

Venture Capital

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Abstract

Venture capital has emerged as an important intermediary in financial markets, providing capital to young high-technology firms that might have otherwise gone unfunded. Venture capitalists have developed a variety of mechanisms to overcome the problems that emerge at each stage of the investment process. At the same time, the venture capital process is also subject to various pathologies from time to time, which can create problems for investors or entrepreneurs. This handbook chapter reviews the recent empirical literature on these organizations and points out area where further research is needed.

Keywords

Venture capital, agency costs, optimal contracting, capital constraints, monitoring.

*Harvard University and National Bureau of Economic Research. This chapter is based in part on Gompers and Lerner (1999c, 2001). All errors are our own.

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4. Introduction

Venture capital has attracted increasing attention in both the popular press and academic literature. It is alternately described as the engine fueling innovation in the US economy and as the industry that fueled the boom and bust of the Internet era. The recent dramatic growth and subsequent decline in the venture capital industry during the past decade has been accompanied by new academic research that explores its form and function. This research has increasingly shown that far from being a destabilizing factor in the economy, the venture capital industry, while relatively small compared to the public markets, has had a disproportionately positive impact on the economic landscape. There are several critical research questions, however, that still need to be addressed. This includes the extent to which the US venture capital model will be transferred outside of the US and measuring risk and return in the venture capital sector. Thus, this chapter has a two-fold role: to summarize and synthesize what is known about the nature of venture capital investing from recent research and to raise several areas that have yet to be fully answered.

The current view from the existing research is that that venture capital has developed as an important intermediary in financial markets, providing capital to firms that might otherwise have difficulty attracting financing. These young firms are plagued by high levels of uncertainty and large differences in what entrepreneurs and investors know, possess few tangible assets, and operate in markets that can and do change very rapidly. The venture capital process can be seen as having evolved useful mechanisms to overcome potential conflicts of interest at each stage of the investment process. At the

same time, the venture capital process is also subject to various pathologies from time to time. Various researchers have documented periods of time and settings in which these imbalances have created problems for investors or entrepreneurs.

A natural first question is what constitutes venture capital. Venture capital is often interpreted as many different kinds of investors. Many start-up firms require substantial capital. A firm's founder may not have sufficient funds to finance these projects alone and therefore must seek outside financing. Entrepreneurial firms that are characterized by significant intangible assets, expect years of negative earnings, and have uncertain prospects are unlikely to receive bank loans or other debt financing. Venture capital organizations finance these high-risk, potentially high-reward projects, purchasing equity or equity-linked stakes while the firms are still privately held. At the same time, not everyone who finances these types of firms is a venture capitalist. Banks, individual investors (or "angels"), and corporations are among the other providers of capital for these firms. Venture capital is defined as independent and professionally managed, dedicated pools of capital that focus on equity or equity-linked investments in privately held, high growth companies.

The primary focus of this chapter is on reviewing the empirical academic research on venture capital and highlighting the critical role that venture capital has played in filling an important financing gap. Our empirical understanding of venture capital has grown dramatically over the past decade as large scale databases on venture investing have become widely available to researchers. The theoretical literature on venture capital has likewise exploded during the past decade. The improvement in efficiency might be

due to the active monitoring and advice that is provided (Cornelli and Yosha (1997), Marx (1994), Hellmann (1998)), the screening mechanisms employed (Amit, Glosten, and Muller (1990a, 1990b), Chan (1983)), the incentives to exit (Berglöf (1994)), the proper syndication of the investment (Admati and Pfleiderer (1994)), or the staging of the investment (Bergmann and Hege (1998)). This work has improved our understanding of the factors that affect the relationship between venture capitalists and entrepreneurs.

5. The Development of the Venture Capital Industry

The venture capital industry was a predominantly American phenomenon in its initial decades. It had its origins in the family offices that managed the wealth of high net worth individuals in the last decades of the nineteenth century and the first decades of this century. Wealthy families such as the Phippes, Rockefellers, Vanderbilts, and Whitneys invested in and advised a variety of business enterprises, including the predecessor entities to AT&T, Eastern Airlines, and McDonald-Douglas. Gradually, these families began involving outside professional managers to select and oversee these investments.

The first venture capital firm satisfying the criteria delineated above, however, was not established until after World War II. MIT President Karl Compton, Harvard Business School Professor Georges F. Doriot, and local Boston business leaders formed American Research and Development (ARD) in 1946. This small group of venture capitalists made high-risk investments into emerging companies that were based on technology developed for World War II. The success of the investments ranged widely: almost half of ARD's profits

during its 26-year existence as an independent entity came from its \$70,000 investment in Digital Equipment Company (DEC) in 1957, which grew in value to \$355 million. Because institutional investors were reluctant to invest, ARD was structured as a publicly traded closed-end fund and marketed mostly to individuals (Liles (1977)). The few other venture organizations begun in the decade after ARD's formation were also structured as closed-end funds.

The closed-end fund structure employed by these funds had some significant advantages that made them more suited to venture capital investing than the more familiar open-end mutual funds. While the funds raised their initial capital by selling shares to the public, the funds did not need to repay investors if they wished to no longer hold the fund. Instead, the investors simply sold the shares on a public exchange to other investors. This provision allowed the fund to invest in illiquid assets, secure in the knowledge that they would not need to return investors' capital in an uncertain time frame. Most importantly, because it was a liquid investment that could be freely bought or sold, Security and Exchange Commission regulations did not preclude any class of investors from holding the shares.

The publicly traded structure, however, was soon found to have some significant drawbacks as well. In a number of cases, brokers sold the funds to inappropriate investors: i.e., elderly investors who had a need for high current income rather than long-term capital gains. When the immediate profits promised by unscrupulous brokers did not materialize, these investors vented their frustration at the venture capitalists themselves. For instance,

much of General Doriot's time during the mid-1950s was spent addressing investors who had lost substantial sums on their shares of American Research and Development.

The first venture capital limited partnership, Draper, Gaither, and Anderson, was formed in 1958. Unlike the closed-end funds, partnerships were exempt from securities regulations, including the exacting disclosure requirements of the Investment Company Act of 1940. The set of the investors from which the funds could raise capital, however, was much more restricted. The interests in a given partnership could only be held by a limited number of institutions and high net-worth individual investors.

The Draper partnership and its followers applied the template of other limited partnerships: e.g., to develop real estate projects and explore oil fields. The partnerships had pre-determined, finite lifetimes (usually ten years, though extensions were often allowed). Thus, unlike closed-end funds, which often had indefinite lives, the partnerships were required to return the assets to investors within a set period. From the days of the first limited partnerships, these distributions were typically made in stock. Rather than selling successful investments after they went public and returning cash to their investors, the venture capitalists would simply give them their allocation of shares in the company in which the venture firm had invested. In this way, the investors could choose when to realize the capital gains associated with the investment. This feature was particularly important for individuals and corporate investors, as they could arrange the sales in a manner that would minimize their capital gains tax obligation.

While imitators soon followed, limited partnerships accounted for a minority of the venture pool during the 1960s and 1970s. Most venture organizations raised money either through closed-end funds or small business investment companies (SBICs), federally guaranteed risk capital pools that proliferated during the 1960s. While the market for SBICs in the late 1960s and early 1970s was strong, the sector ultimately collapsed in the 1970s. The combination of federal guarantees and limited scrutiny of applicants led to scenario that foreshadowed the savings and loan crisis of the 1980s. Unscrupulous and naïve operators were frequently granted SBIC licenses. Frequently, their investments proved to be either in firms with poor prospects or in outright fraudulent enterprises.

Activity in the venture industry increased dramatically in late 1970s and early 1980s. Table 1 and Figure 1 provide an overview of fundraising by venture partnerships, highlighting the changing volume of investments over the years, as well as the shifting mixture of investors. Industry observers attributed much of the shift to the U.S. Department of Labor's clarification of the "prudent man" rule in 1979. Prior to this year, the Employee Retirement Income Security Act (ERISA) limited pension funds from investing substantial amounts of money into venture capital or other high-risk asset classes. The Department of Labor's clarification of the rule explicitly allowed pension managers to invest in high-risk assets, including venture capital. In 1978, when \$424 million was invested in new venture capital funds, individuals accounted for the largest share (32 percent). Pension

funds supplied just 15 percent. Eight years later, when more than \$4 billion was invested, pension funds accounted for more than half of all contributions.¹

The subsequent years saw both very good and very trying times for venture capitalists. On the one hand, venture capitalists backed many of the most successful high-technology companies during the 1980s and 1990s, including Apple Computer, Cisco Systems, Genentech, Microsoft, Netscape, and Sun Microsystems. A substantial number of service firms (including Staples, Starbucks, and TCBY) also received venture financing.

At the same time, commitments to the venture capital industry were very uneven. As Figure 1 and Table 1 depict, the annual flow of money into venture funds increased by a factor of ten during the early 1980s, peaking at around six billion (in 2004 dollars). From 1987 through 1991, however, fundraising steadily declined. This fall-back reflected the disappointment that many investors encountered with their investments. As Figure 2 shows, returns on venture capital funds declined in the mid-1980s, apparently because of overinvestment in various industries and the entry of inexperienced venture capitalists. As investors became disappointed with returns, they committed less capital to the industry.

This pattern reversed dramatically in the 1990s, which saw rapid growth in venture fundraising. The explosion of activity in the IPO market and the exit of many inexperienced

¹The annual commitments represent pledges of capital to venture funds raised in a given year. This money is typically invested over three to five years starting in the year the fund is formed.

venture capitalists led to increasing venture capital returns. New capital commitments rose in response, increasing by more than twenty times between 1991 and 2000. While previous investment surges have been associated with falling venture capital returns, this expansion in fundraising saw a rise in the returns to venture funds. Much of the growth in fundraising was fueled by public pension funds, many of which entered venture investing for the first time in a significant way.

The explosion in venture capital investing was also driven by two other classes of investors: corporations and individuals. While the late 1960s and mid 1980s had seen extensive corporate experimentation with venture funds, the late 1990s saw an unprecedented surge of activity. The determinants of this increase were various. Some were similar to those in earlier waves of corporate venturing activity. For instance, the high degree of publicity associated with the successful venture investments of the period, such as Amazon.com, eBay, and Yahoo! triggered the interest of many CEOs, who sought to harness some of the same energy in their organization

This rapid rise in venture capital investing, however, gave way to just as rapid a deflation in venture capital investment activity. The causes of the decline are myriad. Some have commented on the overshooting of the venture industry and how the level of investment activity in 1999 and 2000 was driven up by irrational sentiment towards technology stocks. This sentiment fueled the rise in public equity values and the IPO market. When the business model for many of the startup companies, especially Internet-

related firms, failed to deliver profits, investors began to realize that valuation levels assigned to these companies did not make rational sense.

In addition, corporations which had fueled much of the purchasing of new technology suddenly found themselves with excess capacity and slow end user demand. Technology spending by these companies quickly dried up and startups no longer had markets for their products. This decline in spending was protracted and many venture capital-backed startups could not recover.

Finally, the venture capital industry itself contributed to the overshooting and subsequent decline. Many venture capital firms played “follow the leader” strategies and invested in companies that were too similar to one another. This meant that even in attractive markets, product prices were driven down to unprofitable levels. Good ideas and good companies failed because the size of the markets addressed could not support the level of investment activity that took place in 1999 and 2000.

These factors led to a rise in venture capital-backed company failures and a rapid write-down in investment values. As fund portfolio values declined, interim internal rates of return became negative and investment levels declined. In the aftermath of the retrenchment, many venture capital firms decided to reduce the amount of capital that they had raised, essentially foregoing commitments that their investors had made to their funds. As the investment pace slowed, the level of fundraising declined even more dramatically. While

fundraising in the past few years has begun to recover, how far it rises and whether it reaches the speculative levels of 1999 and 2000 is an open question.

6. The Venture Capital Investment Process

Venture capitalists typically invest the money in young firms that may be little more than in the head of a talented engineer or scientist. Most of the firms that venture capitalists finance have few other sources of cash and many are subject to severe credit rationing. In order to overcome this capital rationing, however, the control and monitoring aspects of venture capitalists' investment process are paramount. Researchers have explored how the types of contracts utilized, the timing of investment, and the active involvement of the venture capital investor play important roles in improving the likelihood of success for the startup company

Tables 2 through 4 present historical information on the mixture of investments. Table 2 provides a detailed summary of investments in 1998; Table 3 presents a more aggregated summary of investments (in manufacturing firms only) over the past three decades; and Table 4 provides a summary of investments in the ten states with the most venture capital activity over the past three decades.

Before considering the mechanisms employed by venture capitalists, it is worth highlighting that a lengthy literature has discussed the financing of young firms. Uncertainty and informational asymmetries often characterize young firms, particularly in high-technology industries. These information problems make it difficult to assess these

firms, and permit opportunistic behavior by entrepreneurs after financing is received. This literature has also highlighted the role of financial intermediaries in alleviating these information problems.

To briefly review the types of conflicts that can emerge in these settings, Jensen and Meckling (1976) demonstrate that conflicts between managers and investors (“agency problems”) can affect the willingness of both debt and equity holders to provide capital. If the firm raises equity from outside investors, the manager has an incentive to engage in wasteful expenditures (e.g., lavish offices) because he may benefit disproportionately from these but does not bear their entire cost. Similarly, if the firm raises debt, the manager may increase risk to undesirable levels. Because providers of capital recognize these problems, outside investors demand a higher rate of return than would be the case if the funds were internally generated.

More generally, the inability to verify outcomes makes it difficult to write contracts that are contingent upon particular events. This inability makes external financing costly. Many of the models of ownership (e.g., Grossman and Hart (1986) and Hart and Moore (1990)) and financing choice (e.g., Hart and Moore (1998)) depend on the inability of investors to verify that certain actions have been taken or certain outcomes have occurred. While actions or outcomes might be observable, meaning that investors know what the entrepreneur did, they are assumed not to be verifiable: *i.e.*, investors could not convince a court of the action or outcome. Start-up firms are likely to

face exactly these types of problems, making external financing costly or difficult to obtain.

If the information asymmetries could be eliminated, financing constraints would disappear. Financial economists argue that specialized financial intermediaries, such as venture capital organizations, can address these problems. By intensively scrutinizing firms before providing capital and then monitoring them afterwards, they can alleviate some of the information gaps and reduce capital constraints. Thus, it is important to understand the tools employed by venture investors discussed below as responses to this difficult environment, which enable firms to ultimately receive the financing that they cannot raise from other sources. It is the nonmonetary aspects of venture capital that are critical to its success.

One of the most common features of venture capital is the meting out of financing in discrete stages over time. Sahlman (1990) notes that staged capital infusion is the most potent control mechanism a venture capitalist can employ. Prospects for the firm are periodically reevaluated. The shorter the duration of an individual round of financing, the more frequently the venture capitalist monitors the entrepreneur's progress and the greater the need to gather information. Staged capital infusion keeps the owner/manager on a "tight leash" and reduces potential losses from bad decisions.²

²Two related types of agency costs exist in entrepreneurial firms. Both agency costs result from the large information asymmetries that affect young, growth companies in need of financing. First, entrepreneurs might invest in strategies, research, or projects that have high personal returns but low expected monetary payoffs to shareholders. For example, a biotechnology company founder may choose to invest in a certain type of

Venture capitalists should weigh potential agency and monitoring costs when determining how frequently they should reevaluate projects and supply capital. The duration of funding should decline and the frequency of reevaluation should increase when the venture capitalist expects conflicts with the entrepreneur are more likely.

If monitoring and information gathering are important, venture capitalists should invest in firms in which asymmetric information is likely to be a problem. The value of oversight will be greater for these firms. The capital constraints faced by these companies will be very large and the information gathered will help alleviate the constraint. Early-stage companies have short or no histories to examine and are difficult to evaluate. Similarly, high-technology companies are likely to require close monitoring. A significant fraction of venture investment should therefore be directed towards early-stage and high-technology companies.

In practice, venture capitalists incur costs when they monitor and infuse capital. Monitoring costs include the opportunity cost of generating reports for both the venture capitalist and entrepreneur. If venture capitalists need to "kick the tires" of the plant, read reports, and take time away from other activities, these costs can be substantial.

research that brings him/her great recognition in the scientific community but provides little return for the venture capitalist. Similarly, entrepreneurs may receive initial results from market trials indicating little demand for a new product, but may want to keep the company going because they receive significant private benefits from managing their own firm. Second, because entrepreneurs' equity stakes are essentially call options, they have incentives to pursue highly volatile strategies, such as rushing a product to market when further testing may be warranted.

Contracting costs (e.g., legal fees) and the lost time and resources of the entrepreneur must be imputed as well. These costs lead to funding being provided in discrete stages.

The nature of the firm's assets also has important implications for expected agency costs and the structure of staged venture capital investments. Intangible assets should be associated with greater agency problems. As assets become more tangible, venture capitalists can recover more of their investment in liquidation. This reduces the need to monitor tightly and should increase the time between refinancings. Industries with high levels of R&D should also have more frequent agency problems, and venture capitalists should shorten funding duration. Finally, a substantial finance literature (e.g., Myers (1977)) argues that firms with high market-to-book ratios are more susceptible to these agency costs, thus venture capitalists should increase the intensity of monitoring of these firms.

Gompers (1995) tests these predictions using a random sample of 794 venture capital-financed companies. The results confirm the predictions of agency theory. Venture capitalists concentrate investments in early stage companies and high technology industries where informational asymmetries are significant and monitoring is valuable. Venture capitalists monitor the firm's progress. If they learn negative information about future returns, the project is cut off from new financing. Firms that go public (these firms yield the highest return for venture capitalists on average) receive more total financing and a greater number of rounds than other firms (which may go bankrupt, be acquired, or remain private). Gompers also finds that early stage firms receive significantly less

money per round. Increases in asset tangibility increase financing duration and reduce monitoring intensity. As the role of future investment opportunities in firm value increases (higher market-to-book ratios or R&D intensities), firms are refinanced more frequently. These results suggest the important monitoring and information generating roles played by venture capitalists.

Consistent evidence regarding the strength of contractual terms in these agreements is found in Kaplan and Stromberg's (2003) analysis of 130 venture partnership agreements. The overall use of contracts to control potential adverse behavior on the part of entrepreneurs has been modeled in a number of settings. Kaplan and Stromberg test a variety of these theories to determine whether factors like information asymmetries are critical to the types of contracts that are signed between venture capitalists and entrepreneurs. They find that venture contracts are effective at separating cash flow ownership from board rights, liquidation rights, voting rights and other control rights. Similarly, future financing and allocation of ownership in the firm is often based on reaching contingent milestones. The results support the contracting view of Aghion and Bolton (1992) and Dewatripont and Tirole (1994).

In addition to the staged capital infusions, venture capitalists will usually make investments with other investors. One venture firm will originate the deal and look to bring in other venture capital firms. This syndication serves multiple purposes. First, it allows the venture capital firm to diversify. If the venture capitalist had to invest alone into all the companies in his portfolio, then he could make many fewer investments. By

syndicating investments, the venture capitalist can invest in more projects and largely diversify away firm-specific risk.

A second potential explanation for syndication patterns is that involving other venture firms provides as a second opinion on the investment opportunity. There is usually no clear-cut answer as to whether any of the investments that a venture organization undertakes will yield attractive returns. Having other investors approve the deal limits the danger that bad deals will get funded. This is particularly true when the company is early-stage or technology-based.

Lerner (1994a) tests this “second opinion” hypothesis in a sample of biotechnology venture capital investments. In a sample of 271 firms, Lerner finds that in the early rounds of investing, experienced venture capitalists tend to syndicate only with venture capital firms that have similar experience. Lerner argues that if a venture capitalist were looking for a second opinion, then he would want to get a second opinion from someone of similar or better ability, certainly not from someone of lesser ability.

A related topic is explored by Hochberg, Ljungqvist, and Lu (2004) who examine the relationship among various venture capital investors in syndicate networks and the performance of the companies in which they invest. Hochberg et al. create a measure of centrality based on syndicate patterns in the network. This measure, the Bonacich (1987) measure, controls for how central a venture capital firm is to the entire industry. Firms with greater Bonacich measures are more central to the industry based upon their

syndicate patterns. Hochberg et al. find that this measure is a strong predictor of performance for the underlying portfolio companies. Portfolio companies that receive an investment by a venture firm that is more central to the industry are more likely to be successful (as measured by the probability of exiting through an IPO or acquisition). In addition, they are more likely to survive to a subsequent financing round than are similar firms financed by venture capitalists that are less central based on their syndication patterns. These patterns support the results found by Lerner in his earlier work.

The advice and support provided by venture capitalists is often embodied by their role on the firm's board of directors. Lerner (1995) examines the decision of venture capitalists to provide this oversight. He examines whether venture capitalists' representation on the boards of the private firms in their portfolios is greater when the need for oversight is larger. This approach is suggested by Fama and Jensen (1983) and Williamson (1983), who hypothesize that the composition of the board should be shaped by the need for oversight. These authors argue that the board will bear greater responsibility for oversight—and consequently that outsiders should have greater representation—when the danger of managerial deviations from value maximization is high. If venture capitalists are especially important providers of managerial oversight, their representation on boards should be more extensive at times when the need for oversight is greater.

Lerner examines changes in board membership around the time that a firm's chief executive officer (CEO) is replaced, an approach suggested by Hermalin and Weisbach's (1988) study of outside directors of public firms. The replacement of the top manager at an

entrepreneurial firm is likely to coincide with an organizational crisis and to heighten the need for monitoring. He finds that an average of 1.75 venture capitalists are added to the board between financing rounds when the firm's CEO is replaced in the interval; between other rounds, 0.24 venture directors are added. No differences are found in the addition of other outside directors. This oversight of new firms involves substantial costs. The transaction costs associated with frequent visits and intensive involvement are likely to be reduced if the venture capitalist is proximate to the firms in his portfolio. Consistent with these suggestions, he find that geographic proximity is an important determinant of venture board membership: organizations with offices within five miles of the firm's headquarters are twice as likely to be board members as those more than 500 miles distant. Over half the firms in the sample have a venture director with an office within sixty miles of their headquarters.

The role that venture capitalists play in shaping the overall board of directors at the time of the IPO is also explored in Baker and Gompers (2004a). In particular, they examine the determinants of board structures and the effects that these board structures play in determining the success of the firm. With data from 1,116 IPO prospectuses, they describe board size and composition for a set of firms with a median age of less than six years and a median equity capitalization of \$42 million. This analysis gives insights on the role that venture capitalists play - beyond providing money - and the bargaining process between the CEO and outside shareholders.

The venture capital-backed board has fewer insiders and quasi-outsiders and more independent outside directors. These results hold when we control for ownership structure and the endogeneity of venture financing, suggesting a causal relationship where venture capitalists, in addition to monitoring management and providing capital, give advice and value-added services that otherwise might be performed by instrumental board members. The evidence is consistent with the Hermalin and Weisbach (1998) notion that board structure is the outcome of a bargain between the CEO and the outside investors. First, the fraction of outsiders on the board of directors falls with CEO tenure and voting control. Venture capitalists appear to be a counterweight to CEO control. Venture capitalists not only reduce inside representation indirectly by reducing the control of the CEO with their concentrated outside ownership stakes, but also reputable venture firms are directly associated with greater outsider representation on the board. Second, a possible interpretation of the venture reputation effect is that reputable venture firms gain power by having access to adequate replacements for the founder. Consistent with this notion, the probability that a founder remains on as CEO at the time of the IPO falls with venture firm reputation. Baker and Gompers also explore the performance implications of better boards and find that the better board structure of venture capital backing improves long-term firm outcomes.

Hellmann and Puri (2002) examine the value that is added by venture capitalists, i.e., the role that they play in the professionalization of start-up companies. They examine a sample of 170 Silicon Valley start-ups and find that venture capitalists play a role at the top of the organization, in terms of replacing the original founders with an

outside CEO. Moreover they seem to influence developments further down the organization, in terms of playing a role for the introduction of stock option plans, the hiring of a VP of sales and marketing, and the formulation of human resource policies.

There are several specific questions that Hellmann and Puri address. First, they explore whether venture capitalists provide support in building up the internal organization. They look at several measures including the recruitment processes, the overall human resource policies, the adoption of stock option plans, and the hiring of a vice president of marketing and sales. When they compare similar companies that did and did not receive venture capital financing, they find that companies that obtain venture capital are more likely and are faster to professionalize along these various dimensions.

In work similar to Baker and Gompers (2004), Hellmann and Puri look at the position of the CEO and ask whether a founder is more likely to be replaced by an outsider as CEO when a venture capitalist invests in the firm. Not surprisingly, venture capitalists are more likely to replace a founder as CEO. To attract a new CEO, venture capital is particularly important for early stage companies that do not have any signs of success, still important for companies with a product on the market, and no longer important by the time companies have gone public.

Another mechanism utilized by venture capitalists to avoid conflicts is the widespread use of stock grants and stock options. Managers and critical employees within a firm receive a substantial fraction of their compensation in the form of equity or options. This tends to align the incentives of managers and investors. Baker and Gompers (2004 b) examine the role that venture capitalists play in setting compensation and incentives of entrepreneurs. They find that venture capitalists increases the sensitivity of management's compensation to the firm's performance relative to similar nonventure capital-financed companies. Fixed salaries are lower and the size of the equity stake held is higher for venture capital-backed CEOs.

The venture capitalist also employs additional controls on compensation to reduce potential gaming by the entrepreneur. First, venture capitalists usually require vesting of the stock or options over a multi-year period. In this way, the entrepreneur cannot leave the firm and take his shares. Similarly, the venture capitalist can significantly dilute the entrepreneur's stake in subsequent financings if the firm fails to realize its targets. This provides additional incentives for the entrepreneur. In order to maintain his stake, the entrepreneur will need to meet his stated targets.

Until this point, this section has highlighted the ways in which venture capitalists can successfully address agency problems in portfolio firms. The argument is often made by venture capital practitioners, however, that the industry has gone through periods of disequilibrium. During periods when the amount of money flowing into the industry has dramatically grown, they argue, the valuations at which investments are made or the

likelihood that certain transactions get funded can shift dramatically. If there are only a certain number of worthy projects to finance, then a substantial increase in the amount of venture fundraising may increase the prices that are paid to invest in these companies. These higher prices may ultimately affect the returns on investment in the industry.

Sahlman and Stevenson (1987) chronicle the exploits of venture capitalists in the Winchester disk drive industry during the early 1980s. Sahlman and Stevenson believe that a type of “market myopia” affected venture capital investing in the industry. During the late 1970s and early 1980s, nineteen disk drive companies received venture capital financing. Two-thirds of these investments came between 1982 and 1984, the period of rapid expansion of the venture industry. Many disk drive companies also went public during this period. While industry growth was rapid during this period of time (sales increased from \$27 million in 1978 to \$1.3 billion in 1983), Sahlman and Stevenson question whether the scale of investment was rational given any reasonable expectations of industry growth and future economic trends.³ Similar stories are often told concerning investments in software, biotechnology, and the Internet. The phrase “too much money chasing too few deals” is a common refrain in the venture capital market during periods of rapid growth.

Gompers and Lerner (2000) examine these claims through a dataset of over 4000 venture investments between 1987 and 1995 developed by the consulting firm

³Lerner (1997) suggests, however, that these firms may have displayed behavior consistent with strategic models of “technology races” in the economics literature. Because firms had the option to exit the competition to develop a new disk drive, it may have indeed been rational for venture capitalists to fund a substantial number of disk drive manufacturers.

VentureOne. They construct a hedonic price index that controls for various firm attributes that might affect firm valuation, including firm age, stage of development, and industry, as well as macroeconomic variables such as inflow of funds into the venture capital industry. In addition, they control for public market valuations through indexes of public market values for firms in the same industries and average book-to-market and earnings-to-price ratios.

The results support contentions that a strong relation exists between the valuation of venture capital investments and capital inflows. While other variables also have significant explanatory power—for instance, the marginal impact of a doubling in public market values was between a 15% and 35% increase in the valuation of private equity transactions—the inflows variable is significantly positive. A doubling of inflows into venture funds leads to between a 7% and 21% increase in valuation levels.

While prices rose somewhat in 1987, they declined and remained quite flat through the 1990s. Starting in 1994, however, prices steadily increased. This increase coincided with the recent rise in venture fundraising. The regression results show that this rise in fundraising is an important source of the increase in prices. The results are particularly strong for specific types of funds and funds in particular regions. Because funds have become larger in real dollar terms, with more capital per partner, many venture capital organizations have invested larger amounts of money in each portfolio company. Firms have attempted to do this in two ways. First, there has been a

movement to finance later-stage companies that can accept larger blocks of financing. Second, venture firms are syndicating less. This leads to greater competition for making later-stage investments. Similarly, because the majority of money is raised in California and Massachusetts, competition for deals in these regions should be particularly intense and venture capital inflows may have a more dramatic effect on prices in those regions. The results support these contentions. The effect of venture capital inflows is significantly more dramatic on later-stage investments and investments in California and Massachusetts.

C. Exiting Venture Capital Investments

In order to make money on their investments, venture capitalists need to turn illiquid stakes in private companies into realized return. Typically, as was discussed above, the most profitable exit opportunity is an initial public offering (IPO). In an IPO, the venture capitalist assists the company in issuing shares to the public for the first time. Table 5 summarizes the exiting of venture capital investments through initial public offerings as well as comparable data on non-venture capital offerings.

Initial empirical research into the role of venture capitalists in exiting investments focused on the structure of IPOs. Barry, Muscarella, Peavy and Vetsuypens (1990) focus on establishing a broad array of facts about the role of venture capitalists in IPOs, using a sample of 433 venture-backed and 1123 non-venture IPOs between 1978 and 1987.

Barry, *et al.*, document that venture capitalists hold significant equity stakes in the firms they take public (on average, the lead venture capitalist holds a 19% stake immediately prior to the IPO, and all venture investors hold 34%), and hold about one-third of the board seats. They continue to hold their equity positions in the year after the IPO. Finally, venture-backed IPOs have less of a positive return on their first trading day. The authors suggest that this implies that investors need less of a discount in order to purchase these shares (*i.e.*, the offerings are less “underpriced”), because the venture capitalist has monitored the quality of the offering.

Meggison and Weiss (1991) argue that because venture capitalists repeatedly bring firms to the public market, they can credibly stake their reputation. Put another way, they can certify to investors that the firms they bring to market are not overvalued. Certification requires that venture capitalists possess reputational capital, that the acquisition of such a reputation is costly, and that the present value of lost reputational capital by cheating is greater than the one-time gain from behaving in a duplicitous manner.

Meggison and Weiss test these ideas using a matched set of 640 venture-backed and non-venture IPOs between 1983 and 1987. First, they examine the quality of the underwriters who bring firms to market. They show that the underwriters of venture-backed firms are significantly more experienced than the underwriters of comparable non-venture offerings. Meggison and Weiss also find that institutional holdings of venture-backed firms after the IPO are larger than comparable non-venture companies.

Third, Megginson and Weiss gather evidence on expenses associated with going public. Venture-backed IPOs have significantly lower fees than non-venture IPOs. Fourth, Megginson and Weiss demonstrate that venture capitalists retain a majority of their equity after the IPO. Megginson and Weiss argue that this is a commitment device. Finally, Megginson and Weiss present evidence that the underpricing of venture capital-backed IPOs is significantly less than the underpricing of non-venture IPOs.

More recent research has examined the timing of the decision to take firms public and to liquidate the venture capitalists' holdings (which frequently occurs well after the IPO). Several potential factors affect when venture capitalists choose to bring firms public. One of these is the relative valuation level of publicly traded securities. Lerner (1994b) examines when venture capitalists choose to finance a sample of biotechnology companies in another private round versus taking the firm public in. Using a sample of 350 privately held venture-backed firms, he shows take firms public at market peaks, relying on private financings when valuations are lower. Seasoned venture capitalists appear more proficient at timing IPOs. The results are robust to the use of alternative criteria to separate firms and controls for firms' quality. The results are not caused by differences in the speed of executing the IPOs, or in the willingness to withdraw the proposed IPOs.

Another consideration may be the reputation of the venture capital firm. Gompers (1996) argues that young venture capital firms have incentives to “grandstand”: *i.e.*, they take actions that signal their ability to potential investors. Specifically, young venture

capital firms bring companies public earlier than older venture capital firms in an effort to establish a reputation and successfully raise capital for new funds. He examines a sample of 433 venture-backed initial public offerings (IPOs) between 1978 and 1987, as well as a second sample consisting of the first IPOs brought to market by 62 venture capital funds. The results support predictions of the grandstanding hypothesis. For example, the effect of recent performance in the IPO market on the amount of capital raised is stronger for young venture capital firms, providing them with a greater incentive to bring companies public earlier. Young venture capital firms have been on the IPO company's board of directors 14 months less and hold smaller percentage equity stakes at the time of IPO than the more established venture firms. The IPO companies that they finance are nearly two years younger and more underpriced when they go public than companies backed by older venture capital firms. Much of the difference in underpricing and the venture capitalists' percentage equity stake is associated with a shorter duration of board representation, indicating that rushing companies to the IPO market imposes costs on the venture firm. The results suggest that the relation between performance and capital raising affects the incentives and actions of venture capitalists.

The typical venture capital firm, however, does not sell their equity at the time of the IPO. The negative signal that would be sent to the market by an insider “cashing out” would prevent a successful offering. In addition, most investment banks require that all insiders, including the venture capitalists, do not sell any of their equity after the offering for a pre-specified period (usually six months) as noted in Brav and Gompers (2004). Once that lock-up period is over, however, venture capitalists can return money to investors in one of two

ways. They can liquidate their position in a portfolio company by selling shares on the open market after it has gone public and then paying those proceeds to investors in cash. More frequently, however, venture capitalists make distributions of shares to investors in the venture capital fund. Many institutional investors have received a flood of these distributions during the past several years and have grown increasingly concerned about the incentives of the venture capitalists when they declare these transfers.

Gompers and Lerner (1998a) examine how investors might be affected by distributions. These distributions have several features that make them an interesting testing ground for an examination of the impact of transactions by informed insiders on securities prices. Because they are not considered to be “sales”, the distributions are exempt from the anti-fraud and anti-manipulation provisions of the securities laws. The legality of distributions provides an important advantage. Comprehensive records of these transactions are compiled by the institutional investors and the intermediaries who invest in venture funds, addressing concerns about sample selection bias. Like trades by corporate insiders, transactions are not revealed at the time of the transaction. Venture capitalists can immediately declare a distribution, send investors their shares, and need not register with the SEC or file a report under Rule 16(a). Rather, the occurrence of such distributions can only be discovered from corporate filings with a lag, and even then the distribution date cannot be precisely identified. To identify the time of these transactions, one needs to rely on the records of the partners in the fund. They characterize the features of the venture funds making the distributions, the firms whose shares are being distributed, and the changes

associated with the transactions in a way that can discriminate between the various alternative explanations for these patterns.

From the records of four institutions, Gompers and Lerner construct a representative set of over 700 transactions by 135 funds over a decade-long period. The results are consistent with venture capitalists possessing inside information and of the (partial) adjustment of the market to that information. After significant increases in stock prices prior to distribution, abnormal returns around the distribution are a negative and significant -2.0 percent, comparable to the market reaction to publicly announced secondary stock sales. The sign and significance of the cumulative excess returns for the twelve months following the distribution appear to be negative in most specifications, but are sensitive to the benchmark used.

Significant differences appear in the returns for some sub-samples. Distributions that occur in settings where information asymmetries may be greatest—especially where the firm has been taken public by a lower-tier underwriter and the distribution is soon after the IPO—have larger immediate price declines. Post-distribution price performance is related to factors that predict event window returns.

Finally, Brav and Gompers (1997) explore the long-run performance implications of venture capital backing after they perform an IPO. In particular, they examine whether the pre-IPO performance differences noted by Hellmann and Puri (2002) or Gompers and Lerner (1998b) carry over to when the companies go public, long after they received venture

financing. Brav and Gompers find that venture capital-backed companies do indeed outperform comparable nonventure-capital-backed companies, with venture capital backed companies earning 40% more over five years after the IPO.

4. Venture Investing and Innovation

In this section, I explore the issue of venture capital impact on innovation. I begin by reviewing the evidence regarding the overall impact of venture capital on innovation. I then turn to exploring the impact of the historic boom-and bust pattern on these shifts. I highlight that while the overall relationship between venture capital and innovation is positive, the relationships across the cycles of venture activity may be quite different.

A lengthy theoretical literature has been developed in recent years, as financial economists have sought to understand the mechanisms employed by venture capitalists. These works suggest that these financial intermediaries are particularly well suited for nurturing innovative new firms.

It might be thought that it would be not difficult to address the question of the impact of venture capital on innovation. For instance, one could look in regressions across industries and time whether, controlling for R&D spending, venture capital funding has an impact on various measures of innovation. But even a simple model of the relationship between venture capital, R&D, and innovation suggests that this approach is likely to give misleading estimates.

Both venture funding and innovation could be positively related to a third unobserved factor, the arrival of technological opportunities. Thus, there could be more innovation at times that there was more venture capital, not because the venture capital caused the innovation, but rather because the venture capitalists reacted to some fundamental technological shock which was sure to lead to more innovation. To date, only two papers have attempted to address these challenging issues.

The first of these papers, Hellmann and Puri (2000), examines a sample of 170 recently formed firms in Silicon Valley, including both venture-backed and non-venture firms. Using questionnaire responses, they find empirical evidence that venture capital financing is related to product market strategies and outcomes of startups. They find that firms that are pursuing what they term an innovator strategy (a classification based on the content analysis of survey responses) are significantly more likely and faster to obtain venture capital. The presence of a venture capitalist is also associated with a significant reduction in the time taken to bring a product to market, especially for innovators. Furthermore, firms are more likely to list obtaining venture capital as a significant milestone in the lifecycle of the company as compared to other financing events.

The results suggest significant interrelations between investor type and product market dimensions, and a role of venture capital in encouraging innovative companies. Given the small size of the sample and the limited data, they can only modestly address concerns about causality. Unfortunately, the possibility remains that more innovative firms

select venture capital for financing, rather than venture capital causing firms to be more innovative.

Kortum and Lerner (2000), by way of contrast, examine these patterns can be discerned on an aggregate industry level, rather than on the firm level. They address concerns about causality in two ways. First, they exploit the major discontinuity in the recent history of the venture capital industry: as discussed above, in the late 1970s, the U.S. Department of Labor clarified the Employee Retirement Income Security Act, a policy shift that freed pensions to invest in venture capital. This shift led to a sharp increase in the funds committed to venture capital. This type of exogenous change should identify the role of venture capital, because it is unlikely to be related to the arrival of entrepreneurial opportunities. They exploit this shift in instrumental variable regressions. Second, they use R&D expenditures to control for the arrival of technological opportunities that are anticipated by economic actors at the time, but that are unobserved to econometricians. In the framework of a simple model, they show that the causality problem disappears if they estimate the impact of venture capital on the patent-R&D ratio, rather than on patenting itself.

Even after addressing these causality concerns, the results suggest that venture funding does have a strong positive impact on innovation. The estimated coefficients vary according to the techniques employed, but on average a dollar of venture capital appears to be three to four times more potent in stimulating patenting than a dollar of traditional corporate R&D. The estimates therefore suggest that venture capital, even though it

averaged less than three percent of corporate R&D from 1983 to 1992, is responsible for a much greater share—perhaps ten percent—of U.S. industrial innovations in this decade.

The evidence that venture capital has a powerful impact on innovation might lead us to be especially worried about market downturns. A dramatic fall in venture capital financing, it is natural to conclude, would lead to a sharp decline in innovation.

But this reasoning, while initially plausible, is somewhat misleading. For the impact of venture capital on innovation does not appear to be uniform. Rather, during periods when the intensity of investment is greatest, the impact of venture financing appears to decline. The uneven impact of venture on innovation can be illustrated by examining the experience during two “boom” periods in the industry..

One example was the peak period of biotechnology investing in the early 1990s. While the potential of biotechnology to address human disease was doubtless substantial, the extent and nature of financing seemed to many observers at the time hard to justify. In some cases, dozens of firms pursuing similar approaches to the same disease target were funded. Moreover, the valuations of these firms often were exorbitant: for instance, between May and December 1992, the average valuation of the privately held biotechnology firms financed by venture capitalists was \$70 million. These doubts were validated when biotechnology valuations fell precipitously in early 1993: by December 1993, only 42 of 262 publicly traded biotechnology firms had a valuation over \$70 million.

Most of the biotechnology firms financed during this period ultimately yielded very disappointing returns for their venture financiers and modest gains for society as a whole. In many cases, the firms were liquidated after further financing could not be arranged. In others, the firms shifted their efforts into other, less competitive areas, largely abandoning the initial research efforts. In yet others, the companies remained mired with their peers for years in costly patent litigation.

The boom of 1998-2000 provides many additional illustrations. Funding during these years was concentrated in two areas: Internet and telecommunication investments, which, for instance, accounted for 39% and 17% of all venture disbursements in 1999. Once again, considerable sums were devoted to supporting highly similar firms—e.g., the nine dueling Internet pet food suppliers—or else efforts that seemed fundamentally uneconomical and doomed to failure, such as companies which undertook the extremely capital-intensive process of building a second cable network in residential communities. Meanwhile, many apparently promising areas—e.g., advanced materials, energy technologies, and micro manufacturing—languished unfunded as venture capitalists raced to focus on the most visible and popular investment areas. It is difficult to believe that the impact of a dollar of venture financing was as powerful in spurring innovation during these periods as in others.

5. What We Don't Know About Venture Capital

While financial economists know much more about venture capital than they did a decade ago, there are many unresolved issues that would reward future research. In this

final section, I highlight three areas for further research that I consider particularly promising.

5.1 Understanding Risk and Return

One critical, but unanswered area, is the assessment of venture capital as a financial asset. Many institutions, primarily public and private pension funds, have increased their allocation to venture capital and private equity in the belief that the returns of these funds are largely uncorrelated with the public markets.

It is natural to see how they come to this conclusion. Firms receiving capital from private equity funds very often remain privately held for a number of years after the initial investment. These firms have no observable market price. In order to present a conservative assessment of the portfolio valuation, private equity managers often refrain from marking portfolio firm values to market, preferring to maintain the investments at book value.

But as discussed throughout this analysis, there appear to be many linkages between the public and private equity market values. Thus, the stated returns of private equity funds may not accurately reflect the true evolution of value, and the correlations reported by Venture Economics (1997) and other industry observers may be deceptively low. To ignore the true correlation is fraught with potential dangers.⁴

⁴ In a preliminary analysis using data from one venture group, Gompers and Lerner (1997) find that the correlation between venture capital and public market prices increases substantially when the underlying venture portfolio is “marked-to-market.” An alternative approach is to examine the relatively modest number of publicly traded venture capital funds, as is done by Martin and Petty (1983).

Recent work by Kaplan and Schoar (2004) and Cochrane (2004) has attempted to deal with this stale price problem. Kaplan and Schoar use the change in the level of the S&P 500 as a benchmark from the time of investment while Cochrane uses econometric corrections for stale prices and selection biases in the data. While the results of each are somewhat contradictory, they are important first steps in addressing a problem that is clearly central to the asset allocation decision of many investors.

5.2 The Internationalization of Venture Capital

The rapid growth in the U.S. venture capital market has led institutional investors to look increasingly at venture capital alternatives abroad. Until very recently, outside of the United Kingdom (where performance of funds has been quite poor) and Israel, there has been little venture capital activity abroad.⁵ (Table 6 provides an international comparison of venture capital activity.) Black and Gilson (1998) argue that the key source of the U.S. competitive advantage in venture capital is the existence of a robust IPO market. Venture capitalists can commit to transfer control back to the entrepreneur when a public equity market for new issues exists. This commitment device is unavailable in economies dominated by banks, such as Germany and Japan.

⁵ One potential source of confusion is that the term venture capital is used differently in Europe and Asia. Abroad, venture capital often refers to all private equity, including buyout, late stage, and mezzanine financing (which represent the vast majority of the private equity pool in most overseas markets). In the U.S., these are separate classes. I confine our discussion of international trends—as the rest of the paper—to venture capital using the restrictive, U.S. definition.

These arguments, however, have less credibility in light of the events of the past twelve months. There has been a surge in venture capital investment, particularly relating to the Internet, in a wide variety of nations across Asia, Europe, and Latin America. While local groups (many recently established) have made some of these investments, much of the activities have been driven by U.S.-based organizations.

In a pioneering study, Jeng and Wells (1999) examine the factors that influence venture capital fundraising in 21 countries. They find that the strength of the IPO market is an important factor in the determinant of venture capital commitments, echoing the conclusions of Black and Gilson. Jeng and Wells find, however, that the IPO market does not seem to influence commitments to early-stage funds as much as later-stage ones. While this work represents an important initial step, much more remains to be explored regarding the internationalization of venture capital.

One provocative finding from the Jeng and Wells analysis is that government policy can have a dramatic impact on the current and long-term viability of the venture capital sector. In many countries, especially those in Continental Europe, policymakers face a dilemma. The relatively few entrepreneurs active in these markets face numerous daunting regulatory restrictions, a paucity of venture funds focusing on investing in high-growth firms, and illiquid markets where investors do not welcome IPOs by young firms without long histories of positive earnings. It is often unclear where to begin the process of duplicating the success of the United States. Only very recently have researchers begun to examine the ways in which policymakers can catalyze the growth of venture capital and the

companies in which they invest. (Three recent exceptions are Irwin and Klenow (1996), Lerner (1999), and Wallsten (1996).) Given the size of recent initiatives undertaken both in the United States and abroad (summarized in Lerner (1999) and Gompers and Lerner (1999b)), much more needs to be done in this arena.

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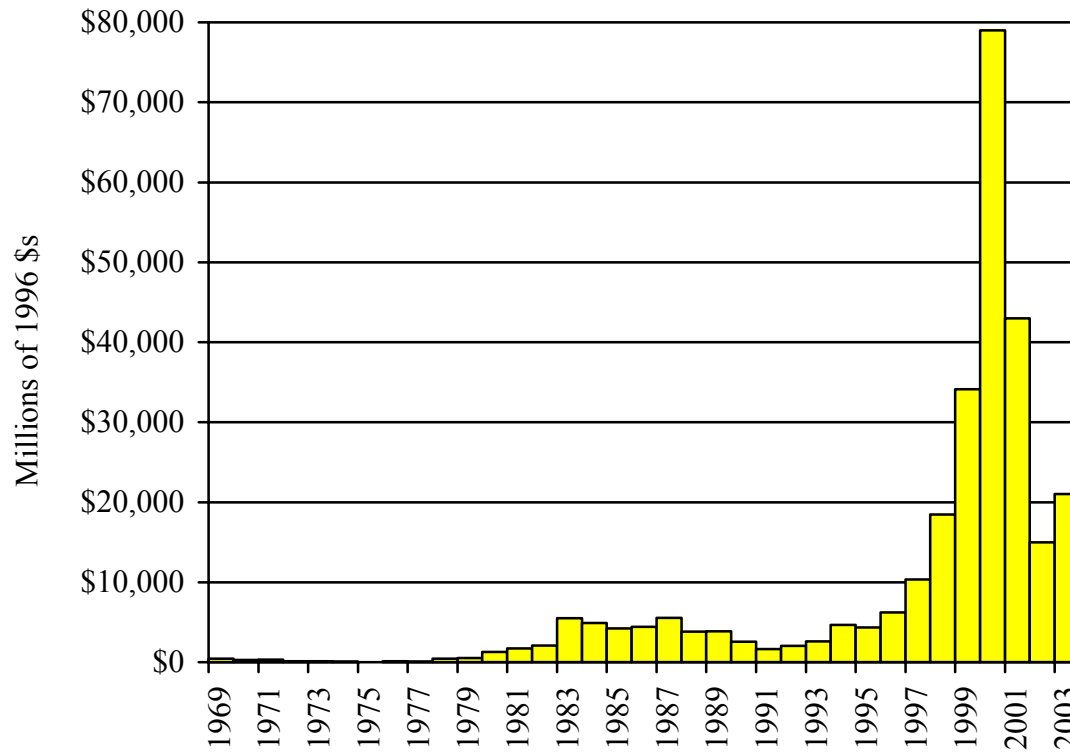


FIGURE 1--Commitments to the venture capital industry. Commitments are defined as the amount of money that is pledged to venture capital funds in that year. Amounts are in millions of 1996 dollars. Source: Venture Economics and Asset Alternatives.

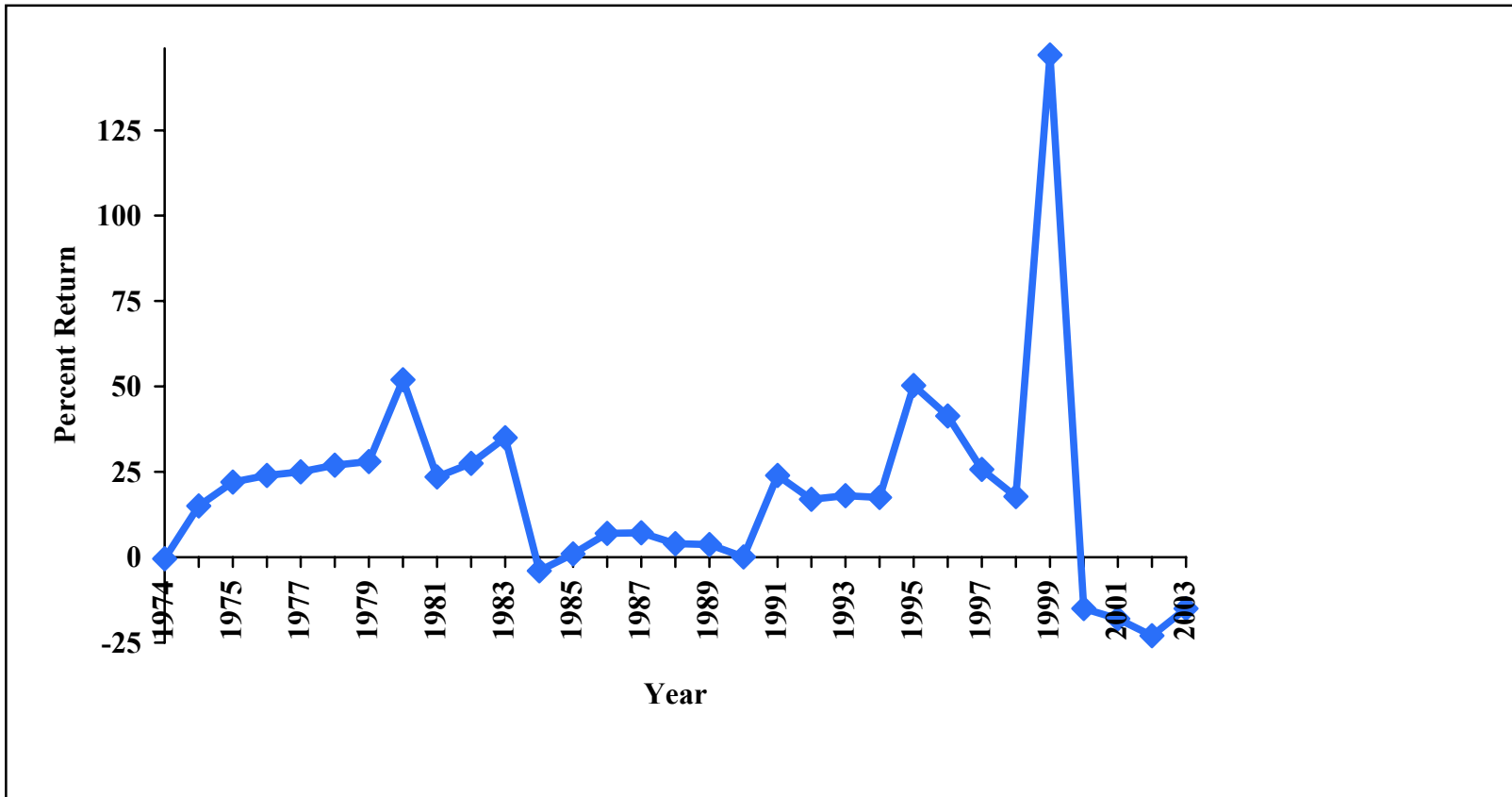


FIGURE 2--Return on venture capital. The average annual internal rate of return on venture capital funds, net of fees and profit-sharing, is plotted by year. Source: Compiled from Venture Economics data.

TABLE 1--Summary statistics for venture capital fund-raising by independent venture partnerships. All dollar figures are in millions of 2004 dollars.

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
<i>First closing of</i>													
Number of funds	23	27	57	81	98	147	150	99	86	112	78	88	50
Size (millions of	414	469	1.20	1.66	2.02	5.28	4.69	4.06	4.295	5.217	3.606	3.354	2.431
<i>Sources of funds</i>													
Private pension	15%	31%	30%	23%	33%	26%	25%	23%	39%	27%	27%	22%	31%
Public pension	^a	^a	^a	^a	^a	5%	9%	10%	12%	12%	20%	14%	22%
Corporations	10%	17%	19%	17%	12%	12%	14%	12%	11%	10%	12%	20%	7%
Individuals	32%	23%	16%	23%	21%	21%	15%	13%	12%	12%	8%	6%	11%
Endowments	9%	10%	14%	12%	7%	8%	6%	8%	6%	10%	11%	12%	13%
Insurance	16%	4%	13%	15%	14%	12%	13%	11%	10%	15%	9%	13%	9%
Foreign	18%	15%	8%	10%	13%	16%	18%	23%	11%	14%	13%	13%	7%
<i>Independent venture partnerships as a share of</i>													
<i>the total venture</i>			40%	44%	58%	68%	72%	73%	75%	78%	80%	79%	80%

^aPublic pension funds are included with private pension funds in these years.

^bThis series is defined differently in different years. In some years, the *Venture Capital Journal* states that non-bank SBICs and publicly traded venture funds are included with independent venture partnerships. In other years, these funds are counted in other categories. It is not available after 1994.

Source: Compiled from the unpublished Venture Economics funds database and various issues of the *Venture Capital Journal*. The numbers differ slightly from Lerner and Gompers (1996) due to continuing emendations to the funds database.

TABLE 1--Summary statistics for venture capital fund-raising by independent venture partnerships. All dollar figures are in millions of 1992 dollars.

	1991	1992	1993	1994	1995	1996	1997	1998	1999
<i>First closing of funds</i>									
Number of funds	34	31	46	80	84	80	103	161	186
Size (millions of	1.48	1.950	2.48	3.582	4.045	6.805	8.060	16.933	31.299
<i>Sources of funds</i>									
Private pension	25%	22%	59%	47%	38%	43%	40%	37%	9%
Public pension funds	17%	20%	a	a	a	a	a	10%	9%
Corporations	4%	3%	8%	9%	2%	13%	30%	18%	16%
Individuals	12%	11%	7%	12%	17%	9%	13%	11%	19%
Endowments	24%	18%	11%	21%	22%	21%	9%	8%	15%
Insurance	6%	14%	11%	9%	18%	5%	1%	3%	11%
Foreign	12%	11%	4%	2%	3%	8%	7%	13%	22%
<i>Independent venture partnerships as a share of</i>									
<i>the total venture</i>	80%	81%	78%	78%					

^aPublic pension funds are included with private pension funds in these years.

^bThis series is defined differently in different years. In some years, the *Venture Capital Journal* states that non-bank SBICs and publicly traded venture funds are included with independent venture partnerships. In other years, these funds are counted in other categories. It is not available after 1994.

Source: Compiled from the unpublished Venture Economics funds database and various issues of the *Venture Capital Journal*. The numbers differ slightly from Lerner and Gompers (1996) due to continuing emendations to the funds database.

TABLE 2-Number and dollar amount of venture capital disbursements in the U.S. in the first three quarters of 1999, by VentureOne industry classification. All dollar figures are in millions of current dollars.

<i>Industry</i>	<i>Number of Transactions</i>	<i>Total \$ Invested</i>
Communications and networking	255	\$4,498
Electronics and computer hardware	59	\$423
Information services	296	\$3,053
Semiconductors and components	58	\$518
Software	489	\$4,233
<i>Total of information technology</i>	<i>1157</i>	<i>\$12,726</i>
Healthcare services	47	\$411
Medical compounds	84	\$649
Medical devices and equipment	114	\$827
Medical information systems	44	\$336
<i>Total of life sciences</i>	<i>289</i>	<i>\$2,233</i>
Retail and consumer products	30	\$227
Other companies	454	\$5,580
<i>Total of non-technology or other</i>	<i>484</i>	<i>\$5,807</i>
<i>Grand total</i>	<i>1979</i>	<i>\$20,957</i>

Source: Compiled from unpublished VentureOne databases.

TABLE 3--Number and dollar amount of venture capital disbursements for U.S. manufacturing industries, by industry and five-year period. The count of venture capital investments in each five-year period is the sum of the number of firms receiving investments in each year. All dollar figures are in millions of 1992 dollars.

		Panel A: Venture Capital Investments (#s)					
#	<i>Industry</i>	<i>1965-69</i>	<i>1970-74</i>	<i>1975-79</i>	<i>1980-84</i>	<i>1985-89</i>	<i>1990-96</i>
1	Food and kindred	1	9	6	23	80	93
2	Textile and apparel	4	12	9	19	27	70
3	Lumber and furniture	2	8	6	24	62	37
4	Paper	2	2	2	2	12	14
5	Industrial chemicals	1	1	1	6	18	23
6	Drugs	1	12	34	245	554	746
7	Other chemicals	1	7	8	10	52	46
8	Petroleum refining and extraction	3	3	26	92	27	14
9	Rubber products	1	5	6	19	11	7
10	Stone, clay and glass products	0	1	3	14	48	31
11	Primary metals	0	3	5	20	44	33
12	Fabricated metal products	0	0	0	2	1	2
13	Office and computing machines	39	84	108	744	641	442
14	Other non-electrical machinery	12	12	32	254	280	162
15	Communication and electronic	23	65	60	497	736	709
16	Other electrical equipment	0	6	16	36	52	50
17	Transportation equipment	1	7	5	6	24	25
18	Aircraft and missiles	0	0	0	12	20	4
19	Professional and scientific instruments	13	37	70	383	549	544
20	Other machinery	7	14	16	62	89	98
	Total	111	288	413	2,470	3,327	3,150

TABLE 3 (continued)

		Panel B: Venture Capital Disbursements (millions of 1992 \$s)					
#	<i>Industry</i>	<i>1965-69</i>	<i>1970-74</i>	<i>1975-79</i>	<i>1980-84</i>	<i>1985-89</i>	<i>1990-96</i>
1	Food and kindred	4	19	7	25	212	258
2	Textile and apparel	6	15	14	27	45	186
3	Lumber and furniture	4	17	9	26	200	354
4	Paper	1	8	3	3	22	46
5	Industrial chemicals	0	1	1	41	34	33
6	Drugs	0	15	136	623	1,869	3,017
7	Other chemicals	1	40	4	9	155	87
8	Petroleum refining and extraction	12	6	92	359	110	29
9	Rubber products	1	3	15	28	8	18
10	Stone, clay and glass products	0	1	5	34	99	45
11	Primary metals	0	8	11	25	67	166
12	Fabricated metal products	0	0	0	1	0	1
13	Office and computing machines	67	404	288	3,253	2,491	1,426
14	Other non-electrical machinery	64	17	37	677	669	323
15	Communication and electronic	44	189	82	1,746	2,646	2,627
16	Other electrical equipment	0	8	53	78	107	104
17	Transportation equipment	0	10	4	9	47	96
18	Aircraft and missiles	0	0	0	19	19	8
19	Professional and scientific instruments	13	86	114	811	1,449	1,509
20	Other machinery	7	28	22	113	176	350
	Total	\$225	\$874	\$895	\$7,907	\$10,423	\$10,685

Source: Based on Kortum and Lerner (1999) and supplemented with tabulations of unpublished Venture Economics databases.

TABLE 4--Number and dollar amount of venture capital disbursements for all industries in the ten states with the most venture capital activity, by state and five-year period. The count of venture capital investments in each five-year period is the sum of the number of firms receiving investments in each year. All dollar figures are in millions of 1992 dollars.

Panel A: Venture Capital Investments (#s)						
<i>State</i>	<i>1965-69</i>	<i>1970-74</i>	<i>1975-79</i>	<i>1980-84</i>	<i>1985-89</i>	<i>1990-96</i>
California	65	179	310	1,863	2,645	3,380
Massachusetts	45	93	155	708	1,014	1,028
Texas	18	71	84	373	584	489
New York	28	90	73	311	324	276
New Jersey	15	35	47	171	291	336
Colorado	5	22	31	194	258	298
Pennsylvania	8	21	32	120	290	311
Illinois	16	29	31	133	214	312
Minnesota	12	34	42	170	186	194
Connecticut	3	20	37	136	217	210
Total, all states	302	847	1,253	5,365	8,154	9,406

Panel B: Venture Capital Disbursements (millions of 1992 \$s)						
<i>State</i>	<i>1965-69</i>	<i>1970-74</i>	<i>1975-79</i>	<i>1980-84</i>	<i>1985-89</i>	<i>1990-96</i>
California	218	546	691	6,711	9,670	13,603
Massachusetts	61	155	197	1,943	2,829	3,386
Texas	37	140	148	1,161	2,171	2,010
New York	32	154	162	688	1,404	1,394
New Jersey	33	82	77	370	1,214	1,711
Colorado	12	50	46	493	805	951
Pennsylvania	18	41	116	370	1,530	1,109
Illinois	59	134	117	287	1,208	1,413
Minnesota	6	90	44	270	406	522
Connecticut	1	32	85	319	1,463	724
Total, all states	\$687	\$1,935	\$2,259	\$15,261	\$30,742	\$37,162

Source: Based on tabulations of unpublished Venture Economics databases.

TABLE 5--The distribution of venture-backed and non-venture IPOs for the period 1978-1999. This table compares the distribution of IPOs in this sample versus all IPOs recorded over this period of time. All dollar figures are in millions of 1992 dollars.

Year	Number of venture-backed IPOs	Amount raised in venture- backed IPOs	Total number of IPOs	Total amount raised in all IPOs	Venture-backed IPOs as percent of all IPOs (number)	Venture-backed IPOs as percent of all IPOs (amount)
1978	6	\$134	42	\$485	12.50%	21.59%
1979	4	\$62	103	\$777	3.74%	7.34%
1980	24	\$670	259	\$2,327	8.48%	22.35%
1981	50	\$783	438	\$4,848	10.25%	13.91%
1982	21	\$738	198	\$1,901	9.59%	27.97%
1983	101	\$3,451	848	\$17,999	10.64%	16.09%
1984	44	\$731	516	\$5,179	7.86%	12.37%
1985	35	\$819	507	\$13,307	6.46%	5.80%
1986	79	\$2,003	953	\$23,902	7.66%	7.73%
1987	69	\$1,602	630	\$19,721	9.87%	7.52%
1988	36	\$915	435	\$6,679	8.28%	13.70%
1989	39	\$1,110	371	\$6,763	10.51%	16.41%
1990	43	\$1,269	276	\$4,828	15.58%	16.29%
1991	119	\$3,835	367	\$16,872	32.43%	22.73%
1992	157	\$4,317	509	\$23,990	30.84%	17.99%
1993	193	\$4,905	707	\$40,456	27.30%	12.12%
1994	159	\$3,408	564	\$27,786	28.19%	12.26%
1995	205	\$6,251	566	\$36,219	36.22%	17.26%
1996	284	\$10,976	845	\$38,245	33.61%	28.70%
1997	138	\$4,419	628	\$40,278	21.34%	10.60%
1998	78	\$3,388	319	\$31,075	24.45%	10.90%
1999	271	\$20,757	485	\$56,952	55.87%	36.45%

Sources: Barry, et al. (1992), Ritter (1997), and various issues of the *Going Public: The IPO Reporter* and the *Venture Capital Journal*.

TABLE 6—The size of the venture capital pool in 21 nations in 1995. I use Jeng and Wells' figures for early-stage funds in each country outside the U.S. because I believe it to be most comparable to venture capital funds as defined in the U.S. Figures for Australia and New Zealand are 1994 estimated levels; figures for Israel are a 1995 estimate; and figures for Portugal are the actual level in 1994. All dollar figures are in millions of current U.S. dollars.

<i>Country</i>	<i>Total Venture Capital Under Management</i>
Australia	54
Austria	0.4
Belgium	8
Canada	182
Denmark	4
Finland	1
France	35
Germany	116
Ireland	1
Israel	550
Italy	60
Japan	11
Netherlands	100
New Zealand	1
Norway	7
Portugal	9
Spain	24
Sweden	9
Switzerland	1
United Kingdom	36
United States	3,651

Source—Compiled from Jeng and Wells (1999), as slightly amended by the author.