

PRIVATE EQUITY RETURNS: AN EMPIRICAL EXAMINATION OF THE EXIT OF VENTURE-BACKED COMPANIES

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In this paper, we examine 52 322 financing rounds in 23 208 unique firms, over the period 1980 through 2000 by venture and buyout funds and estimate the probability of exit, time to exit, exit multiples, and the expected gains from private equity investments. The expected multiple (after accounting for dilution and the probability of exit) ranges from a low of 1.12 for late-stage firms to a high of 5.12 for firms financed in their early stages. We find that the gains from venture-backed investments depend upon the industry, the stage of the firm being financed, the valuation at the time of financing, and the prevailing market sentiment. Our study is a first step in understanding the risk premium required for the valuation of private equity investments.



1 Introduction

Little is known about the return characteristics of private equity investments.¹ In a recent review paper, Gompers and Lerner (2000b) cite this as one aspect of “what we don’t know about venture capital”. Hellman and Puri (2000, 2002) find that innovator firms are usually faster to market than imitator firms, and amongst these, those with venture capital (VC) backing tend to make it to market

even faster. Gompers (1996) shows that young VCs tend to “grandstand”, that is, take actions to signal their ability to investors, and hence they tend to be more aggressive in bringing firms to market. In addition, Lerner (1994) has shown that venture capitalists are able to time the market and bring their firms public under favorable conditions. In this article, we summarize the VentureXpert database in a comprehensive manner to bear on this question by estimating the probability of exit, industry-adjusted exit multiples, and expected gains on private equity investments for a large sample of venture-backed investments.

An examination of the exit outcomes of venture-backed financings is a question of interest to both the academic and the practitioner community. First,

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as Moskowitz and Vissing-Jorgensen (2001) point out, the private equity market is as important as the public market in terms of size and is actually larger for most of their sample period. The sheer size alone is reason enough to study the risk–return trade-off in this market. Also, Gompers and Lerner (2000b) assert that this is a critical area of study because when private equity is mixed with public equity in a portfolio, a better understanding of risk and return would result in superior portfolio choice. They believe that the current inability to value and determine the correlation of private firms with public firms imposes a serious impediment to optimal portfolio choice. Prior research estimated private equity performance using a proxy for private firms, such as publicly traded venture funds (Gompers and Lerner, 1997; Martin and Petty, 1983). In contrast, this paper investigates venture-backed companies to shed light more directly on the risk premium required for the valuation of private equity investments.²

Second, our study is useful in determining the private company discount. Specifically, many finance professionals struggle with the issue of how to value private companies. Unlike publicly traded companies, a private company has no observable stock price to serve as an objective measure of market value. Investors may typically demand a discount for these investments because they may be unable to sell the asset for a period of time. A number of prior studies have attempted to estimate the lack of liquidity. These studies fall into one of three categories. The first estimates the marketability discount by comparing the price of an asset during a period in which it is non-marketable to a period in which it is marketable. Specifically, they compare share prices of firms in the initial public offerings (IPO) to transaction prices in those same shares prior to the IPO.³ The second approach compares share prices of two claims on the same underlying asset, where one claim is marketable and the other is not. This approach is typically implemented by

comparing the price of restricted stock with freely tradeable securities.⁴ The third approach compares acquisition prices of private companies with those of comparable public companies.⁵ As Bajaj *et al.* (2001) argue, these approaches have several limitations. We account for some of the possible pitfalls in estimating the private company discount by comparing the valuation of the private firm with the expected value at the liquidity event. Additionally, our approach permits us to estimate the discount for companies in various stages of their growth cycle, industry, and at different points in time. Moskowitz and Vissing-Jorgensen state that 66% of private companies fail in their first 10 years. All these factors would lead to higher rates of required return on private equity, reflected in the discount charged at the time the venture capitalist invests in these firms. It is important to understand that what we are capturing is more than a non-tradeability discount. The venture capitalists provide an important monitoring and mentoring role to the companies they finance. They often sit on boards of companies in which they invest, and make available their network to these companies. Thus, almost certainly a part of the return is due to these activities.

Our empirical approach is straightforward. We start with a sample of over 52 000 rounds of financing over the period 1980–2000 for which we were able to obtain data from VentureXpert. We follow each of these investments, and estimate the probability of their being acquired or having an IPO. We find that for our sample the probability of an exit via an IPO is roughly 20–25%, and is fairly constant for firms financed in an early stage, expansion stage, or later stage. Similarly, we find the probability of exit via an acquisition is approximately 10–20%. The probability of an acquisition is much higher for the firms financed in later stages. In other recent work covering a smaller period, Gompers and Lerner (1999b) report that, for the period 1983–1994, about 31% of the firms in the VentureOne database completed an IPO and another 29% were acquired. The overall

probability of exit increases as we move from early- to late-stage companies. As many as 44% of the companies in late-stage financings experienced a liquidity event, while only 34% of early-stage firms had a successful exit. There is also high cross-sectional variation in the probability of an exit across different industries. The high-tech, biotech, and medical sectors had a higher probability of successful exit relative to new ventures operating in other sectors. We also find that there is a variation in time to exit across different stages of financing. For over two-thirds of late-stage companies, successful exit happens within 3-years of financing, while only one-third of early-stage companies have a liquidity event within 3-years of financing.

We next estimate the exit multiples obtained for firms that had an IPO or an acquisition/buyout.⁶ We find that exit multiples depend upon the stage of financing. For example, the average for early-stage firms that have an IPO is about 21; for firms that have an acquisition/buyout the average is 10.23. Parts of these high multiples are a result of favorable valuation changes in the industry. Once we adjust the multiples for industry performance, the multiples for early-stage companies are 16 and 7, respectively. Also, later-stage investments return an average of four times the initial investment. After adjusting for industry movements, the multiples fall to around 2.5. Also, the multiples for acquired firms are usually much lower than the multiples for IPOs over the same time period and in similar industries. Average multiples for firms being acquired range from 10.2 for early-stage firms to 4.6 for later-stage companies. Also, there is substantial cross-sectional variation in the exit multiples across industries. Firms in the communications, Internet, and semiconductor segments had the highest multiples, followed closely by the firms in the software and hardware segments.

The remainder of the paper is organized as follows. Section 2 discusses our data sources and reports

descriptive statistics for the sample transactions. Section 3 reports evidence on the probability of exit categorized by year, industry, and stage of company being financed. Section 4 reports evidence on the exit multiple and Section 5 provides results on the expected private equity gains.

2 Sample and data descriptions

2.1 Sample selection

Our sample is obtained from Thompson Financial Data's VentureXpert database. VentureXpert obtains information on private equity investments from over 1000 different companies that make private equity investments. Over 700 of these partner companies are venture funds, while over 250 are buyout and other equity funds. We limit our analysis to the period between 1980 and 2000. We further restrict the study to investments made in US private firms. This selection process results in a sample of 52 322 financing rounds in 23 208 unique firms. We follow these firms till there is an exit or till the end of 2000. The information about the exit is available in the VentureXpert database, and we verify it against the new issue database (for IPOs), and the mergers and acquisitions database (for acquisitions), also provided by Thompson Financial Data Corporation.⁷

2.2 Distribution of financing

Table 1 reports the frequency of financing rounds over time and across industries. Deal flow increases from the 1980s to the next decade. There appear to be cycles in the amount of private equity financing. The period 1986–1990 evidenced large deal flow, which declined in the early 1990s. More recently, the years 1996–2000 comprise a much higher level of financing than evidenced before. For example, in year 2000 we have data on 7386

Table 1 Frequency of financing rounds

Industry sector	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
<i>A: 1980–1989</i>											
Agriculture/forestry/fisheries	1	8	10	11	10	9	11	9	7	11	4
Biotechnology	20	43	57	70	52	80	103	125	141	140	131
Communications	49	116	139	200	232	241	265	296	256	268	222
Computer hardware	109	192	275	367	377	277	263	229	218	215	162
Computer other	0	2	3	3	3	4	3	3	6	6	6
Computer software	19	51	122	221	268	265	275	262	252	279	322
Construction	5	10	4	16	10	14	18	14	15	18	13
Consumer related	50	65	113	132	133	158	195	258	339	330	241
Finance/insurance/real estate	20	26	35	29	28	39	63	75	82	94	88
Industrial/energy	103	171	193	171	170	168	195	211	219	240	200
Internet specific	2	3	5	17	15	14	24	30	31	26	28
Manufacturing	14	26	63	53	57	32	60	72	109	143	86
Medical/health	47	64	100	157	186	195	211	276	251	305	292
Other	2	7	17	11	6	3	2	0	2	9	1
Semiconductor/other	78	105	118	149	215	199	193	196	178	179	155
Transportation	17	11	19	20	22	22	33	41	52	42	38
Utilities	1	0	1	0	1	0	0	2	5	7	6
Total	558	922	1314	1663	1814	1751	1965	2156	2233	2370	2047
Industry sector	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total
<i>B: 1990–2000</i>											
Agriculture/forestry/fisheries	5	4	6	8	7	11	8	25	6	9	180
Biotechnology	127	150	152	150	132	178	214	246	200	219	2730
Business services	30	31	35	34	38	54	68	127	123	146	1153
Communications	206	292	246	274	277	379	437	553	541	797	6286
Computer hardware	122	131	89	104	112	112	141	144	123	185	3947
Computer other	9	12	6	3	5	2	7	8	7	10	108
Computer software	304	362	317	341	373	584	773	900	1012	1287	8589
Construction	9	4	7	9	5	16	29	34	21	21	292
Consumer related	158	183	175	193	244	263	362	419	249	201	4461
Finance/insurance/real estate	104	74	100	113	120	264	174	235	159	174	2096
Industrial/energy	134	152	118	117	120	182	210	248	119	116	3557
Internet specific	29	35	31	50	108	312	489	700	2075	3310	7334
Manufacturing	50	51	52	35	53	61	68	92	68	50	1295
Medical/health	237	317	261	276	290	426	497	567	457	453	5865
Other	3	3	2	3	6	11	17	88	36	26	255
Semiconductor/other	117	133	107	105	118	114	169	232	194	326	3380
Transportation	25	26	24	18	35	34	58	91	50	48	726
Utilities	6	3	4	2	2	2	5	7	6	8	68
Total	1675	1963	1732	1835	2045	3005	3726	4716	5446	7386	52322

The frequency of financing rounds in each industry category by year. The sample is obtained from Thompson Financial Data's VentureExpert database which obtains information on private equity investments from over 1000 different companies; 700 of these partner companies are venture funds, while over 250 are buyout and other equity funds. The sample spans over the period 1980–2000 for investments made in 23 208 US firms.

financing rounds, which is more than double the number of deals financed in any year up to 1997. This increase in the period 1996–2000 is largely a function of increased capital commitments to the so-called “new economy” firms, for example, Internet, communications, hardware and software businesses.

Certain industries have received a large proportion of available private equity financing. The top five industry groups account for over 60% of the total number of investments. The highest number of investments were in the computer software industry (16.4%), followed by Internet (14.0%), communications (12.0%), medical (11.2%), and computer hardware (7.5%).

In Tables 2 and 3, we report the characteristics of financing and exit over time and across industries.⁸ There has been a steady increase over time in the average number of rounds of financing obtained by firms before liquidity events. Given the larger scale of start-up firms in the 1990s, it is likely that they required more financing than anticipated at the outset, marking a difference from the 1980s. This is also noticeable from the trend in the amount of money raised before an IPO or before being acquired.

Not surprisingly, the amount of financing prior to an IPO is higher than that raised before an acquisition. For example, for the Internet company sector, an average firm raised 43 million dollars prior to an IPO versus 17 million prior to being acquired. Interestingly enough, the number of financing rounds before an acquisition is quite similar to that before an IPO, and in some years, tends to be higher.

Also, we see that, as others have documented, there are hot IPO periods.⁹ Our data also show that hot financing markets occur concurrently with hot IPO and acquisition markets. The correlation between the number of financing rounds and the number

of IPOs is 94%, an extraordinarily high number. While the number of IPOs appears to increase slightly in the 1990s, there is a substantial increase in the number of firms being acquired, reflecting the recent increase in merger and acquisition activity.¹⁰

The liquidity events for our sample firms are also high in a select few industries. Not surprisingly, the same five industry groups, comprising over 60% of financing rounds, account for the bulk of the IPOs and acquisitions.

3 Exit probabilities

3.1 Methodology

Each financing round in our sample is categorized based on the stage of the firm that was being financed. We follow the convention used in the database, thereby dividing the sample into five categories: early-stage companies, expansion-stage, later-stage, buyout/acquisition stage, and others (which includes stages classified as special situations).

Denote the i th financing in stage j in year t by f_{ijt} , $i = 1, \dots, N_{jt}$, $j \in J$, $t = 1, \dots, T$, where N_{jt} is the number of financings in stage j in year t and T is the number of years in the database. Stage j is a choice from set $J = \{\text{early, expansion, late, buyout, other}\}$. The total number of financing rounds in the database is then equal to:

$$N = \sum_j \sum_t N_{jt} \quad (1)$$

For each financing f_{ijt} , we record whether the financing resulted in an exit within 3-years of financing, and whether it ultimately resulted in an exit. Exit is marked by the indicator function 1_{ijt} , which indicates if the financing resulted in an exit, and by the indicator function $1_{ijt'}$ if the exit also occurred within 3-years of financing (note that

Table 2 Deal flow and exit categorized by year

Year	IPO											Acquisitions/buyout								
	Number of financing rounds	Amount of money raised	Average number of rounds			Amount of money raised			Frequency	Average number of rounds			Amount of money raised							
			Mean	Median	Frequency	Mean	Median	Frequency		Mean	Median	Frequency	Mean	Median	Frequency					
1980	558	727	2.71	2	22	4.24	1.70													
1981	922	1578	2.33	2	58	2.76	1.05													
1982	1314	2021	2.23	2	32	5.64	3.05			1	3.00	3	6.38	6.38						
1983	1663	3770	2.30	2	187	5.43	2.24			1	1.00									
1984	1814	4228	2.57	2	86	6.38	2.67			3	3.33	5	12.285	12.285						
1985	1751	4246	2.85	3	81	12.54	7.55			2	2.50	4	5.751	5.751						
1986	1965	6204	2.78	2	222	9.84	3.76			10	3.00	2	12.21	4.45						
1987	2156	5409	3.49	3	172	11.98	7.86			12	2.25	2	9.52	6.45						
1988	2233	7727	3.91	3	76	15.12	11.40			21	2.48	1	8.050	4.000						
1989	2370	7505	3.79	3	85	13.34	8.35			20	3.50	4	14.654	8.496						
1990	2047	8069	4.08	3	97	15.12	9.11			20	2.80	2	8.62	5.22						
1991	1675	4994	4.15	3	233	21.48	11.00			23	2.87	2	18.74	5.36						
1992	1963	8480	4.14	3	287	26.82	11.85			30	2.77	2	17.437	6.129						
1993	1732	6157	4.22	4	322	23.08	12.27			77	3.44	3	17.430	8.611						
1994	1835	8064	4.10	3	230	14.27	8.60			87	4.57	3	9.87	6.77						
1995	2045	11029	4.44	4	299	19.21	9.83			119	3.55	3	15.22	6.81						
1996	3005	18847	4.27	4	414	18.59	12.27			132	4.11	3	15.640	7.959						
1997	3726	24288	3.80	3	248	23.39	14.24			194	3.32	2	13.334	5.216						
1998	4716	31041	3.52	3	169	35.78	19.64			214	3.43	2	15.33	8.00						
1999	5446	68855	3.92	4	517	48.75	32.61			243	2.89	2	17.45	11.50						
2000	7386	114300	4.38	4	450	60.87	43.71			263	3.00	2	20.380	12.963						
Total	52322	347542			4287					1472										

Characteristics of the deal flow and exit by the year in which new ventures were financed. The sample is obtained from Thompson Financial Data's VentureExpert database which obtains information on private equity investments from over 1000 different companies; 700 of these partner companies are venture funds, while over 250 are buyout and other equity funds. The sample spans over the period 1980–2000 for investments made in 23 208 US firms. All dollar figures are in millions of dollars.

Table 3 Deal flow and exit categorized industry

Year	Number of financing rounds	Amount of money raised	IPO						Acquisitions/buyout					
			Average number of rounds			Average amount of money raised			Average number of rounds			Average amount of money raised		
			Frequency	Mean	Median	Frequency	Mean	Median	Frequency	Mean	Median	Frequency	Mean	Median
Agriculture/forestry/fisheries	180	480	4	3.00	3	32.49	2	1.00	1	50.000	50.000	50.000		
Biotechnology	2730	12783	433	4.40	4	27.86	65	3.62	3	15.274	15.274	9.275		
Business services	1153	8343	64	1.95	2	18.19	39	2.23	1	20.81	20.81	7.81		
Communications	6286	55081	519	4.26	4	40.65	193	3.63	3	21.72	21.72	13.39		
Computer hardware	3947	13642	350	3.77	3	14.31	102	4.24	3	13.529	13.529	8.549		
Computer other	108	318	9	3.40	4	20.82	4	8.25	7	15.571	15.571	14.425		
Computer software	8589	39709	625	4.19	3	20.32	338	3.69	3	11.91	11.91	8.13		
Construction	292	1762	15	2.25	1	60.34	11	1.18	1	3.48	3.48	3.55		
Consumer related	4461	32171	358	2.64	2	25.82	124	2.91	2	26.091	26.091	10.500		
Finance/insurance/real estate	2096	17034	113	2.44	2	30.83	87	2.63	2	18.468	18.468	3.932		
Industrial/energy	3557	17441	248	3.07	2	19.33	107	2.61	2	10.11	10.11	5.59		
Internet specific	7334	84615	474	3.62	3	42.86	115	2.97	2	17.41	17.41	9.68		
Manufacturing	1295	9975	63	2.16	2	46.85	32	2.00	1	17.201	17.201	11.189		
Medical/health	5865	25472	585	3.87	3	15.53	138	3.85	3	11.551	11.551	5.995		
Other	255	1762	4	2.00	2	392.16								
Semiconductor/other	3380	18812	362	4.06	3	19.14	90	4.40	3	16.02	16.02	8.60		
Transportation	726	6656	55	2.06	1	15.26	23	2.04	2	26.715	26.715	10.612		
Utilities	68	1485	6	2.25	2	30.00	2	6.50	7	15.135	15.135	15.135		
Total	52322	347542	4287				1472							

Characteristics of the deal flow and exit by the industry in which new ventures operates. The sample is obtained from Thompson Financial Data's VentureExpert database which obtains information on private equity investments from over 1000 different companies; 700 of these partner companies are venture funds, while over 250 are buyout and other equity funds. The sample spans over the period 1980–2000 for investments made in 23 208 US firms. All dollar figures are in millions of dollars.

$1_{ijt'} \leq 1_{ijt}$). The probability of exit $p(j, t)$ across all firms in financing stage j in year t is computed as follows:

$$p(j, t) = \frac{\sum_i 1_{ijt}}{N_{jt}} \quad (2)$$

Likewise, the probability of exit in 3-years across all firms in financing stage j in year t is computed as follows:

$$p(J, t < 3) = \frac{\sum_i 1_{ijt'}}{N_{jt}} \quad (3)$$

A similar analysis is undertaken for a classification of probabilities by industry and financing stage.

Denote the i th financing in stage j in industry k by f_{ijk} , $i = 1, \dots, N_{jk}$, $j \in J$, $k = 1, \dots, K$, where N_{jk} is the number of financings in stage j in industry k and K is the number of industry classifications in the sample. For each financing f_{ijk} , we record whether the financing resulted in an exit within 3-years of financing, and whether it ultimately resulted in an exit. Exit is marked by the indicator function 1_{ijk} , which indicates if the financing resulted in an exit, and by the indicator function $1_{ijk'}$ if the exit also occurred within 3-years of financing (note that $1_{ijk'} \leq 1_{ijk}$).

The probability of exit across all firms in financing stage j in industry k is computed as follows:

$$p(j, k) = \frac{\sum_i 1_{ijk}}{N_{jk}} \quad (4)$$

Likewise, the probability of exit in 3-years across all firms in financing stage j in year t is computed as follows:

$$p(j, k, t < 3) = \frac{\sum_i 1_{ijk'}}{N_{jk}} \quad (5)$$

3.2 Exit probabilities

Panel A of Table 4 presents the probability of an investment round in our sample having an

IPO. Panel B presents similar data for an acquisition/buyout. Combined exit probabilities are depicted in panel C. In addition to the overall probability of exit, we also estimate the probability of a liquidity event within 3-years of financing.

We find that the probability of exit via an IPO increases as we progress from early stage to the expansion stage, and into the later stage. The probability of a firm financed in the buyout stage to have an IPO is as expected quite low, as firms in that stage are more likely to be sold.

The probability of exit falls off dramatically in the last 3-years in the sample (1998–2000). This is partly because for many of these recently financed firms, enough time has not passed for them to have had a successful exit. It is for this reason that we report averages of exit probabilities only for the sub-period 1980–1997.

We find that for our sample the probability of an exit via an IPO is roughly 20–25%, and is fairly constant for firms financed in an early stage, expansion stage, or later stage. Similarly, we find the probability of exit via an acquisition is approximately 10–20%. The probability of an acquisition is much higher for the firms financed in later stages. Therefore, the total probability of exit lies in the range of 30–45%. In other recent work covering a smaller period, Gompers and Lerner (1999b) report that, for the period 1983–1994, about 31% of the firms in the VentureOne database completed an IPO and another 29% were acquired. They also found that around 19% of the firms were liquidated, and 21% were still privately held.¹¹ They conducted a logit regression to establish the determinants of the exit, and found that the development stage of the firm (i.e. development, beta, shipping, profitable, or restart stage) is a significant determining factor. The variation across stages is quite marked in our data as well.

Table 4 Probability of liquidity events categorized by year of financing

Year	Buyout/acq stage		Early stage		Expansion stage		Later stage		Others	
	In < 3 years (%)	Total (%)	In < 3 years (%)	Total (%)	In < 3 years (%)	Total (%)	In < 3 years (%)	Total (%)	In < 3 years (%)	Total (%)
<i>A: Probability of an IPO</i>										
1980	8.20	16.39	16.02	31.55	23.45	48.28	40.00	50.00	12.93	19.83
1981	8.54	23.17	12.02	26.85	20.66	32.84	29.51	42.62	4.27	9.40
1982	3.96	16.83	8.30	25.96	15.93	27.14	27.34	35.94	3.62	9.06
1983	8.45	20.42	6.05	19.97	15.09	27.85	26.95	42.55	8.55	13.82
1984	12.50	18.18	4.52	16.47	10.94	22.39	17.19	29.17	6.48	12.04
1985	9.57	14.35	4.09	16.21	10.54	23.58	22.73	34.71	7.14	19.05
1986	6.09	14.78	3.91	19.16	7.29	22.57	25.93	35.56	18.18	30.30
1987	2.51	10.97	2.85	20.97	5.91	21.71	15.11	25.98	13.04	17.39
1988	2.25	10.30	4.44	26.61	6.75	22.13	9.83	25.64	16.00	28.00
1989	4.80	10.40	8.07	27.20	11.56	25.81	17.52	29.93	4.76	33.33
1990	7.29	13.07	9.89	27.36	17.05	26.93	17.59	28.97	35.71	42.86
1991	15.38	22.38	11.96	32.83	16.48	27.36	20.05	27.27	27.78	50.00
1992	14.29	23.50	11.85	28.49	15.79	27.05	16.13	26.76	25.00	25.00
1993	11.32	17.61	15.81	28.85	17.34	25.57	19.46	22.18	10.00	10.00
1994	14.66	16.23	16.28	27.24	21.12	26.52	18.10	21.09	17.86	17.86
1995	12.20	16.93	12.58	22.22	23.26	28.33	22.29	25.00	16.13	16.13
1996	13.23	14.76	10.22	21.86	16.81	23.17	19.88	22.26	0.00	2.56
1997	9.84	10.88	10.19	12.38	15.92	18.67	15.73	16.59	5.17	5.17
1998	8.05	8.05	9.35	9.35	16.23	16.23	16.28	16.28	1.27	1.27
1999	5.70	5.70	1.78	1.78	10.86	10.86	27.03	27.03	2.17	2.17
2000	1.22	1.22	0.18	0.18	1.92	1.92	4.73	4.73	1.57	1.57
<i>Average from 1980 to 1997</i>										
	8.24	14.36	8.76	22.62	14.37	24.79	18.97	25.67	7.84	13.63
<i>B: Probability of buyout/acquisition</i>										
1980	0.00	8.20	0.00	1.94	0.00	1.38	0.00	6.67	0.00	1.72
1981	0.00	0.00	0.51	4.09	0.00	2.21	0.00	4.92	0.00	3.42
1982	0.99	2.97	0.21	3.62	0.29	3.24	0.78	2.34	0.00	0.36
1983	0.00	1.41	0.42	4.22	0.00	2.51	1.42	7.09	0.66	1.97
1984	0.00	1.14	0.80	6.91	1.03	5.81	2.60	8.33	0.00	6.48
1985	0.00	1.91	0.76	6.97	1.00	7.02	0.83	5.79	0.00	4.76
1986	1.74	6.96	0.81	6.34	1.56	9.03	1.85	10.37	3.03	6.06
1987	0.31	5.96	1.36	7.07	1.48	7.24	1.81	6.04	8.70	8.70
1988	0.94	6.55	0.40	10.48	2.01	10.49	1.71	9.83	0.00	4.00
1989	0.96	7.20	0.99	10.20	2.28	11.96	1.46	12.77	0.00	9.52
1990	1.01	10.80	2.01	14.37	1.72	16.33	6.90	27.24	7.14	14.29
1991	5.59	16.08	5.87	14.35	4.96	18.24	12.35	27.74	5.56	16.67
1992	6.91	18.43	6.69	16.25	8.04	21.78	11.57	24.67	25.00	25.00
1993	10.69	25.79	8.12	19.02	10.33	19.09	14.98	27.82	20.00	35.00
1994	14.14	19.90	10.47	19.10	10.11	17.30	13.71	19.51	7.14	7.14
1995	9.06	13.78	7.63	15.93	11.26	15.95	22.08	26.67	6.45	6.45
1996	9.67	13.74	11.03	16.70	11.64	15.49	20.18	21.96	2.56	3.42
1997	8.55	9.59	10.87	13.23	12.24	13.80	13.54	13.54	6.90	6.90

Table 4 *Continued*

Year	Buyout/acq stage		Early stage		Expansion stage		Later stage		Others	
	In < 3 years (%)	Total (%)	In < 3 years (%)	Total (%)	In < 3 years (%)	Total (%)	In < 3 years (%)	Total (%)	In < 3 years (%)	Total (%)
1998	5.52	5.52	8.29	8.29	9.04	9.04	6.35	6.35	0.85	0.85
1999	2.68	2.68	4.11	4.11	6.07	6.07	1.62	1.62	2.17	2.17
2000	0.41	0.41	0.22	0.22	1.14	1.14	0.00	0.00	0.00	0.00
<i>Average from 1980 to 1997</i>										
	3.89	9.50	4.36	11.08	5.35	12.25	10.81	18.10	1.98	4.38
<i>C: Probability of an IPO or acquisition</i>										
1980	8.20	24.59	16.02	33.50	23.45	49.66	40.00	56.67	12.93	21.55
1981	8.54	23.17	12.53	30.95	20.66	35.06	29.51	47.54	4.27	12.82
1982	4.95	19.80	8.51	29.57	16.22	30.38	28.13	38.28	3.62	9.42
1983	8.45	21.83	6.47	24.19	15.09	30.37	28.37	49.65	9.21	15.79
1984	12.50	19.32	5.31	23.37	11.97	28.21	19.79	37.50	6.48	18.52
1985	9.57	16.27	4.85	23.18	11.54	30.60	23.55	40.50	7.14	23.81
1986	7.83	21.74	4.72	25.51	8.85	31.60	27.78	45.93	21.21	36.36
1987	2.82	16.93	4.22	28.04	7.39	28.95	16.92	32.02	21.74	26.09
1988	3.18	16.85	4.84	37.10	8.76	32.61	11.54	35.47	16.00	32.00
1989	5.76	17.60	9.07	37.39	13.84	37.77	18.98	42.70	4.76	42.86
1990	8.29	23.87	11.90	41.73	18.77	43.27	24.48	56.21	42.86	57.14
1991	20.98	38.46	17.83	47.17	21.44	45.60	32.40	55.01	33.33	66.67
1992	21.20	41.94	18.55	44.74	23.83	48.83	27.70	51.42	50.00	50.00
1993	22.01	43.40	23.93	47.86	27.67	44.66	34.44	50.00	30.00	45.00
1994	28.80	36.13	26.74	46.35	31.24	43.82	31.81	40.60	25.00	25.00
1995	21.26	30.71	20.21	38.15	34.52	44.28	44.38	51.67	22.58	22.58
1996	22.90	28.50	21.26	38.56	28.45	38.66	40.06	44.21	2.56	5.98
1997	18.39	20.47	21.06	25.61	28.16	32.47	29.27	30.12	12.07	12.07
1998	13.56	13.56	17.64	17.64	25.27	25.27	22.63	22.63	2.12	2.12
1999	8.39	8.39	5.89	5.89	16.93	16.93	28.65	28.65	4.35	4.35
2000	1.63	1.63	0.40	0.40	3.06	3.06	4.73	4.73	1.57	1.57
<i>Average from 1980 to 1997</i>										
	12.12	23.86	13.12	33.69	19.72	37.03	29.78	43.76	9.83	18.00

The probabilities of exit by year of financing. Panel A presents the probability of an IPO, panel B presents the probability of an acquisition/buyout and panel C presents probability of an IPO or an acquisition. Total exit probabilities are depicted in panel C. In addition to the total probability of exit, we also present the probability when exit occurs within 3 years of financing. The exit probability is presented by financing stage, i.e. early, expansion, later, buyout stage, or others. The probability of an exit by IPO is computed to be the ratio of the number of firms in any financing year that led to an IPO divided by the number of financing rounds in the same year. The probability of an exit by acquisition is computed to be the ratio of the number of firms in any financing year that led to a buyout divided by the number of financing rounds in the same year. The average across all years is the number of exits divided by the total number of financings. Notice that we present averages only for the period 1980–1997. This is due to the fact that the data on financing from 1998 to 2000 is too recent to determine whether or not exit has definitively occurred, or failed to occur.

Table 4, Panel B reports the probability of exit via an acquisition. The probabilities increase as we move from early- to late-stage financings. However, it is interesting that the probability of an acquisition is actually slightly higher for early-stage companies than it is for firms classified as buyout targets. This may be because many early-stage firms that were unable to make it to the IPO stage settled instead for a buyout. Panel C reports the total probabilities of a liquidity event, either from an IPO or an acquisition. As many as 44% of the companies in late-stage financings experienced a liquidity event, reflecting the efficacy of the market for private equity.

Table 5 presents exit probability data across different industry segments. Clearly, some industries have

had a higher proportion of successful exits. Specifically, the “new economy” sectors evidenced much higher success rates. Also, across almost all industry groups we find that the probability of an IPO increases with the financing stage.

In results not reported, we also estimated exit probabilities stratified by the number of the financing round.¹² It is natural to expect that the probability of exit will increase as the number of the round also increases. Renewed financing is usually conditional on prior success, and should presage an increase in the probability of a successful exit. Specifically, the probability of exit increases rapidly for the first two financing rounds, and increases very slowly thereafter. This suggests that failure is a greater danger in

Table 5 Probability of liquidity events categorized by industry

Industry sector	Buyout/acquisition		Early stage		Expansion stage		Later		Others	
	In < 3 years (%)	Total (%)	In < 3 years (%)	Total (%)	In < 3 years (%)	Total (%)	In < 3 years (%)	Total (%)	In < 3 years (%)	Total (%)
<i>A: Probability of an IPO</i>										
Agriculture/forestry/fisheries	3.13	3.13	0.00	2.22	3.45	6.90	0.00	0.00	0.00	0.00
Biotechnology	7.69	23.08	17.06	38.31	30.21	42.57	31.86	36.47	22.58	29.03
Business services	4.06	5.90	4.23	6.19	7.16	11.57	6.90	7.59	2.99	2.99
Communications	7.46	11.33	7.33	18.71	12.78	20.27	20.29	25.67	12.21	15.12
Computer hardware	12.12	16.67	5.17	15.36	12.33	19.87	18.42	24.34	16.26	27.64
Computer other	33.33	33.33	2.94	14.71	9.76	26.83	0.00	0.00	0.00	0.00
Computer software	17.75	28.99	3.87	11.52	10.23	17.15	17.78	21.83	11.54	16.92
Construction	1.72	5.17	0.00	7.50	1.27	3.80	7.89	21.05	0.00	10.53
Consumer related	6.49	11.91	5.99	10.73	7.38	13.11	11.40	14.14	4.30	5.91
Finance/insurance/real estate	11.05	16.45	4.35	9.78	6.70	9.50	8.58	9.98	0.90	0.90
Industrial/energy	5.17	8.98	5.25	15.41	5.40	11.96	11.72	16.85	2.86	7.62
Internet specific	16.00	20.80	6.17	8.54	12.01	13.03	23.24	24.30	3.23	4.84
Manufacturing	2.54	6.43	3.69	6.45	4.00	6.18	8.03	12.41	4.00	5.33
Medical/health	14.91	22.00	9.19	21.27	15.50	22.71	18.13	22.52	4.42	9.73
Other	6.00	8.00	0.00	0.00	0.00	0.00	4.76	4.76	0.00	0.00
Semiconductor/other	11.40	22.37	4.98	19.28	14.07	26.78	18.64	31.28	9.57	24.35
Transportation	5.88	8.82	5.51	10.24	5.78	13.29	7.55	17.92	2.08	6.25
Utilities	11.11	11.11	0.00	0.00	12.50	12.50	20.00	60.00	0.00	0.00
<i>B: Probability of a buyout/acquisition</i>										
Agriculture/forestry/fisheries	0.00	6.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 5 Continued

Industry sector	Buyout/acquisition		Early stage		Expansion stage		Later		Others	
	In < 3 years (%)	Total (%)	In < 3 years (%)	Total (%)	In < 3 years (%)	Total (%)	In < 3 years (%)	Total (%)	In < 3 years (%)	Total (%)
Biotechnology	15.38	23.08	3.46	8.38	3.75	6.99	7.01	11.02	0.00	0.00
Business services	6.27	10.70	4.56	7.49	4.13	5.51	4.14	8.28	0.00	0.00
Communications	4.97	9.25	5.62	9.81	5.56	11.08	8.53	14.18	1.74	4.65
Computer hardware	1.52	7.58	3.28	9.99	5.27	10.67	6.84	12.50	2.44	6.50
Computer other	0.00	0.00	2.94	23.53	9.76	29.27	24.00	48.00	0.00	0.00
Computer software	8.33	20.65	6.66	13.53	7.96	12.81	13.28	17.84	6.92	9.23
Construction	2.59	4.31	0.00	2.50	5.06	8.86	0.00	0.00	0.00	0.00
Consumer related	2.30	6.57	2.79	5.99	3.22	7.95	6.20	12.99	0.00	1.61
Finance/insurance/ real estate	3.60	10.28	1.36	3.80	7.56	12.53	15.78	26.22	0.00	0.22
Industrial/energy	3.20	6.27	1.83	7.42	2.07	8.72	4.95	9.34	0.48	2.38
Internet specific	0.00	0.80	3.32	4.27	3.40	4.31	5.01	6.08	8.06	8.06
Manufacturing	1.86	5.08	0.92	3.69	1.82	3.27	0.73	6.57	0.00	1.33
Medical/health	8.31	12.47	3.32	7.89	4.40	8.18	6.73	10.37	7.08	7.96
Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Semiconductor/ other	2.19	9.65	3.84	9.48	6.02	12.37	6.95	15.96	0.87	6.09
Transportation	2.94	6.25	0.79	1.57	4.62	9.25	4.72	6.60	0.00	0.00
Utilities	14.81	44.44	0.00	0.00	4.17	4.17	0.00	0.00	0.00	0.00
<i>C: Probability of an IPO or acquisition</i>										
Agriculture/forestry/ fisheries	3.13	9.38	0.00	2.22	3.45	6.90	0.00	0.00	0.00	0.00
Biotechnology	23.08	46.15	20.51	46.69	33.96	49.56	38.88	47.49	22.58	29.03
Business services	10.33	16.61	8.79	13.68	11.29	17.08	11.03	15.86	2.99	2.99
Communications	12.43	20.58	12.95	28.52	18.34	31.34	28.82	39.86	13.95	19.77
Computer hardware	13.64	24.24	8.45	25.35	17.60	30.53	25.26	36.84	18.70	34.15
Computer other	33.33	33.33	5.88	38.24	19.51	56.10	24.00	48.00	0.00	0.00
Computer software	26.09	49.64	10.53	25.05	18.19	29.97	31.06	39.67	18.46	26.15
Construction	4.31	9.48	0.00	10.00	6.33	12.66	7.89	21.05	0.00	10.53
Consumer related	8.79	18.49	8.77	16.72	10.60	21.06	17.60	27.13	4.30	7.53
Finance/insurance/ real estate	14.65	26.74	5.71	13.59	14.25	22.03	24.36	36.19	0.90	1.12
Industrial/energy	8.36	15.25	7.08	22.83	7.46	20.68	16.67	26.19	3.33	10.00
Internet specific	16.00	21.60	9.49	12.82	15.41	17.34	28.25	30.38	11.29	12.90
Manufacturing	4.40	11.51	4.61	10.14	5.82	9.45	8.76	18.98	4.00	6.67
Medical/health	23.23	34.47	12.51	29.16	19.90	30.90	24.86	32.90	11.50	17.70
Other	6.00	8.00	0.00	0.00	0.00	0.00	4.76	4.76	0.00	0.00
Semiconductor/other	13.60	32.02	8.82	28.76	20.08	39.15	25.59	47.24	10.43	30.43
Transportation	8.82	15.07	6.30	11.81	10.40	22.54	12.26	24.53	2.08	6.25
Utilities	25.93	55.56	0.00	0.00	16.67	16.67	20.00	60.00	0.00	0.00

The probabilities of exit by industry. Panel A presents the probability of an IPO, panel B presents the probability of an acquisition/buyout and panel C presents probability of an IPO or an acquisition. Total exit probabilities are depicted in panel C. In addition to the total probability of exit, we also present the probability when exit occurs within 3 years of financing. The exit probability is presented by financing stage, i.e. early, expansion, later, buyout stage, or others. The probability of an exit by IPO is computed to be the ratio of the number of firms in any financing year that led to an IPO divided by the number of financing rounds in the same year. The probability of an exit by acquisition is computed to be the ratio of the number of firms in any financing year that led to a buyout divided by the number of financing rounds in the same year. The average across all years is the number of exits divided by the total number of financings.

early rounds, as would be expected. It also implies that later rounds may be less useful in increasing the probability of success. Again, we see that the probability of exit increases with the stage of financing.

In addition, we estimated exit probabilities stratified by the amount of financing in the round. We first sorted our sample firms into deciles based on the amount of financing. We find that the probability of exit increases with the amount of financing, though this seems much more marked for IPO exits, than for exits via acquisition.

Finally, we examined exit probabilities stratified by the amount of the post-money valuation. For exits via an IPO, there is a marked increase in the likelihood of an exit as the valuation increases. It is interesting that exactly the opposite effect occurs

for exits via acquisitions, that is, the probability of exit declines as the post-money valuation increases. The conclusion that we draw from these opposite effects is that firms with high post-money valuations are more likely to exit via an IPO than by acquisition. (See Figures 1 and 2.)

4 Exit multiples

4.1 Methodology

The private equity valuation discount is reflected in the extra rate of return required on the private firm over the return earned by investing in a public firm. Investing in private equity is akin to buying a highly risky discount security, where the maturity date is unknown. Substantial payoff risk is also

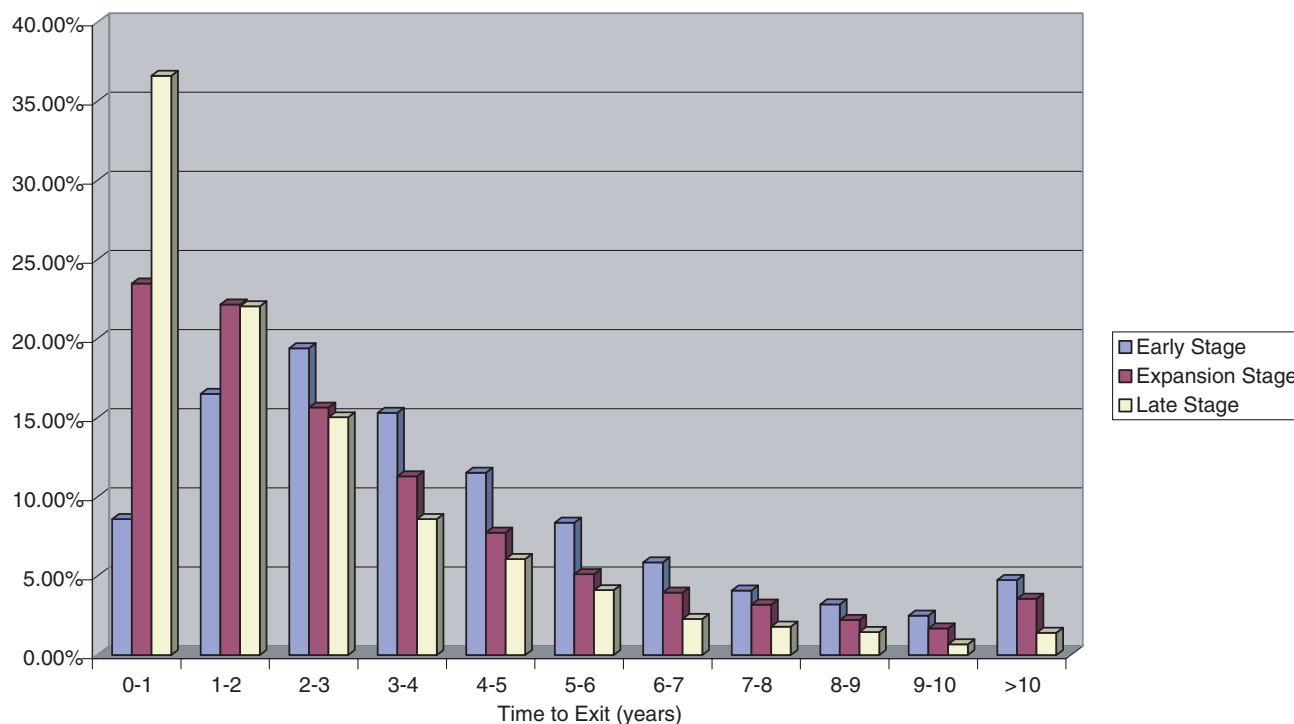


Figure 1 Frequency of time to exit for the firms in our sample having an IPO or an acquisition/buyout. The sample is obtained from Thompson Financial Data's VentureExpert database which obtains information on private equity investments from over 1000 different companies; 700 of these partner companies are venture funds, while over 250 are buyout and other equity funds. The sample spans over the period 1980-2000 for investments made in 23 208 US firms.

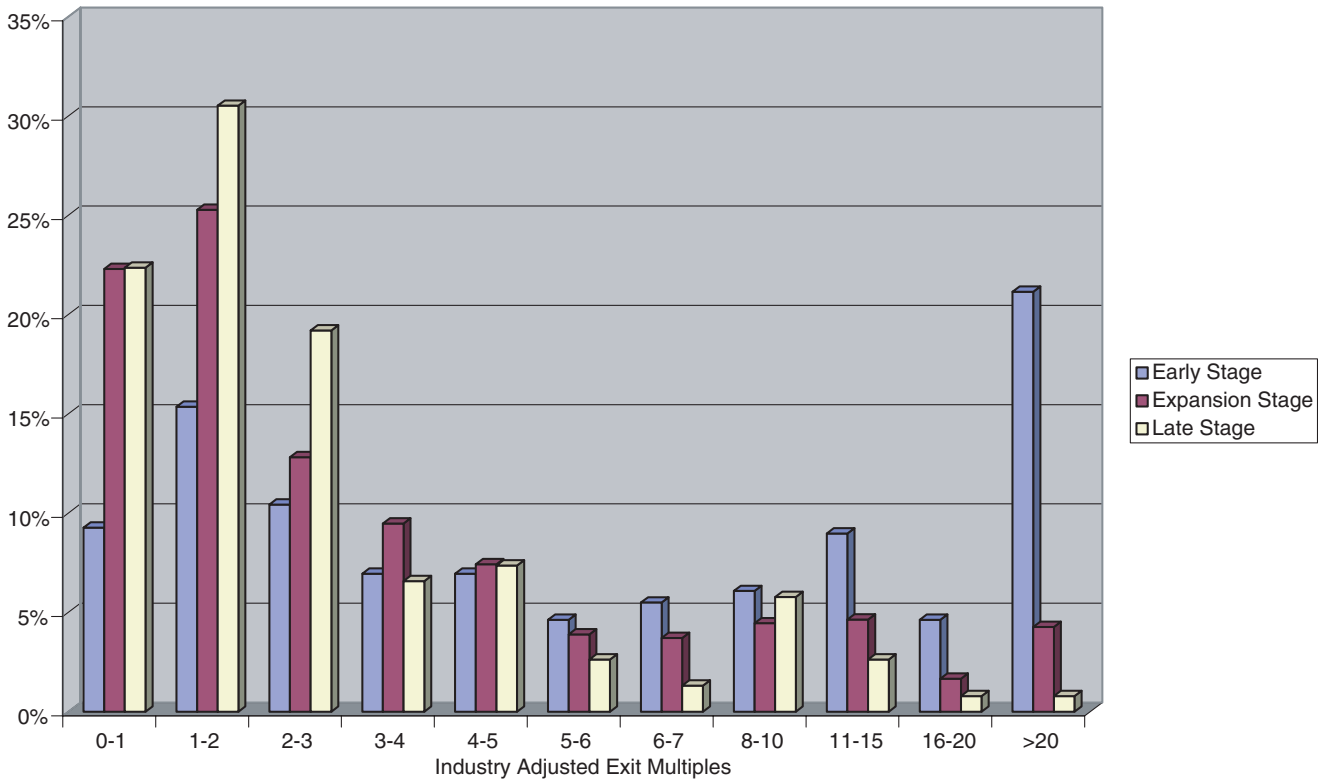


Figure 2 Frequency of industry adjusted exit multiples for the firms in our sample having an IPO or an acquisition/buyout. The sample is obtained from Thompson Financial Data’s VentureExpert database which obtains information on private equity investments from over 1000 different companies; 700 of these partner companies are venture funds, while over 250 are buyout and other equity funds. The sample spans over the period 1980-2000 for investments made in 23 208 US firms.

borne. Given these features, venture capitalists tend to think of payoffs more in terms of multiples of their initial investment, rather than in terms of steady, annual rates of return. Hence, part of the value creation comes from the VCs’ ability to negotiate an attractively discounted price. Our goal in this paper is to cast light on the extent of this discount.

For each firm, which has an IPO or is acquired, exit multiples are computed as follows, denoted X_{ijt} or X_{ijk} (generically X_{ij}) depending on whether the data are segmented by year of financing or by industry category, respectively. The following variables are defined:

$$X_{\text{raw}} = \frac{\text{Exit valuation (at IPO or ACQ)}}{\text{Financing valuation}}$$

$$X_{\text{ind}} = \frac{\text{Industry index (at IPO or ACQ)}}{\text{Industry index at financing}}$$

$$X_{ij} = \frac{X_{\text{raw}}}{X_{\text{ind}}}$$

Here, X_{ij} is the return multiple expressed over the benchmark return. Both the valuation at exit and financing are post-money. This ratio is commonly used by venture capitalists as it provides a direct way of assessing the payback from the private equity investment. Notice that the excess return (denoted R_{ij}) is equal to $(X_{\text{raw}} - X_{\text{ind}})$. Thus, on an initial investment of 100, an IPO at a value of 500 would imply that $X_{\text{raw}} = 5$, and if the industry index went from 100 to 150, then the excess return is $R_{ij} = 350\%$. The excess multiple would be $5/1.5$.

It is important to ensure that the raw multiple has been adjusted for dilution effects during the financing path, as the stake of the original capital providers gets diluted in subsequent financing rounds. This is best explained with an example. Let the original investment be 100. The second round of financing is also for an amount of 100, with a post-money valuation of 500. This implies that the original investors have parted with 20% of the firm ($= 100/500$). Hence, the first-round retention ratio is 80%. Assume then that the firm has an IPO value of 1000, and raises extra capital in the IPO of 300. The dilution at the IPO is 30% ($= 300/1000$), or a retention ratio of 70%. The cumulative retention ratio is, therefore, 56% ($= 0.8 \times 0.7$). The multiple on the initial investment before dilution effects is 10 ($= 1000/100$). The multiple on the initial investment after dilution is correctly accounted for is equal to 5.6, that is, the multiple of 10 multiplied by the cumulative retention ratio. Using similar logic, the second-round investment multiple would be 1.4, that is, the multiple of 2 ($= 1000/500$) diluted by the cumulative retention ratio of 70%.

Our multiple measure is not adjusted for the time between financing and exit. The annualized values are computed as follows:

$$X_{\text{annual}} = [X_{\text{raw}}]^{1/t} \quad (6)$$

$$t = \frac{\text{days}}{365} \quad (7)$$

$$R_{\text{annual}} = X_{\text{annual}} - 1 \quad (8)$$

Therefore, if $X_{\text{raw}} = 5$, and the number of days from financing to IPO is 900, then $X_{\text{annual}} = 5^{(365/900)} = 5^{0.40556} = 1.92075$. The return is $R_{\text{annual}} = 0.92075$, or 92% per annum.

This approach offers a method for normalization and comparison of gains, since each firm takes a different amount of time to exit. However, the measure does have some limitations. When the number

of days is very small, the measure tends to inflate annualized multiples excessively. This often occurs when a financing has been undertaken just prior to an IPO. In the preceding example, if $\text{days} = 10$, then $X_{\text{annual}} = 3.25 \times 1025$. This creates outliers, which distort further empirical analysis.

A pragmatic solution to this problem is to round up all fractions of a year to a whole year. The new expression for annualized multiples is then stated by

$$X_{\text{annual}} = [X_{\text{raw}}]^{1/t} \quad (9)$$

$$t = \text{CEIL} \left[\frac{\text{days}}{365} \right] \quad (10)$$

where the function $\text{CEIL}(x)$ stands for the integer immediately greater than x . Hence, the same analysis in the steps above is now implementable using annualized multiples.

4.2 Exit multiples

Valuations at funding stage are usually affected by the state of the stock markets and supply of venture capital. Lerner (1997) finds that financing pressure significantly affects valuations. More money chasing deals will result in higher pre-money valuations. In a recent paper, Gompers and Lerner (2000b) construct a hedonic price index for venture valuations. This index is shown to be very sensitive to venture fund inflows. They estimate that a doubling of venture flows results in a 7–21% increase in valuation levels.¹³

Table 6 presents valuation multiples by year of financing. We are able to assess whether there is time series variation in valuation multiples by year of financing, leading to an alternative view of “hot” financing markets, that is, whether the year of financing determines exit multiples. In hot financing markets, money chases deals (Gompers and Lerner, 2000a), and may result in higher

post-money valuations, leading to lower realized multiples.

Panel A of Table 6 presents raw exit multiples for investments that led to an IPO for the period 1984–2000.¹⁴ As is expected, the realized multiples are highest for early-stage companies (21.01), lower for expansion-stage firms (7.90), and are lowest for later-stage companies (4.01). This pattern is noticeable for both multiples and annualized returns. Multiples for buyout stage firms are slightly higher than those for expansion stage firms. It is worth noting that multiples are often high, and the average for early-stage firms is about 21, whereas the annualized average multiple for the same firm is a little greater than 2. This drops to about 4.01 (annualized 1.82) for later-stage firms. There is wide variation in multiples across all the years we examined, and there is little evidence of a time trend over the past decade.

Panel B summarizes results for acquired firms, and the pattern of decreasing multiples as we progress from early- to late-stage firms is evident here as well. This pattern confirms the expected relationship between risk and return: firms in early stages bear much greater risk *ex-ante*. However, a distinctive finding is that the multiples for acquired firms are usually lower than those for IPOs. Average multiples range from about 10.0 for early-stage firms to about 4.6 for later-stage companies. Buyout-stage firms have higher multiples. Once again, there is very high time series variation in multiples. A lower multiple for a firm which exits through an acquisition is in no way suggestive of a sub-optimal exit strategy.¹⁵

Panel C of Table 6 corresponds to Panel A, but presents the results after adjusting for returns that may be attributed to the industry. This results in a reduction in multiples, with IPOs ranging from 15.79 for early-stage financings to 2.91 for later-stage rounds. The multiples for acquisitions are

much lower, ranging from 6.72 in early stages to 2.57 in later rounds, as can be seen in Panel D.

Table 7 presents exit multiples by industry segment. There is substantial cross-sectional variation in the data. For IPOs, the semiconductor, communications, and Internet segments evidence the highest multiples, followed closely by the software and hardware segments. A similar pattern is seen in the case of buyout exits, where hardware, software, Internet, and communications were the segments with the highest exit multiples.

In unreported results, we estimated exit multiples after stratifying the sample by financing round. For early-stage financings, the multiples drop rapidly as the round number increases, corresponding to the perceived risk at early rounds. This effect cuts across IPO and acquisition exits. The effect exists, though is weaker for the expansion- and later-stage financing rounds.

We also examined exit multiples when the data are stratified by deciles of financing amount. For firms exiting via an IPO, the multiples are higher for smaller financings. This effect is more marked for early-stage firms than for later-stage firms. The fact that a firm invests little, yet makes it to an IPO, would naturally result in greater multiples. For exits via acquisition, there appears to no such effect.

Finally, we examined exit multiples for data stratified by the post-money valuation amount. Since multiples are calculated as a function of the post-money amount, there is a natural inverse relationship here. This is borne out in the data we looked at.

5 Expected multiples

5.1 Methodology

To estimate the expected multiple, we proceed as follows. Denote the i th multiple in stage j in year t

Table 6 Valuation multiples categorized by year of financing

Year	Buyout/acquisition			Early stage			Expansion stage			Later stage			Others		
	Raw	Annualized	Frequency	Raw	Annualized	Frequency	Raw	Annualized	Frequency	Raw	Annualized	Frequency	Raw	Annualized	Frequency
<i>A: Raw multiples for firms having an IPO</i>															
1984				4.18	1.15	1									
1985							3.95	1.13	1						
1986			2												
1987		2.80	1.16	1.85	1.11	1									
1988		2.50	1.02				9.36	1.25	2						
1989		3.45	1.35				0.74	0.93	1						
1990		3.28	1.38				1.43	1.13	5						
1991	2.40	1.55	1.22	4.38	1.22	5	1.75	1.27	2						
1992	1.33	1.33	1.59	11.92	1.33	11	3.03	1.49	11						
1993		8.54	1.43	4.72	1.58	16	2.65	2.22	7						
1994	30.97	2.36	1.61	5.39	1.52	15	2.81	1.58	11	5.82	2.41	1			
1995	2.20	1.48	2.07	8.17	2.56	27	6.40	2.97	8						
1996	3.45	1.99	2.21	8.63	1.63	48	3.62	1.68	32						
1997	14.62	2.33	3.04	8.31	2.22	108	4.74	1.94	50						
1998	5.55	4.18	5.88	6.11	3.15	110	4.90	3.45	73	3.05	1.59	3			
1999	6.69	5.28	4.98	5.61	3.93	129	3.35	3.21	136						
2000		0.94	9.94	1.41	1.41	35	1.09	1.09	27						
<i>Average 1980-1997</i>															
	10.67	2.10	2.26	7.90	1.97		4.01	1.82		5.82	2.41				
<i>B: Raw multiples for firms having an acquisitions/buyout</i>															
1988															
1989	22.33	1.56	1												
1990															
1991			3.82	1.56	1.68	1									
1992			2.70	1.28	0.90	1	15.65	1.72	2						
1993	10.22	1.39	1.31	0.52	0.90	1	0.80	0.92	2						
1994			2.27	1.48	1.22	1	0.42	0.80	1						
1995			2.19	1.48	4.80	2	2.54	1.35	2	2.31	1.52	1			
1996			26.53	4.52	0.88	2	3.63	1.41	6						
1997			5.50	2.60	1.87	6	12.56	1.49	2						
1998	1.05	1.02	3.00	2.58	1.74	5	4.46	4.46	4	4.28	4.28	1			
1999			5.22	5.22	3.60	13	2.20	2.20	2	2.18	2.18	1			
2000			3.72	3.72	1.99	5									
<i>Average 1980-1997</i>															
	16.28	1.48	10.23	2.69	2.03		4.63	1.33		2.31	1.52				

C: Industry adjusted multiples for firms having an IPO

1984					1.27	1.02	1							
1985														
1986		1.41	1.04	2				1.07	1.01	1				
1987		0.90	0.90	3	1.34	1.05	1							
1988		1.73	1.17	3				4.02	1.13	2				
1989		2.30	1.26	3	1.02	1.03	3	0.48	0.83	1				
1990		0.99	1.01	3				0.94	0.97	5				
1991	1.87	14.10	1.47	5	1.60	1.00	5	1.35	1.09	2				
1992	1.32	3.37	1.35	7	5.13	1.16	11	2.15	1.30	11				
1993		4.01	1.25	10	2.83	1.33	15	2.05	1.94	7				
1994	14.71	4.43	1.35	19	2.78	1.25	15	1.76	1.32	11	4.22	2.06	1	
1995	1.45	10.12	1.72	27	6.08	2.10	27	4.35	2.40	8				
1996	2.68	17.43	1.95	87	5.73	1.44	48	2.70	1.53	32				
1997	13.47	25.65	2.64	65	6.97	2.01	105	3.65	1.79	50				
1998	4.27	28.69	4.70	67	4.75	2.66	110	4.07	2.99	73	2.29	1.36	3	
1999	7.02	8.67	4.27	25	4.43	3.22	128	2.87	2.72	131				
2000		0.98	0.98	3	1.55	1.55	35	1.19	1.19	26				
<i>Average 1980–1997</i>	9.10	15.79	1.96		5.73	1.73		2.91	1.62		4.22	2.06		

D: Industry adjusted multiples for firms having an acquisitions/buyout

1988														
1989	5.71	1.28	1											
1990														
1991		1.82	1.22	1										
1992		1.26	1.06	1	2.04	1.43	1	6.26	1.42	2				
1993	4.66	1.25	1	1	0.24	0.79	1							
1994		1.35	1.16	1	0.91	0.95	1	0.77	0.89	2				
1995					6.02	4.01	2	0.29	0.73	1	1.46	1.21	1	
1996		23.54	4.13	3	0.60	0.72	2	1.82	1.22	2				
1997		3.62	2.12	4	1.83	1.64	6	2.57	1.28	6				
1998	0.84	0.92	1	2	4.18	1.55	5	0.06	0.06	2				
1999		4.21	4.21	4	3.69	2.91	13	3.33	3.33	4	3.45	3.45	1	
2000		6.62	6.62	1	2.40	2.40	5	2.81	2.81	2	2.65	2.65	1	
<i>Average 1980–1997</i>	5.19	6.72	2.12		2.11	1.73		2.57	1.19		1.46	1.21		

The valuation multiples categorized by the year in which financing was received. Panels A and B present raw multiples when firms had an IPO or a buyout/acquisition. Panels C and D present industry adjusted multiples. The “raw” multiple is computed as the ratio of the post-money value of the firm when it exits to the post-money valuation it received at the time of financing. The annualized multiple is the raw multiple annualized to the nearest year. Corresponding industry adjusted multiples are the ratio of the raw multiples and performance of publicly traded firms in the same industry.

Table 7 Valuation multiples categorized by industry

Year	Buyout/acquisition			Early stage			Expansion stage			Later stage			Others		
	Raw	Annualized	Frequency	Raw	Annualized	Frequency	Raw	Annualized	Frequency	Raw	Annualized	Frequency	Raw	Annualized	Frequency
<i>A: Raw multiples for firms having an IPO</i>															
Biotechnology				2.39	1.13	28	1.34	1.07	53	1.83	1.25	31			
Business services	3.23	1.48	1	5.40	1.47	3	5.59	2.74	6						
Communications	6.79	4.65	8	21.83	2.79	50	5.70	2.76	63	3.02	1.92	63	3.35	1.83	2
Computer hardware	3.31	1.82	1	7.17	1.88	9	4.56	2.17	12	2.14	1.78	14	2.20	1.24	2
Computer other				1.21	1.07	2	1.54	1.03	4						
Computer software	0.65	0.65	1	11.62	2.07	56	3.21	1.58	83	2.81	2.17	85			
Consumer related	1.73	1.28	3	0.98	0.99	6	14.30	2.11	15	2.43	1.26	8			
Finance/insurance/ real estate				0.85	0.96	1				0.48	0.48	1			
Industrial/energy	1.28	1.16	2	5.73	1.50	6	1.97	1.83	11	2.86	2.44	9			
Internet specific	3.67	2.16	7	17.36	3.63	132	6.60	3.29	176	3.76	2.94	125			
Manufacturing	6.08	2.47	1												
Medical/health	4.51	2.22	7	3.17	1.22	22	1.43	1.12	44	1.00	0.92	15			
Semiconductor/ other	65.19	3.38	2	110.25	3.61	14	5.87	1.88	37	3.97	3.68	9			
<i>B: Raw multiples for firms having an acquisitions/buyout</i>															
Biotechnology	4.66	1.25	1	2.91	2.91	1	0.39	0.61	3	1.24	0.95	4			
Business services				3.78	3.22	5	2.89	2.79	6	4.43	2.36	4			
Communications				1.35	1.16	1	5.20	2.09	3	5.25	2.41	3	1.46	1.21	1
Computer hardware				0.84	0.92	1	9.32	2.21	6	1.47	1.53	4	2.65	2.65	1
Computer software				4.65	4.65	3	2.32	2.30	7	4.08	4.08	1	3.45	3.45	1
Internet specific				5.71	1.28	1	3.79	1.78	2	1.25	1.00	2			
Medical/health							3.17	3.10	2	0.77	0.89	2			
Semiconductor/ other															

C: Industry adjusted multiples for firms having an IPO

Biotechnology	4.14	1.32	28	2.02	1.25	54	2.55	1.46	31
Business services	5.51	1.77	1	7.16	3.04	6			
Communications	8.65	5.55	8	8.32	3.18	64	3.89	2.13	64
Computer hardware	5.21	2.28	1	7.23	2.59	12	2.46	1.98	14
Computer other		2.12	2	2.35	1.19	4			
Computer software	0.97	1.00	2	4.75	1.88	86	3.76	2.57	85
Consumer related	2.16	1.41	3	12.32	2.17	15	4.10	1.38	8
Finance/insurance/ real estate	1.87	1.17	1				0.36	0.36	1
Industrial/energy	1.69	1.33	2	2.09	1.80	11	2.99	2.55	9
Internet specific	4.54	2.50	7	8.61	3.97	176	4.33	3.38	129
Manufacturing	5.06	2.25	1						
Medical/health	6.87	2.23	7	2.05	1.25	44	1.26	1.06	16
Semiconductor/ other	67.80	3.53	2	8.11	1.97	37	4.78	4.33	9

D: Industry adjusted multiples for firms having an acquisitions/buyout

Biotechnology	10.22	1.39	1	0.74	0.86	3	2.09	1.25	4
Business services				2.61	1.38	1			
Communications		4.30	5	3.25	3.07	6	5.86	2.25	4
Computer hardware		2.19	1	6.80	2.82	5	14.57	2.89	4
Computer software	1.05	1.02	1	4.49	2.79	10	1.76	1.69	4
Internet specific		5.75	3	2.53	2.45	7	6.28	6.28	1
Medical/health	22.33	1.56	1	5.66	2.20	2	1.29	1.03	2
Semiconductor/ other		3.09	1	3.09	2.98	2	0.80	0.92	2

The valuation multiples categorized by the industry in which the firm being financed operates. Panels A and B present raw multiples when firms had an IPO or a buyout/acquisition. Panels C and D present industry adjusted multiples. The "raw" multiple is computed as the ratio of the post-money value of the firm when it exits to the post-money valuation it received at the time of financing. The annualized multiple is the raw multiple annualized to the nearest year. Corresponding industry adjusted multiples are the ratio of the raw multiples and performance of publicly traded firms in the same industry.

by X_{ijt} , $i = 1, \dots, N_{jt}$, $j \in J$, $t = 1, \dots, T$, where N_{jt} is the number of financings in stage j in year t and T is the number of years in the database. Stage j is a choice from the set $J = \{\text{early, expansion, late, buyout, other}\}$. For each set of financing multiples X_{ijt} , we compute the expected exit multiple as follows:

$$\begin{aligned} & \text{Expected exit multiple}(j, t | \text{IPO or ACQ}) \\ &= E(X_{jt} | \text{IPO or ACQ}) \\ &= p(j, t | \text{IPO or ACQ}) \times \frac{\sum_i X_{ijt}}{N_{jt}} \end{aligned}$$

which follows from the fact that the multiple for failure to exit is zero. Denote the i th multiple in stage j in industry k by X_{ijk} , $i = 1, \dots, N_{jk}$, $j \in J$, $k = 1, \dots, K$, where N_{jk} is the number of financings in stage j in industry k and K is the number of industry categories in the database. For each set of financing multiples X_{ijk} , we compute the expected exit multiple as follows:

$$\begin{aligned} & \text{Expected exit multiple}(j, k | \text{IPO or ACQ}) \\ &= E(X_{jt} | \text{IPO or ACQ}) \\ &= p(j, k | \text{IPO or ACQ}) \times \frac{\sum_i X_{ijk}}{N_{jk}} \end{aligned}$$

Note that the expected multiple is an equally weighted multiple.

Finally, we compute the overall expected multiple. Each new firm either exits its private status, or fails to make it to the public company stage. Exit occurs in two forms: (i) IPO and (ii) buyout/acquisition by another firm. The expected multiple X_j on firm j from funding round to exit is stated in the following return equations:

$$\begin{aligned} E[X_{jt}] &= E[X_{jt} | \text{IPO}] + E[X_{jt} | \text{ACQ}] \\ E[X_{jk}] &= E[X_{jk} | \text{IPO}] + E[X_{jk} | \text{ACQ}] \end{aligned}$$

These two equations are for the data analyzed by year of financing and by industry category, respectively.

5.2 Expected multiples

Table 8 presents the industry adjusted expected multiples by year of financing. We notice considerable variation in multiples across the time series. Panel A contains industry adjusted multiples for both IPOs and acquisitions, and Panel B contains the expected industry adjusted multiples, which are obtained by multiplying the probability of exit by the exit multiple.

First, notice that expected multiples from early-stage financing tend to be much higher than those from the other stages, presumably as a result of the higher risk borne by the private equity investor at this stage of the process. The higher discounts apply to early-stage investments and become correspondingly lower for later-stage financings. Notice also that there are many years where the expected multiple is less than one, that is, a negative return. However, in the later years in the sample this is not the case, and large multiples were earned in the 1990s.

Cochrane (2001) has argued that high levels of return may simply be on account of another form of selection bias, that is, firms go public only when they have achieved a high rate of return. He finds that failure to correct for this bias results in average returns in the 700% range. After implementing a correction for exit probability, the arithmetic average returns result in levels in the 50% range. Our sample is fairly comprehensive, and we have a large number of firms that do not result in exits, from which we carefully compute the survival probability. By breaking the sample into buckets, we also believe that the correlation between stage of financing, vintage, and industry with returns is captured in a meaningful way. Hence, we believe that the bias is mitigated. Indeed, we do obtain returns at levels close to those obtained by Cochrane after making the selection bias correction.

Table 8 Expected Private Equity Multiples by Year of Financing

Year	Buyout/acquisition			Early stage			Expansion stage			Later stage			Others		
	Raw	Annualized	Frequency	Raw	Annualized	Frequency	Raw	Annualized	Frequency	Raw	Annualized	Frequency	Raw	Annualized	Frequency
<i>A: Industry adjusted multiples for firms having an IPO or an acquisition/buyout</i>															
1984				1.27	1.02	1									
1985										1.07	1.01	1			
1986			2	1.41	1.04										
1987			3	0.90	0.90	3	1.34	1.05	1						
1988			3	1.73	1.17										
1989	5.71	1.28	1	2.30	1.26	3	1.02	1.03	3	4.02	1.13	2			
1990			3	0.99	1.01					0.48	0.83	1			
1991	1.87	1.37	1	12.05	1.43	6	1.60	1.00	5	0.94	0.97	5			
1992	1.32	1.32	2	3.10	1.31	8	4.87	1.18	12	1.35	1.09	2			
1993	4.66	1.25	1	3.76	1.23	11	2.67	1.29	16	2.79	1.32	13			
1994	14.71	1.96	1	4.27	1.34	20	2.66	1.23	16	2.05	1.94	7			
1995	1.45	1.20	1	10.12	1.72	27	6.07	2.24	29	1.60	1.25	13	4.22	2.06	1
1996	2.68	1.82	5	17.57	2.00	89	5.52	1.41	50	3.90	2.21	9	1.46	1.21	1
1997	13.47	2.17	13	24.37	2.61	69	6.69	1.99	111	2.65	1.51	34			
1998	3.78	3.01	7	27.93	4.63	69	4.72	2.61	115	3.54	1.73	56	2.29	1.36	3
1999	7.02	5.64	4	8.06	4.26	29	4.37	3.19	140	4.01	2.95	74	3.45	3.45	1
2000			4	2.39	2.39	4	1.64	1.64	39	2.89	2.74	135	2.65	2.65	1
<i>Average 1984–1997</i>															
	8.78	1.88		15.42	1.97		5.54	1.73		2.88	1.58		2.84	1.63	
<i>B: Expected private equity multiples</i>															
1984				0.36	9.15	0.89				0.43	10.99	0.93			
1985															
1986			0.86	0.36	6.64										
1987			0.81	0.25	6.40										
1988			0.91	0.64	4.83										
1989	1.36	6.76	1.05	0.86	2.61	0.94	0.39	5.70	0.85	1.43	5.81	1.06	0.65	0.65	
1990			0.81	0.41	4.29	0.81				0.53	2.35	0.76	0.76	0.76	
1991	0.72	1.15	0.75	5.69	3.26	1.70	0.73	5.27	0.94	0.74	1.14	0.77	1.14	1.14	
1992	0.55	0.65	0.40	1.39	3.58	1.10	2.38	2.94	1.34	1.43	1.98	1.20	1.98	1.98	
1993	2.02	6.58	1.11	1.80	3.54	1.18	1.19	2.89	1.06	1.03	1.56	1.02	1.56	1.56	
1994	5.31	3.68	1.57	1.98	2.84	1.27	1.17	2.54	1.06	0.65	1.81	0.79	1.81	1.81	1.05
1995	0.44	1.84	0.64	3.86	3.33	1.50	2.69	1.70	1.79	2.01	1.85	1.46	2.01	2.01	0.42
1996	0.76	1.37	0.82	6.78	3.03	1.88	2.13	2.10	1.44	1.17	1.62	1.10	1.62	1.62	
1997	2.76	1.68	1.83	6.24	2.39	2.15	2.17	2.01	1.47	1.07	1.52	1.04	1.52	1.52	
1998	0.51	1.25	0.59	4.93	1.56	2.77	1.19	1.33	1.14	0.91	1.13	0.92	0.91	0.91	0.10
1999	0.59	0.76	0.50	0.47	0.87	0.43	0.74	0.66	0.63	0.83	0.47	0.67	0.83	0.83	0.03
2000			0.00	0.01	0.41	0.00	0.05	0.42	0.00	0.06	0.32	0.00	0.06	0.06	0.00
<i>Average 1984–1997</i>															
	2.03			5.12			2.04			1.12			0.69		

The expected multiples for our sample firms categorized by the year of financing. Panel A presents the industry adjusted multiple for firms having an IPO or an acquisition/buyout. Panel B presents the expected industry adjusted multiple estimated as the product of the probability of an exit via an IPO or an acquisition/buyout and the industry adjusted multiple.

Returns may be high because the period studied was one of hot IPO markets, as well as an active M&A market. This may have fueled highly priced exits, with the resultant high return levels.

High returns also reflect the fact that private equity is non-traded, and comes with minimal supervision. Hence, there is a concomitantly appropriate rate of return. Moskowitz and Vissing-Jorgensen state that 66% of private companies fail in their first 10-years. All these factors would lead to higher rates of required return on private equity, reflected in the discount charged at the time the venture capitalist invests in these firms.

Table 9 presents the industry adjusted expected multiples by industry segment. There is substantial industry variation in expected multiples. Communications and the Internet segments account for much higher rates of return than do the other categories. The pattern of stage-based returns seen in Table 8 is also in evidence here—early-stage investments do provide higher levels of return. And returns on IPOs tend to be much higher than returns on buyout firms, again lending credence to the notion that firms that fail to access the public markets are bought out at lower prices.

6 Summary and Implications

Little is known about the risk and return characteristics of private equity investments. We examine over 52 000 financing rounds by venture and buyout funds and estimate the probability of exit, the expected multiples, and the gains from private equity investments. Our analysis shows that the probability of exit, the valuation multiple, and the expected gains depend upon the industry, the stage of the firm being financed, and the prevailing market sentiment.

In addition to our study being the first comprehensive examination of the gains from venture-backed financing, the results have implications for valuing private companies. Unlike publicly traded firms, a private company has no observable stock price to serve as an objective measure of market value. Therefore, to value private companies, many valuation experts tend to find a set of comparable publicly traded companies and take valuation ratios like price-to-sales or price-to-earnings, and apply these to the observable accounting characteristics of the private companies. They next apply a marketability discount to account for the lack of liquidity, because there does not exist a ready market for these investments. The amount of discount to be applied is often ad-hoc. Our expected exit multiples can provide a guideline about the appropriate amount of marketability discount.

Our empirical results may be used to estimate the marketability discount using the following equations:

$$D_{jt} = 1 - \frac{1}{E[X_{jt}]}$$

$$D_{jk} = 1 - \frac{1}{E[X_{jk}]}$$

As an example, if $E[X] = 1.5$, then $D = 33\%$. We find that financing in late-stage companies, the private equity discounts are about 11%, and for early-stage companies the discounts are 80%.¹⁶ It is important to understand that what we are capturing is more than a non-tradeability discount. The venture capitalists provide an important monitoring and mentoring role to the companies they finance (for evidence on this, see Hellman and Puri, 2000, 2002). They often sit on boards of companies in which they invest, and make available their network to these companies. Thus, almost certainly a part of the return is due to these activities. These high returns are to some extent being driven by success of investments in the new economy companies like

Table 9 Expected private equity multiples by industry

Year	Buyout/acquisition			Early stage			Expansion stage			Later stage			Others		
	Raw	Annualized	Frequency	Raw	Annualized	Frequency	Raw	Annualized	Frequency	Raw	Annualized	Frequency	Raw	Annualized	Frequency
<i>A: Industry adjusted multiples for firms having an IPO or an acquisition/buyout</i>															
Biotechnology	4.66	1.25	1.00	2.41	1.19	29.00	1.29	1.05	56.00	1.76	1.21	35.00			
Business services	3.23	1.48	1.00	5.40	1.47	3.00	5.25	2.56	7.00						
Communications	6.79	4.65	8.00	20.19	2.83	55.00	5.45	2.77	69.00	3.11	1.95	67.00	3.35	1.83	2.00
Computer hardware	3.31	1.82	1.00	6.59	1.80	10.00	4.69	2.15	15.00	2.69	1.89	17.00	1.95	1.23	3.00
Computer other			1.21	1.07	2.00	1.54	1.03	4.00							
Computer software	0.75	0.79	2.00	11.40	2.09	62.00	3.24	1.65	93.00	2.75	2.14	89.00	2.65	2.65	1.00
Consumer related	1.73	1.28	3.00	0.98	0.99	6.00	14.30	2.11	15.00	2.43	1.26	8.00			
Finance/insurance/ real estate			0.85	0.96	1.00			0.48	0.48	1.00					
Industrial/energy	1.28	1.16	2.00	5.73	1.50	6.00	1.97	1.83	11.00	2.86	2.44	9.00			
Internet specific	3.67	2.16	7.00	17.07	3.65	135.00	6.43	3.25	183.00	3.76	2.95	126.00	3.46	3.45	1.00
Manufacturing	6.08	2.47	1.00												
Medical/health	4.66	2.11	8.00	3.15	1.23	23.00	1.53	1.15	46.00	1.03	0.93	17.00			
Semiconductor/ other	65.19	3.38	2.00	110.25	3.61	14.00	5.73	1.95	39.00	3.38	3.17	11.00			
<i>B: Expected private equity multiples</i>															
Biotechnology	2.15	6.58	1.12	0.55	2.94	0.82	0.52	1.79	0.69	0.84	1.24	0.87			
Business services	0.54	2.11	0.74	0.20	3.10	0.60	0.44	1.65	0.61						
Communications	1.40	1.19	1.32	0.81	2.50	0.92	0.87	1.60	0.91	1.24	1.25	1.19	0.66	1.17	0.70
Computer hardware	0.80	1.99	0.89	0.46	2.83	0.76	0.66	2.22	0.83	0.99	1.35	0.99	0.67	1.29	0.73
Computer other			0.41	3.72	0.79	0.58	1.77	0.73							
Computer software	0.37	1.15	0.42	0.52	2.70	0.79	0.50	1.64	0.65	1.09	1.05	1.09	0.69	0.46	0.45
Consumer related	0.32	1.47	0.46	0.17	5.79	0.73	0.44	1.48	0.58	0.66	2.74	0.86			
Finance/insurance/ real estate			0.13	3.22	0.53			0.17	0.33	0.00					
Industrial/energy	0.20	1.28	0.28	0.34	2.68	0.67	0.38	2.01	0.62	0.75	1.08	0.77			
Internet specific	0.79	1.37	0.84	0.47	2.00	0.68	0.56	1.11	0.60	1.14	0.70	1.21	0.45	0.52	0.21
Manufacturing	0.70	1.10	0.72												
Medical/health	1.61	2.18	1.24	0.36	2.88	0.70	0.35	2.10	0.61	0.34	1.04	0.35			
Semiconductor/ other	20.87	1.88	5.04	1.04	3.21	1.01	0.76	1.50	0.83	1.60	2.58	1.20			

The expected multiples for our sample firms categorized by industry. Panel A presents the industry adjusted multiple for firms having an IPO or an acquisition/buyout. Panel B presents the expected industry adjusted multiple estimated as the product of the probability of an exit via an IPO or an acquisition/buyout and the industry adjusted multiple.

Internet businesses, semiconductor, software, and biotech.

The estimation framework of this paper will assist VCs in making portfolio decisions.¹⁷ Our study is the first step in understanding the risk premium required for the valuation of private equity investments. It will be of particular interest to the VC community and valuation practitioners.

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Notes

- ¹ One notable exception is a contemporaneous paper by Cochrane (2001), which discusses the biases inherent in this kind of analysis.
- ² Moskowitz and Vissing-Jorgensen consider the larger market of private companies, not only those that are venture-backed. However, we restricted our focus to a very large sample of purely venture-backed firms, as we believe the results we get are more focused, being based on a homogeneous class of financings. The number of financings in this area are large, and should, therefore, ensure that the results are general to the area.
- ³ See, for example, Emory (1994).
- ⁴ See, for example, Hertz and Smith (1993).
- ⁵ See Koeplin *et al.* (2000).
- ⁶ The exit multiple is the ratio of the value of the firm upon successful exit to the amount of financing, making suitable

adjustments for dilution. See also Schwienbacher (2002) for an interesting model of the choice of exit route by the venture capitalist. To the best of our knowledge, this paper is the first to carefully account for dilution over a series of financing rounds in the *same* venture. Treating each round as independent of its predecessor would overstate returns, if the dilution from the latest round of financing (and all predecessor rounds) were not correctly adjusted for. We follow each venture and make adjustments for dilution, so as to “follow the first dollar” from inception of the venture to its final exit.

- ⁷ It is important to note that we examine private equity in the case of venture-backed firms. This constitutes a subset of the entire private equity in the economy. Our goal is to cast light on the risk and return relationship of venture-financed companies. For a study covering a broader set of private companies, see Moskowitz and Vissing-Jorgensen (2001).
- ⁸ For some firms the exit strategy may be liquidation, and others may choose to remain private. In our analysis, these firms are assumed to have failed to exit via a liquidity event.
- ⁹ See, for example, Ritter (1991).
- ¹⁰ It is also possible that the data on acquisition is more readily available and completely collected by the Securities Data Corporation in the recent years.
- ¹¹ See also Gompers (1995).
- ¹² These results are available on request from the authors.
- ¹³ Valuations are known to be impacted by the degree of VC involvement. Barry *et al.* (1990) find that firms with a significant VC stake had much higher probabilities of successful exit, as well as lower IPO underpricing. These are important issues in determining valuation and exit probabilities. Megginson and Weiss (1991) also report that VC reputation has an impact on valuations.
- ¹⁴ Valuation data were unavailable for earlier periods.
- ¹⁵ All through our analysis we are assuming that managers make optimal exit decisions.
- ¹⁶ These are computed from Table 8, wherein the multiples are 1.12 and 5.12, respectively.
- ¹⁷ We make the important observation here that an “estimation” framework does not coincide with the presence of “predictability”. We are not positing the existence of inefficiency in the private equity market.

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