deletion that can occur in traditional MKT_t/INC_t or MKT_t/BV_t multiple studies. Consider the Liu, Nissim, and Thomas [2002] study which adopted a “horse-race” ranking methodology in which the ability of alternative accounting variables to predict the current stock price was compared. The variables included six historical series (cash flow, cash flow from operations, EBITDA, revenues (sales), earnings, and book value of equity) and two forward-looking series (analyst forecasts of EPS and long-term growth in EPS). The

conclusion was that “despite the importance of top-line revenues, its value-relevance is limited until it is matched with expenses” (pp. 137-138). The sample examined had sizable reductions – they excluded “firm-years with negative values for any value driver” and “firms not covered by IBES, typically firms with low and medium market capitalization.” The authors noted that their “results may not be descriptive of startup firms reporting losses and high growth firms with negative operating cash flows” (p. 138).

The research in this paper examines MKT_t/REV_t multiples. The observations we delete due to non-positive denominators are minimal vis-à-vis studies on MKT_t/INC_t or MKT_t/BV_t multiples.³ Moreover, we present results for different samples, some of which represent companies with below average representation in previous research on market multiples (namely technology and smaller companies). The privately-held venture-backed company sample we examine has only recently been the subject of empirical research. Our results highlight how companies with either negative net income or negative book value can still be the subject of capital market multiple research as opposed to being ignored in a “deleted observations” subsample.

“Management” of Reported Financial Numbers

The earnings management literature has examined multiple dimensions, including analysis of the revenue series, various expense series, balance sheet items, and cash flow items. Stubben [2010] examines the ability of revenue and accrual models to detect simulated and actual earnings management. Callen, Robb, and Segal [2004] illustrate research with a focus on the revenue series. They report finding that “revenues are value relevant in explaining market value of equity whereas earnings are not significant in explaining the market value of equity for firms reporting negative earnings. Given our assumption that revenue manipulation flows through accounts receivable, we show that firms with a more extreme string of past and anticipated losses report higher accounts receivable to sales ratio” (p. 30). Bowen, Davis, and Rajgopal [2002] study

³ An analysis of Compustat companies listed on the NYSE, AMEX, or NASDAQ finds only 15 negative annual revenue observations over the 1980-2004 period. We examined the respective 10K’s of each of the 15 negative revenue observations – 3 were errors in Compustat.

revenue reporting policies of internet companies. They report that “the pressure to seek external financing influences Internet managers’ choices to report barter and/or grossed-up revenue.” The transitory revenue results in Section VIII of this paper provide further insight into how the reported revenue series may differ from that which the capital market views as value relevant.

Analysis of 1998-2000 Capital Market “Bubble”

Phrases such as “bubble period,” “irrational exuberance,” and “Internet euphoria” have been used to describe the 1998 to 2000 capital market period. There were major swings in the market capitalization of many companies in this period. Multiple studies have been undertaken of the valuation of Internet companies in this period (see for example, Trueman, Wong, and Zhang [2000, 2001] and Hand [2001, 2003]). These studies typically analyze companies in the era when stock prices were increasing or at historically ex post high levels. Core, Guay, and Van Buskirk [2003] examine the determinants of market to book value multiples for several samples (all firms, high-tech and young firms) in the 1975 to 1999 period. They conclude that while the regression models’ “explanatory power decline in the New Economy subperiod... the regression model’s structure during the New Economy subperiod is not unusual compared to other subperiods” (p. 43).

We analyze the 1980 to 2004 period, which includes the subsequent dramatic reductions in market capitalization of many stocks as well as their prior sizable runups. This coverage provides a stronger foundation to make inferences about the 1998-2000 period vis-à-vis other periods. Moreover, we examine venture-backed privately-held companies as well as publicly-traded companies. This sample provides further insight into the so-called “bubble period” as many public companies with dramatic increases in market capitalizations in the 1998-2000 period came from our venture-backed sample of companies.

Early-Stage Company Valuation and Growth

There is an emerging literature on how early stage companies grow over time and the factors that affect their valuation. One stream of this literature has focused on the valuation and financial evolution of privately-held venture capital backed companies (see, for example, Davila, Foster, and Gupta [2003], Hand [2005], and Armstrong, Davila, and Foster [2006]). Another stream of research examines revenues and revenue forecasts of these companies (see, for example, Armstrong, Davila, Foster, and Hand [2007]). A third stream examines the evolution of the management control systems (including revenue/sales budgeting) of early-stage companies – see, for example, Davila [2005], Davila and Foster [2005, 2007], Sandino [2007], Davila, Foster and Li [2009], and Davila, Foster and Jia [2010]. Research is also focusing on the financial statements prepared or released by start-up or privately held ventures – see Cassar [2009] and Allee and Yohn [2009]. Hand [2011] documents how, for a sample of 1,133 venture-backed companies, both financial (current year revenues) and non-financial (patents, headcount, etc.) explain one-year-ahead revenue forecasts. Extensive evidence on the revenue growth rates of early-stage companies in many countries is in Foster, Davila, Haemmig, He, Jia, von Bismarck and Wellman [2011]. The research in this paper extends this literature by examining factors that explain differences in the revenues of early-stage companies as well as the drivers of early-stage company valuation.

III RESEARCH HYPOTHESES EXAMINED

We examine the following three hypotheses:

- **Hypothesis One.** Smaller companies have higher MKT_t/REV_t ratios. Smaller companies are hypothesized to have greater potential for future higher revenue growth rates. There is strong evidence supporting Hypothesis One. This finding highlights the impact that sample deletion procedures can play in excluding interesting and important observations. Smaller companies, on average, are more likely to have negative net income or negative book value. They are also less likely to have extensive analyst coverage. In our samples, smaller companies are more likely to come from the high technology sector where intangible assets are of much interest. Revenues for

such companies potentially are an important signal that they are converting “investments” in intangible assets (ideas, innovations, discoveries, development of a sales force, etc.) into products/services commercially valued by customers or partners.

- **Hypothesis Two.** Companies with higher recent positive revenue growth rates will have higher MKT_t/REV_t ratios than companies with lower recent positive revenue growth rates. Past revenue growth is hypothesized to have significant momentum (i.e., persistence) such that the higher the most recent year’s revenue growth, the higher the likely future revenue growth. There is strong evidence supporting Hypothesis Two.

- **Hypothesis Three.** Companies with negative reported revenue growth and higher MKT_t/REV_t ratios have a higher likelihood of negative transitory revenue. Transitory revenue is the difference between reported revenue and underlying revenue. The capital market is hypothesized to use a broad information set (certainly larger than just the most recent revenue growth observation) and is able to identify the companies whose current reported revenue contains a higher negative transitory component. There is strong evidence supporting Hypothesis Three.

IV. Samples of Companies Examined

Three samples of companies are examined in this paper. These three samples were chosen to ensure sizable cross-sectional and time-series differences in MKT_t/REV_t multiples of the companies examined. They were also chosen to gain insight into the 1998-2000 period where MKT_t/REV_t multiples for large numbers of publicly and privately traded companies reached levels not previously encountered.

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

Companies of particular interest in our research are those with extreme movements in market capitalization. Extreme variation in the numerator of the revenue multiple enables the research to probe the magnitude of any associated variation in the denominator of the market-to-revenue multiple. The 1998-2001 period is a recent period with very large variations in market capitalizations. Focusing on this period, we used the following criteria to identify two subgroups with differing variations in market capitalization.

First, we calculated the sequence of end-of-month aggregate market capitalizations from January, 1998 to December, 2001 of all companies on the NASDAQ, AMEX, and NYSE exchanges 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.

Second, we then calculated the ratio of high-to-low market capitalizations (a) before the peak (from (1) and (2)), and (b) after the peak (from (2) and (3)). The average of the two ratios from (a) and (b) 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).⁴

⁴ The analysis used to identify the two Sample One sub-samples is conducted at the three-digit SIC industry level and not the company level. Our industry market capitalization amounts are based on all companies listed at the chosen date of interest. As new companies list or existing companies delist, there will be a changing number of companies underlying the aggregate industry market capitalizations at different dates.

Table 1 (Panel A) 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:⁵

- I. All Companies
- II. Pooled Selected SIC Industries (II.A + II.B + II.C + II.D)
 - II.A. Computer Hardware (357, 366, 367)
 - II.B. Computer Software (737)
 - II.C. Telecommunications (481)
 - II.D. Biotechnology/Pharmaceuticals (283)
- III. All Other Companies (in I. but not in II).

At the March 10, 2000 peak, our four selected industry groups comprised approximately 50% of the total market capitalization of the NYSE/AMEX/ NASDAQ. NASDAQ firms in Group II made up 57.6% of the total NASDAQ market capitalization. NYSE/AMEX firms in Group II made up 42.4% of NYSE/AMEX total market capitalization.

Although the Sample One selection criteria focused only on the 1998-2001 period, it is interesting to note that our Selected SIC industries subsample has differed from the All Other Companies subsample on several key risk related variables for many years prior to the 1998-2001 period. Appendix A reports that from at least 1985, companies in the Selected SIC Industries subsample have had (a) higher security market risk (measured by both the Beta and standard deviation of security returns), and (b) a higher percentage of companies with negative net income vis-à-vis the All Other Companies subsample. Some key differences we find between subsamples II and III in the 1998-2001 period are by construction of the research design. However, differences we observe both pre-1998 and post-2001 are not by construction.

⁵ March 10, 2000 is the date when the NASDAQ reached its peak value (up through December 31, 2004).

IV.B. Sample Two: Publicly Traded Internet Companies

In the late 1990's and early 2000's the phrase "internet company" was used to describe many new companies where the internet played a key role in user engagement or revenue yield. Revenues rather than net income was the more frequently used financial statement item in valuation analysis of these so-called Internet companies. This was in part due to most such companies not having positive net income, especially in the 1998-2001 period. Sample Two comprises publicly traded Internet companies drawn from 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).⁶ To facilitate comparisons with our SIC industry analysis, we cross-classified the 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) accounted for over 10 % of the Internet sample (as of 3/10/2001).

Table 1 (Panel B) lists the aggregate market capitalizations (as of 1/1/1998, 3/10/2000, and 12/31/2001) and the number of companies (as of March 10, 2000) for the following groups:

- I. All Internet Companies
- II. Pooled Selected Internet-SIC Industries (II.A + II.B + II.C + II.D)
 - II.A. Internet-Computer Hardware

⁶ There is no universally agreed upon definition of an Internet company. The accounting literature has relied heavily on the 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, 2001), Demers and Lev (2001), Hand (2001), Bartov, Mohanram and Seethamraju (2002), Davis (2002), Demers and Lewellen (2003), Keating, Lys and Magee (2003), and Bauman, Bauman and Das [2010]. Depending on whether the authors were targeting all Internet firms or just a subset (e.g., only B2C firms), sample sizes these papers analyzed range between 24 and 261. The finance literature approach appears to be to identify which new IPOs have an internet connection. The Ritter database has this approach as does Schultz and Zaman [2001], Ljungqvist and Wilhem [2003], and Ofek and Richardson [2002, 2003]. The samples in these papers ranged from 393 to 538.

- II.B. Internet-Computer Software
- II.C. Internet-Telecommunications
- II.D. Internet-(Miscellaneous) Business Services

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

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

The Internet sample is dominated by companies that went public after 1995.⁷ In contrast, Sample One includes companies of many different IPO and age vintages. The Internet sample is almost exclusively traded on NASDAQ. On March 10, 2000, 96.2% of the total companies in Sample Two were listed on NASDAQ. The NASDAQ internet companies made up 97.8% of the total NASDAQ/NYSE/AMEX Internet market capitalization on that date.

IV.C. Sample Three: Privately-Held Venture-Backed Companies

Revenues are a pivotal variable for valuing privately-held venture-backed companies. Venture capital exists, in part, to finance early-stage companies whose rapid growth aspirations often result in their having negative operating cash flow (and often negative income) in their early years. Our Sample Three draws on a VentureOne database. VentureOne is a commercial organization that collects and sells information about venture-backed companies and their investors. The focus is on each company up to the time of an IPO, a trade sale or some other exit. For each company included in its database, information on private 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 is available. Several financial statement-based numbers (revenue and net income) are also included for a subset of these companies. The database is at its

⁷ 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).

most comprehensive from the early 1990's onwards. 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 S-1 filings with the SEC).

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 Companies in Sample Three

I.A Software

I.B Consumer-Business Services

I.C Communications

I.D Biopharmaceuticals

I.E Hardware/Equipment

Table 1 (Panel C) summarizes the composition of these VentureOne industry groups. Of the 11,910 companies in Table 1 (Panel C), 1,262 had gone IPO by March 2005. We also report the number of these IPO companies that were classified as Internet companies using the Sample Two Internet company listing (from Jay Ritter's website). Approximately 18.9% (or 239 companies) of this 1,262 IPO Sample became publicly-listed Internet companies, with most (92.8%) of these having their IPO between 1996 and 2000. At the time of their public listing, the majority (55.25%) of the Venture One companies with IPO's are classified into the six 3-digit SIC code industries that comprise our Selected SIC Industry group in Sample One.

V. Time-Series and Cross-Sectional Distribution of MKT/REV Multiples

Figure 1 presents time-series plots from 1980-2004 for the MKT_t/REV_t (the ratio of market capitalization of common equity to the most recent annual revenue) multiple for Samples One to Three. Each plot has the 90th, 70th, 50th, 30th, and 10th percentiles of the annual cross-sectional distribution. These percentiles are computed on a year-by-year basis. Sample One has two subsamples. Both have similar scales (0 – 100) in Figure 1 to facilitate comparability. The Selected SIC Industries subsample was selected based on high market capitalization variation in the 1998-2001 period vis-à-vis the All Other Companies subsample. There are dramatic MKT_t/REV_t multiple differences across these two subsamples in Figure 1. The 90th and 70th percentiles of the Selected SIC Industries subsample are consistently higher than that of the comparable deciles for the All Other Companies subsample. The MKT_t/REV_t plots for Samples Two and Three are scaled (0 to 350) higher than for Sample One to reflect the sizably higher 90th MKT_t/REV_t percentile values, especially in the 1999 to 2000 period. Specific values for the 90th percentile across the different samples for selected years are:

	1985	1995	1998	1999	2000	2001	2002	2004
Sample One: NASDAQ/NYSE/AMEX								
Selected SIC Industries	6.6	20.2	18.6	80.3	46.1	27.4	13.9	41.7
All Other Companies	5.1	5.1	4.6	5.9	6.1	5.4	4.4	7.2
Sample Two: Internet Companies	-	-	85.6	233.1	33.5	9.1	5.5	11.6
Sample Three: Venture-Backed Companies	-	78.3	142.5	161.0	332.5	149.8	233.4	100.0

In subsequent sections of this paper, we examine hypotheses that pertain to these time-series or cross-sectional differences in MKT_t/REV_t multiples.⁸

⁸ One caveat on the sizably higher levels of the Sample Three MKT_t/REV_t multiples is that VentureOne uses as one of its information sources the S-1 filings of companies attempting to have an IPO. This may bias the private company sample to the more successful venture-backed private companies. However, many non-IPO exits for such private companies are in trade-sales (acquisitions) for which market competition can be intense. See Appendix A of Armstrong, Davila and Foster [2006] for discussion and evidence of

VI. Hypothesis One: Company Size and MKT/REV Ratios

Hypothesis One is that smaller companies have higher MKT/REV ratios. Theoretical valuation models often include a growth term. For example, in the classic Miller-Modigliani [1961] framework, growth was defined as investments with returns greater than their cost of capital – see Fama and Miller [1972]. Much subsequent valuation research has used the Black-Scholes [1973] option-theoretic framework to incorporate growth options into equity valuation. Hypothesis One rests on smaller companies providing higher growth potential than larger companies. At an extreme level, high compound growth rates over extended periods will constrain larger companies before smaller companies due to theoretical limits imposed by the size of the market, industry or economy in which the company operates. For any innovative product that creates a given new market demand, the relative effect on a company’s revenue or net income will be greater for a smaller company than for a larger company. Smaller companies may also encounter fewer regulatory obstacles in their early growth strategies.

Figure 2 shows the 90th, 70th, 50th, 30th, and 10th percentiles of distribution for the MKT/REV ratio for five company size categories. These five categories (in \$ millions of revenues) and the percentage of observations in each category for the three samples we examine are:

	I \$0-\$5	II \$5-\$25	III \$25-\$100	IV \$100-\$1000	V > \$1000
Sample One: NASDAQ/NYSE/AMEX					
Selected SIC Industries	17.5%	23.7%	24.8%	23.8%	10.2%
All Other Companies	10.8%	16.4%	21.6%	34.1%	17.4%
Sample Two: Internet Companies	10.5%	27.3%	31.7%	26.2%	4.3%
Sample Three: Venture-Backed Companies	32.8%	40.1%	21.1%	5.9%	0.1%

possible biases from a sample that is exclusively comprised of venture-backed private companies that filed for an IPO.

Not surprisingly, Sample Three (VC-backed private companies) contains the highest percentage of observations in each of the two smallest company size categories (\$0 - \$5 million and \$5 - \$25 million in revenue) and the lowest percentage in the largest company size category (> \$1,000 million in revenue). The All Other Companies subsample of Sample One has the lowest percentage of observations in the two smallest categories and the highest percentage in the largest category. The Selected SIC Industries subsample has 41.2% of observations in the \$0 - \$25 million revenue size range compared to 27.2% of observations for the All Other Companies subsample of Sample One.

Figure 2 (Panel A) shows the Sample One MKT_t/REV_t distribution over the 1980 to 2004 period for the five company size categories. The vertical MKT_t/REV_t scalings on the five size categories are as follows: \$0-\$5 million (scale of 0-400); \$5-\$25 million (0-35); \$25-\$100 million (0-20); \$100-\$1000 million (0-20); > \$1000 million (0-15). The 90th percentile MKT_t/REV_t value for the smallest company group (\$0-\$5 million) is consistently, over time, higher than the 90th percentile MKT_t/REV_t value of the other four company size categories for both the Selected SIC Industries subsample and the All Other Companies subsample. Figure 2 (Panel B) shows company size breakdowns for Samples Two and Three. Results are shown only for a subset of years and a subset of company size categories due to either zero or minimal observations in some years or company size categories. For example, it is only since (approximately) 1996 that a sizable number of Internet companies have been publicly listed. Very few VC-backed companies with over \$100 million of revenues have remained private stand-alone companies. The vertical MKT_t/REV_t scalings in Panel B on the five size categories are \$0-\$5 million (scale of 0-2,500); \$5-\$25 million (0-300); \$25-\$100 million (0-120); \$100-\$1000 million (0-70); > \$1000 (0-25). The most extreme MKT_t/REV_t values plotted in Figure 2 (Panel B) are those for the smallest company size category for both Samples Two and Three.

In Section IX of this paper we include company size (revenues) as an independent variable in a multivariate regression analysis with MKT_t/REV_t as the dependent variable. The company size

variable consistently has a negative coefficient that is highly statistically significant across all samples examined. In the next section of this paper we explore the recent revenue growth hypothesis and highlight how company size also is central to understanding the relative effect of recent revenue growth on MKT/REV ratios.

VII. Hypothesis Two: Recent Revenue Growth and MKT/REV Ratios

Hypothesis Two is that companies with higher recent positive revenue growth rates will have higher MKT_t/REV_t ratios than companies with lower recent positive revenue growth rates. Its rationale is that the most recent revenue growth is a value-relevant predictor of future revenue growth or other value-relevant variables. The early literature on the time-series properties of accounting numbers focused on earnings. The key conclusion from multiple studies was that the first differenced earnings series was either serially uncorrelated or in some studies exhibited statistically significant negative serial correlation – see, for example, Ball and Watts [1972].⁹ In contrast, the revenue series shows statistically significant evidence of positive serial correlation. We computed autocorrelations for lags 1 to 4 for the first differenced annual revenue series for companies in our two groups for Sample One.¹⁰ The time-period is 1980 to 2004. Table 2 shows the results. For comparison purposes, we also report results for the operating income series and the income before extraordinary items series. The Selected SIC Industries group in Sample One has over 20,000 observations while the All Other Industries group has over 90,000 observations. Table 2 highlights the statistically significant evidence of positive autocorrelation for the first differenced annual revenue series for both Sample One groups. Moreover, the Selected SIC Industries group ($r_1=0.36$; $r_2=0.18$; $r_3=0.16$; $r_4=0.17$) shows stronger positive autocorrelations than the All Other Companies group ($r_1=0.18$; $r_2=0.02$; $r_3=0.07$; $r_4=0.09$). The positive autocorrelations for revenues in Table 2 contrasts sharply with the minimal to negative autocorrelations for both the operating income series and the income before extraordinary items series.

⁹ Ball and Foster [1982] and Foster [1986, pp. 238-245], provide reviews of this early literature.

¹⁰ Samples Two and Three have too limited a time-series for individual companies to compute comparable autocorrelations.

We now explore further evidence pertaining to our Hypothesis Two – companies with higher recent positive revenue growth rates will have higher MKT_t/REV_t ratios. In Section IX we present multivariate regression results that strongly support this hypothesis. This section of our paper highlights key factors that warrant recognition in quantifying the importance of past revenue growth in MKT/REV analysis. Annual revenue growth is computed as

$$\left(\frac{Revenue_t}{Revenue_{t-1}} - 1 \right) \times 100\%$$

For a subset of observations there is information for $revenue_t$, but not for $revenue_{t-1}$ in our databases. For Samples One and Two, this is primarily due to newly-listed companies. Sample Three has a subset of missing observations due to the VentureOne data not always having a full sequence of annual revenue numbers. Note that where the private company in Sample Three starts in year t , there is no year $t-1$ annual revenue number by definition. The percentage of observations that fall in the positive revenue growth (or no change), negative revenue growth, and missing observations categories are:

	Positive Revenue Change	Negative Revenue Change	Missing Observation	Total
Sample One: NASDAQ/NYSE/AMEX Companies				
Selected SIC Industries	58.2%	28.7%	13.1%	100.0%
All Other Companies	62.6%	27.6%	9.8%	100.0%
Sample Two: Internet Companies	48.3%	26.1%	25.6%	100.0%
Sample Three: Venture-Backed Companies	61.9%	7.2%	30.9%	100.0%

The “missing observation” category appears to be not a random sample and is of considerable interest in any study on market-to-revenue multiples or revenue growth.

A. Annual Revenue Growth Rates, Industry/Sector, and Time Period

Cross-sectional distributions of the annual revenue growth rate from 1980 to 2004 are presented in Figure 3 for the Selected SIC Industries (Panel A) and All Other Companies (Panel B) subsamples of Sample One. Several patterns are observable in Figure 3. First, the 90th percentile

for the Selected SIC Industries group consistently exceeds the 90th percentile for the All Other Companies Group over the 1980-2004 period. The Selected SIC Industries has consistently had higher revenue growth in the upper tail of its distribution. Second, there is consistently larger revenue growth variability for the Selected SIC Industries group than the All Other Companies group. One measure of variability in revenue growth is the 90th to 10th interpercentile range. Panel C in Figure 3 plots this interpercentile range for the two groups over the 1980 to 2004 period. For 1999 and 2000, the interpercentile range had values of 266% and 305%, respectively, which is well above the range outside of the 1998-2000 period. Every year from 1980 to 2004, the interpercentile range for the Selected SIC Industries is larger. Recall that the industries in the two subsamples were chosen using **only** 1998-2001 information. The results in Figure 3 and Appendix A highlight how the Selected SIC Industries exhibited higher variability and higher risk in both capital market and fundamental measures long before the 1998-2001 period.¹¹

The MKT_t/REV_t multiples in Figure 1 for Sample Two (the Internet Sector) typically exceed those for the Selected SIC Industries in Figure 1 for comparable years. Figure 4 presents annual revenue growth rates for the 90th, 70th, and 10th percentiles that highlight that Sample Two, likewise has higher revenue growth rates vis-à-vis Sample One for the 90th and 70th percentiles, especially in the 1998 to 2000 years. The magnitude of the 90th and 70th percentiles for the Internet companies (i.e., Sample Two) during 1998 to 2000 are well above either of the two Sample One subgroups for comparable years and well above historical revenue growth rates for the Sample One subgroups before the advent of Internet companies.

¹¹ The higher risk Selected SIC Industries subsample had dramatically higher positive security returns in the 1998-2000 period. Capital market theory would predict that these companies would also have dramatically more negative security returns in the event of a market decline. This is exactly what happened by December 2001. Table 1 shows the following aggregate market capitalizations (in \$ billions):

	1/1/1998	3/10/2000	12/31/2001
Selected SIC Industries	\$2,849	\$9,262	\$4,593
All Other Companies	\$8,202	\$9,135	\$9,619

Figure 4 also plots annual revenue growth rate deciles for the privately-held venture-backed companies (Sample Three). The vertical scales for Samples One and Two in Figure 4 are identical (90th percentile: scale of 0-800%; 70th percentile: 0-300%) to visually highlight the higher annual revenue growth for the Internet Companies vs. the Selected SIC Industries and for the Selected SIC Industries vs. All Other Companies. Sample Three is scaled differently (90th percentile: scale of 0-2,000%; 70th percentile: 0-500%) to avoid differences across other samples being visually diminished by the extreme revenue growth rates for the venture-backed private companies. Sample Three has even higher annual revenue growth rates than either Samples One or Two. Note also the dramatic declines in annual revenue growth rates in Figure 4 for the Selected SIC Industries (in 2001), the Internet companies (in 2001), and the venture-backed companies (in 2002 and 2003).

Table 3 shows the distribution (10th, 20th, ..., 80th, 90th percentiles) of revenue growth rates for our five different size company categories and for the pooled sample. The data in Table 3 highlights how smaller companies have both higher negative revenue growth rates (see the 10th and 20th percentiles) and higher positive revenue growth rates (see the 80th and 90th percentiles).

B. MKT/REV Multiples and Sign/Size of Revenue Growth Rates

Other things being equal, it is expected that the capital market favorably values companies with positive recent revenue growth vis-à-vis companies with negative revenue growth. Table 4 reports distribution statistics (10th percentile, 50th percentile, 90th percentile) for the MKT_t/REV_t multiple for three mutually exclusive groups:

- A.) Companies with positive or zero reported revenue growth in the most recent year,
- B.) Companies with negative reported revenue growth in the most recent year, and

C.) Companies without the prior or current year's reported revenue number in the database with which to compute a revenue growth rate (typically, these are newly-listed companies in Samples One and Two¹²)

These three groups do not appear to have similar MKT_t/REV_t distributions, especially in their upper tails. The groups with the highest MKT_t/REV_t observations in their upper tails are typically those in either the negative revenue growth group or the missing revenue growth group. This is counter to the expectation noted above.

Consider the MKT_t/REV_t distribution comparison between the negative revenue growth group and the positive revenue growth group. The ratio of the 90th MKT_t/REV_t percentile of the negative revenue growth group to the 90th MKT_t/REV_t percentile of the positive revenue growth group exceeds one for most years. Summary data for this ratio are:

	Time Period	Average Ratio	# Years with Ratio > 1
Sample One: NASDAQ/NYSE/AMEX			
Selected SIC Industries	1980-2004	2.36	22/25
All Other Companies	1980-2004	1.58	22/25
Sample Two: Internet Companies	1997-2004	5.26	3/8
Sample Three: Venture-Backed Companies	1992-2004	31.87	13/13

For Samples One and Three, there is a consistent pattern for the 90th MKT_t/REV_t percentile for the negative revenue growth group exceeding that of the positive revenue growth group. The pattern for Sample Two (Internet companies) is less consistent. While the mean ratio of 5.26 is greater than 1, it is heavily impacted by the 1995 observation where the 90th percentile is 2,101.6. The MKT_t/REV_t distribution for the missing revenue observation sample is typically even more positively skewed than the other two groups in Table 4.

¹² For companies in Sample Three, there is occasionally a missing current year's reported revenue number due to the absence of a regulatory mandate for private companies to publicly disclose financial data. VentureOne relies in part on voluntary disclosure by private companies in their financial data bases and also on regulatory disclosures. (S-1 filings associated with an IPO are a key data source. These S-1 filings can be used to "back-fill" numbers not previously publicly disclosed.)

Hypothesis Three explores the potential role of transitory revenue in explaining the extreme positive skewness in MKT_t/REV_t ratios for the negative revenue growth subsample in Table 4.

VIII. Hypothesis Three: Transitory Revenue and MKT/REV Ratios

Hypothesis Three is that companies with negative revenue growth and higher MKT_t/REV_t ratios have a higher likelihood of negative transitory revenue. The concept of transitory revenue is a potential explanation for the Table 4 counter-intuitive result that the median and upper percentiles of the MKT/REV ratio of companies with negative revenue growth exceed those with positive revenue growth.

Transitory revenue is linked to *reported revenue* and *underlying revenue* as follows:

$$\begin{array}{ccccc} \text{Reported} & & \text{Underlying} & & \text{Transitory} \\ \text{Revenue} & = & \text{Revenue} & + & \text{Revenue} \end{array}$$

Reported revenue is what each company reports in its financial statements. We compute MKT/REV as market capitalization at the end of the fiscal year end divided by the reported revenue for that fiscal year. *Underlying revenue* is the (unobservable) variable that the capital market perceives as relevant to capturing the ongoing revenue generating capacity of a company in a given period. *Transitory revenue* are components that are noise in inferring underlying revenue from reported revenue.¹³ Examples of components include random and “one-off” events, activities by management to shift/misrepresent reported revenues across periods, and the revenues that result from using accounting methods not viewed as appropriate by the capital market.

Revenue Growth Transition Matrix Analysis

¹³ Beaver and Morse [1978], Beaver [1989, pp. 91-101], and Foster [1986, pp. 436-443] provide further discussion of the “transitory” vs. “permanent” distinction with respect to reported earnings.

Insight into the role of transitory revenue can be gained by examining the multi-year behavior of revenue growth from portfolios formed using MKT_t/REV_t for (a) positive revenue growth observations, (b) negative revenue growth observations, and (c) missing observations. We use several steps to construct a transition matrix:

- 1.) For all of the observations in year t , compute and rank the year t revenue growth ($t/t-1$) for those observations with available information. Form 10 equally-sized portfolios. Portfolio 1 has the lowest (starting with the most negative) revenue growth rate and Portfolio 10 has the highest (finishing with the most positive). An 11th portfolio of observations with missing revenue growth in year t is also formed
- 2.) For each of the ten portfolios from step 1, compute and rank the year $t+1$ revenue growth ($t+1/t$) and form 10 equally-sized portfolios.

Table 5 presents the results in a percentage of observations format for the transition matrix. Under the null hypotheses of no association across years in revenue growth, each cell in the 10 x 10 matrix is expected to have the same percentage of observations. Three patterns observable in Table 5 are:

- 1.) The revenue “momentum” corner portfolios in Table 4 – [1,1] for successive years of lowest growth and [10,10] for successive years of highest growth – have higher than expected percentages:

	Portfolio 1,t/ Portfolio 1,t+1	Portfolio 10,t/ Portfolio 10,t+1
Sample One: NASDAQ/NYSE/AMEX		
Selected SIC Industries	27.42%	37.87%
All Other Companies	29.60%	34.93%
Sample Two: Internet Companies	26.67%	41.82%
Sample Three: Venture-Backed Companies	21.15%	36.59%

Momentum in the [10,10] corner is consistent with economic factors giving current high revenue growth companies a sustaining advantage over multiple years (e.g., due to, say, superior

branding, exclusive patents, deeper customer relationships, or a sustainable low-cost advantage). Here, above average revenue growth $t/t-1$ is likely to indicate above average revenue growth in $t+1/t$. Momentum in the [1,1] corner is consistent with the factors giving rise to revenue decline (e.g., poor quality problems, inexperienced management repeatedly incurring self-inflicted wounds, or aggregate market declining due to a disruptive technology) persisting over multiple years.

2.) The “reversal” corner portfolios in Table 5 – [1,10] and [10,1] – have above expected percentages for both corners of the Sample One transition matrix, for neither of the reversal corners for the Sample Two matrix, and only the [Port 1, t ; Port 10, $t+1$] corner for Sample Three:

	Portfolio 1,t/ Portfolio 10,$t+1$	Portfolio 10,t/ Portfolio 1,$t+1$
Sample One: NASDAQ/NYSE/AMEX		
Selected SIC Industries	17.95%	14.37%
All Other Companies	16.10%	13.99%
Sample Two: Internet Companies	6.06%	5.45%
Sample Three: Venture-Backed Companies	13.94%	5.23%

Above average “reversal” is consistent with transitory revenue growth being a sizable component of reported revenue growth for some companies. For Samples One and Three, the [Port 1, t ; Port 10, $t+1$] combination is above average. Negative transitory revenue growth in year t will likely result in an annual revenue growth in year $t+1$ that is above average (due to the “abnormally” low year t reported revenue in the numerator of year t and the denominator in year $t+1$).

3.) Table 5 shows the row percentages for those observations with a missing revenue number in the REV_t/REV_{t-1} computation. Using the portfolio cutoff points for year $t+1$ we classify those observations into one of the ten REV_{t+1}/REV_t portfolios.¹⁴ The percentage membership of the ten

¹⁴ Specifically, for each Sample of companies, we form ten equally sized portfolios based on the observation’s revenue growth from year t to year $t+1$ (excluding the missing revenue growth observations). We then use the lowest and highest revenue growth for each portfolio to establish the revenue growth range

revenue growth portfolios in year $t+1$ indicate that the year t subsample with missing observations has a disproportionately higher percentage in the higher revenue growth portfolios in year $t+1$. For example, the combined percentages in portfolios 9 and 10 are: Sample One – Selected SIC Industries (52.99%); Sample One – All Other Companies (45.32%); Sample Two – Internet Companies (56.09%); and Sample Three – Venture-backed Companies (43.81%). One explanation for Sample One and Two is that the newly-listed IPO companies include those from Sample Three. Figure 4 documents the quantumly higher revenue growth rates in the private company sample.

Multi-Year Analysis of MKT/REV Portfolios With Different Sign of Annual Revenue Growth

Across each of the three samples, there is a positive revenue growth expectation. For instance, the median annual revenue growth rates are: Sample One – Selected SIC Industries (11.4%); Sample One – All Other Companies (8.4%); Sample Two – Internet Companies (47.1%); and Sample Three – Venture-backed Companies (56.0%). Hypothesis Three is that companies with reported negative revenue growth will likely include a subset where the current reported revenue number includes a sizable negative transitory component. We now examine whether the capital market sets MKT_t/REV_t multiples recognizing this negative transitory component in an empirically observable way. We first examine the sample with positive revenue growth observations, in part to use it as a benchmark to interpret the sample with negative revenue growth observations.

Figure 5 (Panel A) shows the median company revenue growth rates for ten portfolios ranked on the basis of their MKT_t/REV_t values; Panel A is based only on observations with positive revenue growth in year t . These ten portfolios comprise the top 10%, next 10%, ..., bottom 10% of MKT_t/REV_t observations for each company/year combination. By construction, they range from

of each of the ten portfolios. The observations with missing revenue growth from year $t-1$ to year t are then assigned to one of the ten portfolios based on their revenue growth from year t to year $t+1$. We report these assignments in Table 5.

the highest to the lowest MKT_t/REV_t observations. However, this does not mechanically rank the portfolios on the basis of revenue growth. Table 6 reports the correlation between the median MKT_t/REV_t multiple of each portfolio and its median annual revenue growth. The analysis is conducted for the annual revenue growth at year t , year $t+1$, and year $t+2$ for the ten portfolios constructed in year t . For the subsample of observations with positive revenue growth in the year the MKT_t/REV_t multiple is computed (i.e., year t), there is a significant positive correlation at the portfolio level between MKT_t/REV_t and annual revenue growth in each of years 1, 2, and 3 for Samples One (both Selected SIC Industries and All Other Companies) and for Sample Three. The Internet sample has significant positive correlations in years 1 and 2, but not in year 3. A word of caution is appropriate in interpreting the Internet sample results. The analysis in Figure 5 is conducted in event time (rather than calendar time). The sample with the least diversification in constructing multiple sequences of calendar time to package in event time is the Internet sample. The Internet sample is heavily concentrated in the 1997 to 2002 period and exhibits the most precipitous drop in annual revenue growth in 2000 and beyond (see Figure 4). In contrast, Samples One and Three have longer time sequences to effect the time period diversification.

The general finding from Figure 5 (Panel A) is that the capital market sets higher MKT_t/REV_t multiples for companies with positive revenue growth not only in year t , but also with the realized growth rates in years $t+1$ and $t+2$. For the observations with positive annual revenue growth, there is support for both the sign and magnitude of past revenue growth as well as subsequent realized revenue growth being positively associated with MKT_t/REV_t multiples.

Figure 5 (Panel B) and Table 5 both report results for those observations with negative revenue growth. There is a key dramatic difference from the positive revenue growth observations in Figure 5 (Panel A). In the year the ten MKT_t/REV_t portfolios are formed (i.e., year t), there is a high negative correlation between the median MKT_t/REV_t in year t of each portfolio and the magnitude of the revenue growth in year t . This significant negative correlation supports the

hypothesis that reported revenue in year t includes a negative transitory revenue component that the capital market takes into account. The more negative the transitory revenue component, the lower the denominator of the MKT_t/REV_t computation. Hypothesis Three can be empirically probed by observing the realized annual revenue growth rates in years $t+1$ and $t+2$ for the ten portfolios in Panel B. The revenue growth rates in years $t+1$ and $t+2$ are positively correlated with the MKT_t/REV_t multiples. This flipping of the sign and magnitude of the portfolio revenue growth rates between year t and year $t+1$ in Panel B is most marked for Samples One and Three. Our results are consistent with Hypothesis Three – the capital market sets MKT_t/REV_t multiples such that the magnitude of transitory revenue is recognized; higher MKT_t/REV_t multiples are assigned to those negative Year t revenue growth companies with higher realized (and presumably expected) annual revenue growth in years $t+1$ and $t+2$.

Table 6 shows results for: (a) the correlations between median MKT_t/REV_t and median annual revenue growth in years t , $t+1$, and $t+2$ (in Panel A), and (b) the correlations between median annual revenue growth of the ten MKT_t/REV_t portfolios for pairs of years t , $t+1$, and $t+2$ (in Panel B). The correlations in Panel B highlight the revenue momentum factor for the positive revenue growth subsample. It is the strongest in samples One and Three. The Internet companies in Sample Two exhibit significant evidence of revenue momentum between years t and $t+1$, but none between years t and $t+2$ or between years $t+1$ and $t+2$. The results for the negative revenue growth portfolios in Panel B highlight the reversal pattern associated with the negative transitory revenue component in year t . Note also the positive correlations between the median annual revenue growth rates across portfolios between years $t+1$ and $t+2$ (with the Internet sample having the lowest positive correlation). Portfolios formed on MKT_t/REV_t in year t for a sample with negative revenue growth have positive Pearson correlations between median annual revenue growth rates in years $t+1$ and years $t+2$ of 0.98 (Sample One – Selected SIC), 0.95 (Sample One – All Other), 0.45 (Sample Two – Internet), and 0.90 (Sample Three – Venture-backed). This is

strong support for our negative transitory revenue hypothesis for the MKT_t/REV_t multiples of negative revenue growth companies in year t .

IX. Multivariate Analysis

This section incorporates our prior analysis into a multivariate framework. Table 7 presents rank regression results that further probe the three hypotheses for our three samples. We present results for rank regressions due to the extreme observations found in each of the three samples:

Dependent Variable	MKT_t/REV_t
Independent Variables	
Company Size	$\log(REV_t)$
Current Revenue Growth	$[(REV_t/REV_{t-1}) - 1]$
Future Revenue Growth	$[(REV_{t+1}/REV_t) - 1]$
Profitability	Income/Revenue if > 0 Neg. Income/Revenue if ≤ 0
Leverage	$\frac{\text{Long-term debt}}{\text{Total assets}}$
1998-2000 Time Period	Indicator = 1 if 1998-2000

Table 7 reports results for the regression with combinations of independent variables. Regression #1 reports results that pertain to Hypothesis One which predicts a negative relationship between MKT_t/REV_t and company size. Across each of the samples for Regression #1, this hypothesis is strongly supported. Hypothesis Two – companies with higher positive current revenue growth will have higher MKT_t/REV_t – is consistently supported by the Regression 2 results. Regressions 3 to 5 combine variables related to company size, current revenue growth, and future revenue growth (defined as the realized revenue growth in Year $t+1$ /Year t). The future revenue growth variable is added in Regressions 3b, 4 and 5 to recognize that the capital market uses a broad based information set when forecasting future revenue growth. Both the current revenue growth and the future revenue growth measures are expected to have measurement error regarding capturing the expected revenue growth implicit in MKT_t/REV_t . The current revenue

growth variable (REV_t/REV_{t-1}) will incorporate factors affecting Year t but not expected to affect subsequent years. The future revenue growth variable (REV_{t+1}/REV_{t-1}) will incorporate factors affecting Year t+1 that were unanticipated at the end of Year t. Both measures also are scalars (representing one year of revenue growth) whereas the capital market likely is impounding a vector (representing revenue growth over a sequence of future years). The regression results in Regressions 1 to 5 consistently support Hypotheses 1 and 2.

Existing textbooks emphasize the importance of profitability in capital market valuation – see, for example, Palepu and Healy [2007] and Penman [2009]. Regression #6 reports regression results for MKT_t/REV_t as the dependent variable and two related profitability independent variables:

- INC/REV (Net Income/Revenues) – if net income is positive or zero
- $NEGINC/REV$ (Negative Net Income/Revenues)

We include these two separate profitability variables due to prior research documenting “anomalous” results for the loss company observations.¹⁵ Results are reported for the two publicly traded company samples; the VentureOne database has limited net income observations for the privately held Sample Three companies. For both Sample One subsamples the coefficients on the two profitability variables are positive and statistically significant – the more profitable the company, the higher the MKT_t/REV_t multiple. However, the internet companies show insignificant coefficients on the two profitability variables in Regression #6.

Regression #7 pools the independent variables in Regression #1 to #6. We also include two additional variables:

- Financial leverage (long-term debt to total assets)
- 1998-2000 time period intercept dummy variable

The rank regressions in Regression #7 provide strong support for Hypotheses One and Two in a multivariate context.

¹⁵ Collins, Pincus and Xie [1999] report results showing an “anomalous significantly negative price-earnings relation using the simple earnings capitalization model for firms that report losses” (p.29).

Sample Two (internet companies) alone has several changes in the sign or significance of individual independent variables for Regression #7 vis-à-vis Regressions #1 to #6. In Regression #7, the coefficient on the future revenue growth for Sample Two is positive and significant whereas the coefficient on the current revenue growth is positive but insignificant; both growth variables are positive and significant in Regression #4 and #5. Regression #7 reports significant positive coefficients on the two profitability variables for Sample Two whereas they were insignificantly negative in Regression #6.

A comparison of the R^2 's across selected regressions provides additional insight into the differing significance of the company size, revenue growth, and profitability variables. We successively use the Adjusted R^2 's in Regression #1 (company size), #4 (revenue growth), and #6 (profitability) as the numerator and the Adjusted R^2 in Regression #7 as the denominator:¹⁶

	Sample One		Sample Two Internet Companies	Sample Three VC-Backed Private Companies
	Selected SIC Industries	All Other Companies		
Company Size (#1 / #7)	$\frac{8.2\%}{36.9\%} = 22.2\%$	$\frac{9.5\%}{43.6\%} = 21.8\%$	$\frac{7.1\%}{40.1\%} = 17.7\%$	$\frac{68.1\%}{67.2\%} = 101.3\%$
Revenue Growth (#4 / #7)	$\frac{11.1\%}{36.9\%} = 30.1\%$	$\frac{6.0\%}{43.6\%} = 13.8\%$	$\frac{35.7\%}{40.1\%} = 89.0\%$	$\frac{20.9\%}{67.2\%} = 31.1\%$
Profitability (#6 / #7)	$\frac{15.7\%}{36.9\%} = 42.5\%$	$\frac{30.2\%}{43.6\%} = 69.3\%$	$\frac{4.3\%}{40.1\%} = 10.7\%$	-

For the two Sample One subgroups of companies, profitability variables contribute the most explanatory power. Revenue growth is more important for the Selected SIC Industries than for the All Other Companies; the R^2 for revenue growth variables in Regression #4 are 30.1% of the Regression #7 R^2 for the Selected SIC Industries subsample, but only 13.8% for the All Other Companies subsample. Revenue growth is the dominant contributor for Sample Two (Internet

¹⁶ Due to possible collinearity among the company size, revenue growth, and profitability variables, the sum of these percentages may overstate the combined explanatory power of these variables in a multivariate context.

Companies) while company size is the dominant contributor for Sample Three (venture-backed private companies).

Table 8 reports for Sample One rank regressions for the (a) positive revenue growth, (b) negative revenue growth, and (c) missing revenue growth observation subsamples in panels A through C, respectively. The positive revenue growth subsample is the largest subsample and has results similar to Regression #7 in Table 7. The negative revenue growth subsample has a sign reversal on the two revenue growth independent variables – the coefficient on current revenue growth is significantly negative while the coefficient on future revenue growth is significantly positive. These results support Hypothesis Three and are consistent with the “flipping” of the portfolio revenue growth rates in Year t and Year $t+1$ in Figure 5 (Panel B). The missing observations subsample has (by definition) no current revenue growth independent variable; the coefficient on the future revenue growth variable is significantly positive.

The multivariate results in Tables 7 and 8 reinforce the findings reported in prior sections.

Revenue growth and company size are key determinants of MKT_t/REV_t multiples. Moreover, the capital market is able to distinguish (in a probabilistic sense) cases where both current and future revenue growth are positively correlated from cases where they are negatively correlated.

X. Overview and Extensions Of Research

Our findings have implications for research in at least four areas – capital market valuation, “management” of reported financial numbers, analysis of the 1998-2000 capital market “bubble era”, and early-stage company valuation and growth.

Capital Market Valuation Research

Prior capital market research has recognized that deleting observations with negative net income or negative book value results in samples under-represented in:

- a.) high-technology companies, and
- b.) younger early-stage companies

The samples examined in this paper include a broad cross-section of (a) and (b) companies as well as companies from other industries and in their post early-stages. We document several marked features of (a) and (b) companies. Such companies typically have higher revenue growth rates, higher variability in revenue growth rates, and a higher negative income likelihood. The strong support for our Hypothesis One (negative association between MKT_t/REV_t and company size) and Hypothesis Two (positive association between MKT_t/REV_t and recent positive revenue growth) highlights the importance of recognizing company size and revenue growth variables in company valuation research. Note, moreover, that these variables are also highly statistically significant in a broad sample of non-high technology publicly traded companies (Sample One – All Other Companies).

Our analysis is of increased interest in the post-“internet bubble” period given the continued high profile valuation of select individual early-stage companies e.g., Facebook (2004/2005 startup), Zynga (2007 startup), and Groupon (2008 startup).

Management of Reported Financial Numbers Research

The earnings management literature hypothesizes that management proactively uses accounting rules (such as revenue or expense recognition) to change reported accounting numbers. One explanation for a transitory component in reported numbers is management accounting “adjustments” for reasons related to misrepresenting underlying economics e.g., changing software revenue recognition assumptions to maximize a compensation bonus or an earn-out provision. However, other explanations (of a non-management manipulation kind) for the transitory component exist – e.g., a negative transitory revenue component could be due to a delay in a recurring computer hardware sales shipment cycle due to an unexpected shortage of

component parts. In some cases, a negative transitory revenue component in Year t may well result in a positive transitory revenue component in Year $t+1$. Research on ways to better identify contexts where transitory revenue is sizable (and their possible explanations) can assist the probing of earnings “management” hypotheses. The research in this paper used the joint combination of (i) a high MKT_t/REV_t multiple, and (ii) a negative current revenue growth to identify negative transitory revenue contexts. Alternative combinations of MKT_t/REV_t levels and revenue growth rates could potentially be used to identify positive transitory revenue contexts. Note that a key assumption here is that the capital market is able to identify (in a relatively high probabilistic sense) this transitory component when setting MKT_t/REV_t multiples.

Analysis of 1998-2000 Capital Market “Bubble Era”

The working assumption in many descriptions of the 1998-2000 capital market period is that company fundamentals did not explain the historically high levels of market multiples. Our research looks at both the pre and post behavior of revenue growth and documents their dramatic decline in 2000/2001 vis-à-vis 1998-2000. We document that industries with the largest increases/decreases in market capitalization in the 1998-2001 period had characteristics that identified them as relatively high risk for an extended period **prior to** 1998 e.g., higher beta, higher standard deviation of security returns, and higher percentage of negative net income. Our results are consistent with capital markets behaving more rationally along the predictions of capital market theory than many observers are willing to recognize.

Our results also highlight that the capital market 1998-2000 surge and subsequent decline in valuations was not restricted to the so-called internet companies that have been the focus of many research studies. While internet companies exhibited very high positive (negative) rates of returns in the 1998-2000 (2000-2001) period, the dollar amount of their aggregate market capitalization increase/decrease is dwarfed by the aggregate increase/decrease in market capitalization of our Selected SIC Industries group, which comprise the broader computer software/hardware/telecommunications/biotech-pharmaceuticals sectors. Aggregate market

capitalizations of our Selected SIC Industries group and the Internet Companies are (from Table 1 - \$ billions¹⁷):

	Selected SIC Industries	Internet Companies	Selected SIC Industries Excluding Overlapping Internet Companies
Aggregate Market Capitalizations			
1/1/1998	\$ 2,489	\$ 80	\$ 2,412
3/10/2000	9,262	1,630	7,762
12/31/2001	4,593	279	4,337
Aggregate Changes			
1/1/1998 – 3/10/2000	\$ 6,773 ↑	\$ 1,550 ↑	\$ 5,350↑
3/10/2000 – 12/31/2001	4,669 ↓	1,351 ↓	3,425↓

Research probing the 1998-2001 capital market era needs to examine a broader set of companies than just those labeled as “internet stocks”. Most internet companies were listed on NASDAQ. Many of the companies in our Selected SIC Industries group were listed on the NYSE. The above market capitalization changes highlight that the so-called “internet bubble” is an overly narrow description. The increases/decreases in market capitalization in the 1998-2001 period occurred for many non-internet companies and for many non-NASDAQ companies.

Early-Stage Company Research

Our research documents that both company size and revenue growth are statistically significant independent variables in MKT_t/REV_t models in both public and private markets. We also find the dramatically higher revenue growth rates for our venture-backed private companies sample (Sample Three) vis-à-vis the revenue growth rates for the publicly traded company samples (Samples One and Two) – see Figure 4. Not all early-stage companies are venture capital backed. Venture capitalists traditionally restrict themselves to companies that both address large markets and have the capacity to grow rapidly. The revenue growth rates we report in Figure 4 and Table 4 are consistent with multiple early-stage private companies achieving revenue growth rates not accomplished by many publicly-traded companies. Subsequent research could examine the growth rates on non-venture financed private companies. Such analysis could be part of a broader focus on factors that explain the level and change in revenue growth rates as a company evolves

¹⁷ Table 1 reports the extent to which our Selected SIC Industries and Internet Companies overlap.

over time. Our research highlights that the existence of venture capital financing likely is a facilitator of high revenue growth. Other potential variables that could be examined include the product/service markets targeted by a company and the experience/aspirations of the management team.

The growing analysis of early-stage companies offers many avenues to analyze how key factors affect company valuation and growth e.g., the type of private financing, the role of public listing, the chosen business model and its ability to scale, and the adoption of management control systems. The dramatic time-series and cross-sectional variations in both the capital market variables and the fundamental accounting variables across both the public and private company samples examined in this paper highlight the fruitful opportunities for subsequent research.

Early-stage companies are also of much interest due to many having a relatively high intangible asset composition vis-à-vis tangible assets. Venture capital funding often occurs because companies have negative net cash flows due to their making “investments” in intangibles such as technologies, discoveries, etc. or the buildup of a sales/marketing capability. Revenues are an important signal that such “investments” are being commercially valued by customers or partners. Rapid growth in revenues potentially is a lead indicator of subsequent growth in profitability. An important research area is understanding the strength, time-horizon and determinants of such lead/lag relationships between revenue growth and profitability growth.

APPENDIX A

Risk Differences Across NYSE/AMEX/NASDAQ Subsamples of Listed Companies

The Selected SIC Industries and All Other Companies subsamples of Sample One exhibit sizable differences in risk-related indicators prior to and after, as well as during, the 1998 – 2001 period.

Capital Market Risk: Two frequently used measures of a company’s capital market risk are the CAPM beta and the standard deviation of security returns. The Selected SIC Industries group has had higher relative market risk and higher total market risk than the All Other Companies group for an extended time period since the 1980’s through to 2004:

Year	Beta				Standard Deviation of Returns			
	Selected SIC Industries		All Other Companies		Selected SIC Industries		All Other Companies	
	90 th	50 th	90 th	50 th	90 th	50 th	90 th	50 th
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

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 our All Other Companies group. With this higher risk, finance theory would predict came the potential for larger increases in market capitalization and larger decreases in market capitalization.

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 Industries group differs markedly from the All Other Companies group in terms of its propensity for losses. While there has been an increase since 1980 in the percentage of all

companies reporting negative net income (with a decline in the 2002 to 2004 period), this increase has been concentrated in our Selected SIC Industries group:

Year	Selected SIC Industries	All Other Industries	All Companies Pooled
1980	7.8%	23.5%	21.5%
1985	30.3%	16.3%	18.5%
1990	37.2%	23.1%	25.6%
1995	39.1%	17.2%	21.9%
2000	56.8%	22.3%	31.0%
2001	68.0%	25.3%	36.0%
2004	50.3%	22.7%	29.4%

The results for the All Companies column have been noted before by Hayn [1995], Collins, Pincus, and Xie [1999], and Joos and Plesko [2005]. Over time, the likelihood that a publicly-traded U.S. listed company will report a loss has increased. In 1980, there was roughly a 20% 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	23.6%	21.3%	21.5%
1985	21.5%	16.7%	18.5%
1990	31.5%	21.5%	25.6%
1995	27.5%	15.7%	21.9%
2000	40.5%	18.3%	31.0%
2001	44.1%	25.5%	36.0%
2004	36.4%	20.3%	29.4%

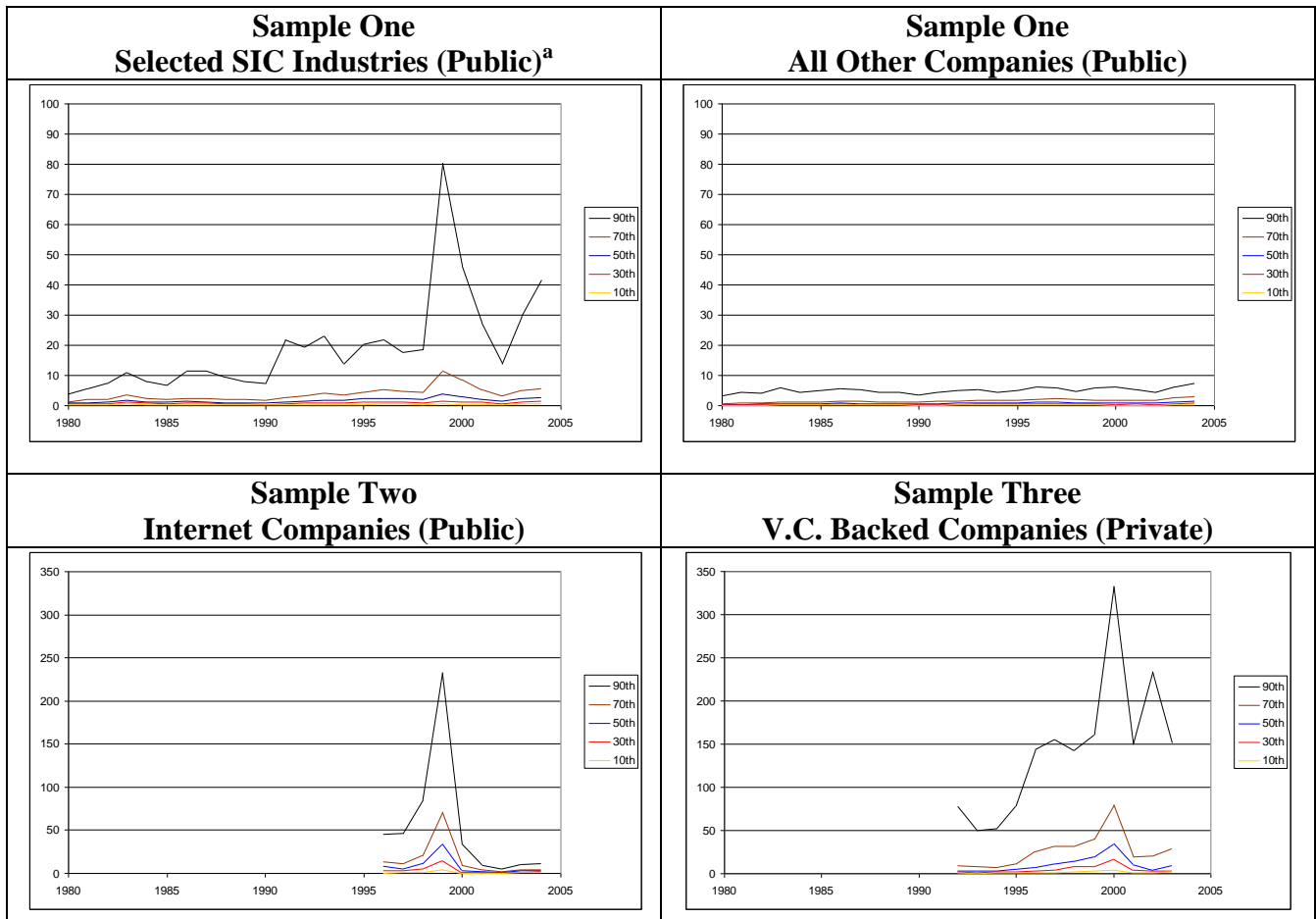
NASDAQ companies are, on average, smaller and younger than companies on the NYSE/AMEX.

Size and age have been found to useful predictors of financial distress [Altman, 2000].

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. Fama and French [2004] report evidence of an increase in loss rates for newly listed companies.

Figure 1

Market Capitalization to Revenue Multiple Percentiles (90th, 70th, 50th, 30th, and 10th) for Sample One (All NYSE/AMEX/NASDAQ Public Companies), Sample Two (Internet Public Companies) and Sample Three (Venture-Backed Private Companies): 1980 to 2004



- a. Comprises companies in Hardware, Software, Telecom, and Biotech/Pharmaceuticals Industries

Figure 2 – Panel A

Annual Market Capitalization-to-Revenue Multiple Percentiles for Sample One Companies in Selected SIC Industries for Various Company Size Categories: 1980 - 2004

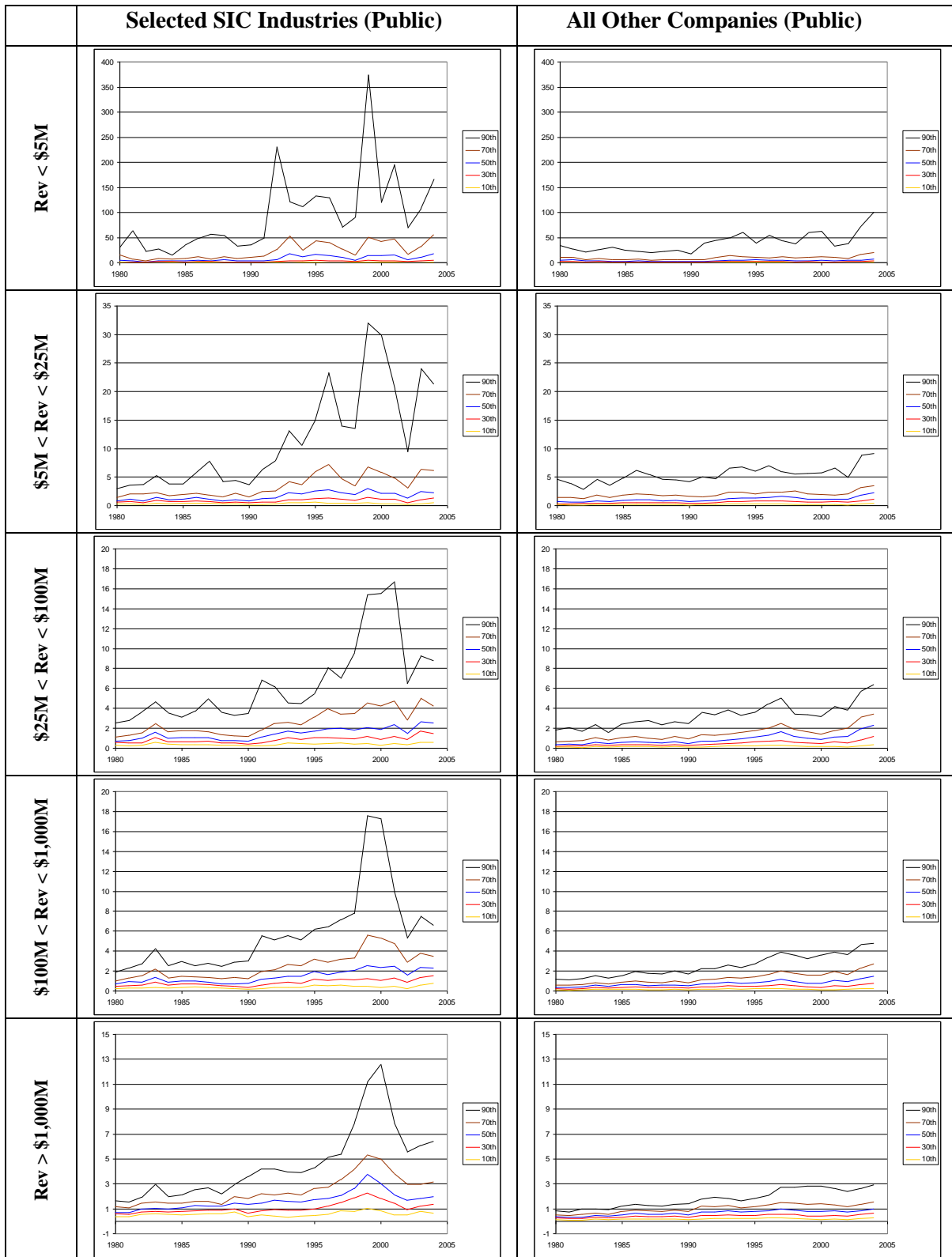


Figure 2 – Panel B

Annual Market Capitalization-to-Revenue Multiple Percentiles for Sample Two and Sample Three Companies for Various Company Size Categories: 1980 - 2004

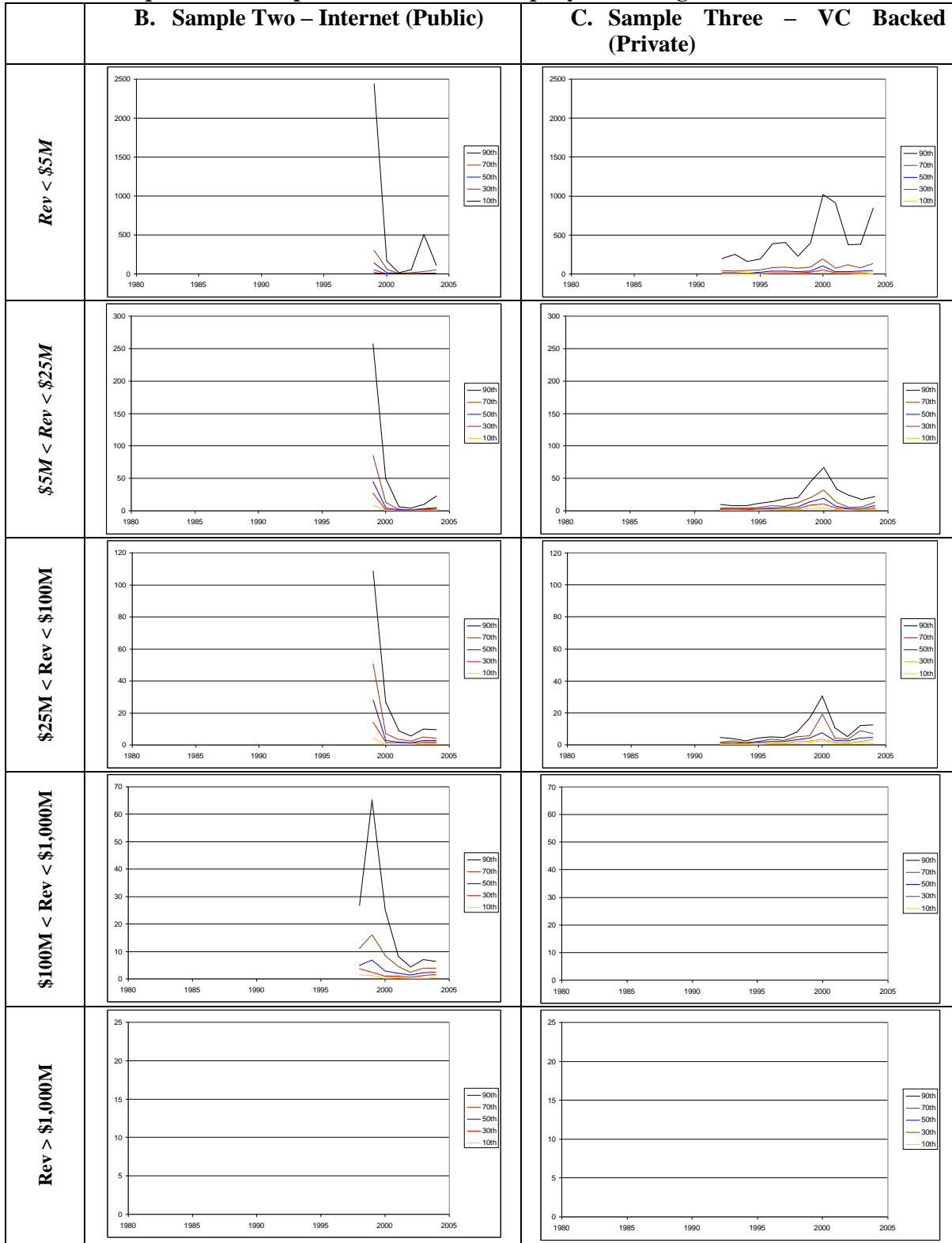
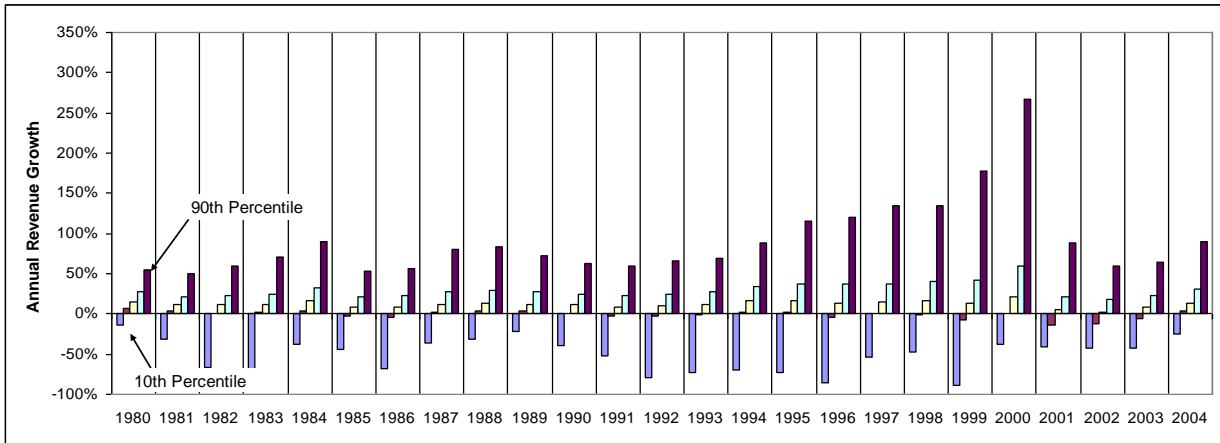


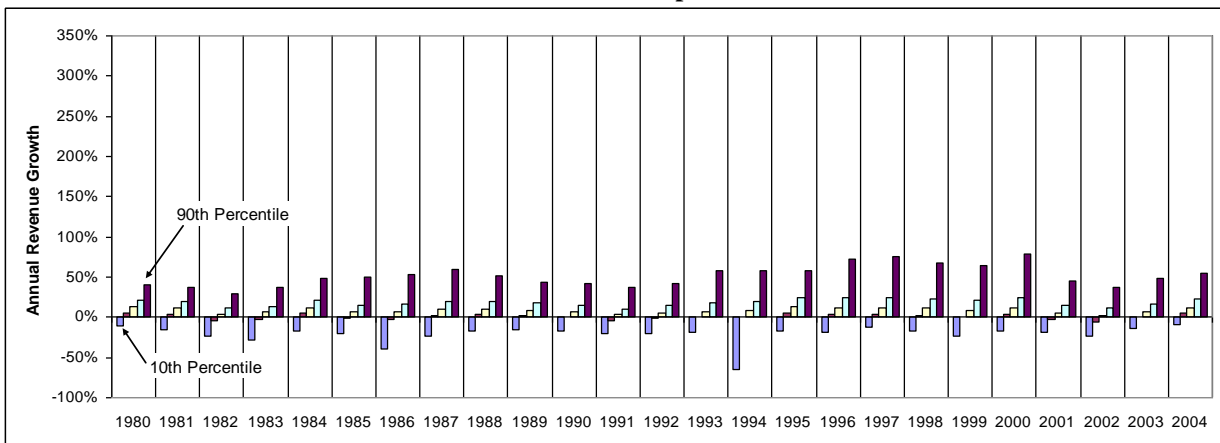
Figure 3

Annual Revenue Growth Percentiles (10th, 30th, 50th, 70th, and 90th) and Interdecile Range (90th – 10th) for Publicly Traded Companies on NYSE/AMEX/NASDAQ: 1980 to 2004

Panel A: Selected SIC Industries (Hardware, Software, Telecom, Biotech/Pharma)



Panel B: All Other Companies



Panel C: Annual Interpercentile (90th – 10th) Range

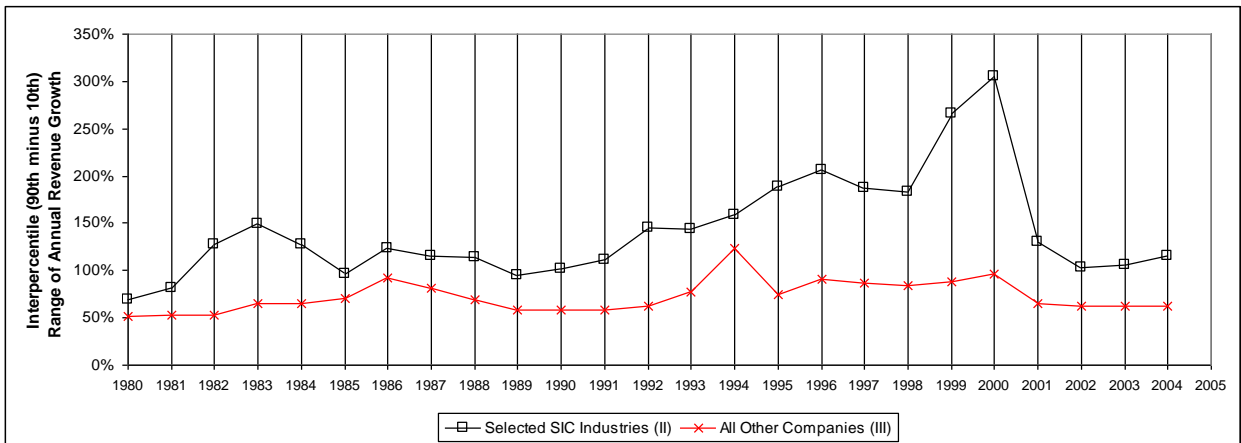


Figure 4
Annual Revenue Growth Rates For Publicly-Traded Companies and Private Venture-Backed Companies: 1996 – 2004
Selected SIC Industries vs. All Other Companies vs. Internet Companies vs. Venture-Backed Companies

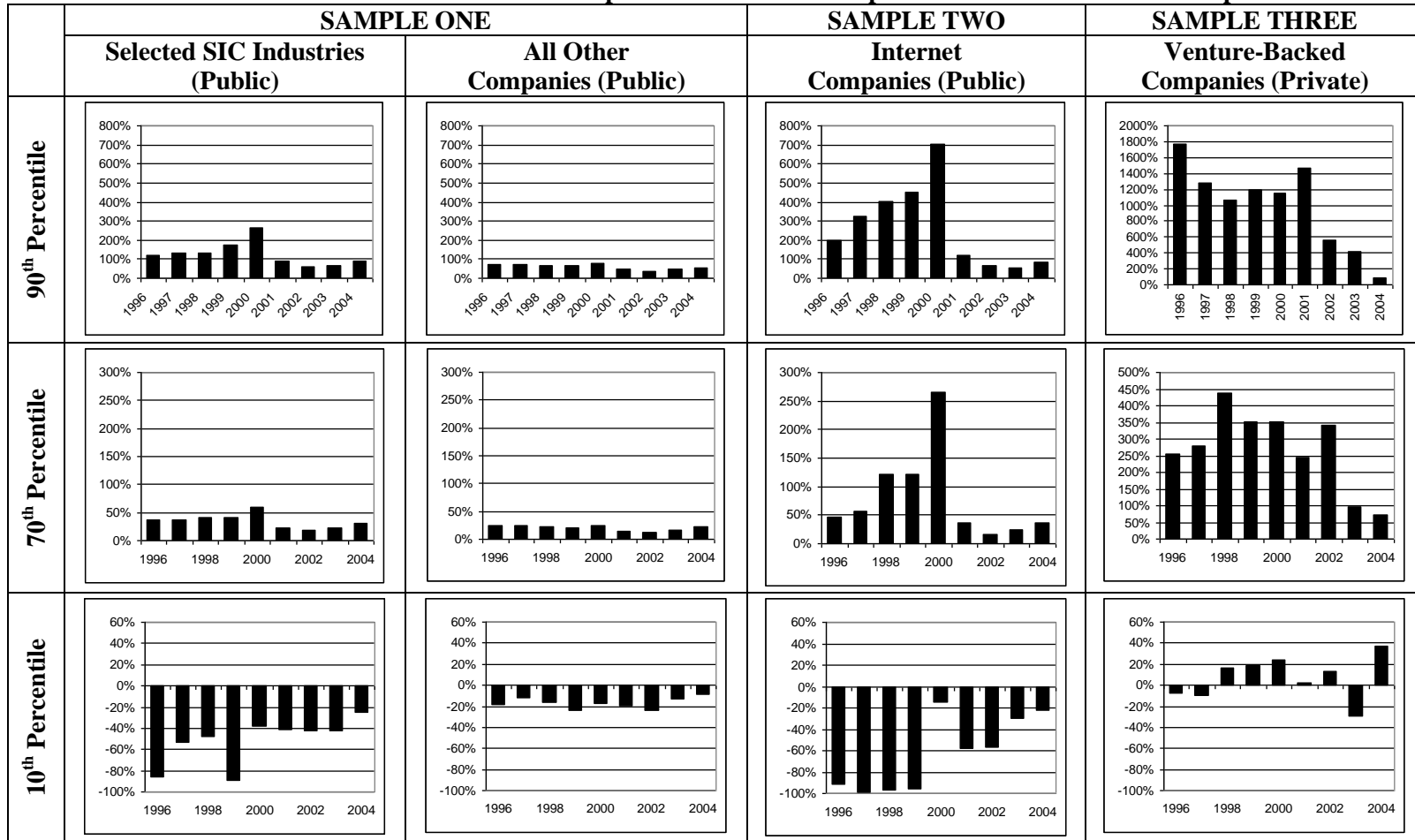


Figure 5 – Panel A
Median Annual Portfolio Revenue Growth in Years t , $t+1$, and $t+2$ for Portfolios Formed Using MKT_t/REV_t Rankings: 10 Portfolios with Positive Revenue Growth in Year t

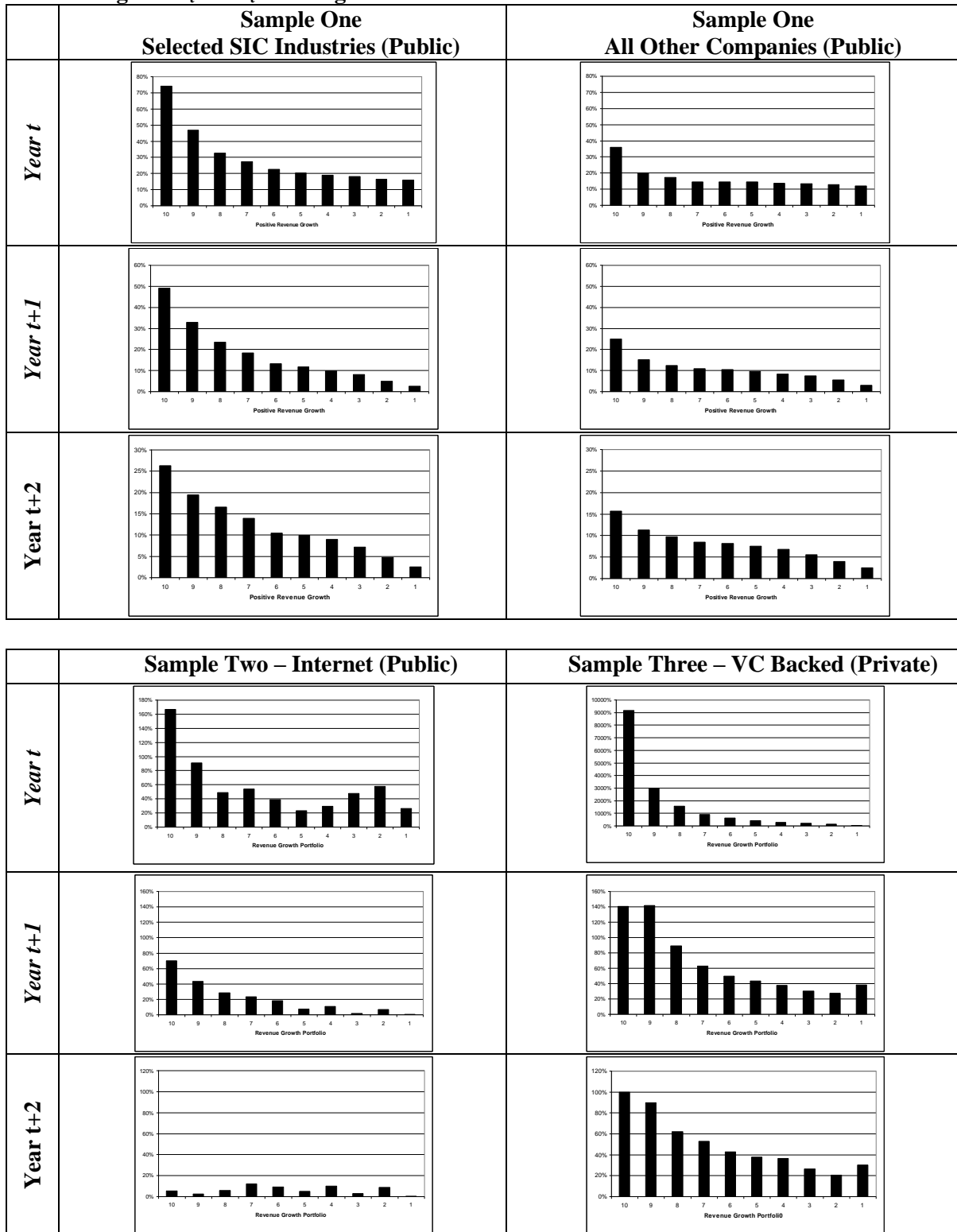


Figure 5 – Panel B

Median Annual Portfolio Revenue Growth in Years t , $t+1$, and $t+2$ for Portfolios Formed Using MKT_t/REV_t Rankings: 10 Portfolios with Negative Revenue Growth in Year t

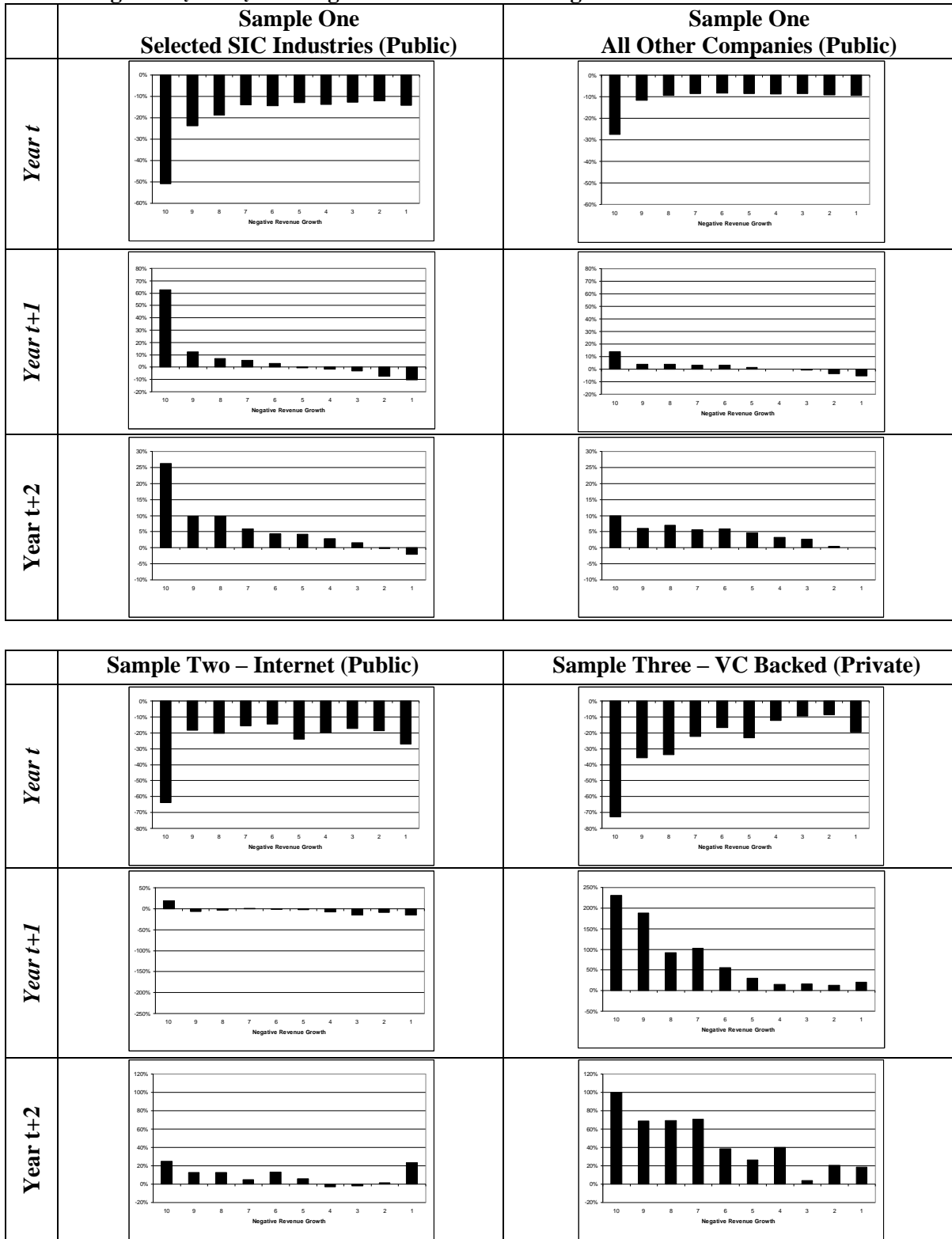


Table 1

Summary Statistics on Three Samples: Sample One (All NYSE/AMEX/NASDAQ Public Companies), Sample Two (Internet Public Companies) and Sample Three (Venture-Backed Private Companies).

Panel A

Sample One - NYSE/AMEX/NASDAQ Companies (Public)	Aggregate Market Capitalization (\$ Billions)			No. of Companies 3/10/2000
	1/1/1998	3/10/2000	12/31/2001	
I. All Companies	\$11,051	\$18,398	\$14,212	8,401
II. Pooled Selected SIC Industries (357, 366, 367, 737, 481, 283)	2,849	9,262	4,593	1,932
II.A. Computer Hardware (357,366,367)	933	4,098	1,612	615
II.B. Computer Software (737)	550	2,504	979	792
II.C. Telecommunications (481)	528	1,387	625	190
II.D. Biotech/Pharma (283)	839	1,273	1,377	335
III. All Other Companies	8,202	9,135	9,619	6,469

Panel B

Sample Two - Internet Companies (Public)	Aggregate Market Capitalization (\$ Billions)			No. of Companies 3/10/2000
	1/1/1998	3/10/2000	12/31/2001	
I. All Internet Companies	\$80	\$1,630	\$279	367
II. Pooled Selected Internet SIC Industries	77	1,500	256	260
II.A. Internet - Computer Hardware	57	653	158	21
II.B. Internet - Computer Software	17	726	72	178
II.C. Internet - Telecommunications	2	47	2	23
II.D. Internet - Business Services	1	75	24	38
III. All Other Internet Companies	3	130	23	107

Panel C

Sample Three - VC Backed Companies (Private)	Number of Companies	Number with IPO	Internet Coy's with IPO(c)
I. All VentureOne Companies	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

- (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 2
Mean Autocorrelations for First Differenced Annual Financial Series
for Sample One (NYSE/AMEX/NASDAQ Publicly-Traded Companies): 1980-2004

	r_1	r_2	r_3	r_4
Revenues				
Selected SIC Industries	0.36	0.18	0.16	0.17
All Other Companies	0.18	0.02	0.07	0.09
Operating Income				
Selected SIC Industries	0.03	-0.06	0.03	0.01
All Other Companies	-0.10	-0.01	-0.01	0.01
Income Before Extraordinary Items				
Selected SIC Industries	-0.25	-0.07	-0.10	0.02
All Other Companies	-0.27	-0.04	-0.07	0.02

Table 3

Annual Revenue Growth Rate Percentiles (10th, 20th...90th) By Company Size Category (\$ Millions: I, \$0-\$5; II, \$5-\$25; III, \$25-\$100; IV, \$100-\$1,000; > \$1,000) For Samples One, Two, and Three

Sample One - Selected SIC Industries (Public): Company Size Categories							
	I	II	III	IV	V	Pooled	
	\$0 - \$5	\$5 - \$25	\$25 - \$100	\$100 - \$1,000	> \$1,000	All	
Revenue Growth Rate Percentiles	10th pctle	-85.4%	-32.8%	-21.5%	-13.2%	-8.6%	-33.4%
	20th pctle	-56.7%	-17.9%	-8.2%	-2.1%	-0.1%	-13.6%
	30th pctle	-37.4%	-7.9%	0.3%	4.5%	4.2%	-2.8%
	40th pctle	-19.7%	0.8%	7.5%	10.2%	7.5%	4.8%
	50th pctle	-4.3%	8.4%	14.4%	15.7%	10.8%	11.4%
	60th pctle	10.4%	17.2%	22.0%	22.1%	14.3%	18.8%
	70th pctle	31.3%	28.4%	31.9%	31.0%	19.4%	28.7%
	80th pctle	76.3%	46.0%	46.7%	45.5%	26.3%	45.6%
	90th pctle	233.2%	94.0%	79.6%	75.6%	41.6%	89.3%
	nobs	5,090	6,872	7,184	6,920	2,969	29,035
Sample One - All Other Companies (Public): Company Size Categories							
	I	II	III	IV	V	Pooled	
	\$0 - \$5	\$5 - \$25	\$25 - \$100	\$100 - \$1,000	> \$1,000	All	
Revenue Growth Rate Percentiles	10th pctle	-84.5%	-26.0%	-16.2%	-9.9%	-8.2%	-19.9%
	20th pctle	-52.5%	-11.7%	-5.5%	-2.3%	-1.6%	-6.6%
	30th pctle	-31.3%	-3.8%	0.5%	2.3%	2.0%	-0.2%
	40th pctle	-15.7%	2.1%	5.0%	6.0%	5.1%	4.3%
	50th pctle	-3.5%	7.4%	9.4%	9.7%	7.9%	8.4%
	60th pctle	7.6%	13.6%	14.4%	13.7%	10.9%	12.9%
	70th pctle	23.6%	21.8%	21.0%	18.8%	14.8%	18.9%
	80th pctle	55.4%	35.5%	31.1%	26.4%	20.6%	28.6%
	90th pctle	157.0%	70.9%	54.1%	43.0%	33.4%	52.7%
	nobs	13,702	20,752	26,974	43,222	22,043	126,693
Sample Two - Internet Companies (Public): Company Size Categories							
	I	II	III	IV	V	Pooled	
	\$0 - \$5	\$5 - \$25	\$25 - \$100	\$100 - \$1,000	> \$1,000	All	
Revenue Growth Rate Percentiles	10th pctle	-86.6%	-38.0%	-23.7%	-12.3%	-8.2%	-28.8%
	20th pctle	-51.6%	-15.4%	-5.0%	0.8%	0.1%	-8.0%
	30th pctle	-17.4%	5.1%	11.3%	8.5%	5.9%	7.4%
	40th pctle	29.0%	34.8%	26.7%	22.2%	10.6%	24.3%
	50th pctle	70.2%	64.1%	48.7%	34.1%	13.7%	47.1%
	60th pctle	163.0%	109.7%	78.2%	54.8%	26.0%	77.3%
	70th pctle	295.8%	194.4%	130.3%	87.5%	48.9%	129.2%
	80th pctle	684.9%	320.3%	224.6%	144.8%	68.4%	233.8%
	90th pctle	1359.2%	632.5%	448.5%	296.8%	90.5%	523.6%
	nobs	229	596	690	571	93	2,179
Sample Three - Venture Capital-Backed Companies (Private): Company Size Categories							
	I	II	III	IV	V	Pooled	
	\$0 - \$5	\$5 - \$25	\$25 - \$100	\$100 - \$1,000	> \$1,000	All	
Revenue Growth Rate Percentiles	10th pctle	-33.4%	5.2%	3.4%	1.1%		-2.1%
	20th pctle	0.0%	20.0%	12.7%	6.9%		12.1%
	30th pctle	22.9%	32.8%	20.9%	12.9%		25.0%
	40th pctle	49.7%	47.0%	30.2%	18.5%		39.1%
	50th pctle	79.3%	64.2%	40.1%	26.2%		56.0%
	60th pctle	127.3%	89.4%	52.2%	35.6%		80.6%
	70th pctle	200.0%	119.9%	70.6%	45.0%		118.5%
	80th pctle	356.3%	197.1%	103.9%	73.2%		200.0%
	90th pctle	771.6%	393.1%	195.7%	113.7%		422.2%
	nobs	1,610	1,965	1,034	287		4,896

Table 4
MKT/REV_t Multiple Distribution Summary for Subsamples Formed On Sign of Revenue Growth in Year t

Sample One Selected SIC	Total Obs.	Positive Revenue Growth Subsample					Negative Revenue Growth Subsample					Missing Revenue Growth Subsample				
		MKT/Rev Multiple			Nob's	% of Total Sample	MKT/Rev Multiple			Nob's	% of Total Sample	MKT/Rev Multiple			Nob's	% of Total Sample
		10th Perc.	50th Perc.	90th Perc.			10th Perc.	50th Perc.	90th Perc.			10th Perc.	50th Perc.	90th Perc.		
1995	1484	0.5	2.3	11.2	906	61.1%	0.2	1.3	52.0	275	18.5%	0.6	3.6	55.4	303	20.4%
1998	1962	0.5	2.2	11.8	1165	59.4%	0.3	1.2	26.4	574	29.3%	0.8	5.2	80.1	223	11.4%
1999	2154	0.6	3.2	27.3	1182	54.9%	0.3	1.8	47.1	564	26.2%	1.7	31.6	365.8	408	18.9%
2000	2313	0.4	2.8	26.4	1313	56.8%	0.2	1.5	45.3	582	25.2%	1.0	9.8	132.0	418	18.1%
2001	2168	0.5	2.8	22.3	1067	49.2%	0.2	1.4	24.1	950	43.8%	0.7	6.7	145.7	151	7.0%
2004	1726	0.7	2.5	16.0	1146	66.4%	0.4	2.6	114.5	468	27.1%	1.2	11.7	1,277.2	112	6.5%
Sample One All Other																
1995	6524	0.2	1.0	3.8	4453	68.3%	0.1	0.8	7.3	1193	18.3%	0.2	1.4	14.7	878	13.5%
1998	6767	0.2	1.1	4.0	4395	64.9%	0.1	0.8	5.6	1801	26.6%	0.3	1.8	12.3	571	8.4%
1999	6710	0.2	0.9	4.0	4198	62.6%	0.1	0.8	6.7	1865	27.8%	0.4	2.3	104.1	647	9.6%
2000	6451	0.1	0.9	4.2	4526	70.2%	0.0	0.5	10.5	1461	22.6%	0.4	2.6	83.9	464	7.2%
2001	6075	0.2	1.1	4.8	3394	55.9%	0.1	0.6	4.5	2322	38.2%	0.3	2.0	132.3	359	5.9%
2004	4966	0.3	1.5	5.7	3642	73.3%	0.2	1.5	12.0	1067	21.5%	0.7	4.3	330.3	257	5.2%
Sample Two Internet																
1995	17	0.4	1.4	8.7	10	58.8%					0.0%	1.0	23.5	2,101.6	7	41.2%
1998	69	1.6	6.1	28.0	33	47.8%	0.1	4.3	10.5	9	13.0%	4.3	24.4	91.7	27	39.1%
1999	275	2.1	11.9	113.6	50	18.2%	0.6	2.0	37.2	11	4.0%	6.8	44.5	282.3	214	77.8%
2000	379	0.3	2.4	20.6	207	54.6%	0.1	1.3	60.9	15	4.0%	0.9	6.9	67.1	157	41.4%
2001	319	0.4	2.4	10.4	175	54.9%	0.2	1.5	4.9	124	38.9%	0.6	3.6	12.7	20	6.3%
2004	202	0.8	3.0	11.0	139	68.8%	0.5	2.3	23.4	59	29.2%	1.0	1.9	30.5	4	2.0%
Sample Three V.C. Private Backed																
1995	262	0.7	3.8	17.7	186	71.0%	0.8	13.0	190.0	22	8.4%	1.2	26.4	203.3	54	20.6%
1998	274	1.7	10.0	60.0	147	53.6%	2.1	14.5	211.1	15	5.5%	4.8	27.6	300.0	112	40.9%
1999	361	2.6	16.5	83.2	238	65.9%	3.5	16.3	600.0	25	6.9%	2.1	34.3	648.5	98	27.1%
2000	254	3.5	24.2	160.8	150	59.1%	4.9	81.5	739.0	17	6.7%	3.8	56.2	1,971.1	87	34.3%
2001	107	1.5	5.3	45.3	51	47.7%	1.1	19.1	1,649.7	9	8.4%	1.4	10.0	397.5	47	43.9%
2004	88	1.0	6.9	24.8	57	64.8%	11.2	400.0	5,068.8	5	5.7%	0.8	4.0	538.2	26	29.5%

Table 5
Transition Matrix for Revenue Growth Decile in Year t and Year t+1 for Sample One
Selected SIC Industries and All Other Companies: 1980 – 2004
(Portfolio 1 is lowest revenue growth...Portfolio 10 is highest revenue growth)

Panel A - Selected SIC Industries

		Revenue Growth in Year t+1										
		port1	port2	port3	port4	port5	port6	port7	port8	port9	port10	Total
Rev Growth in Year t	port 1	27.42%	14.07%	8.35%	5.52%	5.39%	4.64%	4.87%	5.69%	6.11%	17.95%	100.00%
	port 2	13.68%	19.40%	15.91%	10.16%	7.96%	7.96%	7.73%	6.74%	5.56%	4.93%	100.00%
	port 3	8.31%	12.68%	17.02%	16.73%	12.36%	10.25%	7.76%	7.03%	4.63%	3.22%	100.00%
	port 4	5.29%	8.05%	13.02%	21.96%	19.07%	12.16%	8.28%	5.62%	4.08%	2.47%	100.00%
	port 5	4.70%	7.36%	9.73%	13.71%	19.99%	16.80%	12.26%	7.50%	5.33%	2.63%	100.00%
	port 6	4.63%	7.66%	9.92%	9.99%	12.45%	17.75%	17.19%	10.45%	6.87%	3.09%	100.00%
	port 7	5.75%	7.76%	7.96%	8.05%	9.14%	12.85%	16.40%	16.40%	10.68%	5.00%	100.00%
	port 8	6.87%	7.92%	7.56%	6.61%	6.18%	8.54%	12.42%	18.63%	18.17%	7.10%	100.00%
	port 9	8.97%	7.33%	6.18%	4.31%	4.93%	6.31%	8.45%	14.00%	23.77%	15.75%	100.00%
	port 10	14.37%	7.76%	4.37%	2.96%	2.53%	2.76%	4.64%	7.96%	14.79%	37.87%	100.00%
Total		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	
Missing		8.64%	4.10%	3.40%	3.31%	3.76%	5.39%	7.37%	11.04%	17.04%	35.95%	100.00%

Panel B - All Other Companies

		Revenue Growth in Year t+1										
		port1	port2	port3	port4	port5	port6	port7	port8	port9	port10	Total
Rev Growth in Year t	port 1	29.60%	13.37%	7.84%	5.26%	5.00%	4.60%	4.92%	5.70%	7.60%	16.10%	100.00%
	port 2	14.55%	19.06%	14.94%	10.78%	8.48%	7.28%	6.80%	6.37%	6.01%	5.72%	100.00%
	port 3	7.96%	13.95%	17.38%	16.26%	12.12%	9.92%	7.96%	6.01%	4.95%	3.49%	100.00%
	port 4	5.82%	10.23%	13.91%	17.52%	16.12%	12.26%	9.37%	6.64%	4.91%	3.22%	100.00%
	port 5	4.76%	8.37%	11.58%	15.02%	16.20%	14.93%	11.57%	8.37%	5.97%	3.21%	100.00%
	port 6	4.68%	7.55%	9.62%	10.52%	13.97%	16.19%	15.19%	10.96%	7.23%	4.09%	100.00%
	port 7	4.78%	6.96%	8.24%	8.71%	10.85%	13.58%	15.77%	15.44%	10.41%	5.26%	100.00%
	port 8	5.47%	7.05%	6.38%	6.86%	7.96%	10.27%	13.96%	18.02%	16.02%	8.03%	100.00%
	port 9	8.39%	7.31%	5.64%	5.60%	5.84%	6.92%	9.17%	14.39%	20.77%	15.97%	100.00%
	port 10	13.99%	6.14%	4.46%	3.46%	3.47%	4.05%	5.29%	8.09%	16.13%	34.93%	100.00%
Total		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	
Missing		8.36%	5.35%	6.02%	5.45%	5.55%	6.28%	7.58%	10.08%	14.23%	31.09%	100.00%

Panel C – Sample Two (Internet Companies)

		Revenue Growth in Year t+1										
		port1	port2	port3	port4	port5	port6	port7	port8	port9	port10	Total
Rev Growth in Year t	port 1	26.67%	20.00%	13.94%	7.27%	9.09%	6.06%	4.24%	2.42%	4.24%	6.06%	100.00%
	port 2	11.45%	19.88%	21.69%	15.06%	15.06%	9.64%	4.22%	1.20%	1.20%	0.60%	100.00%
	port 3	4.82%	10.84%	20.48%	28.31%	18.07%	11.45%	3.01%	1.20%	1.20%	0.60%	100.00%
	port 4	6.06%	7.27%	10.91%	18.79%	18.18%	16.36%	13.94%	3.64%	1.82%	3.03%	100.00%
	port 5	7.83%	6.63%	6.02%	9.04%	16.27%	17.47%	19.88%	7.83%	6.02%	3.01%	100.00%
	port 6	7.23%	10.24%	6.02%	7.83%	8.43%	13.25%	21.69%	12.65%	7.23%	5.42%	100.00%
	port 7	13.33%	9.70%	8.48%	4.85%	4.85%	6.67%	10.91%	19.39%	16.97%	4.85%	100.00%
	port 8	9.64%	6.02%	6.02%	3.01%	4.22%	6.02%	12.65%	25.30%	16.87%	10.24%	100.00%
	port 9	7.23%	7.23%	4.82%	4.22%	3.01%	7.23%	5.42%	15.66%	21.08%	24.10%	100.00%
	port 10	5.45%	2.42%	1.82%	1.21%	3.03%	6.06%	3.64%	10.91%	23.64%	41.82%	100.00%
Total		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	
Missing		2.59%	1.20%	0.80%	2.20%	5.59%	7.19%	11.98%	12.38%	16.77%	39.32%	100.00%

Panel D – Sample Three (Venture-backed Companies)

		Revenue Growth in Year t+1										
		port1	port2	port3	port4	port5	port6	port7	port8	port9	port10	Total
Rev Growth in Year t	port 1	21.25%	12.89%	9.76%	5.92%	6.62%	6.62%	6.62%	9.06%	7.32%	13.94%	100.00%
	port 2	13.89%	24.65%	20.49%	12.85%	7.99%	4.86%	5.21%	3.82%	2.78%	3.47%	100.00%
	port 3	10.76%	14.24%	21.53%	16.67%	12.85%	6.60%	5.56%	4.51%	3.13%	4.17%	100.00%
	port 4	10.42%	15.97%	13.19%	19.44%	17.01%	10.42%	6.25%	2.78%	3.47%	1.04%	100.00%
	port 5	8.68%	6.94%	12.50%	12.15%	16.32%	12.85%	12.85%	7.29%	6.25%	4.17%	100.00%
	port 6	9.38%	9.72%	5.56%	12.15%	12.85%	16.32%	14.58%	10.07%	5.90%	3.47%	100.00%
	port 7	7.99%	5.90%	6.94%	7.29%	11.46%	17.01%	12.50%	14.58%	10.42%	5.90%	100.00%
	port 8	6.55%	4.14%	2.41%	4.48%	6.90%	14.48%	15.17%	20.69%	13.45%	11.72%	100.00%
	port 9	5.59%	4.55%	4.90%	6.29%	4.55%	6.29%	16.43%	16.78%	19.23%	15.38%	100.00%
	port 10	5.23%	1.05%	2.79%	2.79%	3.48%	4.53%	4.88%	10.45%	28.22%	36.59%	100.00%
Total		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	
Missing		10.51%	7.10%	5.97%	5.38%	6.22%	6.96%	6.86%	7.20%	12.78%	31.03%	100.00%

Table 6

Correlation For 10 Portfolios Ranked on MKT_t/REV_t Between (A) Median MKT/REV and Median Annual Revenue Growth, and (B) Annual Revenue Growth Across Time Periods

Panel A: Correlation Between Median MKT/REV and Median Annual Revenue Growth for 10 Portfolios

	Sample One		Sample Two	Sample Three
	Selected SIC Industries	All Other Companies	Internet Companies	VC Backed Companies
Positive Revenue Growth Portfolios				
MKT_t/REV_t & REV_{t+1} Growth				
Pearson	0.97	0.99	0.95	0.83
Spearman	1.00	0.98	0.60	0.92
MKT_t/REV_t & $REV_{t+1/t}$ Growth				
Pearson	0.93	0.97	0.98	1.00
Spearman	1.00	1.00	0.96	1.00
MKT_t/REV_t & $REV_{t+2/t+1}$ Growth				
Pearson	0.86	0.92	-0.04	0.99
Spearman	1.00	1.00	0.17	0.98
Negative Revenue Growth Portfolios				
MKT_t/REV_t & REV_{t+1} Growth				
Pearson	-0.98	-0.99	-0.93	-0.92
Spearman	-0.80	-0.51	0.01	-0.83
MKT_t/REV_t & $REV_{t+1/t}$ Growth				
Pearson	0.97	0.89	0.87	0.79
Spearman	1.00	0.99	0.78	0.90
MKT_t/REV_t & $REV_{t+2/t+1}$ Growth				
Pearson	0.91	0.72	0.59	0.70
Spearman	0.99	0.96	0.45	0.89

Panel B: Correlation Between Median Annual Revenue Growth of Portfolios Across Time Periods

	Sample One		Sample Two	Sample Three
	Selected SIC Industries	All Other Companies	Internet Companies	VC Backed Companies
Positive Revenue Growth Portfolios				
Year t & Year t+1				
Pearson	0.99	0.95	0.91	0.83
Spearman	1.00	0.99	0.71	0.92
Year t & Year t+2				
Pearson	0.94	0.89	-0.03	0.86
Spearman	0.99	0.99	0.17	0.96
Year t+1 & Year t+2				
Pearson	0.98	0.98	0.06	0.99
Spearman	1.00	1.00	0.31	0.98
Negative Revenue Growth Portfolios				
Year t & Year t+1				
Pearson	-0.98	-0.82	-0.76	-0.90
Spearman	-0.80	-0.46	-0.01	-0.89
Year t & Year t+2				
Pearson	-0.95	-0.62	-0.63	-0.84
Spearman	-0.78	-0.34	-0.42	-0.74
Year t+1 & Year t+2				
Pearson	0.98	0.95	0.45	0.90
Spearman	0.99	0.98	0.37	0.80

Table 7

Regression Analysis (Rank Regression) Using (a) MKT_t/REV_t As Dependent Variable, and
(b) Revenue Growth, Company Size, Profitability and Other Variables

	Sample One				Sample Two		Sample Three	
	Selected SIC		All Other		Internet		VC-backed	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Regression #1								
Intercept	19538	202.73	85789	431.18	1085	38.82	1108	97.45
log(REV)	-0.29	-52.20	-0.31	-117.19	-0.21	-11.07	-0.83	-50.87
Adj. R-sq	8.2%		9.5%		7.1%		68.1%	
Regression #2								
Intercept	10508	104.04	52538	246.43	400	21.31	385	16.88
Current Rev Growth	0.26	36.82	0.17	49.25	0.39	19.00	0.32	6.14
Adj. R-sq	5.2%		2.2%		20.8%		4.7%	
Regression #3								
Intercept	14875	114.63	72816	261.31	724	23.68	1022	43.18
log(REV)	-0.26	-45.07	-0.27	-97.74	-0.19	-11.28	-0.78	-33.90
Current Rev Growth	0.29	43.09	0.17	55.05	0.39	20.23	0.15	4.64
Adj. R-sq	12.0%		9.6%		25.8%		62.1%	
Regression #3b								
Intercept	14750	118.47	69869	266.45	624	20.32	946	47.00
log(REV)	-0.27	-51.38	-0.29	-115.26	-0.13	-8.22	-0.73	-40.11
Future Rev Growth	0.30	56.80	0.23	89.75	0.39	24.01	0.18	9.61
Adj. R-sq	17.1%		14.7%		31.7%		70.4%	
Regression #4								
Intercept	7876	66.89	43583	175.96	261	14.059	232	9.63
Current Rev Growth	0.19	27.37	0.10	29.15	0.22	10.88	0.11	2.19
Future Rev Growth	0.25	40.18	0.21	67.32	0.32	17.89	0.45	12.46
Adj. R-sq	11.1%		6.0%		35.7%		20.9%	
Regression #5								
Intercept	11394	81.6	61103	203.69	445	15.282	936	32.40
log(REV)	-0.25	-43.27	-0.27	-95.92	-0.13	-8.07	-0.73	-29.62
Current Rev Growth	0.22	32.68	0.11	33.68	0.24	11.76	0.10	3.02
Future Rev Growth	0.24	39.89	0.20	66.61	0.29	16.35	0.13	5.07
Adj. R-sq	17.3%		13.3%		38.6%		63.3%	
Regression #6								
Intercept	-7539	-19.27	-51279	-97.28	1066	108.94		
INC/REV	0.57	47.94	0.84	245.32	-0.33	0.08		
NEG INC/REV	0.90	69.37	0.90	199.91	-0.14	0.08		
Adj. R-sq	15.7%		30.2%		4.3%			
Regression #7								
Intercept	-7793	-25.15	-24675	-46.36	138	1.31	982.82	41.76
log(REV)	-0.21	-36.27	-0.22	-90.81	-0.17	-4.35	-0.7715	-33.9815
Current Rev Growth	0.15	29.38	0.04	19.19	0.02	0.84	0.13462	4.34423
Future Rev Growth	0.25	49.61	0.18	79.31	0.45	19.44	2.79494	2.51403
INC/REV	0.65	56.61	0.76	233.64	0.20	2.01		
NEG INC/REV	0.90	73.12	0.75	163.21	0.30	3.43		
Leverage	-0.16	-29.39	-0.10	-45.38	-0.14	-5.89		
1998-2000 Dummy	1993	19.54	4131	17.87	190	10.48	181.214	10.379
Adj. R-sq	36.9%		43.6%		40.1%		67.2%	

Table 8

**Sample One Regression Analysis (Rank Regression) Using MKT_t/REV_t as Dependent Variables
For Three Subsamples Based on Sign of Current Revenue Growth
(Panel A: Positive; Panel B: Negative; Panel C: Missing Observations)**

Positive Current Revenue Growth				
	Selected SIC		All Other	
	Coef.	t-stat	Coef.	t-stat
Intercept	-5830.62	-29.74	-20794.45	-54.55
log(REV)	-0.06	-8.43	-0.13	-46.55
Current Rev Growth	0.22	33.17	0.10	34.98
Future Rev Growth	0.18	27.40	0.14	49.79
INC/REV	0.66	58.83	0.77	225.51
NEG INC/REV	0.89	65.96	0.76	135.24
Leverage	-0.15	-22.73	-0.08	-29.73
1998-2000 Period	1075.88	14.10	1937.86	11.55
R-sq	41.68%		49.37%	
nobs	15,131		73,574	

Negative Current Revenue Growth				
	Selected SIC		All Other	
	Coef.	t-stat	Coef.	t-stat
Intercept	1198.46	5.32	-1170.76	-3.65
log(REV)	-0.28	-17.90	-0.30	-54.19
Current Rev Growth	-0.09	-6.82	-0.11	-19.60
Future Rev Growth	0.20	18.35	0.16	33.26
INC/REV	0.34	8.58	0.80	81.67
NEG INC/REV	0.56	15.22	0.64	56.65
Leverage	-0.13	-11.23	-0.12	-22.85
1998-2000 Period	252.60	4.53	695.91	5.52
R-sq	26.62%		32.89%	
nobs	6,353		27,929	

Missing Current Revenue Growth				
	Selected SIC		All Other	
	Coef.	t-stat	Coef.	t-stat
Intercept	-7.75	-0.07	-1007.32	-5.39
log(REV)	-0.26	-20.02	-0.36	-55.49
Current Rev Growth				
Future Rev Growth	0.25	23.62	0.24	42.57
INC/REV	0.39	15.26	0.57	66.29
NEG INC/REV	0.79	28.56	0.78	64.24
Leverage	-0.20	-18.66	-0.11	-19.51
1998-2000 Period	277.61	8.08	1145.19	12.80
R-sq	56.56%		53.69%	
nobs	4064		15681	

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