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What Drives Venture Capital Fundraising?

DURING THE PAST twenty years, commitments to the U.S. venture capital industry have grown dramatically. This growth has not been uniform: it has occurred in concentrated areas of the country, and peaks in fundraising have been followed by major retrenchments. Despite the importance of the venture capital sector in generating innovation and new jobs, few academic studies have explored the dramatic movements in venture fundraising.

In this paper we examine the forces that affected fundraising by independent venture capital organizations from 1972 through 1994. We study both industry fundraising patterns and the success of individual venture organizations. We find that regulatory changes affecting pension funds, capital gains tax rates, overall economic growth, and research and development expenditures, as well as firm-specific performance and reputation, affect fundraising. The results are potentially important for understanding and promoting venture capital investment.

Margaret Blair, Diane Denis, Martin Feldstein, Thomas Hellmann, James Poterba, Peter Reiss, Andrei Shleifer, and participants at the Harvard-MIT Public Finance seminar, the Brookings Panel on Economic Activity, the Conference on European Venture Capital at Università Bocconi, and the American Finance Association annual meeting provided helpful comments and suggestions. We would also like to thank Gabe Biller, Kay Hashimoto, and Qian Sun for excellent research assistance. Dan Feenberg provided us with state-level tax data. Chris Allen helped in collecting data. Support for this project was provided by the Advanced Technology Program and the Division of Research, Harvard Business School.

Various factors may affect the level of commitments to venture capital organizations. James Poterba has argued that many of the changes in fundraising could arise from changes in either the supply of or the demand for venture capital.[1] When we refer to the supply of venture capital, we mean the desire of investors to place money into venture capital funds. Demand is then the desire of entrepreneurs to attract venture capital investment in their firm. For example, decreases in capital gains tax rates might increase commitments to venture capital funds through increases in the desire of taxable investors to make new commitments to funds as well as through increases in the demand for venture capital investments when workers have greater incentives to become entrepreneurs. Our research methodology attempts to distinguish between supply and demand factors that affect the quantity of venture capital.

We find that demand-side factors appear to have had an important impact on commitments to venture capital funds. Capital gains tax rates have a significant effect at the industry, state, and firm levels. Decreases in the capital gains tax rates are associated with greater venture capital commitments. The effect, however, appears to occur through the demand for venture capital: rate changes affect both taxable and tax-exempt investors. Similarly, R&D expenditures, especially expenditures by industrial firms, are positively related to venture investments in particular states.

We also find that the Department of Labor's clarification of its "prudent man" rule, which enabled pension funds to freely invest in venture capital, and the performance and reputation of individual venture firms influence fundraising. Higher recent returns (as measured by the value of equity held in firms taken public) lead to greater capital commitments to new funds. Older and larger organizations also attract more capital. Finally, we examine factors that affect venture organizations' decisions to raise funds targeted at early-stage, start-up firms. These funds are potentially the most important for generating new companies and innovation. We find that smaller, West Coast venture organizations are more likely to have raised an early-stage venture fund.

1. Poterba (1989).

The Institution of Venture Capital

Many new firms require substantial capital.[2] A company's founder may not have sufficient funds to finance company projects and might therefore 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. For many of these young companies, the tremendous uncertainty and asymmetric information may make venture capital the only potential source of financing. Venture capital organizations finance these high-risk, potentially high-reward projects, purchasing equity stakes while the firms are still privately held. Venture capitalists have backed many high-technology companies including Apple Computer, Cisco Systems, Genentech, Intel, Microsoft, Netscape, and Sun Microsystems. A substantial number of successful service firms (including Federal Express, Staples, Starbucks, and TCBY) have also received venture financing.

Venture capitalists are often active investors, monitoring the progress of firms, sitting on boards of directors, and meting out financing based on the attainment of milestones. Whereas banks monitor the financial health of firms that they lend to, venture capitalists monitor strategy and investment decisions and take an active role in advising firms. Venture capitalists often retain important rights that allow them to intervene in the company's operations when necessary. In addition, these capitalists provide entrepreneurs with access to consultants, investment bankers, and lawyers. Alon Brav and Paul Gompers have shown that venture capital backing adds value even after the initial public offering: the returns of venture-backed companies are substantially better than those without venture capital in the five years after going public.[3]

The first modern venture capital firm, American Research and Development (ARD), was formed in 1946 by MIT President Karl Compton, Harvard Business School Professor Georges F. Doriot, and local business leaders. A small group of venture capitalists made high-risk

2. Much of this discussion is based on Gompers and Lerner (1996).
3. Brav and Gompers (1997).

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 twenty-six-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. Because institutional investors were reluctant to invest, ARD was structured as a publicly traded, closed-end fund and marketed mostly to individuals.[4] The few other venture organizations begun in the decade after ARD's formation were also structured as closed-end funds.

The first venture capital limited partnership, Draper, Gaither, and Anderson, was formed in 1958. Imitators soon followed, but limited partnerships accounted for a minority of the venture pool during the 1960s and 1970s. Most organizations raised money either through closed-end funds or small business investment companies (SBICs), federally guaranteed risk-capital pools that proliferated during the 1960s. Although the market for SBICs in the late 1960s and early 1970s was strong, the incentives to take greater risks than government guarantees created ultimately led to the collapse of the sector. The annual flow of money into venture capital during its first three decades never exceeded a few hundred million dollars and usually was much less.

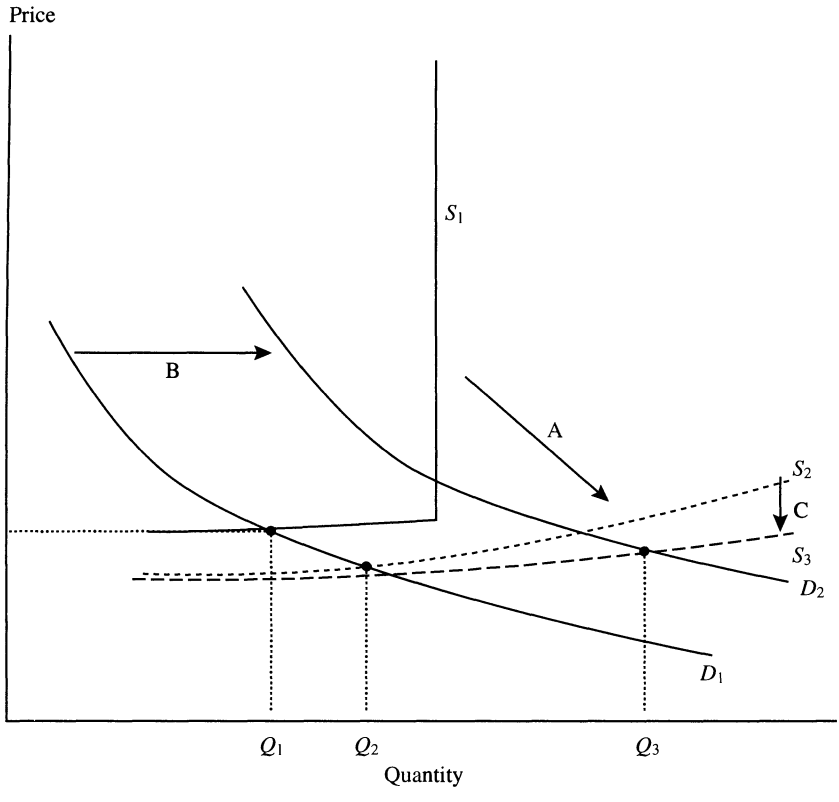
One change in the venture capital industry during the past twenty years has been the rise of the limited partnership as the dominant organizational form. Limited partnerships also have an important advantage that makes them attractive to tax-exempt institutional investors: capital gains taxes are not paid by the limited partnership. Instead taxes are paid only by the (taxable) investors. Venture partnerships have predetermined, finite lifetimes (usually ten years, although extensions are often allowed). Investors in the fund are limited partners. To maintain limited liability, investors must not become involved in the day-to-day management of the fund.

The Economics of Venture Capital

The predominance of limited partnerships in the venture capital industry—the typical venture organization raises a fund every few

4. Liles (1977).

Figure 1. Supply and Demand in Venture Capital



Source: Authors' construction. Equilibrium before the clarification of ERISA is represented by Q_1. After ERISA, the supply curve shifts from S_1 down to S_2 (A) and the new equilibrium quantity of venture capital is Q_2. Capital gains tax reductions move both demand to D_2 (B) and supply to S_3 (C) and the equilibrium quantity of venture capital moves to Q_3.

years—makes it easier to track venture fundraising. We can therefore examine marketwide and firm-specific influences on fundraising.

Supply and Demand in Venture Capital

In this section we develop predictions about what factors might influence the quantity of venture capital in an economy. To understand the mechanism through which these factors work, it is important to discuss supply and demand in the venture capital market. Figure 1 presents a simple illustration of equilibrium in the venture capital mar-

ket. The supply of venture capital is determined by the willingness of investors to provide funds to venture firms. The willingness of investors to commit money depends on the expected rate of return on venture investments. Therefore, in the venture capital market, price is the expected rate of return on new venture capital investments. Higher expected returns lead to a greater desire of investors to supply venture capital—that is, like most supply schedules, this one slopes upward.

The demand schedule is simply the number of entrepreneurial firms seeking venture capital that can supply a particular expected rate of return. As the price increases, that is, as the expected return increases, fewer entrepreneurial firms demand capital because the number of projects meeting that threshold declines. The demand schedule therefore slopes downward.

We discuss the equilibria in the supply and demand framework by examining the quantity of venture capital. Although any supply and demand equilibrium also implies a particular price (an expected rate of return), we cannot measure the anticipated rate of return in the venture capital market. Nor does the actual rate of return provide a useful proxy. Returns from venture capital investments can only be observed many years after the original investments because private firms are valued at cost until they are sold or taken public many years later. Because of these accounting policies, the stated returns for venture funds are exceedingly variable and somewhat misleading.[5] We feel fairly comfortable that the expected rate of return, or price, does not vary much across the sample period. As we discuss later, however, supply curves for venture capital are likely to be very elastic. Thus changes in equilibrium will have a significantly larger effect on quantities than on prices.

The supply schedule for venture capital is likely to be flat. Investors choose to place money in financial assets because of their monetary returns. Because close substitutes for these cash flows exist, either through a single security or combination of securities, investors have a particular expected return on venture capital that just compensates for

5. See the discussion in Gompers and Lerner (1997). In addition, practices of reporting valuations of companies are often very different from one venture organization to another. Finally, information on fund returns is closely guarded, and even the intermediaries who specialize in compiling the data do not have very comprehensive coverage.

the systematic riskiness of the investments.[6] If perfect substitutes for venture capital existed, the supply curve should be totally flat. We draw supply curves as sloping slightly upward in figure 1. One source of an upward slope would be differential taxes. Because the return on venture capital investments is taxable, investors with higher tax rates would require progressively higher expected rates of return to induce them to invest in venture funds versus some tax-free investment.

The Employment Retirement Income Security Act and Venture Commitments

One policy decision that potentially had an effect on commitments to venture funds through supply changes was the Department of Labor's clarification of the "prudent man" rule in the Employment Retirement Income Security Act (ERISA). Through 1978 the rule stated that pension managers had to invest with the care of a prudent man. Consequently, many pension funds avoided investing in venture capital entirely: it was believed that a fund's investment in a start-up company could be viewed as imprudent. In early 1979 the Department of Labor ruled that portfolio diversification was a consideration in determining the prudence of an individual investment. Thus the ruling implied that allocating a small part of a portfolio to venture capital funds would not be seen as imprudent. The clarification opened the door for pension funds to invest in venture capital.

We conjecture that the supply curve for venture capital before the clarification of ERISA might have looked like S_1 in figure 1. The upward inelastic segment of S_1 results because pension funds, which control substantial amounts of capital, were unable to invest in venture funds. The supply of venture capital may have been limited at any expected rate of return. If the initial demand for venture capital is represented by D_1, the equilibrium quantity of venture capital would be given by Q_1.

After ERISA, the supply curve moved to S_2. The supply curve moved down and flattened out because pension funds, which are tax exempt, required a lower expected rate of return on venture investments than did taxable investors. The curve would not have an inelastic segment

6. Scholes (1972).

because the resources of pension funds could now be invested in venture capital funds. When we looked at the data, we expected that the quantity of venture capital supplied would increase to Q_2 after ERISA was clarified. This effect should be significant only for contributions by pension funds because ERISA regulations have no bearing on other types of investors.

Capital Gains Taxes and Venture Capital Fundraising

The effect of capital gains tax rates on commitments to the venture capital industry has been debated in academic studies as well as political circles. The effect of reductions in the capital gains tax rate on commitments was one of the intended benefits of the 1994 reduction of the tax from 28 percent to 14 percent on investments in small companies held for five years.

Poterba argued that it was unlikely that capital gains taxes affected venture capital by shifting the supply curve.[7] The supply effect of capital gains tax reductions is illustrated by C in figure 1. A reduction in the capital gains tax rate would lower the required expected (pretax) rate of return on venture investments for taxable investors. This would cause the right-hand side of supply curve S_2 to shift down to S_3. Most investors in venture capital after 1980 have been tax-exempt institutions, and the supply effect may therefore have been small.

Poterba then developed a model of the decision to become an entrepreneur. He argues that the capital gains tax rate could have a dramatic effect on this choice. Lower capital gains tax rates make it relatively more attractive for a manager or worker to start his or her own company. Most of a manager's compensation comes in the form of salary and cash bonuses that are taxed at the ordinary income tax rate. Most of the compensation from being an entrepreneur is in the form of capital appreciation on the equity of the company. Poterba argues that it is possible that reductions in the capital gains tax rates could have a first-order effect on the demand for venture capital as more people are induced to become entrepreneurs and better projects are brought to market. This outcome would increase the quantity of venture capital

7. Poterba (1989).

demanded to D_2 and increase the equilibrium quantity of venture capital to Q_3.[8]

If the capital gains tax rate has an important impact on commitments to venture capital funds, we would expect a significant relation at the industry level and at the level of specific funds. Lower capital gains taxes should lead to increases in commitments to the industry as a whole as well as to individual funds. We can also shed light on whether Poterba's argument about supply and demand effects is valid. If capital gains taxes affect commitments to venture capital primarily through the demand for venture capital, we would expect that reductions in the capital gains tax rate would increase the commitments of both tax-exempt and tax-sensitive investors. If the effect is primarily due to supply changes, contributions by tax-exempt investors should be unrelated to the capital gains tax rate. Because we can separate contributions to venture funds by investor type, we should be able to determine whether the demand effects (B in figure 1) or supply effects (C) of decreases in the capital gains tax rate are more important.

Other Macroeconomic Factors and Venture Fundraising

Venture capital fundraising is potentially affected by other macroeconomic factors. Both the expected return on alternative investments and the general health of the economy could affect commitments to venture capital funds. If the economy is growing quickly, there may be more attractive opportunities for entrepreneurs to start new firms and thus increases in the demand for venture capitalists. Formally, the demand curve would shift to the right. The greater investment opportunity might be associated with greater commitments to the venture capital industry. Growth in gross domestic product (GDP), increased returns in the stock market, and greater R&D expenditures would all be potential proxies for demand conditions.

8. Anand (1993) examines investments by venture capital firms in private communications companies and finds that the level and composition of investment appears to be affected negatively by increases in the capital gains tax rate. The author's ability to draw conclusions, however, is limited because he looks only at one industry. Investments in one industry may be affected by many other factors, including technology shifts, tastes, or other investment opportunities. Examining the impact of capital gains tax rates on the quantity of venture capital raised appears to be a much more satisfactory way to address the issue.

Interest rates could also affect the supply of venture capital. Bonds are an alternative investment to venture capital. If interest rates rise, the attractiveness of investing in venture capital funds may deteriorate. This would decrease the willingness of investors to supply venture capital at all prices (that is, at all expected return levels).

Firm Performance and Fundraising

In addition to the marketwide factors already discussed, we look for firm-specific characteristics that may influence venture capital fundraising. First, a substantial body of research examines the relation between past performance and investment. Allocations by investors across asset classes seem to be driven, in part, by the relative performance of various sectors in the recent past. If there is short-run momentum in returns, as Grinblatt, Titman, and Wermers show, this response may be rational.[9]

The flow of money into and out of various types of financial institutions in response to performance has been documented extensively for mutual funds. Although the early research on mutual funds indicated that fund managers as a group do not significantly outperform the market, recent work has shown that cash flows appear to respond to past performance.[10] Sirri and Tufano find that performance relative to peers in the same investment category is an important determinant of new capital commitments to mutual funds.[11] They examine 690 equity mutual funds and rank them by their performance relative to funds that have the same investment focus. They find that the top performing funds in any particular investment style receive substantial new commitments in the subsequent year. The relation between performance and commitments, however, is not linear. Funds that perform poorly do not appear to be penalized in the following year: money does not leave them. Sirri and Tufano note that one exception is new funds. Money does seem to leave them if they are poor performers.

Chevalier and Ellison have examined how these patterns affect investment incentive functions.[12] They found that funds that have under-

9. Grinblatt, Titman, and Wermers (1995).
10. For the earlier research, see Jensen (1968) and Ippolito (1989).
11. Sirri and Tufano (1998).
12. Chevalier and Ellison (1997).

performed their peers in the first part of a year have an incentive to increase the riskiness of their portfolios to enhance the chances that they will end up near the top of the performance charts. If they bet wrong and fail, they will lose few of their current investors.

If the evidence from mutual funds has implications for venture capital, we would expect that recent performance would be positively related to commitments to new funds. As in Sirri and Tufano's mutual fund results, the reputation of the venture organization may influence the flow of new commitments when it raises a new fund.[13] Several measures of reputation may be important. These include the age of the venture organization and the amount of capital under management. Older and larger venture organizations are likely to have more established reputations. They may therefore receive larger capital commitments than similar younger funds.

Venture Industrywide Results

We examine the implications of performance and capital gains tax rates for commitments to venture capital funds by performing two layers of analysis. The first examines the flow of venture capital commitments into the industry. We examine the commitments to new venture capital funds from 1969 through 1994, first aggregating all commitments in the United States. We then take up an analysis of the level of venture activity state by state.

Aggregate Fundraising Results

Data on annual commitments to U.S. venture capital funds come from the consulting firm Venture Economics, which has tracked venture fundraising since the 1960s. Its database not only records venture capital organizations, but also the names of their individual funds. We have checked the entries in the database against the historical information reported in more than 400 venture offering memorandums and partnership agreements, as well as against the fund profiles in the *Venture Capital Journal* and *Private Equity Analyst*.[14] This database is also

13. Sirri and Tufano (1998).

14. The construction and verification of the database are described in Gompers and Lerner (1998).

used in the analysis of information on individual organizations' fundraising in the section on individual results.

This database includes more than 2,000 venture capital funds, SBICs, and related organizations. It is used to prepare directories such as the Venture Economics annual *Venture Capital Performance*, which is compiled from information provided by venture capitalists and institutional investors. In examining fundraising behavior, we look only at venture capital limited partnerships. First, these partnerships are the dominant organizational form in the industry, accounting for 80 percent of commitments in recent years. Furthermore, the actual size of SBICs and corporate venture affiliates is often very difficult to estimate. SBICs have access to matching government funds, often several times greater than the amount contributed by private investors. Corporate programs usually do not have a pool of capital specified in advance and are frequently disbanded before investing much capital. Limited partnerships with their well-defined size and life span offer the cleanest estimate of venture capital inflows.

We totaled commitments to venture funds each year. Commitments are defined as the pledges that venture capitalists receive for investment over the lifetime of the fund. They are not the amount of money actually invested in a given year. Typically, venture funds draw on and invest the committed capital over a two- or three-year period. For example, in 1995 Sierra Ventures raised their fifth fund with aggregate commitments of $100 million. This $100 million would be invested between 1995 and about 1999, but we classified the entire $100 million as having been committed in 1995.

We also needed some measure of returns. Ideally, we would have year-by-year performance data for individual funds, but these data present some problems. As discussed earlier, calculation of returns is hampered by policies of many venture organizations that potentially delay the write-up or write-down of assets. As a proxy for performance of the venture organizations, we used a measure of the market value of equity held by venture capitalists in firms that went public in a particular year. This measure is highly correlated with returns on venture funds. Most money in venture capital is earned on firms that eventually go public. Ignoring those that do not go public is reasonable because their impact on returns is usually small. A 1988 Venture Economics study found that a $1.00 investment in a firm that goes public provides an

average cash return of $1.95 in excess of the initial investment with an average holding period of 4.2 years.[15] The next best alternative, an investment in an acquired firm, yields a cash return of only 40 cents over a 3.7 year mean holding period. Using the initial public offering (IPO) measure also makes sense because marketing documents for venture capital funds often highlight the successful public companies that have been backed by a venture organization. We therefore expected that the amount of venture capital raised would be a positive function of the value of firms taken public by venture capitalists in the previous year.

We identified potential venture-backed IPOs using three sources. The first is the listings of venture-backed IPOs published in *Venture Capital Journal*.[16] We also used listings of the securities distributions by venture funds. Venture capitalists typically unwind their successful investments by distributing the shares to their limited partners. They avoid selling the shares themselves and distributing the proceeds to their limited partners because their investors include both tax-exempt and taxpaying parties. To sell the shares would generate an immediate tax liability, which some of the limited partners may wish to avoid. We obtained lists of the distributions received by a pension fund that is among the largest venture investors and by three investment managers.[17] (These investment managers allocate funds from numerous pension funds into venture capital and other asset classes.) The investors had received distributions from 135 venture funds, most of which are managed by the oldest and most established venture organizations in the industry. Most of the successful investments by these funds can be identified from these lists.

The final sources used to identify IPOs for the sample were the offering documents issued by venture capitalists to raise new funds. Venture organizations often list in these offering memorandums their past investments that either went public or were acquired on favorable terms. We examined more than 400 of these memorandums in the files of Venture Economics.[18] We identified any investments listed as having

15. Venture Economics (1988).

16. This is the same source used by Barry and others (1990) and Megginson and Weiss (1991).

17. Gompers and Lerner (1999).

18. Gompers and Lerner (1998).

gone public. Most of the offering documents are from young venture organizations because Venture Economics' Fund Raiser Advisory Service counsels less experienced firms on strategies for raising capital.

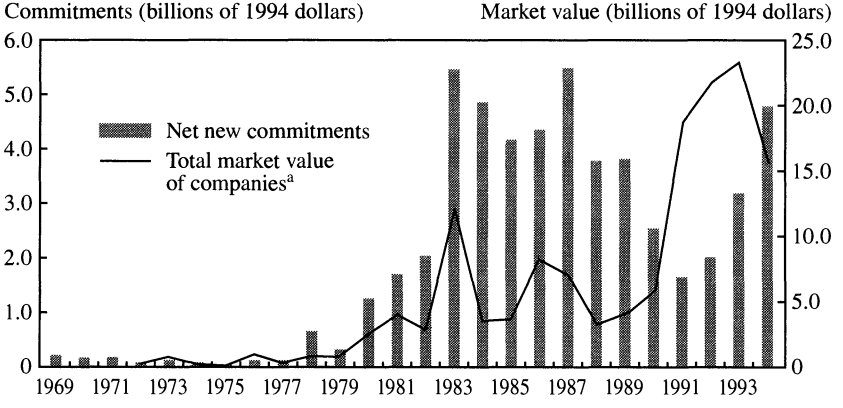
We included in the IPO sample all firms for which a venture investor was listed in the "Management" and "Principal and Selling Shareholders" sections of the IPO prospectus and was also listed in the Venture Economics database. In many cases, it was not immediately obvious whether a venture investor or director was an exact match with a venture organization listed in the database.[19] To address these ambiguities, we consulted the edition of Venture Economics' *Pratt's Guide to Venture Capital Sources* published in the year of the IPO. We compared the addresses and key personnel of each of these ambiguous venture organizations with the information reported in the prospectus. If we were not virtually certain that a venture organization in the prospectus and the database were the same, we did not code it as a match. For each investor, we coded the venture organization, the particular venture fund investing in the firm, and the size of the stake before and after the offering. This process led to the identification of 885 IPOs in which a venture capitalist served as a director or a venture capital fund was a blockholder.

In each year we calculated the market value of the equity stakes in firms going public held by each venture capital organization. This value is the number of shares held by the venture organization multiplied by the IPO offering price. We then summed the market values for each IPO in a given year to obtain an annual performance number for each venture capital organization. We then summed across all venture organizations in a given year to get a measure of venture industry performance.

Figure 2 shows venture capital commitments and the market value of all firms brought public by venture capitalists in each year from 1969 through 1994. From 1969 through 1979 commitments to venture capital and venture-backed IPOs were low. Starting in 1980 commitments to the industry and the value of firms brought public increased. The rise of both reversed in 1984. After 1983 it appears that the shift in venture-

19. In many cases, individual investors (often called "angels") will describe themselves as venture capitalists. Groups of individual investors often make their investments through partnerships, which frequently are given a name not unlike those of venture capital organizations.

Figure 2. Venture Capital Commitments and Market Value of Venture Capital-Backed IPOs, 1969–94



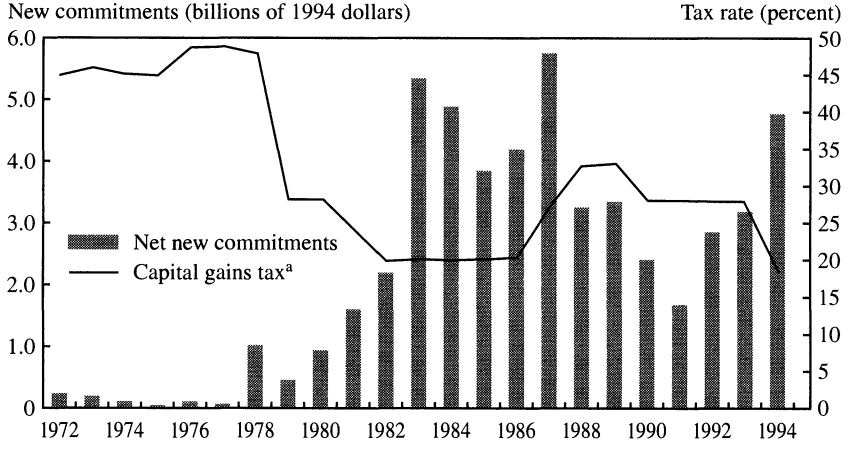
Sources: See text.
a. Annual market value of all venture capital-backed firms issuing equity in an initial public offering

backed IPO market led to changes in commitments to new venture funds. For example, increases in the market value of venture-backed IPOs in both 1986 and 1991–92 preceded resurgences in the venture capital market.

The relation between capital gains taxes and venture capital commitments is shown in figure 3. In the 1970s high capital gains tax rates were associated with low levels of venture capital fundraising. Increases in the capital gains tax rates in 1988 were followed by reductions in venture capital commitments, while the reduction of capital gains for long-held investments in 1994 was followed by a rise in venture fundraising. This negative relation is clearly only suggestive because the influence of various factors needs to be examined.

Detailed information on commitments is shown in table 1. The volatility of commitments is readily apparent. The level of fundraising (expressed in millions of 1994 dollars) can vary dramatically from one year to the next. The volatility in venture fundraising is mirrored by a similar volatility in the IPO market, both for venture-backed companies and for the entire IPO market. There is a dramatic shift from individuals to pension funds after 1978 as the primary capital source for new venture funds.

Figure 3. Net New Commitments to the Venture Capital Industry and Capital Gains Tax Rates, 1972–94



Sources: See text.
a. Highest marginal capital gains tax rate effective in that year.

To assess the impact of each of these variables controlling for the others, we ran multivariate regressions, which are presented in table 2. Our approach here and in the individual firm regressions is to estimate reduced-form specifications and identify those factors that potentially work through demand shifts and those that work through supply shifts. The time series runs from 1972 through 1994. The dependent variable is the natural logarithm of real commitments to the venture capital industry (in millions of 1994 dollars). We present regressions for commitments to the entire venture capital industry, as well as for four subgroups: taxable investors, tax-exempt investors, individuals, and pension funds. The independent variables include the natural logarithm of the market value of firms brought public by venture organizations in the previous year (in millions of 1994 dollars), the real return on Treasury bills in the previous year, the real value-weighted stock market return in the prior year as reported by the Center for Research in Security Prices (CRSP), the previous year's real GDP growth, a dummy variable that equals one for years after 1978 when ERISA's prudent man rule was clarified, and the top marginal capital gains tax rate.

Changes in ERISA's prudent man rule are associated with greater commitments to the venture capital industry, but the effect is not sig-

Table 1. Venture Capital Industry Summary Statistics, 1978–94
Millions of 1994 dollars unless otherwise specified

	1978	*1979*	*1980*	*1981*	*1982*	*1983*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991*	*1992*	*1993*	*1994*
Net new commitments to independent venture capital partnerships	427	483	1,245	1,712	2,089	5,453	4,839	4,191	4,427	5,378	3,718	3,458	2,507	1,529	2,011	2,545	4,766
Source of venture contributions (percent)																	
Corporations	10	17	19	17	12	12	14	12	11	10	12	20	7	5	3	8	9
Individuals	32	23	16	23	21	21	15	13	12	12	8	6	11	12	11	7	12
Pensions funds	15	31	30	23	33	31	34	33	50	39	47	36	53	42	42	59	47
Foreign	18	15	8	10	13	16	18	23	11	14	13	13	7	12	11	4	2
Endowments	9	10	14	12	7	8	6	8	6	10	11	12	13	24	18	11	21
Insurance companies	16	4	13	15	14	12	13	11	10	15	9	13	9	5	15	11	9
Venture capital-backed initial public offerings																	
Number of companies	6	4	27	68	27	121	53	46	97	81	35	39	42	122	157	165	136
Total amount raised	231	95	563	946	661	3,605	863	979	2,546	2,156	851	1,068	1,158	4,031	4,702	4,923	3,351
Total market value of companies	501	335	3,519	4,436	2,860	16,694	4,059	3,805	10,136	8,078	3,516	4,183	5,536	19,269	22,476	23,531	16,018
All IPOs																	
Number of companies	42	103	95	227	100	504	213	195	417	259	96	254	213	403	605	819	646
Total amount raised	835	1,189	1,460	3,346	1,461	11,395	2,956	3,698	10,204	6,118	2,694	14,699	10,481	26,001	41,057	58,248	33,841
Total market value of companies	2,320	4,334	7,662	13,423	6,585	48,140	12,534	13,570	37,998	27,908	13,242	46,445	28,841	72,668	104,775	. . .	. . .

Sources: Authors' analysis of Venture Economics' database; Brav and Gompers (1997); and various issues of the *Venture Capital Journal*.

Table 2. Regressions for Industrywide Fundraising
t-statistics in parentheses

	Dependent variable: Natural logarithm of commitments (in millions of 1994 dollars)				
Independent variable	*Total*	*Taxable*	*Tax-exempt*	*Individuals*	*Pensions*
Natural logarithm of value of all venture capital-backed IPOs in previous year (millions of 1994 dollars)	−0.0124 (−0.06)	−0.0300 (−0.11)	−0.2453 (−1.71)	0.0046 (0.17)	−0.3037 (−1.92)
Previous year's real GDP growth	13.28 (2.01)	16.08 (2.34)	14.48 (3.92)	14.92 (2.10)	12.38 (3.05)
Previous year's T-bill return	0.0022 (0.04)	0.0436 (0.64)	−0.1212 (−3.28)	0.0417 (0.59)	−0.1556 (−3.83)
Previous year's return of CRSP value-weighted index	0.3836 (0.48)	−0.2240 (−0.22)	0.1648 (0.30)	−0.3920 (−0.36)	−0.1092 (−0.18)
Was ERISA's prudent man rule clarified?	2.172 (3.05)	0.8598 (1.25)	2.183 (5.92)	0.6299 (0.89)	2.454 (6.05)
Capital gains tax rate	−3.835 (−1.66)	−2.068 (0.96)	−1.803 (−1.65)	−2.498 (−1.52)	−2.726 (−2.14)
Constant	6.551 (3.01)	5.3195 (1.95)	8.579 (5.85)	5.307 (1.88)	8.918 (5.53)
Summary statistics					
Adjusted R^2	0.824	0.303	0.874	0.250	0.884
p value of F-statistic	0.000	0.000	0.000	0.000	0.000
N	22	17	17	17	17

Sources: Authors' calculations. See text for full explanation of variables and methodology.

nificant for commitments by taxable investors and individuals. As expected, the strongest effect of ERISA's clarification is on contributions by pension funds. We conducted an F-test of the null hypothesis that the coefficient for pension funds does not differ from the coefficient for individuals and taxable investors and found that ERISA's effect on contributions by pension funds is different at the 5 percent confidence level. This result is consistent with a supply-side effect: the easing of pension fund restrictions increased the number of investors wishing to invest in venture capital funds.

Increases in capital gains tax rates consistently depress contributions to the venture industry, although the effect is only significant for contributions to the entire industry and contributions by pension funds.[20]

20. The coefficients on capital gains tax rates are not significantly different from one another across different investor classes. The purpose of the comparison is simply

Although we do find an effect of capital gains taxes on venture capital commitments, it does not appear to be working through the supply side. If changes in the capital gains tax rates had a first-order effect on investors' willingness to invest in venture capital, the effect would be strongest for individuals and taxable parties. The opposite is true. As Poterba suggests, the effect of changes in the capital gains tax rate is likely to come through changes in the demand for venture capital.[21] More and better-quality managers become entrepreneurs when the capital gains tax rate declines and the demand for venture capital increases. This increase in demand leads to a greater quantity of venture capital being supplied in equilibrium.

Once other factors are included, the value of firms taken public by venture organizations in the previous year does not appear to have a dramatic effect on contributions. Although we cannot rule out a role for IPOs in creating liquidity in the venture sector and potentially affecting contributions, we cannot find an effect in the multivariate regressions. This finding is contrary to the arguments of Black and Gilson, who emphasize the importance of a vibrant public market in the development of a venture capital industry.[22] It is consistent, however, with the experience of Israel and Singapore, where venture industries have experienced dramatic growth without having strong domestic public equity markets.

Of the macroeconomic variables, only real GDP growth is important. Increases in the real rate of growth lead to greater commitments to venture funds. Once again, this suggests that increasing demand for venture capital is an important determinant of the quantity. Robust economic growth creates new opportunities for entrepreneurs and increases demand for such capital.

One concern may be that because we are using time series observations on venture fundraising and the independent variables, the results may be affected by serial correlation in the error terms. The Durbin-Watson statistics for each of the regressions were between 1.88 and 2.00, indicating that serial correlation does not affect the results. As a

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to show whether capital gains tax rates affect taxable investors only (as the supply effect would predict) or whether they affect all investors equally (as the demand effect would predict).

21. Poterba (1989).

22. Black and Gilson (1998).

diagnostic, we also ran Cochrane-Orcutt regressions using a lag term, which did not materially change the results.

State-Level Venture Activity

One difficulty with the analysis in the previous section was the relatively small number of observations. To gain additional power for our tests of marketwide venture activity, we examined venture capital activity in each of the fifty states and the District of Columbia from 1976 through 1994. We could then examine how state-level demand and supply factors affect venture investing in those states.

We employed a slightly different approach here than we used with the aggregate and firm-level data. Rather than examine the formation of venture funds in each state, we measured the actual venture capital investments. This reflects the difficulty of assigning venture organizations to particular states. Many organizations have multiple offices, which may account for differing shares of the investments. Venture organizations' headquarters may reflect the need to be proximate to their sources of capital and not their portfolio firms. For instance, many venture organizations are based in New York City, even though the city has historically been the site of few start-up firms. This pattern is particularly true for groups specializing in the later-stage investments, which typically occur after other groups (which may be geographically closer to the portfolio firm) have already joined the board.[23]

We once again used Venture Economics data to determine venture capital activity by state. In this case, we undertook a special tabulation of the number of companies financed and the dollar volume of financing in each state and year between 1976 and 1994. We included all investments by private equity groups in young entrepreneurial firms, but excluded investments in leveraged buyouts and restructurings by groups that primarily make venture capital investments.

We also collected a variety of additional data by state. Gross state product has been compiled on an annual basis by the U.S. Department of Commerce's Bureau of Economic Analysis.[24] For each state, we compiled the total amount of research performed in industry and academia, regardless of funding source. The state industrial R&D data

23. Lerner (1995).

24. Bureau of Economic Analysis (1997); and Friedenberg and Beemiller (1997).

were compiled by the National Science Foundation (NSF) as part of the Survey of Research and Development in Industry.[25] The data posed two problems. First, since 1978 this information has been collected only on a biannual basis. Thus, it was necessary to impute the missing years. Second, certain states are persistently missing. In these instances, the unassigned R&D in each region was assigned to each suppressed state on the basis of its gross state product.[26] The allocation of academic R&D expenditures by state was determined by the NSF's annual Survey of Research and Development Expenditures at Universities and Colleges.[27] We obtained the marginal state tax rate on capital gains through the use of the TAXSIM tax simulation program. We computed the impact of $1,000 of capital gains on a wealthy individual in each state and year, controlling for the possible deductibility of state taxes in federal taxes.[28]

Table 3 shows venture capital activity in each state by counting the number of companies that received venture capital and the total amount of venture capital invested from 1976 through 1994. The tremendous concentration of investment in four states is clearly evident. California has by far the most activity with nearly $20 billion invested (in 1994 dollars). Massachusetts, New York, and Texas are the next most active and account for the bulk of the remaining capital. It is also clear that many states have almost no venture capital activity. We seek to explore these patterns in a regression framework.

Table 4 shows state fixed-effects regressions for the level of venture capital investment per capita and the number of companies receiving venture capital per capita. We employ an observation for each year in each state—a balanced panel. Independent variables include market-wide measures used in the regressions in table 2 (logarithm of IPO activity, the previous year's real Treasury bill return, and the previous year's equity market return). In addition, we include several variables

25. National Science Foundation (1980, 1998b).

26. For instance, in 1977, as in earlier and later years, data for New Hampshire and Vermont are suppressed. Of the $2.4 billion of R&D spending in New England in that year, $2.3 billion is accounted for by Connecticut, Maine, Massachusetts, and Rhode Island. We divide the remaining amount between New Hampshire (65 percent) and Vermont (35 percent), proportional to their gross state product in that year.

27. National Science Foundation (1998a).

28. The program is described in Feenberg and Coutts (1993); the simulation and the resulting data are reproduced at http://www.nber.org/taxsim/state-rates.

Table 3. Venture Capital Activity, by State, 1976–94
Number of companies; amount in millions of 1994 dollars

State	*Companies financed*	*Total venture capital invested*	State	*Companies financed*	*Total venture capital invested*
Alaska	3	52.1	Montana	17	49.2
Alabama	75	199.1	Nebraska	15	8.1
Arizona	189	693.9	Nevada	22	25.8
Arkansas	12	14.7	New Hampshire	136	344.3
California	6,154	19,967.7	New Jersey	643	2,019.2
Colorado	609	1,557.0	New Mexico	38	56.5
Connecticut	486	2,094.2	New York	811	2,369.4
Delaware	26	42.6	North Carolina	239	612.2
District of Columbia	70	211.0	North Dakota	4	28.2
Florida	338	779.7	Ohio	342	1,351.2
Georgia	395	872.0	Oklahoma	60	134.8
Hawaii	4	1.2	Oregon	297	789.3
Idaho	12	58.5	Pennsylvania	575	2,292.4
Illinois	514	1,879.1	Rhode Island	85	226.6
Indiana	137	260.3	South Carolina	37	165.9
Iowa	60	143.4	South Dakota	15	7.6
Kansas	46	90.3	Tennessee	235	844.1
Kentucky	59	173.5	Texas	1,254	3,861.1
Louisiana	45	137.6	Utah	117	246.7
Maine	50	126.8	Vermont	313	969.1
Maryland	321	989.2	Virginia	17	61.6
Massachusetts	2,276	5,886.4	Washington	327	835.8
Michigan	267	808.6	West Virginia	16	33.7
Minnesota	483	837.1	Wisconsin	144	269.4
Mississippi	26	32.0	Wyoming	5	4.2
Missouri	107	611.6			

Sources: Authors' calculations. See text.

that might serve as a proxy for state-level demand conditions. These include the previous year's growth in gross state product per capita as well as measures of the previous year's academic and industrial expenditure on R&D per capita. The R&D expenditure potentially captures demand effects of high-technology firms. If R&D is higher in one state than in another, it may mean that the number of potential entrepreneurs with promising ideas is greater.

In addition, we include a dummy variable that is equal to one after 1978 to capture the effect of changes in ERISA's prudent man rule. Finally, we include several measures of the capital gains tax rate burden. We first control for state and federal capital gains taxes separately by including the maximum marginal state and federal capital gains tax rate separately. We then add the federal and state rates to create a variable that captures the total capital gains tax burden in that state.[29]

Table 4 shows that both industrial and academic R&D spending are significantly related to state-level venture capital activity. Increases in state R&D levels increase both the amount of venture capital invested as well as the number of firms receiving venture capital. This result suggests that academic and industrial R&D spending are potentially important for the creation of entrepreneurial firms that demand venture capital.

Similarly, growth in gross state product per capita is positively related to venture capital activity. This result, consistent with the aggregate results, may indicate the importance of the demand effects. That is, it is important to have a strong, growing economy to create new firms that need venture capital financing.

The dummy variable measuring the shift in ERISA policy continues to have a positive effect in the state-level regressions. After the clarification of ERISA, the amount of venture capital invested per capita as well as the number of firms receiving venture capital per capita increased. Finally, capital gains tax rates continue to matter. In the regressions including both state and federal rates, it is only the federal rate that is significantly related to venture capital activity. The state capital gains tax rate is, however, always negatively related to venture capital activity and is of the same order of magnitude as the effect of federal

29. The state tax measure includes only the marginal impact: any savings in federal taxes due to the deductibility of state taxes are factored in. All regressions include state fixed effects.

Table 4. Regressions for State-Level Venture Capital Activity, 1976–94
t-statistics in parentheses

	Dependent variable			
Dependent variable	*Logarithm of real venture capital investment in the state per million residents*[a]		*Number of companies receiving venture financing in state per thousand residents*	
Logarithm of value of all venture capital-backed IPOs in previous year (millions of 1994 dollars)	−0.2008 (−3.35)	−0.1973 (−3.37)	−0.2414 (−1.46)	−0.2372 (1.46)
Logarithm of previous year's real gross state product per capita	0.5343 (1.73)	0.5438 (1.77)	4.5621 (4.59)	4.5854 (4.68)
Previous year's real gross state product growth in the state	0.0480 (3.11)	0.0478 (3.11)	0.1609 (3.45)	0.1605 (3.45)
Logarithm of previous year's real expenditure on academic R&D per capita in the state	0.7939 (4.88)	0.8032 (5.15)	0.1898 (0.36)	0.2044 (0.39)
Logarithm of previous year's real expenditure on industrial R&D per capita in the state	0.1359 (3.23)	0.1362 (3.24)	0.3208 (2.67)	0.3211 (2.67)
Previous year's T-bill return	−0.1332 (−5.44)	−0.1337 (−5.48)	−0.1294 (−1.83)	−0.1295 (−1.83)

Previous year's return on CRSP value-weighted index	0.0386 (0.15)	0.0235 (0.09)	1.4166 (1.98)	1.3983 (1.99)
Was ERISA's problem man rule clarified?	1.1713 (6.45)	1.1830 (6.70)	1.6815 (3.32)	1.6948 (3.41)
State capital gains tax rate	−2.5838 (−0.91)	. . .	−5.0675 (−0.61)	. . .
Federal capital gains tax rate	−3.4408 (−5.14)	. . .	−6.2439 (−3.37)	. . .
Sum of the state and federal capital gains tax rate	. . .	−3.3684 (−5.45)	. . .	−6.1480 (−3.61)
Summary statistics				
Overall R^2	0.425	0.425	0.426	0.425
p-value of χ^2-statistic	0.000	0.000	0.000	0.000
N	765	765	765	765

Sources: Authors' calculations. See text for full explanation of variables. State fixed effects are not reported.
a. Investment is in millions of 1994 dollars.

rates. The combined federal and state capital gains rate is also significantly related to venture capital activity. The result confirms the earlier findings using nationwide data. Increases in capital gains tax rates do appear to dampen venture capital activity.

Individual Venture Organization Results

In this section we examine fundraising patterns by individual venture organizations. First, we present summary statistics for the database, both in its entirety and segmented by year. We then analyze factors affecting the fundraising ability of individual venture organizations. Finally, focusing on early- and seed-stage firms, we examine the decision of venture organizations to raise funds. The importance of early- and seed-stage funds in creating new firms is widely recognized. Many of the efforts to stimulate venture activity focus on stimulating seed capital funds. Understanding the unique factors affecting the decision to target these firms is important for potential policy decisions. We examine fund information collected by Venture Economics from 1961 through 1992.

Summary Statistics

Table 5 presents information on the completeness of the venture fundraising database. In all, there is information on 1,294 venture capital funds. Of those, we have information on the fund size and closing date for 846 (20 of these are missing the month of closing). The average venture organization in the sample raised 2.23 funds; the median raised only 1.00. The maximum number of venture funds raised by an organization is 25. The average venture organization raised $126 million in 1994 dollars, while the largest raised more than $2 billion.

The time series distribution of our sample is presented in table 6. There was growth in both the number of funds raised and the dollar volume of commitments in the early and mid-1980s. The sample also appears to show a slight growth in the size of funds raised (in constant 1994 dollars). The sum of all the funds in the sample shows $45.0 billion in venture funding, which represents nearly all the capital raised

Table 5. Summary Statistics for Funds in Venture Economics Venture Intelligence Database

Items in record	*Observations*
Completness of records in correted database	
Month and year of closing and fund size	826
Year of closing and fund size	20
Month and year of closing: no size	428
Year of closing: no month or size	20
Neither closing date nor fund size	112

Summary Information for each venture organization	*Mean*	*Median*	*Minimum*	*Maximum*
Number of funds raised	2.23	1	1	25
Total funds raised (millions of 1994 dollars)[a]	126.46	57.11	0.46	2,267.00
Closing date of first fund in sample[b]	3/82	7/83	1.63	12/92
Closing date of last fund in sample[b]	5/85	12/86	1/63	12/92

Sources: Authors' calculations. See text.

a. Does not include venture organizations for which the size of all funds cannot be determined. It does include venture organizations for which the size of some funds cannot be determined.

b. Does not include venture organizations for which the closing date of all funds cannot be determined. It does include venture organizations for which the closing date of some funds cannot be determined. Funds whose month of closing cannot be determined are regarded as closing in July.

by organized venture capital partnerships during the sample period.[30] The lack of size data for 448 of the funds does not impart bias to our results. Our data cover almost all the capital raised over the sample period, and thus the results are clearly applicable to the most important firms.

Fundraising Regression Results

We analyzed firm-level fundraising by using one yearly observation for each venture organization, starting with the year that it raised its first venture capital fund. The dependent variable is either a dummy indicating whether the venture organization raised a fund or the amount of money (in millions of 1994 dollars) raised in that year. Independent variables include the age of the organization, the amount of money it raised during the previous ten years (in millions of 1994 dollars), the value of equity held by this venture organization in firms brought public in that year and the previous year, the value of all venture-backed firms

30. The federal government does not collect numbers on venture capital inflows. The Venture Economics database, however, corresponds closely to those of another consulting firm, Asset Alternatives, as well as to estimates by practitioners.

Table 6. Venture Capital Fund Size and Closings, 1961–92

Year	*Funds closed*	*Funds with size data*	*Size of funds (millions of 1994 dollars)*	
			Average	*Sum*
1961	2	0	. . .	. . .
1962	2	0	. . .	. . .
1963	1	0	. . .	. . .
1964	0	0	. . .	. . .
1965	1	1	41.5	41.5
1966	1	0	. . .	. . .
1967	2	0	. . .	. . .
1968	12	0	. . .	. . .
1969	16	6	73.0	437.7
1970	14	5	50.3	251.3
1971	13	5	61.3	306.6
1972	11	5	24.2	121.1
1973	13	3	36.5	109.4
1974	11	6	14.4	86.5
1975	11	0	. . .	. . .
1976	14	3	38.2	113.5
1977	9	3	28.4	85.2
1978	23	14	30.5	427.1
1979	27	11	44.0	483.5
1980	57	26	47.9	1,245.9
1981	81	47	36.4	1,712.1
1982	98	51	41.0	2,088.8
1983	147	99	55.1	5,452.5
1984	150	106	45.7	4,839.3
1985	99	74	56.6	4,190.6
1986	86	61	72.6	4,427.8
1987	112	95	56.6	5,378.3
1988	78	66	56.3	3,718.0
1989	88	70	49.4	3,457.5
1990	50	36	69.6	2,507.0
1991	34	23	66.5	1,528.7
1992	31	30	67.0	2,010.8
Total	1,294	846	53.2	45,021.7

Sources: Authors' calculations. See text.

brought public in the previous year, real GDP growth in the previous year, the previous year's Treasury bill return, the previous year's stock market return as measured by the annual return on the CRSP value-weighted market index, a dummy variable that equals one after 1978 (indicating years after the clarification of the ERISA prudent man rule), and the top marginal capital gains tax rate on individuals.[31]

We estimated a Heckman two-stage model, which estimates two equations. The first equation is the probability that a fund was raised in a given year. The second is the amount raised given that a fund was raised in a particular year. This two-stage model is appropriate if the correct decision is that venture capitalists first decide whether to raise a new fund. Once they decide to raise it, they then decide the size of fund to raise. The two equations give us insights about factors that affect the probability of raising a new fund and about factors that primarily affect the optimal fund size.

Table 7 gives the results from the Heckman models. The first regression in each model gives the probability of raising a new fund, and the second gives the size of a fund if it is raised. Neither the capital gains tax rate nor ERISA's clarification had a significant effect on the probability of a venture organization's raising a new fund. The ERISA dummy has no effect on the size of the fund either. The capital gains tax rate does, however, have a significant effect: lower capital gains tax rates are associated with larger funds. This finding would be expected if venture organizations raised new funds on a normal cycle that was typically unaffected by external factors. Changes in the capital gains tax rate may affect the quantity of good start-ups to finance as managers are induced to start firms. More good projects would lead venture capitalists to raise larger funds.

A company's performance also has a dramatic effect on fundraising. Both the value of equity held in companies taken public by the venture capital firm in the current year and in the previous year have a positive effect on the probability of raising a new fund and on the size of the fund. The effect of the previous year's IPO volume is about three times as large as the current year's. This might be due to the time it takes to raise a new fund (sometimes many months). Venture organizations go

31. We look at money raised during the previous ten years because that is the specified life span of a typical venture capital limited partnership agreement. The ten-year sum provided the best available estimate of capital under management.

Table 7. Regressions for Individual Venture Fundraising by Individual, Independent Organizations in the Venture Economics Venture Intelligence Database, 1961–92
t-statistics in parentheses

	Dependent variable			
	Model 1		*Model 2*	
Independent variables	*Was fund raised?*	*If so, logarithm of fund size*[a]	*Was fund raised?*	*If so, logarithm of fund size*[a]
Years since raising last fund	−0.4560 (−15.84)	−21.17 (−7.55)	−0.4692 (−21.58)	−14.15 (−7.02)
Square of the number of years since missing last fund	0.0272 (11.94)	0.8710 (3.94)	0.0291 (16.27)	0.5293 (3.28)
Age of the venture organization (years)	0.0136 (2.79)	0.9820 (2.32)	. . .	. . .
Total venture capital raised during previous ten years for venture organization (millions of 1994 dollars)	. . .	. . .	0.0004 (2.14)	0.1670 (9.56)
Value of equity held in firms brought public this year (millions of 1994 dollars)	0.0037 (3.30)	0.3326 (3.50)	0.0029 (2.46)	0.1124 (1.15)
Value of equity held in firms brought public in the previous year (millions of 1994 dollars)	0.0091 (4.39)	1.0310 (6.11)	0.0058 (2.58)	0.3742 (2.07)
Total value of firms brought public in previous year by all venture capitalists (millions of 1994 dollars)	1.3xE-6 (0.23)	−0.0006 (−1.60)	1.7xE-6 (0.34)	−0.0006 (−1.72)

Real GDP growth in the previous year	−0.0048	. . .	0.0006	. . .
	(−0.72)		(0.08)	
T-bill return in previous year	0.0724	. . .	0.0759	. . .
	(3.84)		(5.45)	
Return on the CRSP value weighted index in the previous year	0.0027	. . .	0.0036	. . .
	(2.37)		(2.86)	
Capital gains tax rate	0.0018	−1.1650	0.0021	−1.8156
	(0.31)	(−3.50)	(0.41)	(−5.50)
Was ERISA's prudent man rule clarified?	−0.0382	8.3666	−0.0472	−5.4530
	(−0.37)	(0.96)	(−0.44)	(−0.66)
Constant	−0.6230	−0.5752	−0.6357	28.99
	(−2.15)	(−0.04)	(−2.27)	(1.98)
Summary statistics				
Log likelihood		−8159.3		−8197.4
p-value of χ^2-statistic		0.000		0.000
N		5,573		5,573

Sources: Authors' calculations. All regressions are Heckman two-stage models. See text for full explanation of variables.
a. Fund size in millions of 1994 dollars.

on "road shows" and gauge investor interest, sign up prospective investors, and generate the necessary documents before closing. The more relevant performance is probably the previous year's returns, which are foremost in investors' minds during fundraising.

Reputation also appears to influence the size of the fund raised. Older and larger venture organizations have higher probabilities of raising funds and raise larger funds. The reputation variable potentially captures beliefs about future returns not captured in recent performance variables. The effect of venture organization size is particularly strong on the size of the fund raised. This could indicate that size is a good proxy for reputation. Size might also measure the need to raise larger funds. Large venture organizations may have more employees and general partners. To keep all of them working at capacity, the minimum fund size needed is substantially greater.

The Treasury bill return in the previous year is positively related to the probability of raising a new fund. This effect may stem from the rapid increase in funds being raised in the early 1980s at a time when real interest rates were high. Both the probability of raising a fund and the size of a new fund first decline and then increase with time from the previous fund.[32]

Table 8 shows the fixed-effects regression models. The models include dummy variables for each venture organization that are intended to pick up unmeasured firm-specific factors. If we find a result even after controlling for fixed effects, we can be confident that the effects are robust. We could not estimate the fixed-effects Heckman model. Therefore, we ran two separate regressions. The first is a fixed-effects logit that estimates the probability of raising a fund in a given year. The second is a fixed-effects least squares regression that estimates the size of funds raised if a fund is being raised. The approximation to the two-stage maximum likelihood Heckman model is consistent in the estimations without the fixed effects, so we are confident that the results in table 8 are reasonable.[33]

In both specifications, the capital gains tax rate continues to be a significant factor in venture fundraising. A decrease in the rate increases the funds raised in both specifications. In the first model, the ERISA

32. The regression results are robust to various segmentations of the data, for example, firms located on the West Coast and East Coast.

33. Maddala (1983).

dummy variable has an important impact. Controlling for firm factors, the ERISA clarification leads to a greater probability of raising a new fund.

Venture organization performance (as measured by the value of equity stakes in IPOs) continues to have a positive effect on fundraising. In the two-stage model with firm fixed effects, the probability of raising a fund increases with greater performance, but the size of the fund does not appear to be affected. The reputation variables, however, have mixed signs in the fixed-effects regression that are different from those in the regressions without the firm fixed effects. In the two-stage model, the probability of raising a fund is lower for older and larger organizations, but the fund size is larger. This lower probability may reflect the retirement of partners within older venture organizations. Unconditionally, older firms are more likely to raise a fund because of their better track record. Controlling for firm effects, however, as a firm ages, it becomes less likely to raise a fund.

Stage Focus Results

We also undertook an analysis of the ability of venture capital organizations to raise a fund that focuses on early-stage investments. The early-stage venture market is often considered critical to the success of later-stage investments. Early-stage funds provide new firms with crucial financing in their infancy.[34] Many of the policy initiatives undertaken around the world are aimed at increasing the availability of early-stage capital. Similarly, firms in their very early stages are the most prone to capital rationing and liquidity constraints because the uncertainty and asymmetric information are at their greatest. If we can understand the incentives to raise a focused fund, we might be able to understand industry dynamics better and make better recommendations about promoting new entrepreneurial firms.

We divide firms into two categories in this analysis. We indicate whether the funds analyzed earlier have a stated investment focus on early-stage firms only. (Venture Economics characterizes each fund's focus in its database.) Table 9 presents summary statistics for venture funds that have a stated early-stage focus and those that do not. Funds

34. See, for instance, Organization for Economic Cooperation and Development (1997).

Table 8. Fixed-Effects Regressions for Venture Fundraising by Individual, Independent Organizations in the Venture Economics Venture Intelligence Database, 1961–92

t-statistics in parentheses

	Dependent variable			
	Model 1		*Model 2*	
Independent variables	*Logit—was fund raised?*	*OLS—if so, logarithm of fund size*[a]	*Logit—was fund raised?*	*OLS—if so, logarithm of fund size*[a]
Years since raising last fund	−1.1056 (−18.80)	−2.903 (−1.02)	−1.3034 (−22.83)	2.343 (0.89)
Square of the number of years since raising last fund	0.1069 (16.91)	0.1526 (0.54)	0.1141 (18.74)	−0.2100 (−0.79)
Age of the venture organization (years)	−0.2772 (−11.23)	4.8364 (3.18)	. . .	. . .
Total venture capital raised during previous ten years for venture organization (millions of 1994 dollars)	. . .	. . .	−0.0049 (−7.10)	0.1660 (6.41)
Value of equity held in firms brought public this year (millions of 1994 dollars)	0.0049 (2.03)	0.0128 (0.10)	0.0056 (2.22)	−0.0764 (−0.59)
Value of equity held in firms brought public in the previous year (millions of 1994 dollars)	0.0138 (3.06)	0.2905 (1.38)	0.213 (4.09)	−0.1417 (−0.65)

Total value of firms brought public in previous year (millions of 1994 dollars)	4.1×E-6 (0.38)	−0.0001 (−0.21)	−5.0×E-6 (−0.48)	0.0004 (0.55)
Real GDP growth in the previous year	−0.0315 (−1.42)	−1.875 (−1.42)	−0.0037 (−0.16)	−2.012 (−1.57)
T-bill return in previous year	−0.0160 (−0.43)	−1.727 (−0.77)	0.1154 (3.33)	−1.782 (−0.93)
Return on the CRSP value weighted index in the previous year	0.0009 (0.28)	−0.1847 (−0.80)	0.0061 (1.94)	−0.1959 (−0.89)
Capital gains tax rate	0.0007 (0.06)	−1.153 (−1.92)	0.0039 (0.36)	−1.506 (−2.45)
Was ERISA's prudent man rule clarified?	2.047 (5.75)	0.7768 (0.04)	0.0967 (0.35)	10.22 (0.67)
Constant	1.434 (1.62)	127.15 (2.77)	1.155 (1.26)	127.60 (2.89)
Summary statistics				
Log likelihood/adjusted R^2	−1903.6	0.212	−1939.5	0.252
p-value of χ^2/F-statistic	0.000	0.000	0.000	0.000
N	5,323	1,117	5,323	1,117

Sources: Authors' calculations. See text for a full explanation of the variables and methodology. Firm fixed effects are not reported.
a. Fund size in millions of 1994 dollars.

Table 9. Summaries of Venture Capital Commitments by Stage Focus for Funds Raised by Independent Venture Organizations in the Venture Economics Venture Intelligence Database, 1961–92

Means, in millions of 1994 dollars unless otherwise specified; median in parentheses

	Funds with stated focus on early-stage firms	*Funds without stated focus on early-stage firms*	*Significance of the difference between early and nonearly*
Size of the fund	41.98	56.95	0.000
	(24.66)	(35.88)	(0.000)
Amount of venture capital raised by organization in previous funds	92.20	87.58	0.714
	(39.54)	(26.64)	(0.000)
Organization age (years)	4.38	3.77	0.140
	(3.08)	(0.58)	(0.002)
Date of fund closing	August 1985	August 1983	0.000
	(June 1985)	(May 1984)	(0.000)
Funds raised on West Coast (percent)	38.3	30.3	0.017
Funds raised on East Coast (percent)	32.2	43.6	0.001

Sources: Authors' calculations. See text.

focusing on early-stage investments are significantly smaller, with a mean size of $42 million and a median of $25 million, than funds that do not focus on early-stage investments (mean of $57 million and a median of $36 million). This makes sense because early-stage investments are typically smaller than later-stage investments. Gompers has found that the average early-stage investment is only half as large as the mean later-stage investment.[35] Because the amount of time spent during the investment and monitoring process (in due diligence, negotiations, and so forth) and the need for oversight after the investment are similar, early-stage funds are usually smaller.

Early-stage funds also tend to be raised by venture organizations that are slightly older and larger. One possibility is that older, more experienced venture organizations have the necessary knowledge to raise a focused fund. The early-stage funds are, on average, more recent and are more likely to be raised on the West Coast. Clearly, the mix of investments on the West Coast, primarily California, is heavily concentrated on early-stage, technology-based companies. East Coast firms are more balanced and tend to have portfolios with larger proportions of later-stage companies.

Table 10 shows multivariate regressions analyzing the determinants of fund focus. We used each new venture capital fund as an observation and examined whether it had an early-stage focus. As the summary statistics suggested, smaller funds are more likely to have an early-stage focus. Similarly, firms on the West Coast are more likely to raise an early-stage fund. Finally, a venture organization has been more likely to raise a fund with an early-stage focus after the Department of Labor's clarification of ERISA's prudent man rule. This is potentially due to the clarification stating that investments would be judged prudent not by their individual risk, but by their contribution to portfolio risk. Before the amendment, early-stage funds may have been viewed as too speculative and may have had a more difficult time raising money than a later-stage or general purpose venture capital fund. After the amendment venture organizations could raise focused funds without worrying that pension funds would avoid them out of concern over their perceived riskiness.

35. Gompers (1995).

Table 10. Regressions for Stage Focus of Venture Capital Funds by Independent Organizations in the Venture Economics Venture Intelligence Database, 1961–92
t-statistics in parentheses

Independent variable	*Dependent variable: Did the fund state a focus on early-stage investments?*			
Size of the fund (millions of 1994 dollars)	−0.0057	−0.0035	. . .	. . .
	(−2.82)	(−1.40)		
Age of the venture organization (years)	0.0118	. . .	0.0018	. . .
	(0.75)		(0.13)	
Total venture capital raised during previous ten years for this venture organization[a]	. . .	0.0247	. . .	−3.24 × E-7
		(1.62)		(−0.71)
Was the fund located on the West Coast?	0.4026	0.4619	0.2280	0.2786
	(2.35)	(2.70)	(1.44)	(1.79)
Was ERISA's prudent man rule clarified?	0.7659	0.9025	1.829	1.871
	(1.78)	(2.11)	(4.39)	(4.52)
Capital gains tax rate	0.0208	0.0247	0.0395	0.0404
	(1.36)	(1.62)	(2.70)	(2.80)
Constant	−2.244	−2.502	−4.333	−4.401
	(−3.14)	(−3.49)	(−6.25)	(−6.39)
Summary statistics				
Log likelihood	−455.3	−461.9	−557.4	−571.8
p-value of χ^2 statistic	0.002	0.001	0.000	0.000
N	818	843	1,236	1,283

Sources: Authors' calculations. All regressions are logit estimates. See text for full explanation of variables.
a. Millions of 1994 dollars.

Alternative Explanations

Several alternative explanations may account for our findings. First, the supply and demand for venture capital may be affected by the supply of substitute financing. We have attempted to control for the cost of credit by including the real interest rate. In periods of high real interest rates, venture capital may be more attractive from the entrepreneur's perspective. Similarly, if the availability of bank financing were a major factor in the determination of venture capital commitments, we should have seen an increase in venture capital commitments in the late 1980s and early 1990s, when bank credit to young, small firms was significantly tighter. Instead, we see decreasing venture capital commitments during this period, indicating that bank credit and venture fundraising moved together.

Our results on capital gains taxes and venture commitments may reflect an inability to measure expected GDP growth accurately. If expected growth is somehow correlated with capital gains tax rates, we might be incorrectly attributing the explanatory power of growth to the tax rates. In unreported regressions, we modeled expected GDP growth using the previous four years of real growth. Instead of lagged GDP growth, we reestimated the regressions using the expected growth rate. Results were qualitatively the same as already reported. This is not surprising because the expected GDP growth rate is primarily affected by the previous year's growth.

Finally, the growth in venture capital commitments may have less to do with policy changes and more with greater technological opportunities. In fact, the state-level R&D expenditures indicate that this may be the case. If changes in technological opportunity were causing increases in venture capital investments, we would expect several measures of technological innovation to lead increases in venture fundraising. In particular, Kortum and Lerner show that a surge of patents occurred in the late 1980s and 1990s.[36] This finding suggests that some of the recent growth in venture capital fundraising in the mid-1990s may be due to increases in technological opportunities. The increase in venture fundraising in the late 1970s and 1980s (the period of our sample), however, does not seem to be caused by similar technology

36. Kortum and Lerner (1998).

shifts. Similarly, the state-level analysis shows that even controlling for R&D spending, regulatory policies still have an effect.

Conclusion

We have examined the determinants of fundraising for the venture capital industry and individual venture organizations. We examined supply and demand effects as well as the importance of individual firm performance and reputation.

We find that demand for venture capital appears critical. Higher GDP growth and increases in R&D spending lead to greater venture capital activity. Capital gains tax rates also matter: lower rates lead to more venture capital raised. The effect, however, appears to stem from a greater demand for venture capital. Commitments by tax-exempt pension funds are the most affected by changes in the capital gains tax rate. The clarification in ERISA rules governing pension fund investment has also generally increased commitments to the industry.

Fund performance is an important determinant of the ability of venture organizations to raise new capital. Firms that hold larger equity stakes in companies that have recently gone public raise funds with greater probability and raise larger funds. Reputation, in the form of firm age and size, also positively affects the ability to raise new capital.

There is also evidence that decisions to raise early-stage venture funds have been affected by pension regulations. The probability of raising a focused fund increased after ERISA's clarification. We also find greater early-stage activity in smaller funds and venture organizations on the West Coast, where technology-based start-ups are more prevalent.

Our research has a variety of implications for policymakers who wish to stimulate venture capital activity. The fundraising results indicate that regulatory reform and policy decisions may have an effect on commitments to the venture industry. Although the capital gains tax rate is an important driver of venture capital fundraising, blanket reduction in the rates may be a blunt instrument for promoting venture capital. Our analysis suggests that an important factor for the increase in venture capital is probably an increase in the number of high-quality start-ups. The greater number of good firms leads to more demand for

venture capital. Policies that increase the relative attractiveness of becoming an entrepreneur and promote technology innovation probably would have more effect on venture capital investments than an across-the-board cut in the capital gains tax rate. Furthermore, the results highlight the highly localized nature of venture capital activity. Countries that wish to promote such activity may consider concentrating efforts rather than spreading resources uniformly around the country. This is in contrast to many of the efforts that various countries have instituted.

The results also raise questions for further research. In general, the importance of reputation and performance as determinants of fundraising is consistent with findings of earlier literature on other types of money managers. The decision to invest is clearly predicated on the expectation of future returns, and both past performance and reputation are components of such expectations. But in recent years many of the most established venture organizations in the United States have experienced internal corporate governance problems and have been disbanded. The issue of who carries the reputation with him or her is important. Does reputation follow general partners who start their own funds, or must they establish new reputations? In markets without experienced venture capitalists, how can the lack of reputation be overcome? Clearly, more work is necessary.

Other unanswered questions relate to the effectiveness of public efforts to transfer the venture capital model to other regions. Even if venture capital organizations spur technological innovation in the United States, it is not evident that the model can be seamlessly transferred abroad. Different employment practices, regulatory policies, or public market avenues might limit the formation of funds.[37] Even if it were feasible to transfer such efforts, public economic development programs can be subject to political manipulation such as pressures to award funds to politically connected businesses.

Overseas venture initiatives, however, may be able to benefit from the experience of venture organizations in the United States. In particular, the Israeli Yozma program seems to have successfully captured spillovers of knowledge from U.S. and British venture organizations. In contrast to many forms of government intervention to boost economic

37. See Black and Gilson (1998).

growth, the implementation of these programs has received little scrutiny by economists.[38] This is a ripe area for further exploration.

Venture capital is increasingly regarded as an important component of the U.S. economic landscape. Although policymakers have often tried to affect the flow of funds into the sector, little has been known about the real impact of such policy measures. Our paper begins to answer those questions and points toward areas for future research.

38. Two recent exceptions are Irwin and Klenow (1996) and Lerner (forthcoming).

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Comments

Comment by Margaret M. Blair: The dynamism of the venture capital market in the United States in the past twenty years has been the envy of economies all over the world. But as much as policymakers would like to be able to replicate this success story in other times and places, the truth is that neither they nor scholars know for sure what it is that we did right to encourage the growth of the sector. Was it just an accident, a product of random forces that happened to come together in a particularly propitious way in the past decade or two, especially in California? Or was it the product of some policy choices that could be adopted elsewhere?

Paul Gompers and Josh Lerner make a substantial contribution to our understanding of these questions by analyzing data on flows of investment money into U.S. venture capital funds since the 1970s. They ask whether those flows, in the aggregate, and on a state-by-state and firm-by-firm basis, can be explained by the general condition of the macroeconomy, the rate of technological change, the success of previous venture capital investments, and some specific policy variables such as tax rates and pension fund regulations.

The authors are unable to estimate a two-equation model to sort out supply-side influences and demand-side influences, because the "price" of venture capital (the ex ante expected rate of return) is not directly observable. But they make a variety of plausible arguments about why some explanatory variables would be expected to work through the supply side and some through the demand side. And in the case of one particularly ambiguous relationship—the influence of capital gains taxes—they are able to parse the data in a way that allows them plausibly to sort out supply effects from demand effects. Their

sorting allows them to present a fairly convincing case that the surge in the flow of funds into venture capital investments in the 1980s was largely a product of the growth in the "demand" for venture capital by entrepreneurs. The demand for venture capital, in turn, was stimulated by a growing economy, technological change (for which spending on research and development is used as a proxy), and reductions in the capital gains tax rate, all of which have made it more attractive for individuals with an entrepreneurial bent to start their own new firms.

On the supply side the authors argue that the Department of Labor's clarification of the so-called prudent man rule of the Employment Retirement Income Security Act (ERISA) in 1978 in effect gave pension fund managers permission to invest in venture capital funds as part of a balanced portfolio, which helped open the floodgates of funding into these investments. The authors also use their data (which was collected at the level of individual venture capital funds) to show evidence that a reputation for past investment success on the part of a specific venture capital firm encourages a greater flow of money into subsequent funds raised by the firm.

All of these findings are plausible, but they may not be very useful in devising policy. Consider the various factors that, according to the authors, help to stimulate the growth of venture capital funds.

The firm-level analysis tells us that venture capital organizations that have been successful in the past are more able than other firms to attract new money into new funds that they form. But this is not particularly helpful for making policy if one firm's success in attracting new investment money comes at the expense of another firm. If the policy question is how to stimulate the total amount of venture capital activity, the firm-level analysis is not really relevant. Moreover, the findings of the analysis at the aggregate level are still not very helpful because they seem to tell us little more than that to have a thriving venture capital industry there needs to be a thriving venture capital industry. Success encourages future business. This is not surprising, but it does not give a policymaker much to work with.

The other supply-side factor that the authors believe was important was the clarification of the prudent man rule. Here we have a fairly clear policy change, but the only way it is captured in the data is by a dummy variable for pre-1979 versus 1979 and later. One does not have to study figure 2 very hard to be convinced that such a variable would

be significant in any regression explaining venture capital funding, because nearly all of the activity occurs after 1979. For that reason, however, one cannot say for sure that this dummy variable is picking up the clarification of the prudent man rule or some other factors that began to stimulate venture capital funding in a big way in the 1980s. The authors bolster their argument that clarifying the prudent man rule was important by noting that the flow of funding into venture capital from pension funds in particular was especially strong after 1979. Nonetheless, it seems likely that this dummy variable is proxying for other things not included in the list of explanatory variables, things that are still not well understood and that may also have been driving mergers, takeovers, and corporate restructuring and refinancing activity, all of which took off during that same period. Moreover, the clarification of the prudent man rule, while undoubtedly beneficial, was a one-time change in a rule that does not exist in very many other places. So even if it was helpful, policymakers cannot get any further mileage out of this kind of change.

The three demand-side variables that the authors found to be associated with growth in venture capital activity are overall economic growth, spending on R&D, and a reduction in capital gains taxes. There is a circularity in the logic, however, of any argument that policymakers should try to stimulate economic growth in order to encourage venture capital activity. Presumably the reason they would want to stimulate venture capital activity is, as the authors note in the first paragraph of the paper, "the importance of the venture capital sector in generating innovation and new jobs." So, yes, economic growth is great, and there are plenty of good reasons to try to stimulate economic activity for its own sake. But it does not seem particularly useful to view it as an instrument for stimulating venture capital activity because the rationale for wanting to stimulate venture capital activity is that it will spur economic growth.

The authors also present evidence that reductions in the maximum capital gains tax rate in the 1980s helped stimulate demand for venture capital. Now here is a policy tool politicians love to talk about. In the regressions explaining aggregate (nationwide) annual commitments to venture capital, the coefficient on the capital gains rate is negative in every version of the model, though it is significant (at the 90 percent level) only in the regressions on total commitments, and on commit-

ments by pension funds, while it is not significant (at the 90 percent level) in the regressions explaining commitments by individuals, nor in the regressions in which commitments are broken out by whether they are made by a taxable or a tax-exempt entity. The authors take these results as evidence that capital gains tax rates work through the demand side by increasing the eagerness of entrepreneurial people to start their own firms, rather than by encouraging more outside investors to supply funds for venture investments.

The problem with the analysis at this point, however, is that the authors have only twenty-two observations in the regression on total commitments, and once they break it out by source of the commitments, they have only seventeen observations. But they have six explanatory variables plus a constant, leaving only ten degrees of freedom. Moreover, the capital gains rate changed in only seven of the last seventeen years of their sample period. So they do not have much power in these regressions to reject the null hypothesis that the capital gains tax rate did not matter.

The authors repeat the analysis at the state level, which significantly increases the number of observations they have to work with, and in the state-level regressions explaining venture capital activity they again find negative coefficients on the capital gains tax rate variables. The coefficient is significant in the versions of the model in which the tax rate used is the sum of state and federal rates (with the state rate adjusted for any savings in federal taxes due to the deductibility of state taxes). But when state and federal rates are broken out and entered into the regression separately, only the coefficient on the federal capital gains tax rate is significant, suggesting that it is this part of the variable that is doing all the work in the regression. There is a problem in interpreting this result, however. In a panel regression the *t*-statistics on a macroeconomic variable that only varies from year to year, and does not vary cross-sectionally, will be spuriously inflated because the regression methodology used assumes that there is both state-level and annual variation in all of the variables. If there is a high level of correlation across states in annual venture capital investment, the variables at the level of the macroeconomy, including the federal capital gains tax rate, pick up this cross-sectional correlation and may well be proxying for other unknown year-specific variables that affect many states at the same time.

Of course, the authors might be right that the capital gains tax rate is important in encouraging entrepreneurial activity and thus in stimulating the demand for venture capital financing. But they concede late in the paper that, even if it is, this might be a blunt policy instrument to use for this purpose.

The final factor that Gompers and Lerner consider that appears to strongly influence venture capital activity is spending on R&D, both by academic institutions and industry. Although the authors do not treat this as a policy variable, perhaps they should. During the period covered by their study (1976–94), the federal government funded nearly 30 percent of all industry spending on R&D, and federal, state, and local governments together funded more than 70 percent of spending by universities and colleges on R&D. In constant dollar terms, annual federal spending on R&D channeled through industry climbed steadily during the period from $19.4 billion (in 1992 dollars) in 1976, peaking in 1987 at $34.6 billion, and then declining to $19.3 billion in 1994. The authors' data on venture capital commmitments appear also to have peaked in 1987. Although federal funding of industry R&D has declined since 1987, federal funding of R&D at colleges and universities has climbed since 1987 from $9.1 billion to $12.2 billion in 1994 (in 1992 dollars).[1] But government spending on R&D has declined as a share of both total industry spending and total spending by colleges and universities.

The authors have found that their R&D spending variables, in their state-level regressions, are highly significant predictors of—and probably causally related to—venture capital activity. Such variables are manipulable by government policy and should be considered part of the arsenal of policy tools available to policymakers to stimulate venture capital activity. More research on this relationship is probably warranted.

Comment by Thomas Hellmann. The current paper by Gompers and Lerner is an interesting attempt at answering a question of great importance. The United States has witnessed the rise of venture capital as a unique institutional arrangement for the financing of new and innovative companies. Most people believe that venture capital plays a role in the

1. National Science Board (1998, appendix table 4–4).

competitiveness of the U.S. economy. If venture capital does play such an important role, then it seems natural to ask what determines the size of the industry. Gompers and Lerner set out to provide some answers in this paper.

A pervasive problem in studying the venture capital industry is the lack of data. Gompers and Lerner should be commended for their substantial efforts to gather data. The current paper uses not only data on the aggregate amount of funds committed to venture capital (both state and national), but also attempts to analyze fundraising at the level of the individual fund. The paper thus provides information that simply was not available before. And it is clear that there is further potential in this data beyond the current paper.

The brunt of the paper is concerned with the aggregate behavior of venture capital fundraising, so I will focus most of my comments on that. At the core of the paper is a claim that it is mainly demand and not supply factors that determine the size of the venture capital industry. Let me begin by saying that I am very sympathetic to this idea. At a theoretical level, it is hard to argue that demand considerations are of no importance. And casual observation suggests that in many countries the obstacles to investing in venture capital are relatively minor, yet there is no active venture capital market, suggesting that supply alone cannot be the problem. Instead, it is frequently argued that the lack of venture capital is due first and foremost to the lack of entrepreneurs.

From the research perspective, the obvious challenge is thus to disentangle demand and supply effects. The authors make some interesting efforts at distinguishing between these effects, but the problem turns out to be trickier than anyone can solve in a single paper. The heart of the problem is fairly simple: first, price cannot be observed, and second, good instruments have not yet been found that can isolate demand and supply effects. The authors convincingly explain why an objective price cannot be observed in the relationship between the limited and general partners. They are thus left with the measurement of the quantity of funds.[2] Without observing prices, any change in the quantity of funds

2. The paper also makes an argument that the lack of price data is not a severe omission, because the supply function is very elastic. This argument is slightly confusing: with a perfectly elastic supply function, assets exist that are a perfect substitute for venture capital investment. The authors do not identify these assets, and if there truly were perfect substitutes, then it would be more meaningful to estimate the supply

could come from shifts in the demand or supply schedules. Yet none of the explanatory variables convincingly isolates either. Clearly, the aggregate level of economic activity and the level of interest rates affect both the saving behavior of firms and households (which acts on the supply of funds), and the investment behavior of entrepreneurs (which acts on the demand for funds). Similarly the return in equity markets affects the relative returns of different asset classes (which should affect the supply of venture capital), and it is likely to be correlated with entrepreneurial opportunities (thus affecting the demand).

The only variable that holds some promise of isolating demand is the R&D expenditure by academia and industry. The authors show that R&D expenditure is correlated with venture capital fundraising at the state level (I am not sure why they do not report the equivalent regression at the national level) and suggest that this might be interpreted as evidence for a demand effect. For this to be true, one still needs to argue that the savings behavior of firms and households has no relationship to the amount of spending by firms and academia on R&D. Moreover, entrepreneurial opportunities have to be positively correlated with R&D spending, which amounts to saying that R&D and entrepreneurship are complements. But the correlation between R&D and the quantity of venture capital certainly seems encouraging for the view that demand somehow matters.

A fundamental problem occurs, however, in going further with identifying the demand for venture capital: a better understanding of the entrepreneurial process is necessary. Economists have a profound problem measuring entrepreneurial opportunity, because they tend to rely on measuring realized outcomes, which measure actual choices as opposed to opportunity sets themselves. Moreover, economists have a poor understanding of what economic conditions favor or hamper entrepreneurship.[3] Put differently, it is difficult to talk about the demand for venture capital without a good theory of entrepreneurship. This means that even conceptually it is unclear what variables should be used as instruments for the demand of venture capital.[4]

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function of the joint asset class (or else shifts in the composition of supply might be misinterpreted as demand shocks).

3. This lack of knowledge manifested itself clearly in the very different context of transitional economies.

4. A related point is that not much is known about alternative financing mechanisms

The poor understanding of the entrepreneurial process leads to my next point. Based on the conjecture formulated by Porteba, the authors interpret their findings as evidence that capital gains taxation works through the demand for funds, rather than through supply. There are some issues with the interpretation of the empirical findings, but before I get to that, let me first question the conceptual argument that capital gains taxation is an important factor for the level of entrepreneurship and thus the demand for venture capital. I may be holding a somewhat idiosyncratic view on this matter, but it seems to me that the argument has some political sway but little economic foundation.

It is a well-known fact that capital gains taxation has distributional consequences as well as efficiency consequences. It also seems plausible to me that in a politicized debate, the parties that have an interest in a capital gains reduction would want to highlight the efficiency arguments and downplay the windfall gains. Currently, the "entrepreneurial sector" enjoys a strong political goodwill in the United States. It might thus be attractive for proponents to argue that a capital gains reduction would benefit the entrepreneurial sector.[5]

The proponents' argument is deceptively simple: lower capital gains taxes increase the rewards to successful entrepreneurs if and when they want to cash out. The problem is that it is far from clear how important this effect is. The returns to an entrepreneurial activity, especially of the type financed by venture capital, are not only highly uncertain, but also occur at a fairly distant point in time. It takes several years before a successful company goes public, entrepreneurs have holding periods after the initial public offering, and even after the holding period entrepreneurs typically realize their capital gains at a very slow rate, frequently using various techniques to delay payment of taxes. Thus the gains from a reduction in capital gains taxation ought to be heavily discounted at the time of the entrepreneurial decision. In addition, at the time of founding a company, the one thing entrepreneurs can be sure of is that by the time they cash out, there will have been at least one presidential election and probably several rounds of congressional

for entrepreneurs. Future research might also want to examine substitution effects between venture capital and other forms of entrepreneurial finance.

5. Never mind, also, that entrepreneurs constitute only a tiny fraction of the people (or entities) that pay capital gains taxes, yet their cause is used for a reduction of capital gains across the board.

elections, each of which might bring about changes in capital gains legislation. More generally, it is unclear how much entrepreneurs should look at the current capital gains rate as a predictor for their future tax liability.

More important, it is not clear how much entrepreneurs actually do look at capital gains. This is obviously the point where lack of knowledge about entrepreneurship (both theoretically and empirically) hurts most. In the presence of extreme uncertainty surrounding their ventures, entrepreneurs rarely seem to rely on the mechanics of discounting future cash flows, which implies uncertainty about how, if at all, they are influenced by the capital gains rate. I presume that a lot more research would be required to answer that question. At the anecdotal level, I can say that in my limited experience I have heard entrepreneurs complaining about paying too high a capital gains tax. The complaints, however, came from entrepreneurs who had already succeeded and who were pondering how to avoid paying the tax. I have yet to meet the entrepreneur who tells me about a new innovative idea, but then says the only thing preventing the enterprise from going forward is the capital gains tax the entrepreneur will have to pay in that otherwise blissful case of actual success. Put differently, I am under the impression that even (perhaps especially) in the entrepreneurial context, the distortions of ex ante investment incentives induced by capital gains taxation are of tertiary importance at best. These taxes only seem to come to people's mind once they have accumulated wealth and are directly affected by the distributional consequences.[6]

Apart from these conceptual reservations about the importance of capital gains taxation on demand for venture capital, I am still confused by the results of the paper. At the risk of simplifying, the paper seems to argue that because the data does not fit the supply story, it must be demand that is driving venture capital. This remains speculative unless demand factors can actually be identified. But even if they were, one would still need an explanation for why supply factors are not at work. Indeed, the paper suggests an interesting paradox that remains somewhat unexplored: even though there is a difference by definition in their tax treatment, taxable and tax-exempt investors do not seem to behave

6. Anecdotally, they also seem to matter to investors, but this is obviously on the supply side.

significantly different, and tax-exempt pension funds react even more strongly to capital gains than (presumably taxable) individuals. One possible partial resolution to the paradox might be that taxable investors imitate tax-exempt investors in their investor patterns. Institutionally it is sometimes difficult to get into a limited partnership, so it may be that investors tend to take whatever share is allocated to them, leading to fairly uniform investment behavior.[7] Future research on understanding investor behavior seems clearly warranted.[8]

Apart from my comments on the two question that I consider most fundamental, that is, demand and supply and capital gains taxation, let me briefly make a few comments about the measurement of the size of the venture capital industry. The authors take a very reasonable measure, namely, the amount of money that venture capital funds raise in a particular year. The nature of the limited partnership arrangement is such that venture capital firms raise a particular amount that is put into a "fund." Over the next few year, venture capitalists then have the right to call in the monies that were committed to the fund, typically calling them in a few discrete portions. They then disburse these funds as they invest in companies. The paper recognizes that the amount of funds committed does not correspond to the amount disbursed. It would be interesting in future research to examine whether this distinction affects the analysis. My main concern is that the current measure is better at measuring the available supply of venture capital funds rather than the actual demand. Put differently, if we want to learn more about the demand factors that drive venture capital fundraising, it would seem imprudent to rely on a measure of the funds made available, as opposed to the funds actually invested in companies.

Another interesting measurement issue is the appropriate scope of asset classes. It is not clear whether institutional investors think of venture capital as the relevant unit of analysis or instead make investment decisions on the basis of a broader (or narrow) asset class. In particular, venture capital investments are often lumped together with

7. Another factor that could augment this effect would be relative performance evaluation among investors.

8. Related to this, the authors do not seem to properly recognize the contribution by Anand (1993). Anand models the preferences of the investors more carefully than the current paper, allowing for investor heterogeneity. The authors' critique of Anand's paper—being too narrowly focused on the telecommunications sector—seems secondary compared with its methodological contribution.

leveraged buyout funds and some other private equity funds into what are called "alternative assets." A natural question to ask is how the supply of venture capital interacts with these related asset classes. In a similar vein, it may also be interesting to think of the quantity of venture capital not in terms of the absolute amount, but instead as a fraction of gross domestic product or some measure of savings.

Finally, let me comment briefly on the section with the disaggregate data. The comments on demand versus supply factors and on the role of capital gains taxation obviously also apply to that section. One of the interesting new questions that arises from the disaggregate data is the role of the age of the venture capital firm. Although I agree with the authors that being older may imply having a greater reputation and may also lead to succession problems, I am not yet clear on how these two effects can be isolated. Concerning distinction of early- versus late-stage funds, I echo the authors' view that understanding their differences is of great importance, especially with a view on public policy. Future research might want to investigate whether the early-stage segment of the venture capital market behaves differently from the later-stage segment and how individual venture capital firms move between those two segments.[9]

Authors' Response: We appreciate the thoughtful comments by Margaret Blair and Thomas Hellmann. Their comments at the Brookings conference significantly improved our paper, and their amended comments published in this volume suggest a variety of avenues for future research.

One point mentioned by Thomas Hellmann bears repeating: the challenges associated with empirically examining the venture capital industry. Many data series routinely collected about the public markets by government regulators and private data vendors are not available here; and much of the information available is fraught with inconsistencies and ambiguities. The example of the blurred boundary between venture capital and leveraged buyout funds highlighted by Hellmann is just one example. As the industry matures and more data is collected, these

9. For example, one could run the aggregate-level and individual-level regressions in the two respective subsamples and compare their responsiveness to the various explanatory variables proposed in the paper.

problems may be alleviated; for now, however, they are an inherent feature of empirical research into venture capital.

The reader should be aware of these limitations but should not lose sight of the broader result. The industrywide, state-level, and fund-specific analyses all suggest that public efforts to boost the demand for venture capital are considerably more effective than steps to increase the supply of funds. The findings lead us to view more favorably public efforts designed to enhance the attractiveness of entrepreneurship and the rate of technological innovation and to regard more skeptically efforts to address the supply of venture capital directly. Due to the potential for political distortions, programs that seek to stimulate the supply of venture capital by directly funding small firms must be viewed with particular caution.[10]

Commentators' References

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10. For one example of political distortion, see Lerner (forthcoming).