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The Venture Capital Revolution

Paul Gompers and Josh Lerner

Venture capital has developed as an important intermediary in financial markets, providing capital to firms that might otherwise have difficulty attracting financing. These firms are typically small and young, plagued by high levels of uncertainty and large differences between what entrepreneurs and investors know. Moreover, these firms typically possess few tangible assets and operate in markets that change very rapidly. Venture capital organizations finance these high-risk, potentially high-reward projects, purchasing equity or equity-linked stakes while the firms are still privately held. The venture capital industry has 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.

The primary focus of this article is on drawing together the empirical academic research on venture capital and highlighting what is still not known. With this focus in mind, four limitations should be acknowledged at the outset.

First, this paper will not address the many theoretical papers that examine various aspects of the venture capital market, much of it examining the role that venture capitalists play in mitigating agency conflicts between entrepreneurial firms and outside investors.¹ Second, this article does not focus on the intricacies of the

¹ For a starting point to this theoretical literature on venture capital, the interested reader might begin with the following: Cornelli and Yosha (1997), Hellmann (1998), and Marx (1994) focus on the active monitoring and advice that is provided by venture capitalists; Amit, Glosten and Muller (1990a), (1990b) and Chan (1983) focus on the screening mechanisms employed; Bergloff (1994) looks at the incentives to exit; Admati and Pfleiderer (1994) consider the proper syndication of the investment; and Bergemann and Hege (1998) model the staging of the investment.

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venture financing process from a practitioner point of view, nor on the legal and institutional considerations associated with raising venture financing. For discussion in this area, see Bartlett (1995), Halloran et al. (1998), and Levin (1998). Third, this paper will focus on the venture capital industry, and not on the economic function played by venture capitalists. In other words, we will not seek to address all methods of financing high-risk young firms. Along with venture capital, banks, individual investors (or "angels"), and corporations are among the other providers of capital for these firms. Our understanding of many of the alternative forms of finance—especially "angel" investing—is highly incomplete (Lerner, 1998). Thus, we will focus here on venture capital, defined as independent, professionally managed, dedicated pools of capital that focus on equity or equity-linked investments in privately held, high growth companies.

Finally, venture capital itself is a very young industry, which has been changing rapidly. Thus, while we can discuss the economics of venture capital in past years and today, the extent to which these insights will continue to apply to the venture industry of tomorrow remains unclear.

The Origins of the Venture Capital Industry

The first true venture capital firm was American Research and Development (ARD), established in 1946 by MIT President Karl Compton, General Georges F. Doriot, who was a professor at Harvard Business School, and local business leaders. This small group made high-risk investments in 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 in 1957, which grew in value to \$355 million. ARD was structured as a publicly traded closed-end fund. A closed-end fund is a mutual fund whose shares trade from investor to investor on an exchange like an individual stock. These funds raise capital up front by selling shares to investors. If investors no longer desire to hold the investment, they can sell 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. 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. Institutional investors showed little interest in these shares, citing the risks associated with such an unproven new style of investing. As a result, shares in ARD were 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 publicly traded structure, however, was soon found to have some significant drawbacks. In a number of cases, brokers sold the funds to inappropriate investors: for example, to 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. In fact, 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 during these years.²

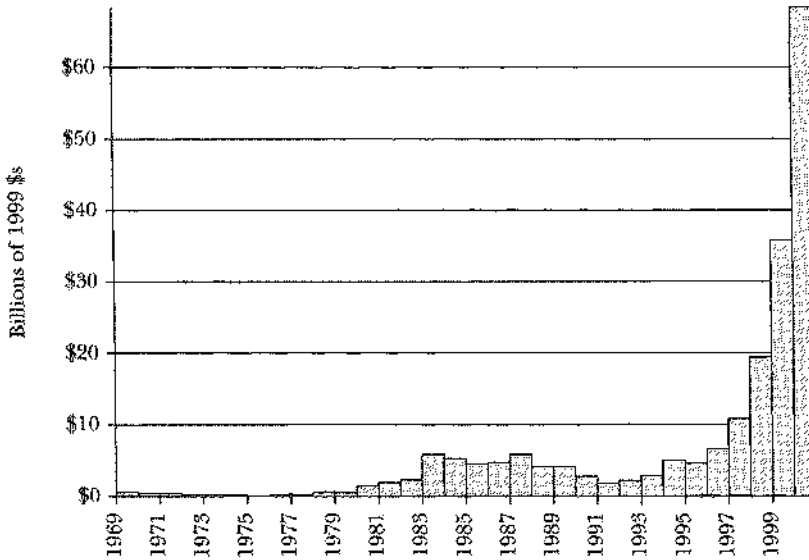
The first venture capital limited partnership, Draper, Gaither, and Anderson, was formed in 1958. Unlike closed-end funds, partnerships were exempt from securities regulations, including the exacting disclosure requirements of the Investment Company Act of 1940. The set of the investors from which the 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 imitators followed the template of other limited partnerships common at the time: for example, those that had been formed to develop real estate projects and explore oil fields. In such cases, the partnerships had predetermined, 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, rather than selling successful investments after they went public and returning cash to their investors, the venture capitalists would simply give investors 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.

In the 1960s and 1970s, although limited partnerships became more common, they still accounted for a minority of the venture pool. During this time, most venture organizations raised money either through closed-end funds or Small Business Investment Companies (SBICs), which were federally chartered risk capital pools that proliferated during the 1960s. Spurred by fears of lagging American technological competitiveness after the Soviet launch of the Sputnik satellite in 1957, the federal government had launched the SBIC program to encourage the development of the venture capital industry. Applicants who were able to secure a small amount of private capital received generous marching funds (or loan guarantees) from the government (for an overview, see Noone and Rubel, 1970). The SBIC program was poorly designed. The extensive regulations soon discouraged most established venture capitalists from participating in the program. Meanwhile, the limited scrutiny of applicants led to the entry of unscrupulous operators who invested either in firms with poor prospects or in outright fraudulent enterprises, typically controlled by friends or relatives. In a scenario that foreshadowed the savings and loan crisis of the 1980s, most of the SBICs collapsed in the late 1960s and 1970s.

Activity in the venture industry increased dramatically in late 1970s and early

² A pattern of venture capital funds trading at a substantial discount to asset value also has frequently been observed in closed-end funds holding publicly traded securities (De Long and Shleifer, 1992).

*Figure 1***Commitments to the Venture Capital Industry** (*billions of 1999 dollars*)

Note: Commitments are defined as the amount of money that is pledged to U.S. venture capital funds in that year.

Source: Venture Economics and Asset Alternatives.

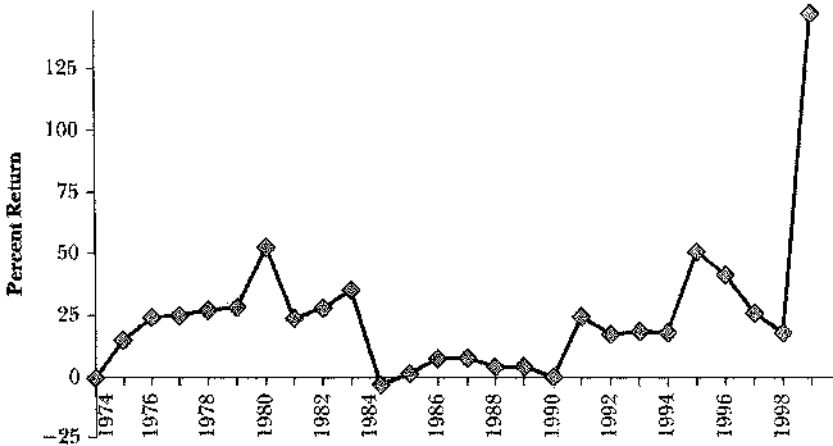
1980s. Figure 1 shows the total amount raised by venture partnerships since the late 1960s. The sources of funding have also shifted over time. In 1978, when \$424 million was invested in new venture capital funds, individuals accounted for the largest share, 32 percent, while pension funds supplied just 15 percent. In 1979, the U.S. Department of Labor clarified its “prudent man” rule in a way that explicitly allowed pension fund managers to invest in high-risk assets, including venture capital. Eight years later, when more than \$4 billion was invested, pension funds accounted for more than half of all contributions.³

When venture capital disbursements are divided by industry, about 60 percent in 1999 went to information technology industries, especially communications and networking, software, and information services. About 10 percent went into life sciences and medical companies, and the rest is spread over all other types of companies. When venture capital disbursements are viewed geographically, a little more than one-third of venture capital went to California. A little less than one-third went to Massachusetts, Texas, New York, New Jersey, Colorado, Pennsylvania, and Illinois, combined. The remaining third was spread between the other 42 states. The concentration on high technology industries and in California and

³ The 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.

Figure 2

Average Annual Rate of Return that Investors in U.S. Venture Capital Funds Received



Note: Returns are net of fees and profit-sharing. See the text for a discussion of the limitations of these return calculations.

Source: Compiled from Venture Economics data.

Massachusetts has been a consistent feature of venture capital investments since at least the mid-1960s.⁴

The past two decades have seen 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 shows, the annual flow of money into venture funds increased by a factor of ten during the early 1980s, peaking at just under \$6 billion (in 1999 dollars). From 1987 through 1991, however, fundraising steadily declined. This fallback 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.⁵

⁴ The breakdown of venture capital is from authors' calculations based on unpublished data from Venture Economics and VentureOne. For detailed information on venture capital disbursements over the past four decades, see Kortum and Lerner (2000).

⁵ These return data must be interpreted with caution. See the discussion below in the section, "What We Don't Know About Venture Capital."

This pattern reversed dramatically in the 1990s, which saw rapid growth in venture fundraising. The explosion of activity in the market for initial public offerings and the exit of many inexperienced venture capitalists led to increasing venture capital returns. New capital commitments rose in response, increasing twenty-fold between 1991 and 2000. As Table 1 shows, much of the recent growth in fundraising was fueled by pension funds, whether those of private companies such as the General Motors Investment Management Company or public agencies like the California Public Employees Retirement System, many of which entered venture investing for the first time in a significant way. While previous investment surges have been associated with depressed venture capital returns, the most recent expansion in fundraising has seen a rise in the returns to venture funds.

Corporate investments in venture capital, whether investments in independent partnerships or direct investments in privately held firms, also increased substantially in the 1990s. While the late 1960s and mid-1980s had seen extensive corporate experimentation with venture funds, the late 1990s saw an unprecedented surge of activity. One reason is that the high degree of publicity associated with the successful venture investments of the period, such as eBay and Yahoo!, triggered the interest of many CEOs, who sought to harness some of the same energy in their organizations.

But the substantial increase in corporate venture capital spending also reflected some more fundamental shifts as well. Many corporations were rethinking the way in which they managed the innovation process. Established mainline corporations that had relied on central R&D laboratories for new product ideas during most of the century were exploring alternatives, including joint ventures, acquisitions, and university-based collaborations. Managers and academics alike had realized that management difficulties led to corporations extracting only a small amount of the value from centralized R&D facilities. Many of the best ideas languished unused or were commercialized in new firms founded by defecting employees. A number of fast-growing technology firms such as Cisco Systems, which relied on acquisitions rather than internal R&D for the bulk of their new ideas, made it apparent that outside venture capital might be a practical alternative—even a superior alternative—to an internal, centralized R&D process.⁶

The growing diffusion of the Internet and an understanding of its implications also triggered the increasing corporate interest in venture capital. A wide range of media, service, and manufacturing firms realized the potential of the Internet to challenge their traditional ways of doing business—but they had few internal resources to address the new communications technology. A corporate venturing effort provided one way to grapple with these new technologies and their implications.

Finally, interest in corporate venturing programs was intensified by a growing receptiveness to corporate collaborations by independent venture capital groups.

⁶ See, for instance, the discussions in Jensen (1993) and Rosenbloom and Spencer (1996).

Table 1
Summary Statistics for Venture Capital Fund-raising by Independent Venture Partnerships

	1979	1983	1987	1991	1995	1999 ^a
<i>First closing of funds</i>						
Number of funds	27	147	112	34	84	204
Size (billions of 1999 \$)	.53	6.01	5.93	1.69	4.60	37.46
<i>Sources of funds</i>						
Private pension funds	31%	26%	27%	25%	38%	9%
Public pension funds	^b	5%	12%	17%	^b	9%
Corporations	17%	12%	10%	4%	2%	16%
Individuals	23%	21%	12%	12%	17%	19%
Endowments	10%	8%	10%	24%	22%	15%
Insurance companies/banks	4%	12%	15%	6%	18%	11%
Foreign investors/other	15%	16%	14%	12%	3%	22%
<i>Independent venture partnerships as a share of the total venture pool^c</i>						
		68%	78%	80%		

^aIn 2000, there were 228 funds raised with total committed capital of \$67.7 billion.

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

^cThis 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 for 1979 and 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.

In earlier years, corporate interest in venture capital had waxed and waned with seemingly little reason, and so traditional venture capital firms had been quite wary of entering into financial arrangements with corporate groups. But as the venture capital arena became increasingly crowded in the late 1990s, the venture community's attitudes began subtly changing. Relationships with corporations were increasingly seen as a source of differentiated competitive advantage. Venture groups were increasingly willing to consider working with these investors, not only accepting money from them as limited partners, but also in structuring various types of collaborations. For example, the venture capital firm Softbank set up a joint venture with K-Mart for the purpose of providing regular customers of the retailers with free Internet access, discounted shopping, and services from Yahoo! (a company in which Softbank was an early investor). The venture capital firm Kleiner Perkins set up the Java Fund as a mechanism for a variety of corporations interested in stimulating demand for software written in the Java language to invest in companies with potential new applications.

Although the limited partnership form continues to dominate the venture capital industry, the 1990s have also seen a revival of the publicly traded venture fund. This revival has occurred despite the troubled historical record noted above and the increasing severity with which the Securities and Exchange Commission sought to enforce regulatory provisions related to such funds. This renaissance has

included the emergence of organizations that were pure venture funds, such as the Internet Capital Group, as well as hybrids that combined a venture fund with operating companies (for instance, CMGI put together under a single corporate umbrella a number of operating Internet business and a substantial venture capital fund, @Ventures) and operating companies that included an “incubator” for new firms (examples include Idealab! and Divine InterVentures).

The renewed appeal of public venture funds stemmed from the desire of individual investors to put some of their money into venture capital and the inaccessibility of traditional venture funds to these investors. More and more workers were managing their own savings in the form of 401(k) plans and other “defined contribution” plans. But for these investors, obtaining access to traditional venture funds was virtually impossible. Securities regulations restricted the funds to individuals who met stringent tests of “sophistication,” which were based on levels of net worth and income tests well beyond those of the average middle-class family. The venture capital firms, mindful of requirements that a limited partnership should not have too many investors, typically set minimum investment levels in the millions or tens of millions of dollars. Indeed, many of the most established funds did not accept any capital at all from new investors: there was sufficient demand from existing investors who had “grandfather rights” to invest in subsequent funds. In the years to come, it is likely that increasing experimentation will seek to match medium-scale individual investors with venture funds.

What We Know About Venture Capital Activity

To understand the venture capital industry, one must understand the whole “venture cycle.” The venture capital cycle starts with raising a venture fund; proceeds through the investment in, monitoring of, and adding value to firms; continues as the venture capital firm exits successful deals and returns capital to its investors; and renews itself with the venture capitalist raising additional funds. The organization of this section mirrors this cycle, highlighting research that has been done on each topic.⁷

Fundraising

Commitments to the venture capital industry have been highly variable over the past 30 years. One topic of continuing interest to researchers has been investigating the determinants of this variability.

The impact of variations in the capital gains tax rate has received particular attention (for example, Poterba, 1987, 1989). The bulk of venture capital funds are from tax-exempt investors, who are not directly affected by a higher or lower capital

⁷ Each aspect of the venture cycle is related to each other. One inevitable consequence of our organizational scheme is that the exiting of venture capital investments has an important influence on the raising of venture funds and venture capital investing.

gains tax rate. In regression analyses, however, Gompers and Lerner (1998b) find that lower capital gains taxes seem to have a particularly strong effect on the amount of venture capital supplied by these tax-exempt investors. The empirical results suggest that the impact of the capital gains tax does not arise through its effect on those supplying venture capital, but rather by spurring corporate employees to become entrepreneurs, leading to more demand for venture capital.

Some other factors already mentioned include regulatory changes such as the Department of Labor's shift in ERISA policies which eased investment restrictions in venture capital and recent past returns of venture funds (for more discussion, see Gompers and Lerner, 1998b).

Black and Gilson (1998) argue that the health of the venture capital market depends fundamentally on a vibrant public market that allows new firms to issue shares. For example, few firms went public in the 1970s and very little venture capital was raised. The growth of the venture capital industry in the early 1980s, the decline in such fundraising in the late 1980s and the unprecedented growth in venture capital fundraising in the 1990s were matched by a rise, then a fall, and then a rise in initial public offering market activity.

A second major research question in this area focuses on whether an independent venture capital limited partnership has organizational advantages over the typical American corporation with dispersed shareholders (Jensen, 1993; Porter, 1992). The key elements of the research inspired by these claims focus on understanding the conditions that govern the relationship between investors (limited partners) and the venture capitalist (general partner) during the fund's life and the incentives that these conditions create.

Gompers and Lerner (1999a) examine the nature of venture capitalists' incentive compensation in 419 venture partnership agreements and "offering memoranda" for funds formed between 1978 and 1992. They find that compensation for older and larger venture capital organizations is more sensitive to performance than the compensation of other venture groups. For example, the oldest and largest venture groups command about a 1 percent greater share of the capital gains from their investment than do their less established counterparts. This greater profit share matters little if the fund is not successful, but can represent a 4 percent or greater increase in the net present value of total compensation if the fund is successful. These differences are statistically significant. Gompers and Lerner do not, however, find any relationship between the incentive compensation and the subsequent performance of the fund.

The most plausible explanation for these empirical patterns appears to be a learning model in which neither the venture capitalist nor the investor initially knows the venture capitalist's ability. A venture capitalist who is just getting started will work hard even without explicit pay-for-performance incentives, because if the fund can establish a good reputation either for selecting attractive investments or adding value to firms in its portfolio, the venture capitalist will gain additional compensation in later funds. These reputation concerns lead to lower pay-for-

performance for smaller and younger venture organizations, and explains the apparent lack of a relationship between incentive compensation and performance.

In addition to the incentives provided by the high-powered compensation, covenants and restrictions that govern the relationship between investors and venture capitalists often play an important role in limiting conflicts. Such restrictions might include, for instance, prohibitions against the venture capitalists raising another fund until this fund is fully invested; investments in areas where the venture capitalist is not expert (for example, in securities of publicly traded firms); and investments in companies where one of the venture capitalists' earlier funds had invested. A single limited partnership agreement governs the relationship between the limited and general partners over the fund's life of a decade or more. Unlike other agreements, like employment contracts or strategic alliances, these contracts are rarely renegotiated.

Gompers and Lerner (1996) examine a sample of 140 executed partnership agreements from a major endowment and two investment managers that select venture capital investments for pension funds and other institutional investors. The evidence illustrates the importance of general market conditions on the restrictiveness of venture capital limited partnerships. Fewer restrictions are found in funds established during years with greater inflows of new capital, funds in which limited partners do not employ investment managers, and funds where general partners enjoy higher levels of compensation. Thus, in settings when venture capitalists have relatively more bargaining power, the venture capitalists are able to raise money with fewer strings attached.

This research has given us a better understanding of how venture capitalists differ from corporations. For instance, corporate middle managers are very unlikely to receive a substantial share of the wealth that the innovations they champion produce. Similarly, corporations do not face the discipline of needing to return their capital to shareholders and to finance new projects through the raising of additional funds. This research, however, can shed only limited light on the relative strength of the venture capital organization as a mechanism for funding innovation. We will revisit that issue later in this paper.

Venture Investing

A lengthy literature has discussed the financing of young firms. Uncertainty and informational asymmetries often characterize young firms, particularly in high-technology industries. If the firm raises equity from outside investors, the manager has an incentive to engage in wasteful expenditures (like lavish offices) because the manager 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 (Jensen and Meckling, 1976). If all the outcomes of the entrepreneurial firm cannot be foreseen, and effort of the entrepreneur cannot be ascertained with complete confidence, it may be difficult to write a contract governing the financing of the firm (Grossman and Hart, 1986; Hart and Moore, 1998).

These problems are especially difficult for companies with intangible assets and whose performance is difficult to assess, such as early stage, high technology companies with a heavy reliance on R&D.⁸ 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 invest in a certain type of research that brings great personal recognition in the scientific community, but provides little return for the investor. 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. In addition, entrepreneurs have incentives to pursue highly volatile strategies, such as rushing a product to market when further testing may be warranted, because they benefit from success but do not actually suffer losses from failure. As a result, external financing for these firms is costly or difficult to obtain.

Specialized financial intermediaries, such as venture capital organizations, can alleviate these information gaps and thus allow firms to receive the financing that they cannot raise from other sources. The tools that venture capital firms have to address these information issues are to scrutinize firms intensively before providing capital and then to monitor them afterwards. The monitoring and information tools of venture capitalists include: meting out financing in discrete stages over time; syndicating investments with other venture capital firms; taking seats on a firm's board of directors; and compensation arrangements including stock options. A number of studies have investigated how venture capitalists employ these tools.

Staged capital infusion may be the most potent control mechanism a venture capitalist can employ (Sahlman, 1990). Staged capital infusion keeps the owner/manager on a "tight leash" and reduces potential losses from bad decisions. The venture capitalist can increase the duration of funding and reduce the frequency of reevaluation as the company becomes better established and conflicts with the entrepreneur appear more likely.

Gompers (1995) uses a random sample of 794 venture capital-financed companies to examine how venture capitalists use staged infusions of capital and other types of monitoring. In fact, venture capitalists do concentrate investments in early-stage companies and high technology industries where informational asymmetries are likely to be most significant and monitoring most valuable. When venture capitalists 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). 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 (as

⁸ These insights fit with the substantial finance literature that has argued that substantial firms with high market-to-book ratios are more susceptible to agency costs (for example, Myers, 1977).

measured by higher market value-to-book value ratios or R&D intensities), firms are refinanced more frequently.⁹

In addition to the staged capital infusions, a venture capitalist who originates a deal will often look to bring in other venture capital firms. This syndication serves multiple purposes. By syndicating investments, each venture capital firm can invest in more projects and largely diversify away firm-specific risk. Involving other venture firms also provides as a second (and third and fourth) opinion on the investment opportunity, which limits the danger that bad deals will get funded.

Lerner (1994a) tests this “second opinion” hypothesis in a sample of 271 biotechnology venture capital investments. He finds that in the early rounds of investing, experienced venture capitalists tend to syndicate only with venture capital firms that have similar experience. This finding supports the second opinion hypothesis, since a venture capitalist looking for a second opinion would want to get a second opinion from a firm of similar (or better) ability, rather than just looking for money from any other firm.

The advice and support provided by venture capitalists is often embodied by their role on the firm’s board of directors. In keeping with the approach of Fama and Jensen (1983) and Williamson (1983), who hypothesize that the composition of the board should be shaped by the need for oversight, Lerner (1995) examines whether the representation of venture capitalists on the boards of the private firms in their portfolios is greater when the need for oversight is larger. Specifically, Lerner examines changes in board membership around the time that a firm’s chief executive officer is replaced, since 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 (Hermalin and Weisbach, 1988). Lerner finds that an average of 1.75 venture capitalists are added to the board between financing rounds when the firm’s chief executive officer 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.

Lerner (1995) also finds evidence that board service is driven by a need to provide monitoring, showing 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 his sample have a venture director with an office within 60 miles of their headquarters. The transaction costs associated with frequent visits and intensive involvement are likely to be reduced if the venture capitalist is geographically nearby.

Yet another mechanism utilized by venture capitalists to influence managers and critical employees is to have them receive a substantial fraction of their compensation in the form of equity or options, which tends to align the interests of employees and investors. Baker and Gompers (2000) find that fixed salaries are lower and the size of

⁹ Consistent evidence regarding the strength of contractual terms in these agreements—including cash flow rights, voting rights, board rights, liquidation rights, and other control rights—is found in Kaplan and Stromberg’s (2000) analysis of 130 venture partnership agreements.

the equity stake held is higher for venture capital-backed chief executive officers, when compared to similar companies not financed by venture capital.

The venture capitalist also employs additional controls on compensation. For example, they usually require vesting of the stock or options over a multiyear period, so that 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 means that an entrepreneur who wishes to maintain the relative size of the personal stake in the firm will need to meet the agreed-upon targets.

Until this point, this section has highlighted the ways in which venture capitalists can address agency problems. The argument is often made by venture capital practitioners, however, that the quality of the investment process changes with the amount of money flowing into the industry.

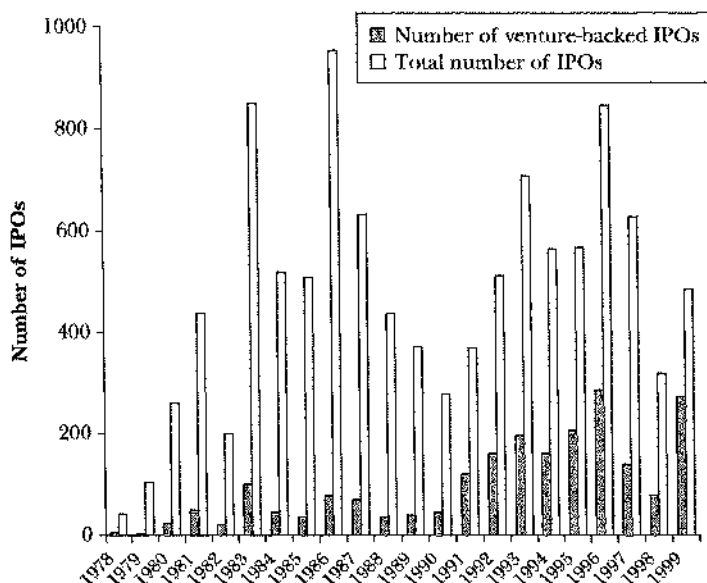
When a surge of money enters the venture capital industry, but there are only a certain number of worthy projects to finance, the result can be a substantial decline in the returns on investment in the industry. The phrase "too much money chasing too few deals" is a common refrain in the venture capital market during periods of rapid growth. Sahlman and Stevenson (1987) describe this situation arising in the disk drive industry in the early 1980s,¹⁰ and similar stories are often told concerning investments in software, biotechnology, and the Internet.

Gompers and Lerner (2000) examine these claims through a dataset of over 4000 venture investments between 1987 and 1995 developed by the consulting firm VentureOne. They examine the effect of the inflow of funds into the venture capital industry on the valuations that venture capitalists paid when investing in young firms. They control for various firm attributes that might affect firm valuation, including firm age, stage of development, industry, public market values for firms in the same industries, and average book-to-market and earnings-to-price ratios. 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 percent 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 percent increase in valuation levels.

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.

¹⁰ Lerner (1997) suggests, however, that these firms may have displayed behavior consistent with strategic models of "technology races" in the economics literature. The rewards from success may have been large enough that it made sense for many firms to enter, even knowing that relatively few would survive. This view suggests that it may have indeed been rational for venture capitalists to fund a substantial number of disk drive manufacturers.

Figure 3
 Number of Venture-backed IPOs and Total Number of IPOs by Year in the United States



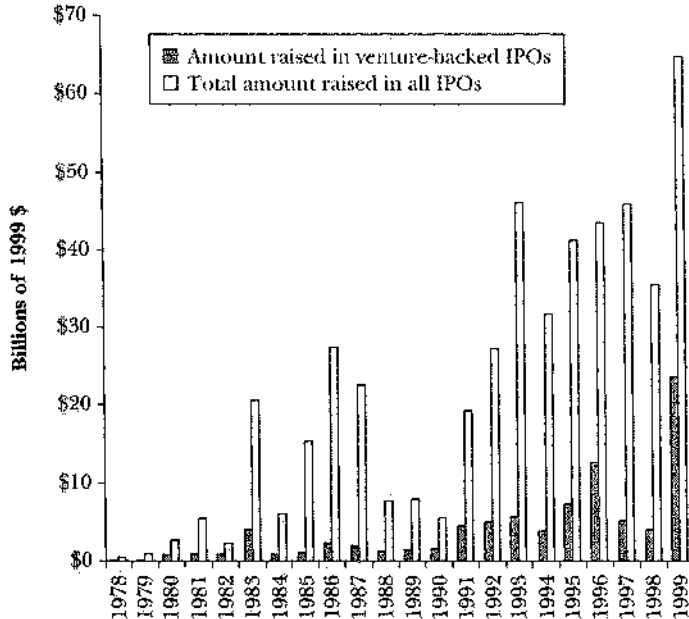
Sources: Barry et al. (1990), Ritter (1998), and various issues of *Going Public: The IPO Reporter* and the *Venture Capital Journal*.

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 has been particularly intense and venture capital inflows have had a more dramatic effect on prices in those regions.

Gompers and Lerner (2000) is based on data only through the mid-1990s, but it seems unlikely that adding data through the end of the 1990s would alter the conclusion that inflows of venture capital tend to raise valuations. After all, in the late 1990s, a surge of money into venture capital funds was accompanied by lofty valuations. In the past, overinvestment by venture capitalists led to too many projects at too high valuations resulted in low returns. Indeed, one reason for the very low returns of venture capital funds from about 1985 to 1990 (as shown in Figure 2) is that the surge of venture capital funds at this time (shown in Figure 1) exceeded the productive projects to be financed. The next few years will show whether information technology companies can absorb very large increases in venture capital from 1998 to 2000, or whether the inflow of venture funds has overwhelmed the number of profitable opportunities.¹¹

¹¹ For our predictions regarding the future evolution of the venture capital industry, the interested reader is referred to Chapter 10 of Gompers and Lerner (2001).

Figure 4

Dollar Volume of Venture-backed IPOs and All IPOs By Year in the United States

Sources: Barry et al. (1990), Ritter (1998), and various issues of *Going Public: The IPO Reporter* and the *Venture Capital Journal*.

Exiting Venture Capital Investments

To make money on their investments, venture capitalists need to turn illiquid stakes in private companies into realized return. Typically, the most profitable exit opportunity is an initial public offering, in which the company issues shares to the public.

Figures 3 and 4 summarize the trends in initial public offerings, both those that originated in venture capital investments and others. The proportion of all initial public offerings that are backed by venture capitalists rose from under 10 percent in the 1980s to about 31 percent in the 1990s—and a remarkable 56 percent in 1999. Interestingly, the share of money raised by initial public offerings that are backed by venture capital has not increased as much. Although the share jumps around a lot, about 17 percent of all funds raised by initial public offerings in the 1980s went to just under 20 percent in the 1990s—and almost all of this increase can be traced to the very large amount of venture-backed initial public offerings in 1999.

Initial empirical research in this area focused on the structure of venture-backed initial public offerings. Barry, Muscarella, Peavy and Vetsuppens (1990) established a broad array of facts about the role of venture capitalists in initial public offerings, using a sample of 433 venture-backed and 1123 non-venture initial public offerings between 1978 and 1987. They document that venture capitalists

hold significant equity stakes in the firms they take public (on average, the lead venture capitalist holds a 19 percent stake immediately prior to the initial public offering, and all venture investors hold 34 percent), and control about one-third of the board seats. They continue to hold their equity positions in the year after the initial public offering. Unlike non-venture initial public offerings, the typical venture-backed offering is not yet profitable at the time it goes public. Finally, venture-backed initial public offerings have less of a positive return on their first trading day. The authors suggest that this implies that investors need less of a discount to purchase these shares (that is, 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 that the firms they bring to market are not overvalued. They test this idea using a matched set of 640 venture-backed and non-venture initial public offerings between 1983 and 1987. They confirm the finding that the underpricing of venture capital-backed initial public offerings is significantly less than the underpricing of non-venture initial public offerings. Some of their other findings offer an explanation for this pattern. For example, they show that the underwriters of venture-backed firms are significantly more experienced than the underwriters of comparable non-venture offerings. Venture-backed initial public offerings have significantly lower fees than non-venture initial public offerings. Venture capitalists also retain a majority of their equity after the initial public offering, which serves as a commitment device. These factors help to explain yet another of their findings, that institutional investors—who may be presumed to be especially knowledgeable—have larger holdings of venture-backed firms after the initial public offering than they do of comparable non-venture companies.

More recent research in this area has examined the timing of the venture capitalist's decision to take firms public and the timing of the decision to liquidate the venture capitalists' holdings, which frequently occurs well after the initial public offering.

Several potential factors affect when venture capitalists choose to bring firms public. One of these is the relative valuation of publicly traded securities. Lerner (1994b) examines when venture capitalists choose to finance a sample of 350 privately held venture-backed biotechnology companies with another private round versus taking the firm public. He shows that the venture capitalists take firms public at market peaks, relying on private financings when valuations are lower. Seasoned venture capitalists appear more proficient at timing initial public offerings. The results are robust to the use of alternative criteria to separate firms and to the addition of controls for the firms' quality.

The superior timing ability of established venture capitalists may be in part due to the fact that they have more flexibility as to when to take companies public. Less-established groups may be influenced in this decision by other considerations. For instance, Gompers (1996) argues that young venture capital firms have incentives to “grandstand”: that is, they take actions that signal their ability to potential

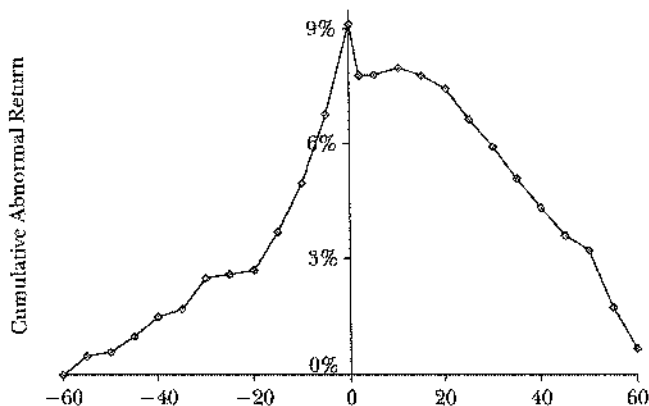
investors. Specifically, young venture capital firms bring companies public earlier than older venture capital firms in an effort to establish a reputation and raise capital for new funds. He examines a sample of 433 venture-backed initial public offerings between 1978 and 1987, as well as a second sample consisting of the first initial public offerings brought to market by 62 venture capital funds. Young venture capital firms have been on the initial public offering company's board of directors 14 months less and hold smaller percentage equity stakes at the time of initial public offering than the more established venture firms. The initial public offering companies that they finance are nearly two years younger and more underpriced when they go public than the companies backed by older venture capital firms. Rushing companies to the initial public offering market, however, imposes costs on the venture firm: a shorter duration of board representation is associated with a greater degree of underpricing and a lower percentage equity stake for the venture capitalist.

The typical venture capital firm does not sell its equity at the time of the initial public offering, since this would send a negative signal to the market that the insiders are "cashing out." Indeed, 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 (Brav and Gompers, 2000). Once that lock-up period is over, venture capitalists can return money to investors either by selling shares on the open market and paying the proceeds to investors in cash or by making distributions of shares to investors in the venture capital fund.

These distributions to investors 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. In addition, transactions are not revealed publicly at the time of the transaction. To identify the precise date of these transactions, one needs to rely on the records of the partners in the fund.

Gompers and Lerner (1998a) construct a representative set of over 700 transactions by 135 funds over a decade-long period, based on the records of four institutional investors. The results are consistent with venture capitalists possessing inside information and of the (partial) adjustment of the market to that information. As depicted in Figure 5, after significant increases in stock prices prior to distribution, abnormal returns immediately after the distribution are a negative and significant -2.0 percent, which is comparable to the market reaction to publicly announced secondary stock sales. The cumulative excess returns for the months following the distribution are negative, but the significance of the long-run returns is sensitive to the benchmark used. Moreover, 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 initial public offering—have larger immediate price declines.

Figure 5

Stock Price around Distribution of Equity by Venture Capitalists

Note: The graph plots the cumulative abnormal return from 60 days prior to distribution to 60 days after distribution by U.S. venture capital funds.

Source: Gompers and Lerner (1998a).

Many institutional investors have received a flood of these venture capital distributions during the past several years and have grown increasingly concerned about the incentives of the venture capitalists when they declare these transfers. The evidence on a run-up of returns before the distribution and decline after the distribution suggests that they are right to be concerned.

What We Don't Know About Venture Capital

While financial economists know much more about venture capital than they did a decade ago, many unresolved issues would reward future research. In this final section, we highlight three of these issues.

Understanding Risk and Return

Many institutions, like 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 reached this conclusion. Firms receiving capital from venture capital funds often remain privately held for a number of years after the initial investment. These firms have no observable market price. To present a conservative assessment of the portfolio valuation, venture capitalists often refrain from marking portfolio firm values to market, preferring to maintain the investments at book value until the company goes public. Thus, reported returns during years with many initial public offerings are biased upwards: had the portfolio been marked to market, many of

the gains would have been realized in the years before the initial public offering. Similarly, returns in years with few initial public offerings are biased downwards.

But the accounting practice of using unvarying book values, of course, does not demonstrate that the market value of these investments is uncorrelated with the stock market. As discussed throughout this analysis, there appear to be many linkages between the public and private equity market values. Thus, the stated returns of venture capital funds may not accurately reflect the true evolution of value, and the correlations reported by Venture Economics (2000) and other industry observers may be deceptively low. 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). These authors showed that eleven publicly traded funds had superior returns relative to the market during the years 1974 through 1979 (a period of strong returns to the venture capital industry as a whole, as Figure 2 notes).

To ignore the true correlation may lead to incorrect investment decisions. This inaccuracy may only have been a modest problem when venture capital was only a minute fraction of most institutions' portfolios. Today, endowments and pension funds are allocating 10 percent, 20 percent, or even 50 percent of their portfolios to illiquid investments such as venture capital. Not to think carefully about the risk and reward profile of venture capital is thus fraught with potential dangers.

The Internationalization of Venture Capital

Until very recently, there has been little venture capital activity abroad. For instance, in 1996, the U.S. venture capital pool was about three times larger than the total venture capital pool in 21 other high-income nations (Jeng and Wells, 2000). Moreover, about 70 percent of the venture capital in the rest of the world was in three countries with especially strong ties to the U.S. economy: Israel, Canada, and Netherlands.¹² This pattern raised questions of why such differences existed, and whether they were permanent.

Black and Gilson (1998) argue that the key source of the U.S. competitive advantage in venture capital is the existence of a robust market for initial public offerings. Because of this market, venture capitalists can commit to transfer control back to the entrepreneur when a public equity market for new issues exists. They point out that this commitment device is unavailable in economies dominated by bank financing, such as Germany and Japan.

¹² 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 United States, these are separate classes. Here, as in the rest of the paper, we confine our discussion to venture capital using the restrictive U.S. definition.

This argument, however, has diminished in credibility in the past two years. 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 (2000) examine the factors that influence venture capital fundraising internationally. They find that the strength of the initial public offering market is an important factor in the determinant of venture capital commitments, echoing the conclusions of Black and Gilson (1998). Jeng and Wells also find, however, that the initial public offering market does not seem to influence commitments to early-stage funds as much as later-stage ones. Another 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 of continental Europe, entrepreneurs 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 initial public offerings by young firms without long histories of positive earnings.

Many nations are interested in encouraging greater venture capital investment, but 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. The recent initiatives along these lines undertaken both in the United States and abroad are summarized in Lerner (1999) and Gompers and Lerner (1999b). (Other analyses are in Irwin and Klenow, 1996, and Wallsten, 2000.) But while this work represents an important initial step, much more remains to be explored regarding the impact of government on venture capital and the extent to which these actions can explain or change the international patterns of venture capital.

The Real Effects of Venture Capital

Many policymakers have a perception that venture capital organizations have had much to do with the rising leadership of U.S. firms in high-technology industries (which can be measured through patent counts or more qualitative measures). But demonstrating a causal relationship between the presence of venture capital investment and innovation or job growth is a challenging empirical problem.

For example, one straightforward approach is to look at regressions across industries and time and examine whether, controlling for other potentially important factors like the level of R&D spending, venture capital funding has an impact on the number of patents or other measures of innovation. But this approach is quite likely to give misleading estimates. Both venture funding and patenting could be positively related to a third unobserved factor—the arrival of technological opportunities. To date, only two papers have attempted to address these challenging estimation issues.

In the first of these papers, Hellmann and Puri (2000) distributed a questionnaire

to a sample of 170 firms in Silicon Valley, including both venture-backed and non-venture firms. They find that firms pursuing what they term an “innovator strategy” (a classification based on the content analysis of survey responses) are significantly more likely to obtain venture capital, and to receive such financing at a younger age. 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. Further, innovators are more likely to list obtaining venture capital as a significant milestone in the life cycle of the company, as compared to other financing events. Their results suggest that venture capital may be especially important for innovative companies. They devote only modest attention, however, to concerns about causality: the possibility remains that more innovative firms select venture capital for financing, rather than venture capital causing firms to be more innovative. Furthermore, the small size and concentrated location of the sample, as well as the sampling procedure employed, raise concerns about the generality of the results.

Kortum and Lerner (2000) examine whether 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 focus on the surge of venture capital funds that occurred after 1978, when the U.S. Department of Labor freed pensions to invest in venture capital. This change in venture capital funding is unlikely to be related to the arrival of entrepreneurial opportunities and so can be taken as exogenous. As a second approach, they estimate the impact of venture capital on the ratio of patents to R&D spending, rather than on patenting itself. In a simple model, they show that dividing by R&D spending acts as a control for the arrival of technological opportunities that are anticipated by economic actors at the time.

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 3 percent of corporate R&D from 1983 to 1992, is responsible for perhaps 10 percent of U.S. industrial innovations in this decade.

Ultimately, the goal must be to see the role that venture capital plays in an economy’s overall process of innovation. For example, as venture capital funding has increased in recent years, central R&D facilities of large corporations have also been redirected toward more applied problems. Determining the extent to which these changes are related, and how both are related to other R&D management innovations, is worthy of further investigation.

Wrapping Up

Empirical research into the venture capital industry has made considerable strides over the past decade. The manners in which venture capital funds are raised

and structured, the capital is invested in young firms, and these investments are concluded are now much better understood.

But at the same time, much remains to be learned. In some cases, the unanswered questions have been posed for years, but lack of access to data has proved to be a major barrier. For instance, confidentiality concerns have made a thorough understanding the risk and reward characteristics of venture capital elusive. In other cases, new research questions have been posed by the recent rapid changes in the venture capital industry. For example, the impact of the dramatic growth in the industry over the past two decades on venture capital organizations and the high-technology companies they fund remain quite uncertain. These and other questions should reward research in the years to come.

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