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Creating Modern Venture Capital: Institutional Design and Performance in the Early Years

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Abstract:

This paper presents some first results of a new study on the evolution of the American venture capital industry—and the firms it helped create and grow—from the 1940s through the 1970s; the period in which modern-style venture capital organizations were created. The paper focuses primarily on the micro-level, entrepreneurs and firms, and takes a longitudinal approach, following these people and organizations for an extended period of time. By considering the details of supply and demand for venture capital services, the paper underscores the critical roles that individual entrepreneurs played in creating a viable venture capital industry in the United States. The paper begins the process of quantifying the aggregate supply of and demand for venture capital finance in the era before large-scale databases were collected. In addition, by examining the personal papers of Georges Doriot, the driving force behind the first public venture capital company, as well as the recollections of a few venture capitalists of the 1960s vintage, the paper provides some qualitative corroboration to the quantitative results.

The paper also compares the performance of firms backed by ARD, Greylock, and the publicly traded SBICs. The findings, albeit preliminary, suggest strong performance among venture-backed firms overall, even at this early stage of the learning process, with common stock returns consistently outperforming those of the broader market (S&P 500) on average. While there is some evidence that the privately-backed venture capital firm offered the greatest advantages to its portfolio firms—or at least selected better performers—the differences are statistically weak. These firm-level returns also demonstrated higher variance, and therefore risk; so higher returns, as expected, came with a cost. Indeed, for the narrower time frame of the 1960s and 70s, Greylock firms performed below the ARD and SBIC-backed firms on average, but they also grew more rapidly over that period.

This paper is part of a larger project. It sets the stage for a number of possible new areas for research, and reveals a number of areas in which additional data and analysis are required.

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Venture capital has existed in one form or another since the earliest days of commercial activity. The institutionalized form of venture capital, as it is practiced today, dates back only to the early post-World War II era. General Georges Doriot is now commonly seen as the first venture capitalist, and American Research and Development Corp—the venture capital firm he ran for more than 25 years—is typically considered the first institutional venture capital firm.¹ This firm began operations in 1946, but the process of its creation started much farther back, as a local response to economic hardship during the Great Depression. For more than a decade, ARD operated essentially alone in the formalized venture capital market; that situation began to change rapidly in the late 1950s, with the launching of the Small Business Investment Company program through the U.S. Small Business Administration in 1958. That program, as well, had roots back to the early depression years and the New Deal institutions formed to alleviate financial distress and stimulate economic recovery at that time. Almost simultaneously, a private-based solution to the same problems—finding long-term, particularly equity-based capital for new and innovative firms that would lead the economy toward higher growth and productivity—began to appear in the form of such private venture capital partnerships as Draper, Gaither, Anderson (1958), Davis & Rock (1961), Draper & Johnson (1962), Sutter Hill Ventures (1965), and Greylock (1965). While the various venture capital

¹ Several well-known families also ran venture capital organizations, but ARD was the first to gather funds from multiple institutional investors and to form a public company for the express purpose of providing both capital and management advice to small, young enterprises. Nonetheless, according to the J.H. Whitney & Co. website, “On February 1, 1946, John Hay (“Jock”) Whitney wrote a single check for \$5 million dollars to J. H. Whitney & Co. and, in so doing, founded the first venture capital investment firm in the United States.” Gupta (2000) also refers to J. H. Whitney & Co. as the first venture capital firm, and the first manager of the company, Benno Schmidt, relates a story of the creation of the term “venture capital” in his firm’s discussions of how to describe itself (in light of the fact that the *New York Times* had repeatedly referred to Whitney & Co. as an investment banking firm). Gupta (2004, p. xiv), however, claims that “Georges Doriot may not have been the first investor of venture capital but he clearly was the first venture capitalist.”

institutions took on different shapes, sizes, and forms, they all held at their core the ideal of creating new enterprises for the greater good.²

While a number of studies have provided some insight into the work of General Doriot and the operations of ARD, and a few others have given a broad picture of the SBIC sector, the literature on the early development of the venture capital industry remains rather sparse.³ Moreover, there has been little detailed investigation into the earliest venture capital investments—that is, the small firms that were financed and nurtured by these institutions and that their supporters hoped would become significant contributors to the economy. This paper takes up this task and presents some early results of a new study on the evolution of the venture capital industry and the firms it helped create and grow. This paper focuses primarily on the micro-level—entrepreneurs and firms—in order to paint a more fine-grained portrait of institutional development. It also takes a longitudinal approach, following these people and institutions for an extended period of time.

This paper, therefore, represents a few steps in the direction of a broader understanding. The first part of the paper quickly surveys the supply of organized venture capital finance from the start of ARDC to the early 1970s, when published sources become fairly accurate, and gives a brief picture of the regulatory environment that created some of the need for a separate industry for venture capital financing. The second part investigates the sources of demand for venture capital, focusing mainly on the entrepreneurs and companies that were financed by venture capitalists in the late 1940s through the 1970s. The third part presents some preliminary evidence on the performance of the various types of venture capital firms and the companies they backed, primarily in the form of public offerings of stocks and their rates of return over the long

² This point is noted in the many discussions surrounding on the formation of ARD and obviously pertains to the SBICs, with their government backing. But a similar motivation applies also to the private venture capital institutions, as has been emphasized (in personal interviews) by some of the earliest people involved in the industry.

³ See, notably, Liles (1977) on ARD and Boston Capital Corp, an SBIC formed in 1960 (and run by Joe Powell, formerly of ARD). See also Hsu and Kenney (2004) on the “rise and demise” of ARD. Gupta (2004) focuses on Doriot himself, more than ARDC. Noone and Rubel (1970) take a fairly thorough look at the first decade of the SBIC program, but do so at the aggregate level. Dominguez (1975) also considers ARD, J.H. Whitney, and the SBIC industry. Bygrave and Timmons (1992) provide in-depth discussion of the venture capital industry relative early, but predominantly for the 1970s and 80s.

run. The final section of the paper concludes and gives a quick overview of directions for continued research.

I. The Supply Side in Aggregate

By the 1940's, the notion of outside funding of innovation at the earliest phases, when the prospective new firm has only ideas and no products or services with obvious markets, represented a significant break from the ingrained practices of most financial intermediaries at the time. Georges Doriot lamented the lack of action, and in 1960, he wrote in his personal ruminations, "at that time—14 years ago—ARD was formed. Everyone wished it good luck – but few people participated, particularly since general business became good and the stock market went up considerably."⁴ Yet he clearly recognized the market failure that was a work on the financial sector at the time: "ARD started on its task – some people became impatient. They did not realize that to build new companies takes many years. From test tube to tank car: 7 years. Why spend seven years waiting for results when the stock market brings them in a matter of months, sometimes a matter of days."⁵

It was not just natural economic forces, but rather a regulatory environment in the United States at the time, that created, at least in part, the market niche that ARD tried to fill. The legal context in which ARD operated stemmed, of course, from the depression-era legislation that placed numerous restraints on American financial institutions in response to the perceived instability and corruption of the system prior to the stock market collapse starting in 1929. The regulation of the depression era followed other laws from earlier in the century that hemmed in the power of banks vis a vis the firms they financed. From a regulatory standpoint, ARD operated as a closed-end investment fund. Its shares were registered under the Securities Act of 1933, and the corporation itself was registered under the Investment Act of 1940. But ARD was exempted "from

⁴ Georges Doriot personal notes (Book I, p. 30). Doriot Collection (EC-MIT).

⁵ *Ibid.*

certain provisions of that Act to facilitate the purchase of its shares by other registered investment companies.”⁶

The difficulty of defining ARD or placing it in the proper “pigeon hole,” raises the broader issue of supplying venture capital within the US financial system of the time. Partly as a result of its history of regulation, American financial institutions became largely specialized by the mid-twentieth century. The costs of screening, monitoring, and advising, in addition to the long lags and great uncertainty in reaping returns, make small firm finance inefficient for most common forms of specialized financial institutions. U.S. commercial banks funded the vast majority of their business out of deposits, and they focused their assets on low-risk, highly liquid investments. For the most part, these banks could not and would not take the risks associated with funding high-technology industries. Some banks were simply too small to be able to diversify away the inherent risks and could not afford to properly screen and monitor new ventures. Large commercial banks also had disincentives to invest in risky technologies: many were complex organizations with managerial hierarchies not conducive to innovative contract design.⁷ Additionally, traditional commercial banks may have taken a more cautious approach to lending after the liquidity crises of the 1930s. As Doriot noted, “why go through the problem and diseases of new small companies when one can invest profitably in large well-known companies.”⁸

Even without these sorts of disincentives, limits on equity stakeholding would have prevented commercial banks from engaging in venture capital type contracts.⁹ Similarly, for the highly-concentrated investment banking sector, limits on equity stakeholding, their own problems of size and inflexibility, a focus on large-scale firms with track records (such as AT&T, the company whose former research lab employees

⁶ *Ibid.* Doriot’s notes contain numerous discussions of regulatory issues faced by ARDC due to its corporate structure.

⁷ There were exceptions, and Harry Healer (personal interview of February 17, 2005) pointed out the very creative approach of the First National Bank of Boston—by far the largest commercial bank in the area—and its “special industries division” led by Serge Seminanko, a Russian émigré.

⁸ Georges Doriot personal notes (Book I, p. 30). Doriot Collection (EC-MIT).

⁹ On the 1933 Glass-Steagall Act and the Banking Holding Company Law of 1956 see the text of the law at <http://www.fdic.gov/regulations/laws/rules/6000-100.html>. Also see the brief overview of the Graham-Leach-Bliley law at <http://minneapolisfed.org/pubs/region/00-06/kroszner.cfm>. Even with Gramm-Leach-Bliley, passed in 1999, many restrictions remain on commercial banking activities. For a discussion of the law, from the Securities Industry Association point of view, see http://www.sia.com/gramm_leach_bliley/.

started the semiconductor industry), and their lack of expertise in frontier technology, would prevent their direct engagement with small, innovative, new firms.

When the fund was launched, it had attracted contributions from an array of investors, both large institutional investors and individuals. For the time, this setup itself was an innovation, as an early prospectus pointed out: “a unique feature of the American Research and Development Corporation is that its stock is owned by institutional as well as individual investors. The institutional group is comprised of investment trusts, life insurance companies, and educational institutions and foundations who own in excess of \$1,500,000 as required in the original offering.”¹⁰ The institutional investors included such names as Adams Express, American International, Massachusetts Investors Trust, John Hancock Life Insurance—plus MIT, Rice, Penn, and Rochester—all of which ARD advertised in its prospectus. A number of individuals, often MIT-connected, also took part, typically with 200 shares: Alan Bemis, Ralph Flanders, Edwin Gilliland, Oscar Haussermann, Boyd MacNaughton, Henry S. Morgan, James J. Storrow, among others.¹¹

From 1946 to 1958 or so, besides the family-based firms, American Research and Development Corp. was the formal venture capital industry; its capital was the supply of venture capital. At the outset, ARD held just over 3.4 million dollars of capital, or more than 24.3 million in 2000 dollars.¹² It raised additional capital in 1949, 1950, and 1951 and again in 1960 and 1961; reaching nearly 90 million dollars (in 2000 terms) of paid-in capital by that point. The capital invested in ARD amounted to a small fraction of the large financial institutions of the time, and to a tiny proportion of the country’s output (Figure 1). The capital was substantial, however, within the context of finance for small, new, innovative businesses—a sector of the economy that gaining growing attention well beyond Massachusetts.

¹⁰ Reproduced page of ARDC prospectus, included in personal files of Georges Doriot. (Doriot Collection, EC-MIT.)

¹¹ These individuals also continued as shareholders at least through 1970, according to a list of 37 long-term shareholders compiled by Doriot in June of 1971. Henry Morgan is listed as having the unusually large (for an individual) allotment 1,000 shares at the outset. John Hancock insurance took the largest noted stake at the outset (10,000 shares), though Massachusetts Investors Trust ended up the larger stakeholder in 1970. Notably, Merrill, Lynch, Pierce, Fenner & Smith started out with only 20 shares (split-adjusted equivalent to 240 shares of 1970) but held over 130,000 shares in 1970. (Personal Notes, p. 227; Doriot Papers, EC-MIT).

¹² Based on the most conservative deflator—the implicit GDP deflator. Less conservative methods can yield far higher estimates. In future work, I hope to augment these estimates with supply figures for the family-based venture capital firms.

Private Venture Capital Partnerships

For many years, ARD operated without competitors, but by the late 1950s and early 1960s, a number of privately-backed venture capital partnerships appeared. One of the first was Draper, Gaither, Anderson, founded by General William H. Draper, Jr.. Like Doriot, Draper had an extensive background in military leadership and deep insights into the problems facing post-World War II economies worldwide. He served as Undersecretary of the Army, and was responsible for economic reconstruction of Germany and Japan under the Marshall Plan.¹³ His son, William Draper III, also went into the venture capital business early on, co-founding Draper and Johnson with Pitch Johnson in 1962 and then co-founding Sutter Hill Ventures with Paul Wythes in 1965. Many of the early private venture capitalists—the younger Draper and Johnson, plus Arthur Rock and William Elfers, for example—took MBA degrees from the Harvard Business School in the early 1950s, where Georges Doriot served as a role model.¹⁴

By their very nature, private venture capital firms are difficult to analyze quantitatively. Data gathering depends on self-reporting, which is variable. The main database for doing so begins ostensibly in 1969, but the aggregate figures are questionable for the first several years.¹⁵ In other words, there is little to go on for creating an aggregate figure for private venture capital from 1958 to the early 1970's.

¹³ Draper was Chief, Economics Division, Control Council for Germany, 1945-46; Military Government Adviser to the Secretary of State, Moscow Conference of Foreign Ministers, 1947; Under Secretary of War, 1947; Under Secretary of the Army, 1947-49; and United States Special Representative in Europe, with rank of Ambassador, January 1952 - June 1953. See Truman Presidential Museum and Library (oral history interview of January 11, 1972). Also see Draper-Richards' brief historical review of the Drapers' involvement in venture capital: <http://www.draperrichards.com/history/>. It is also notable that, as a student at NYU, Draper joined the Ford Peace Expedition to Europe, which, in Draper's words "tried to stop the war at the end of 1915." Draper chaired the delegation of thirty students. According to Draper's recollection, "Contrary to the public impression at the time the peace congress came fairly close to settling the war. However, it did not. Within six months or a year, I saw a number of the student delegates in the Army."

¹⁴ Doriot's influence spread through his work at ARD as well, of course, and former ARD employees formed more than one new venture capital company. Referring to his extended time working under Doriot at ARD, Bill Elfers of Greylock, says: "I never took Doriot's course at HBS, but I took it for 17 years thereafter." (phone interview with Henry McCance.)

¹⁵ Venture economics estimates total capital under management at some roughly static amount in the range of 2.5 to 3 billion dollars between 1969 to 1977, with new commitments estimated to be essentially the same as withdrawals. Quoted in Elfers (1995). Even in nominal terms, that represents a large possible span. In real (2000) terms, it could be as low as 5.8 billion in 1977 or as high as 11.5 billion in 1969.

For these earliest years of the industry, we have to go essentially firm by firm, or person by person.

William Elfers was one of the first employees hired on to the ARD team by Georges Doriot, and he had spent 17 years there when he decided to strike out on his own.¹⁶ In forming the firm, Elfers had learned from the ARD experience that a publicly traded corporate form fit poorly with the goals of a venture capital firm. Having to answer to shareholders, either in person or in the form of widely-disseminated, published reports, ran counter to the goals of a venture capital firm. Not only did some investments look poor when examined at their early stages, but others could be endangered by early revelation of proprietary knowledge of products or processes in development.¹⁷ He also resisted the idea of sole funding from one wealthy family (the Cornings) and instead insisted on gathering funds from a range of institutional and private investors. The Cornings, and their close relatives, the Murfey's, did invest, as did Sherman Fairchild, Walter Burke, Thomas J. and Arthur K. Watson, members of the Thorne and Polk families, as well as the Ayer/Rice Trust.¹⁸ In later rounds of fund-raising, and after considerable weighing of the pros and cons, Elfers and Greylock widened their circle of limited partners to include the substantial resources of university endowments.¹⁹

Elfer's experience with General Doriot taught him two critical lessons in creating his own venture capital firm: 1. pick great people, and 2. learn to let go.²⁰ Doriot was famous for focusing on the personal quality of entrepreneurs, even beyond the quality of the project or idea, and that emphasis continued in Elfer's firm. But one of the main reasons behind Elfer's decision to leave ARD and start his own firm was Doriot's unwillingness to "turn over the keys to the car."²¹ In running his own firm, he avoided that problem and was among the first to institute the pattern of overlapping generations of funds. These successive partnerships allowed Elfers to hand over responsibility for well-defined entities to the people he brought in as general partners.

¹⁶ This paper reports on the first such firm-level study; others are in progress.

¹⁷ Telephone interview with Henry McCance (February, 2005).

¹⁸ Elfers (1995), p. 44.

¹⁹ McCance (February, 2005) and discussed in Elfers (1995), pp. 50-53.

²⁰ McCance (February, 2005).

²¹ *Ibid.* Elfers relates similar sentiments in his recounting of the decision in Elfers (1995).

Greylock started out with less than five million dollars in capital when it began investing in 1965 (Figure 2). In real terms, however, its size was almost the same as ARD's when it started twenty years earlier—both around 20 million (2000 dollars). Despite being a private company dependent on fundraising from limited partners, Greylock continued to bring in new capital at a steady pace. Its capital increased fifty percent in real terms within the first five years, and by the early 1970s, Greylock had doubled its capital. The much-discussed stimulus of the Prudent-Man ruling of 1979 reveals itself in a capital increase for this one firm, but not in the dramatic fashion seen in the venture capital industry as a whole. Capital grew from 46.8 million in 1978 to 56.7 the next year. But Greylock's first fund, Greylock & Co., ended in 1979, so that total capital dropped back to 47.4 million in 1980, while the next wave (Greylock Partners & Co.) was still building. Two years later, capital exceeded 63 million (2000 dollars) and continued growing with the creation of new partnerships every two to four years. So, without the recourse to equity markets that ARD had used to grow, Greylock maintained a growth path quite similar to—if a bit steadier—than its forerunner (Figure 3). At the same time, industry-wide capital was increasing even more rapidly, with capital under management growing from approximately 7.6 billion (2000) dollar in 1979 to more than 18.5 billion (2000) dollars in 1983.²²

The first wave of SBICs

The small business investment companies (SBICs) brought the biggest new influx of capital for financing start-up companies and began to create something of a venture capital industry in the United States. The program was launched in 1958, but it had been many years in the making. The US is unusual, if not unique, in its enthusiasm for unbridled competition and the willingness of its government to go to great lengths to defend it. While this political involvement in markets seems intrusive on the one hand, it has proven over the past century to have induced a number of innovations in industry and finance. One key example for the story of venture capital is the Small Business Administration (SBA)—founded in 1953 with the purpose of aiding entrepreneurs

²² Calculated from Elfers (1995).

wishing to start or grow their companies. Like other supply-side factors in the birth of the venture capital industry, government programs to spur innovation and support small business long predate the onset of modern venture capital. The SBA in particular is the successor of the Reconstruction Finance Corporation (RFC), founded by President Hoover in 1932, and pushed by President Roosevelt, as one of the many programs created to aid businesses hurt by the Great Depression.

With the onset of World War II, it quickly became apparent that government contracts favored larger contractors and spurred them toward even higher production, leaving smaller firms fighting for market share. In line with the tradition of safeguarding competition, Congress created the Smaller War Plants Corporation (SWPC) in 1942, to provide financial and advocacy support to entrepreneurs. While some of the lending came directly from the SWPC, much of the work involved guarantees for loans granted by private-sector financial intermediaries and attempts to encourage patronage of small enterprise. At the end of the war, the SWPC activities were merged into the RFC and to some extent (primarily the educational functions for small entrepreneurs) passed on to the Office of Small Business in the Department of Commerce. In typical mid-century fashion, the Congress then created the Small Defense Plants Administration during the Korean War, but now the primary function was to certify small businesses for RFC lending. The final step in the progression came in 1953 with the unification of the various initiatives and offices under the Small Business Administration, whose function was to “aid, counsel, assist and protect, insofar as is possible, the interests of small business concerns.”

The SBA itself could not make equity investments in companies, and the concern over this gap in the financing of small companies continued to grow, especially as interest rates rose in 1955-57.²³ The Federal Reserve Board report of 1958 estimated the equity gap in the neighborhood of 500 million dollars per year at that time (at least 2.4 billion in 2000 terms).²⁴ Thus, it seemed clear that government intervention was needed in order to resolve this market failure. The structure of the program is perhaps typically American, as is the manner in which funding for SBICs has fluctuated so regularly with

²³ Noone and Rubel (1970).

²⁴ US Federal Reserve (1958). See the discussion in Noone and Rubel (1970) and in Osborn (1975).

political winds. While many varieties of involvement were raised and debated, the ultimate legislation dictated the creation of a new form of financial institution, backed by the government with tax and other incentives, but privately owned and operated. The program got off to a slow start, but it found new support with the inauguration of President Kennedy.²⁵

The SBICs were, and still are, a heterogeneous lot, and they reported their financial status with varying degrees of regularity. Thus, it proves difficult to pin down exact figures on their contribution to the volume of venture capital supply. The program began in 1958, and the first SBICs formed in 1959, but it was not until 1960 and 61 that the first significant wave of formations appeared. By 1964, SBICs numbered more than 700, but their forms and functions differed tremendously (Table 1).²⁶ They averaged well under a million dollars of capital in the early 1960s (roughly 3 to 4 million in 2000 terms), but a significant number raised far more. Of these, a handful gathered capital of the magnitude of ARD and the private venture capital firms of the time—Boston Capital, Capital Southwest, Electronics Capital, Growth Capital, Midland Capital, to name a few of the more prominent, publicly traded SBICs.²⁷ The listed SBICs were among the largest, and on average, they held between 30 and 35 million (2000) dollars of paid-in capital in the 1961-67 period.²⁸

It is difficult to know the full amount of capital and resources under management in the SBICs, since not all of them filed the “required” annual reports to the SBA. From 1961 to 1962, aggregate reported capital grew from 820 million (2000) dollars to over two billion (2000) dollars. The program looked prosperous for those first few years, with capital remaining in that range. But over the mid- to late-1960s, capital exited the SBIC sector, both through firms turning in licenses and going private and through firms exiting the venture capital market altogether. The available figures do exaggerate the decline somewhat, since a decreasing proportion of SBICs sent in reports over the period (Table

²⁵ See Noone and Rubel (1970) for a detailed discussion of the 1958 law, its advantages and shortcomings, and the early history of the program.

²⁶ Over the period 1963 to 1972, the reporting rate generally declined, giving the impression that the total capital of the SBICs declined more than it did. The average level of assets also appears to increase, though the effect is likely due to the bias imparted by smaller SBICs failing to report.

²⁷ Based on data collected from Moody’s. The database includes all SBICs identified as such and reported on in any of the manuals for 1960 to 1970.

²⁸ *Ibid.*

1). Still, by the late 1960s and early 1970s, real doubts appeared about the viability of the program, particularly as political—and therefore financial—support had fluctuated so markedly already in its short history.²⁹ Just as with ARD, the setup of SBICs lent itself to outside examination and premature pressure for performance and sometimes liquidation.

SBICs were structured differently from private venture capital firms, because they used sometimes substantial amounts of SBA-backed debt to finance their investment activities. Overall, in the first decade of the program, the SBA backed well over one billion (2000 dollars) of lending to SBICs. At the same time, the SBICs collected more than two billion (2000 dollars) of private capital and surplus. Annual private capital inflows fluctuated markedly; peaking at close to 80 million (2000 dollars) in 1967 and then falling off for several years, before climbing again in the mid- to late 1970s (Figure 4). At this aggregate level, the leverage of SBICs appeared to be very high, particularly in comparison to private venture capital partnerships or even ARD that carried essentially no debt. The leverage of individual SBICs varied tremendously, however, with the very smallest using far more debt proportionately than the largest. A similar negative relationship also holds for the subset of publicly traded SBICs.³⁰ Yet even the largest SBICs used substantial SBA lending—ranging between about 10 and 30 percent of capital and surplus in the late 1960s and early 1970s. Thus, it could be expected that SBICs would operate and perform differently from private venture capital firms.

II. A Sketch of Demand

Institutionalized venture capital emerged endogenously in the United States, meaning that supply factors provide only part of the story. Without demand from entrepreneurs, venture capital supply would have remained dormant. Early venture capitalists—Doriot at ARD, Elfers at Greylock, Draper, Rock, Johnson, and others in California, and the myriad SBICs and the SBA—all appeared in order to help fill a gap or solve what they saw as a market failure. As the US emerged from World War II, it was enjoying an enormous war-production boom that had finally ended a long period of stagnation and

²⁹ See Noone and Rubel (1970).

³⁰ Based on the database of SBIC-backed firms reported in Moody's from 1961 to 1968, described in the next section.

crisis. When the war ended, however, concerned over sources of continued prosperity began to build. While there had been recognition of the equity gap for existing small businesses during the depression, the end of the war brought renewed vigor to the urge to create entrepreneurial undertakings. The venture capitalists were, after all, entrepreneurs themselves; ready to identify a new market niche. This incipient demand was providing just the opening the first venture capitalists needed.

Doriot clearly recognized the opportunity, both in the form of new ideas (“After WWII great interest in new ideas, new technical developments – interest based on so many statements with reference to R and D having won the war.”) and embodied in individuals eager to start entrepreneurial ventures (“desire for freedom early in life...rebellion against discipline and so-called regimentation experienced by many technical men in the armed services or in large companies...excessive gathering together of too many engineers and others in large corporations leading to codification of minds and efforts”).³¹ In other words, there was seemingly a newly emerging pool of potential entrepreneurs. To this, he enumerated additional catalysts to explain “what has happened to create such interest on the part of so many people, to create new companies,” including the “greatly accelerated technical history” and “large government expenditures for R.D. Engineering Methods.” The incentives, he noted, were also financial and real: “inability of large companies to provide real – proper incentives to newly acquired young people highly technically trained as opposed to older people of higher rank but less specialized desirable knowledge,” and also “high income tax on individuals.”³² Doriot’s personal view of the large corporation perhaps colored his judgment of others’ perceptions. He clearly felt that large, established firms were not the place for those interested in innovation: “in too many large companies the only fun left is to resist change. There is variety in the small company versus boredom in the large one.”³³

While it is clear from Doriot’s writings that the first venture capitalists responded to a substantial perceived demand, it is difficult to quantify precisely such demand. Since venture capitalists’ first job is selection, much of the demand for their services goes

³¹ Quoted from personal papers of Georges Doriot, notes dated January 1960, p. 30. (EC-MIT). Henry McCance notes similar factors (McCance, 2005).

³² *Ibid.*

³³ *Ibid.*, p. 31.

unmet. Others may select themselves out in the belief that they will not receive funding. In addition, the venture capital firm may offer to fund a project but be unable to persuade the entrepreneur to accept the deal. In most cases, therefore, we can only observe the amount of funding provided. Those figures tell us only about the proportion of demand that was met. In the case of ARD, however, we have some evidence on demand through the notes kept by Doriot on projects received and reviewed. The ARD records demonstrate just how strong demand was, particularly in the first few years of operations. Even in their first year, ARD received nearly two hundred projects, and by year two, that number increased to 463. Perhaps tellingly, projects received peaked at 477 in 1949 (Figure 5).³⁴ Over the next few years, new projects received declined almost 80 percent, to just over 100 in 1953. While the early 1960s brought more prospects, the numbers never returned to the levels of the early post-War years.

In all but a handful of years, ARD financed no more than five projects—often only one or two. While there were financing constraints on ARD, so that it could not perhaps fund every worthwhile idea that came along, there was also periodic dissatisfaction with the quality of projects being presented as well as some uncertainty about their own decision-making. In September of 1961, Doriot undertook a study of the projects received and financed, noting that “the following list should be studied carefully with particular reference to the relationship between projects received, financed, and the size of ARD. Obviously, ARD is not growing harmoniously.”³⁵ He noted further, “it is quite possible that should we have more and better investment opportunities, we might be pushed and perhaps wisely so in considering the sale of Giannini – HVEC – Camco, etc. Theoretically anyway new investments should have greater growth potential than some of these companies might.”³⁶ Even more pointedly, he recalled writing in May of 1954 that “We do not have a single interesting project. We do not know of any interesting projects. We do not know where to go to find interesting projects.”³⁷ While he bemoaned the lack of personnel to bring in projects, he clearly felt that the bigger problem was a loss of

³⁴ Personal notes of Georges Doriot, dated May 1965, p. 229. (EC-MIT).

³⁵ Personal notes of Georges Doriot, dated September 2, 1961, p. 74. (EC-MIT).

³⁶ *Ibid*, p. 75. HVEC refers to High Voltage Engineering, one of their first investments (1946) that they were still holding in 1961. Giannini was from 1951, while Camco was from 1953. (according to chronological list of investments in Doriot’s personal notes, p. 113. EC-MIT.)

³⁷ *Ibid*.

direction at ARD itself: “obviously we must work more aggressively and effectively. We must restudy our list of project sources and go after the most promising ones in a hard way. We must be more creative. We must be young again.”³⁸

Similar ruminations appear in Doriot’s notes in early 1963 and again in May of 1965, at which point, he enumerated 13 different “good projects lost.” The list included Alpine Geophysical Associates, Philip A. Hunt Chemical, and Eastern Smelting & Refining and several others who turned down ARD’s offer of funding. Some went elsewhere for financing—either to competitors, such as an SBIC—others raised capital publicly or from shareholders, and still others were bought out by other companies. So, in addition to feeling as though they were not bringing in the optimal numbers or quality of projects, Doriot had a growing sense that they were also losing out on some of the good ones they did see. From the vantage point of a few more decades later, however, it is worth noting that there were no DEC’s among the “good projects lost.”

These notes on ARD’s project review and selection, as well as rejections, underscore the difficulty of defining and measuring demand. In the vast majority of cases, external observers are not privy to that sort of information. Thus, the best we can do in general is to look at the funding that took place. The companies that were funded at least provide some clue to the sources of demand for venture capital. It is now common for venture capital firms to fund specific types of firms and technologies, so in a sense, the venture capitalists shape the demand they see by advertising their sectoral or technological preferences. In the formative years of the industry, however, there was far less specialization at the firm level, and the first venture capitalists sought investments in a range of areas. New technologies of one sort or another formed the basis for many (but not all) of the projects in need of finance. Indeed, it was the appearance of so much potential technological innovation that spurred the creation of the venture capital industry when it did. Many of the earliest post-war technologies, particularly those surrounding computing devices and energy, stemmed from the massive government research and production efforts during the Second World War and represented entirely novel fields of science and technology. The backlog of inventions and possible innovations not applied during the depression and war suddenly could be brought to production with the hope of

³⁸ *Ibid*, p. 76.

finding a ready market. Yet the new technologies raised a new information divide between researchers or potential entrepreneurs on the one hand and financiers and potential investors on the other; increasing the standard information-related problems and producing new, higher levels of risk.³⁹

Technology in itself is neither necessary nor sufficient to create the conditions for successful venture capital funding. The true key is strong growth potential, and high-tech sectors almost by definition can produce rapid growth. Many venture capital investments, however, go to low or medium-tech companies. Indeed, perhaps the first venture capital target of all—Spencer Chemical Company in Kansas—bears little resemblance to the common modern perception of this sort of financing. The investment, made by J. H. Whitney & Co., formed the working capital for Spencer’s conversion of a war-time munitions factory into an ammonium-nitrate fertilizer plant.⁴⁰ While the entrepreneur secured bank lending to purchase the plant from the government, the bank required a large investment of cash for operations. Whitney provided the funds on the basis of preferred stock and a small amount of equity (that amounted to one-third of the company’s equity). Whitney redeemed the preferred shares within a year, and the \$250,000 in equity appreciated at least 40-fold during the same period. Thus, the basic principle of equity financing appeared in this contract, and the key objective of rapid growth materialized as well. Yet the technology involved in the target company was less than revolutionary.

While ARD invested almost solely in projects with proprietary new technology as their foundation, the types of technologies varied considerably over time and even within relatively short time periods. ARD made one of its first investments in High Voltage Engineering, which was founded in 1946, and was the “industrial pioneer” in the area of

³⁹ The technology factor combines two separate issues: First, there were new technologies that the public—that is, existing financial institutions and investors—did not understand and whose marketability they could not easily assess. This kind of information problem would be the same sort of problem that had always been faced in the past. Second, it may be that the new technology differed significantly from past technological revolutions in the potential for laypeople to grasp or for financial experts to assess. The latter point is far more difficult to assess than the former but deserves further exploration as a factor that created a need for a new sort of financial institution that combined much deeper knowledge and experience in science and technology with expertise in finance, markets, and management. Certainly, ARD was unusual for its scientific expertise.

⁴⁰ The facts appear in the interview by Gupta (2000) of Benno Schmidt, who was one of the first partners of J. H. Whitney & Co.

particle accelerators (machines that produce synthetic radiation), both in research and in manufacturing. It also produced X-ray machines for hospitals as well as for industrial applications (such as detecting “minute defects” in nuclear reactors or turbine blades for jet engines).⁴¹ Less typical were ARD’s investments in food processing—Island Packers and Apple Concentrates—which did apply new technologies for the time (1948 and 49, respectively) but which did not fare well, certainly not at the level of Whitney’s famous orange juice concentrate (Minute Maid). Overall, chemicals constituted the largest category of investment early on, but electronics and scientific instruments took the lead by the mid-1950s.⁴² These areas continued to lead into the 1960s, but other areas, such as professional services, technical publishing, and education & media took up more funding as well.

Greylock (private venture capital partnerships)

The Greylock experience highlights once again both the difficulty of defining demand and the extent to which early venture capital firms needed their own entrepreneurial talent in order to create demand of sufficiently high quality. It is clear from Elfer’s recollections of the firms’ early years that new projects did not simply appear on their doorstep. Developing relationships with potential investment targets often meant a courting period of months and even years before the founder or entrepreneur would accept the outside involvement of a venture capital firm. Even if venture capital could improve the performance of a firm by some objective, financial measure, the goals of company owners—particularly in small, family-owned firms—could run counter to such expansion of scale or scope. As a result, at least a few of Greylock’s investments meant little equity participation, because founders wanted to maintain tight reigns on their firms.⁴³

Greylock started out with eclectic tastes in investment targets, funding a relatively diverse array of companies: specialty metals, cable television, chemicals, electronics and

⁴¹ ARD annual report to shareholders (various years).

⁴² Annual reports and internal documents of ARD (EC-MIT). See also Hsu and Kenney (2004) for sector breakdowns of all investments in various periods. They use very broad categories, so the real heterogeneity of the companies is less apparent.

⁴³ See the discussions of the Shipleys or Brookstone, for example, in Elfers (1995).

components of various types, medical equipment, specialized trade publishing, and several others.⁴⁴ Like ARD, Greylock funded only a portion of the projects it considered, though the record is not laid out in the great detail that Doriot provided in his personal notes. Given similar (real) resources in its early funds, though, Greylock funded more projects per year; averaging around 7 or 8, but ranging from 2 to 15. Investment numbers naturally cycled, partly with the economy and partly with the creation of new partnerships (which itself related to the broader economy). The biggest years (prior to the 1980s expansion) came as the first fund was getting going, in 1967 (13) and 68 (11) and then again as the third fund started in 1979 (15).

As the venture capital industry took off and began to attract new entrants in the 1970s, Greylock's sectoral strategy changed. Even in the early 70s, Greylock stood out as one of a relatively small number of funds, particularly of that caliber and vintage, and it enjoyed something of a 'buyer's market' in the prospects it considered.⁴⁵ Given its position, it also focused more on expansion phase investing, letting the family-based venture capital firms take on the riskier start-up funding.⁴⁶ As more and more money flowed into the venture capital industry in the early 1980s, however, competition for the best projects increased. Greylock, like some other established venture capital firms at the time, used a strategy of specialization to differentiate itself in the growing market. Because of its position, it was able to move into more start-up funding and honed in on biotechnology and information technology sectors. As more and more dedicated biotech venture capital firms appeared in the 1990's, Greylock responded by moving more into information technology, where it had a greater comparative advantage.⁴⁷

SBICs

If ARD and Greylock did not maintain special areas of focus early on, the SBICs as a group were all over the map. Looking at a breakdown of financings by sectors

⁴⁴ In addition to the various industries they did fund, Elfers included an array of possible targets in the plan he circulated to prospective investors. These included nuclear military and industrial controls, land development for retirement, residential, and commercial use, oceanography, and local utilities, among others. See Elfers (1995), pp. 17-18.

⁴⁵ McCance (February, 2005).

⁴⁶ *Ibid.*

⁴⁷ *Ibid.* This pattern is also clear in the recounting of specific investments in Elfers (1995).

demonstrates how different the SBICs were as a group from ARD or the private venture capital firms. Less than one-third of SBIC financings went to manufacturing industries, and quite a bit less than that early on, particularly in durable goods sectors (ranging from 15 percent in 1968 to 22 percent in 1972). An enormous amount of SBIC funding went into real estate development, contract construction, retail trade, and services—not areas commonly associated with venture capital investments today, and not much more so at the time.⁴⁸

The picture at the individual level is very different, and this fact underscores the heterogeneity of the SBICs. Many of them were quite distant in form and function from the common conception of a venture capital firm. Some of them, however, were very similar; a few were even run by the same people who also ran private venture capital partnerships. The more venture-capital oriented SBICs did focus on technology-based sectors. The publicly traded SBICs, however, differed substantially from the rest of the pool in size, structure, and portfolios. They invested in technology-based firms much in the way that ARD or Greylock or other private venture capital partnerships did. In fact, some of the SBICs, particularly those in geographical proximity to the major private partnerships co-invested with them in certain target companies. Moreover, a rudimentary statistical test of the SIC codes of listed investment targets reveals only moderate differences in the distributions between ARD and the publicly traded SBICs.⁴⁹ Notably, about 70 percent of the listed SBIC targets fell into the 3000 range of SIC codes, while slightly over 80 percent of listed ARD targets were in those sectors. These sectors cover most areas of manufacturing, in particular those relating to metals, plastics, computer hardware, controls, electronics, industrial machinery, and similar. The next largest sector (SIC 5) also related to manufacturing in both cases, covering various electronic devices and components. Given the timing differences, the sectoral similarities are even more striking.

⁴⁸ Private venture capital firms, like Greylock, did make investments that could be classified in this area, and in fact, Elfers advertised real estate development as one possible area of investment in his original business plan for Greylock.

⁴⁹ The test is based on target firm data collected from Moody's and described in the next section.

III. Performance

By now, the organizational and strategic differences among ARD, Greylock, and the many SBICs are clear. The question remains, however, whether these disparities among venture capital institutions translated into marked variation in performance—for the venture capital firms or for the firms they financed.

Performance of the venture capital firms

It would be natural to expect that the government-backed SBICs would have performed on average less well than either the publicly-traded ARD or the privately-funded limited partnerships, like Greylock. Early studies of venture capital performance showed a notable advantage of ARD over the SBICs.⁵⁰ Of course, since the comparison happens to cover the seven years from 1962 to 1969, it pits the publicly-held SBICs in their first few years against the more mature ARD in the period of its homerun investment in Digital Equipment. Thus, in those years, ARD's net asset value increased at 169 percent per year on average, while the other venture capital firms analyzed grew at highly variable rates—anywhere from negative one percent to positive 70 percent. This latter one was Narragansett Capital, the SBIC started by Royal Little, nephew of Arthur D. Little, and founder of Textron—often considered the first conglomerate in the United States and the purchaser of ARD.⁵¹

For the publicly-traded venture capital firms, it is possible to investigate the factors that contributed to performance based on their published reports. Since data on portfolio returns appear irregularly, it is useful to examine reported market value compared to book value of portfolio shares. A number of characteristics could plausibly be expected to improve an SBICs performance: size, proportion of assets invested, book value of investments, leverage, and possibly experience (trend), for example. Using a

⁵⁰ Noone and Rubel (1970) in particular, but Liles (1977)—comparing only one SBIC against ARD—as well. The particular SBIC that Liles chose was the one run by Joe Powell, a former top ARD employee. Also see the survey of smaller studies in Bygrave and Timmons (1992). They point out that the “folklore” figures of 30-50 percent returns were just that; more accurate return rates fall in the teens and occasionally up to 20 or 30 percent. Returns over 30 percent were rare up to that point.

⁵¹ Royal Little is also claimed to have said, “Never let an inventor run a company. You can never get him to stop tinkering and bring something to market.”

panel regression of market-to-book ratios for the 48 SBICs reported on in Moody's from 1961 to 1967, I evaluate the importance of each of these factors (Table 2). The first and most obvious potential influence is the size of the firm. Size might be considered an advantage for venture capital firms, if there are economies of scale or scope in evaluating projects for example, yet it turns out to be insignificant in predicting performance of the publicly-traded SBICs. The proportion of firm assets that are invested in portfolio companies should presumably increase value—assuming investing in the selected target companies is better than holding government securities or some other conservative investment. While positive, investment rates are statistically significant in only some specifications.

The most significant factors turn out to be the book value of assets, firm leverage, and trend. This last variable is strongly positive, indicating that market values increased over the period—a time that happened to favor equity investing—even controlling for the changes in other firm characteristics. One such characteristic is leverage of the SBICs, a factor that relates negatively to performance. Such a negative relationship makes sense, since greater recourse to debt financing requires venture capital firms to hold some portion of assets in more liquid or marketable form and not so much in long-term equity stakes of potentially risky, small firms. Finally, book values of assets are negatively related to value. Such a relationship would also be expected, assuming the venture capital firms tried to invest in targets it viewed as undervalued.

Performance of target companies

Another way to evaluate the performance of venture capital firms is to study the performance of the companies they finance. Studies such as these have tended to focus on the more recent period and have compared companies with (mostly) private venture capital backing to those with none at all.⁵² Little data exists for earlier periods, and

⁵² Sapienza (1992) on firm growth, Kortum and Lerner (1998) on patenting, Berger and Udell (1998) on small firm financing, and Brav and Gompers (1997) on initial public offerings, for example. Also, see Gompers and Lerner (2004) for further details on similar studies.

therefore few studies have undertaken the task of evaluating the performance of early venture-backed firms, especially those funded in the 1950s and 60s. This section offers a first view of a new longitudinal database that I am constructing on the performance of companies that have been financed by venture capitalists. At this stage, the firms included are those that received funding from ARD, Greylock, or one of the publicly-traded SBICs and that also made it to a public offering of equity and therefore appear in published records. The database currently contains information on 127 companies—39 for ARD, 26 for Greylock, and 62 for the various SBICs.

The main performance measures thus far included are various measures of monthly returns on common equity over an average of 200 months, or more than 16 years per firm. The data spans the period 1950 through 1985, though the original investments predominantly came between 1946 (ARD only) and the early 1970s (mostly Greylock); the SBIC targets were financed in the 1960s. This longer time span permits a truly long-run evaluation of performance of portfolio companies, some of which remain connected to the original funding firm—via equity stakes, through corporate governance relationships, and often simply by maintaining personal relationships. Even at a very rudimentary level, the results indicate a positive average monthly return in excess of the market (the S&P 500) for the entire period studied here. On average, portfolio firms outperformed the larger market by 1.19 points per month. Of the three groups, however, the Greylock firms fared the best on average (and at the median): 1.16, 1.75, and 1.02 excess points per month for ARD, Greylock, and SBIC firms, respectively.

Examining average monthly excess returns over the period, it does appear that the three groups of firms performed along similar paths, though there are a few years in which Greylock firms clearly performed better or worse than the others (Figure 6). Based on average cumulative returns, on the other hand, it appears that ARD firms significantly outperformed the others, though of course those firms had longer runs (Figure 7). The SBIC and Greylock groups are more similar in vintage, but their cumulative returns follow different paths: Greylock performing at lower rates early on but at higher rates toward the end. An estimated density function for Greylock-backed stock returns also shows greater spread than do the comparable densities for ARD and SBIC-backed stocks (Figure 8). Such patterns would be consistent with a riskier

investment strategy for the private partnership compared to the publicly-traded and government-backed SBICs, as should be expected. Statistically speaking, however, the differences among the three sets of firms are insignificant, so this finding in itself does not demonstrate a marked advantage of the privately-backed limited partnership form. Indeed, it is rather remarkable that the SBIC-backed firms held their own throughout such an extended period, particularly in light of the less than favorable evaluations of the SBIC program at varying points in its history.⁵³

It is useful to take the analysis a bit further and examine multiple factors in common stock performance—for which there is, of course, an enormous literature to go on. In particular, financial economists have long been intrigued by the apparent underperformance of initial public offerings of common stocks and have sought to determine the consistency of the phenomenon and to identify explanatory factors, if they exist.⁵⁴ In a related vein, others have studied the cross-section of returns on common stocks in an effort to test the reliability of the CAPM and have often found explanatory power in such factors as firm size and book-to-market ratios.⁵⁵ In this section, I use something of a hybrid approach, examining the factors that explain the returns to venture-backed stocks in a panel setting. Because we are concerned with the impact of factors that do not change over time, and we would like to highlight them rather than assume them to be incorporated into a firm-level fixed effect, the models here mostly use a random-effects regression.

The most significant factor predicting venture-back stock returns—whether dividend adjusted or not—is the average return on the S&P 500 (Table 3). The coefficient estimate is consistently positive and in fact remains a bit more than 1.5 in all cases. This result confirms the impression from the simple comparison of returns, that

⁵³ Naturally, these comparisons exclude target firms that did not go public, so there is a selection bias in the sample. That bias is problematic if the various venture capital firms took public companies of differing quality.

⁵⁴ See, for example, Brav and Gompers (1997) and Gompers and Lerner (2001), who find little evidence of consistent underperformance. These studies contrast with a number of studies on the more recent period, such as Ritter (1991), Loughran and Ritter (1995), and some for the period studied here—Ibbotson (1975), for example. See also Bygrave and Timmons (1992) who demonstrate marked underperformance of venture-backed IPOs in the early 1980s.

⁵⁵ See Fama and French (1996) for example. Fohlin and Reinhold (2006) offer an “out-of-sample” study in the form of common stocks listed on the Berlin Stock Exchange in the early 20th century. They also use a panel approach to investigate the impact of universal bankers sitting in corporate boards.

the venture-backed firms outperformed the broader market. It is also clear from the regression results that the different venture capital firms overall performed similarly to each other. Greylock firms achieve slightly higher returns than ARD firms, and SBIC firms earned slightly less, but the differences are statistically insignificant, once the other factors are considered. Because the venture capital firms funded the firms at different points, the regressions also control for the age of the firms. Age, however, plays little role, regardless of backing.

Despite the common finding that size correlates to stock returns, in this sample, there is essentially no size effect. Book-to-market value of shares, on the other hand, relates negatively and significantly to stock returns. Typically it is assumed that the value effect would be positive: high book-to-market stocks, indicating relatively low market prices, have often grown faster. Such relationships have little theoretical backing, though, and they appear to lack robustness or generality.⁵⁶

Finally, it is interesting to examine the returns to these venture-backed companies in a shorter time-period, closer to the original funding by the venture capital firm. Constraining the period to the 1960s and 1970s does alter some of the results (Table 4). In particular, a very small size effect appears, such that larger firms produce slightly higher returns—opposite of the expected effect for “growth” firms. Moreover, the value effect reverses: high book-to-market firms in this sub-period show stronger performance. Trading volume for the individual stock relates positively to returns, and there is a positive trend in returns over these two decades that did not appear over the longer time-frame. Despite the shortened window, the venture-backed firms still outperformed the S&P 500; in fact, even more so, on average (mostly during the hot market of the mid- to late-1960s).

Of particular note, in the 1960s and 70s, when Greylock was relatively new, the firms it backed returned lower on average than ARD firms. At the same time, the SBIC-backed firms performed about the same as ARD firms on average. Over the period, however, Greylock-backed firms increased their returns faster than the both of the other sets of firms. This result reinforces the importance of examining the longer-run

⁵⁶ Since the measure is available for a relatively small subset of the firms here, I also exclude book-to-market in several specifications. As I continue to gather data, I will update the results and will also include a comparison sample for non-venture-backed firms and for the broader market.

performance of venture-backed firms and highlights once again the material differences in the strategies and organization of different types of venture capital institutions.

IV. Conclusions and Directions for Future Research

This paper has shed new light on the venture capital industry from the 1940s through the 1970s; the period in which modern-style venture capital organizations were created. By considering the details of supply and demand for venture capital services, the paper underscores the critical roles that individual entrepreneurs played in creating a viable venture capital industry in the United States: On the supply side, entrepreneurial financiers like Georges Doriot, William Elfers, and the many founders of SBICs; on the demand side, the pool of qualified and interested entrepreneurs that appeared in the aftermath of World War II. The paper has also begun the process of quantifying the aggregate supply of and demand for venture capital finance in the era before large-scale databases were collected. In addition, by examining the personal papers of Georges Doriot, the driving force behind the first public venture capital company, as well as the recollections of a few venture capitalists of the 1960s vintage, the paper provides some qualitative corroboration to the quantitative results.

The paper also offers new results on comparative performance of firms backed by ARD, Greylock, and the publicly traded SBICs. The findings here suggest strong performance among venture-backed firms overall, even at this early stage of the learning process, with common stock returns consistently outperforming those of the broader market (S&P 500) on average. In other words, investors at the time would have fared significantly better by investing their funds in a comprehensive portfolio of venture-backed firms starting as early as the first such investments went public. While there is some evidence that the privately-backed venture capital firm offered the greatest advantages to its portfolio firms—or at least selected better performers—the differences are statistically weak. These firm-level returns also demonstrated higher variance, and therefore risk; so higher returns, as expected, came with a cost. Indeed, for the narrower time frame of the 1960s and 70s, Greylock firms performed below the ARD and SBIC-backed firms on average, but they also grew more rapidly over that period.

This paper sets the stage for a number of possible new areas for research, and reveals a number of areas in which additional data are required. Several such projects are underway. First, at the firm level, I am in the process of expanding the current target company database in several ways: 1. including more comprehensive financial data on the publicly-traded firms already covered; 2. including financial data on private firms (already identified as venture-backed), though data are much harder to locate for them, particularly if they went out of business relatively early on; and 3. augmenting the list of venture-backed firms for the period up through the 1970s, based on archival work and personal interviews with other early venture capitalists, and then gathering the necessary financial data; and 4. compiling a baseline sample of non-venture-backed firms, both public and private, in order to draw more detailed comparisons. Second, at the industry level, I am continuing to expand the basis for accurate estimates of aggregate supply and demand for venture capital financing, in large part through accumulating data from individual funds started between 1958 and the mid-1970s.

These new data will permit more extensive quantitative analysis of the early venture capital market. The following represent just a few examples of the areas I am investigating:

- accounting performance of target firms
- target firm survival rates
- target firm exits via buyouts versus IPOs
- initial returns on venture-backed IPOs
- involvement of venture capital firms' general partners in target company governance and its impact on firm performance.
- patenting activity and other measures of innovation
- aggregate growth of venture capital supply and demand
- time-series analysis of venture capital, innovation, and economic growth

These new projects will then feed into the larger project on the development of venture capital organizations and similar institutions in the US and Germany and their relationship to scientific and technological innovation over the last half of the twentieth

century. More broadly, this project will help in understanding the relationship between financial and economic innovation and the reasons why institutions vary so much in design and performance over time and across places.

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Table 1. Number and Capital of SBICs

Year	Number of SBICs	Number reporting	Report rate	Capital+surplus (millions 2000 dollars)	Average capital	Leverage
1959	16					
1960	108					
1961	298	204	68	820.57	4.02	0.10
1962	590	516	87	2,011.22	3.90	0.13
1963	669	615	92	2,046.06	3.33	0.25
1964	722	649	90	1,934.39	2.98	0.38
1965	708	645	91	1,829.60	2.84	0.46
1966	686	606	88	1,715.57	2.83	0.58
1967	604	548	91	1,551.92	2.83	0.67
1968	527	441	84	1,391.24	3.15	0.66
1969	454	373	82	1,338.87	3.59	0.64
1970	451	331	73	1,206.15	3.64	0.70
1971	442	288	65	1,123.79	3.90	0.76
1972	436	274	63	1,126.43	4.11	0.86

Sources: Noone and Rubel (1970), Dominguez (1975), SBA (various years). Leverage is the ratio of SBA funds to private capital and surplus for all reporting SBICs.

Table 2. Market-to-Book Value of Assets for SBICs, 1961-1967

	Dependent variable: market/book value of assets		
Total paid-in capital	0.00 (0.07)	0.00 (0.40)	0.00 (0.50)
Percent of assets invested in portfolio companies	0.08 (2.36)*	0.03 (0.83)	-0.06 (1.19)
Book Value Per Share	-0.01 (3.35)**	-0.01 (2.74)**	-0.01 (2.69)**
Year	0.04 (2.09)*	0.05 (2.33)*	0.05 (2.75)**
Leverage (Debt/Total Assets)			-0.23 (3.37)**
Constant	-70.95 (2.05)*	-87.16 (2.30)*	-98.79 (2.71)**
Observations	167	167	167
Number of SBICs	48	48	48
R-squared		0.12	0.20

Note: Absolute value of z statistics in parentheses. * significant at 5%; ** significant at 1%. The first column uses a general estimating equation with robust standard errors. The second two columns use standard fixed effects regression.

Table 3. Factors Associated with Common Stock Returns

	Monthly Return		Dividend-Adjusted Monthly Return	
Size (Market Capitalization)	0.000	0.000	0.000	0.000
	(0.04)	(0.47)	(0.07)	(0.40)
Return on S&P 500	1.526	1.536	1.573	1.538
	(55.66)**	(42.29)**	(53.70)***	(42.08)***
Book-to-market value of common equity		-0.001		-0.001
		(4.21)**		(4.40)***
Age since incorporation	0.000	0.000	0.000	0.000
	(0.68)	(0.15)	(0.12)	(0.09)
Greylock target firms	0.006	0.002	0.005	0.001
	(1.09)	(0.27)	(0.54)	(0.05)
SBIC target firms	-0.003	-0.004	-0.003	-0.005
	(1.17)	(1.12)	(0.56)	(0.70)
Greylock*age	0.000	0.000	0.000	0.000
	(0.35)	(0.39)	(0.17)	(0.30)
SBIC*age	0.000	0.000	0.000	0.000
	(0.82)	(0.46)	(0.18)	(0.33)
Constant	0.033	0.024	-0.03	-0.024
	(4.02)**	(0.96)	(1.46)	(1.17)
mainsic==1	-0.026		0.04	0.064
	(2.36)*		(1.76)*	(1.85)*
mainsic==2	-0.021	-0.006	0.046	0.052
	(2.37)*	(0.24)	(2.13)**	(2.39)**
mainsic==3	-0.023	-0.012	0.039	0.039
	(2.88)**	(0.48)	(1.94)*	(1.94)*
mainsic==5	-0.02	-0.01	0.043	0.045
	(2.32)*	(0.40)	(2.03)**	(2.08)**
mainsic==6	-0.028	-0.05		
	(2.10)*	(1.67)		
mainsic==7	-0.023	-0.011	0.028	0.039
	(2.26)*	(0.43)	(1.08)	(1.42)
mainsic==8	-0.029	-0.014	0.033	0.038
	(2.65)**	(0.54)	(1.37)	(1.52)
Observations	20,132	10,625	17,193	10,625
Number of target firms	98	52	84	52

Note: Absolute value of z statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4. Factors Associated with Common Stock Returns, 1960-1979 only

	Excess Return		Monthly Return	Dividend-Adjusted Monthly Return		
Size (Market Capitalization)	0.000 (1.70)*	0.000 (1.35)	0.000 (2.20)**	0.000 (1.80)*	0.000 (0.93)	0.000 (1.30)
Return on S&P 500	0.712 (20.13)***	0.677 (14.97)***	1.579 (55.62)***	1.744 (47.91)***	1.67 (36.75)***	1.734 (47.57)***
Book-to-market value of common equity		0.000 (2.71)***			0.000 (2.71)***	
Adjusted trading volume	0 (6.49)***	0 (5.34)***	0 (6.11)***	0 (6.28)***	0 (7.13)***	0 (8.69)***
Greylock target firms	-0.063 (3.31)***	-0.05 (2.00)**	0.005 (0.41)	-0.064 (3.29)***		
SBIC target firms	-0.004 (0.52)	-0.008 (0.85)	-0.004 (0.62)	-0.004 (0.54)		
Greylock*trend	0 (3.72)***	0 (2.34)**	0 (0.23)	0 (3.84)***		
SBIC*trend	0 (0.32)	0 (0.33)	0 (0.50)	0 (0.38)		
Trend	0 (2.87)***	0 (1.68)*	0 (0.45)	0 (2.80)***	0 (3.68)***	0 (5.62)***
Constant	-0.032 (2.88)***	0.004 (0.35)	0.009 (2.03)**	-0.068 (3.36)***	-0.015 (2.82)***	-0.018 (4.25)***
mainsic==1	0.032 (2.82)***	0.005 (0.39)		0.07 (3.42)***		
mainsic==2	0.026 (2.47)**	-0.002 (0.19)		0.062 (3.09)***		
mainsic==3	0.025 (2.58)***	-0.006 (0.62)		0.061 (3.16)***		
mainsic==5	0.025 (2.39)**	-0.007 (0.57)		0.063 (3.13)***		
mainsic==6	-0.035 (1.62)	-0.046 (2.01)**				
mainsic==7	0.035 (2.75)***			0.078 (3.70)***		
mainsic==8		-0.029 (2.01)**		0.034 (1.57)		
Observations	13,394	7,923	19,267	12,873	7,923	12,873
Number of target firms	79	51	105	79	51	79
R-squared					0.16	0.16

Note: Absolute value of z statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Figure 1. ARD Paid-In Capital, 1946-1968

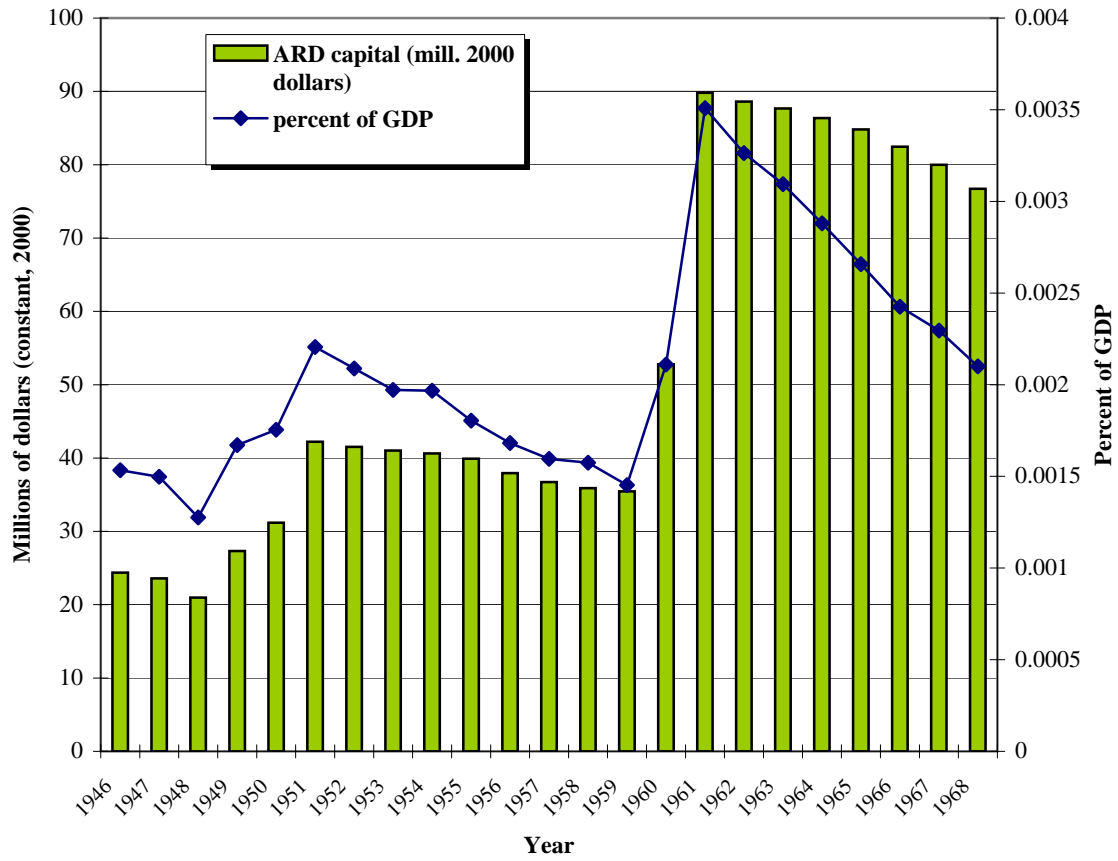


Figure 2. Greylock Paid-In Capital, 1965-1982

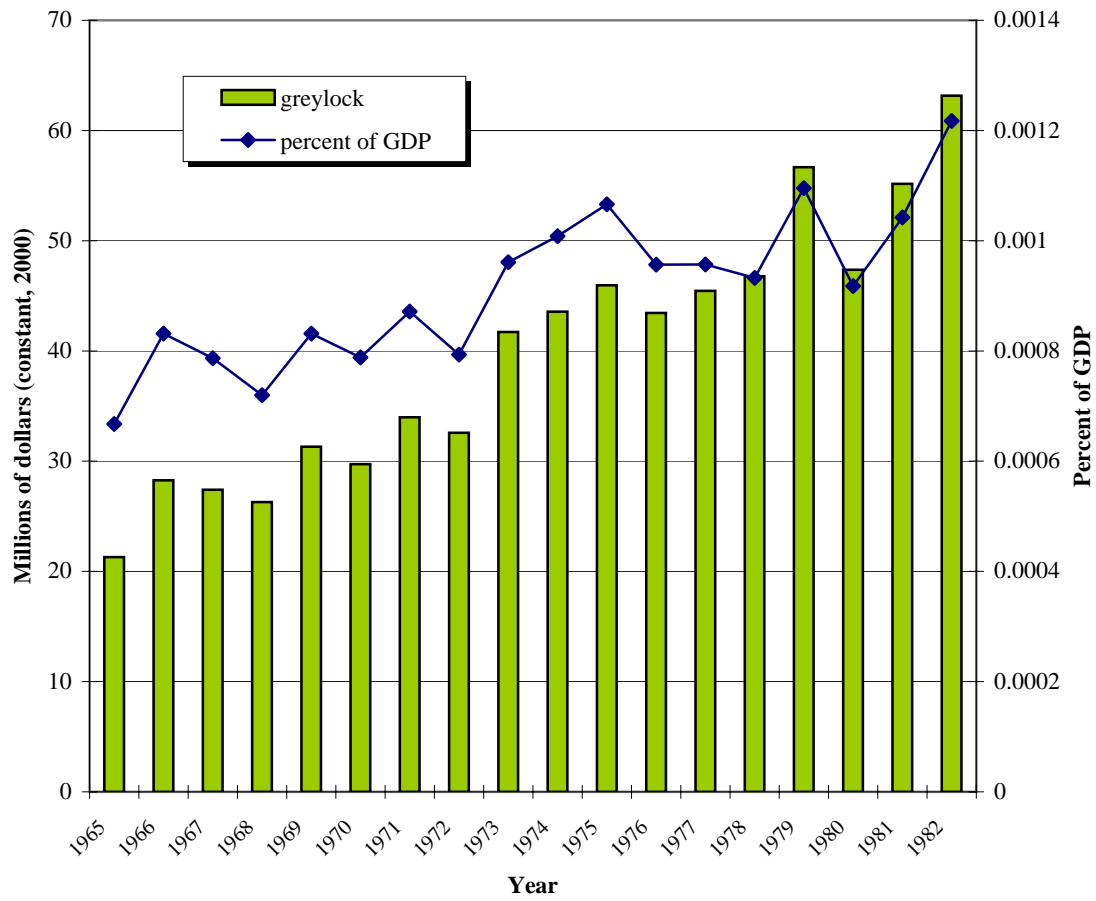


Figure 3. ARD and Greylock Capital

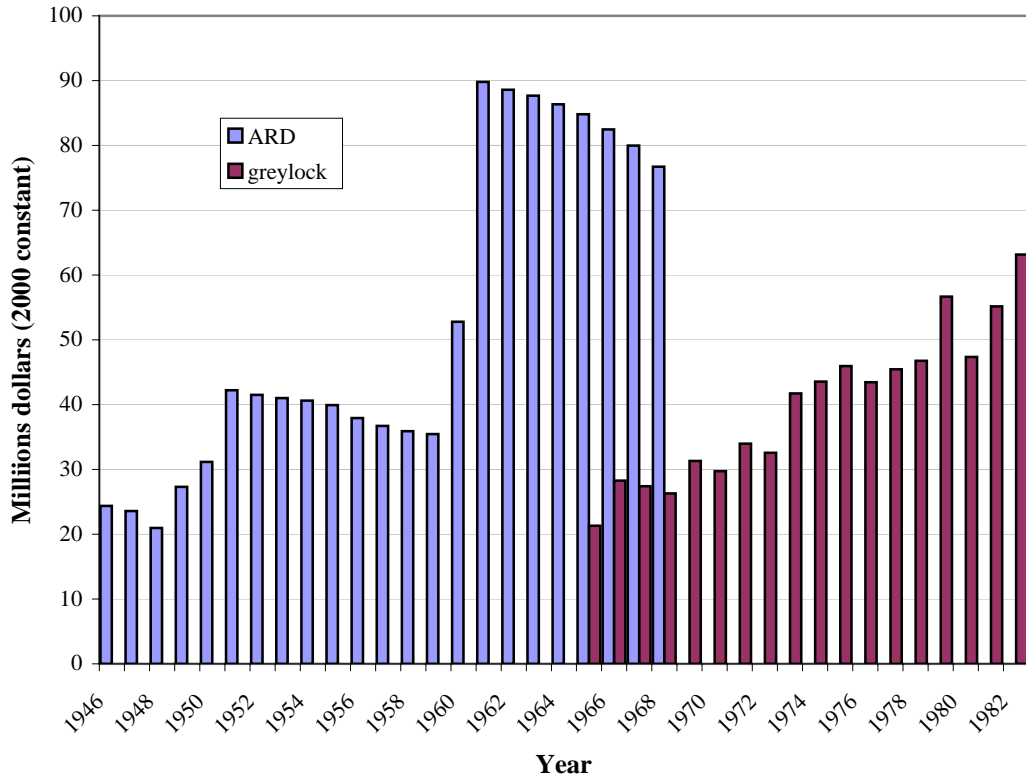


Figure 4. Private Capital Inflows to SBICs, 1965-1993

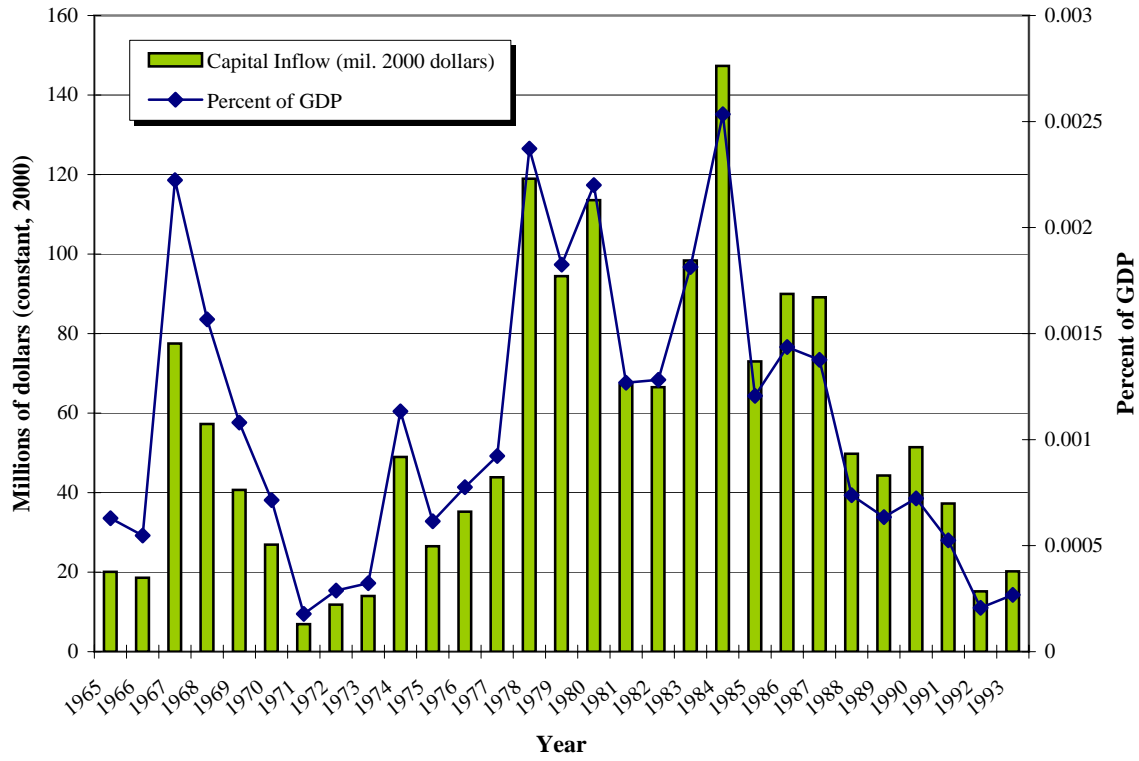


Figure 5. ARD Projects Received & Funded

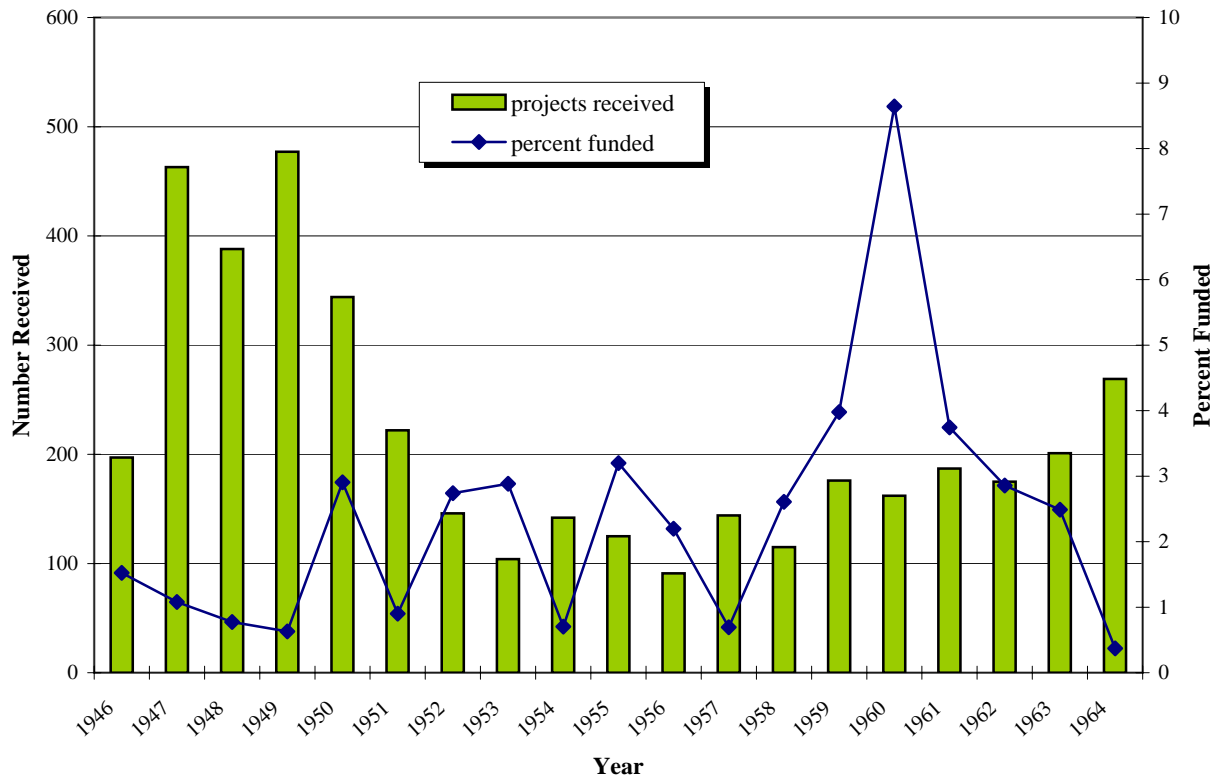
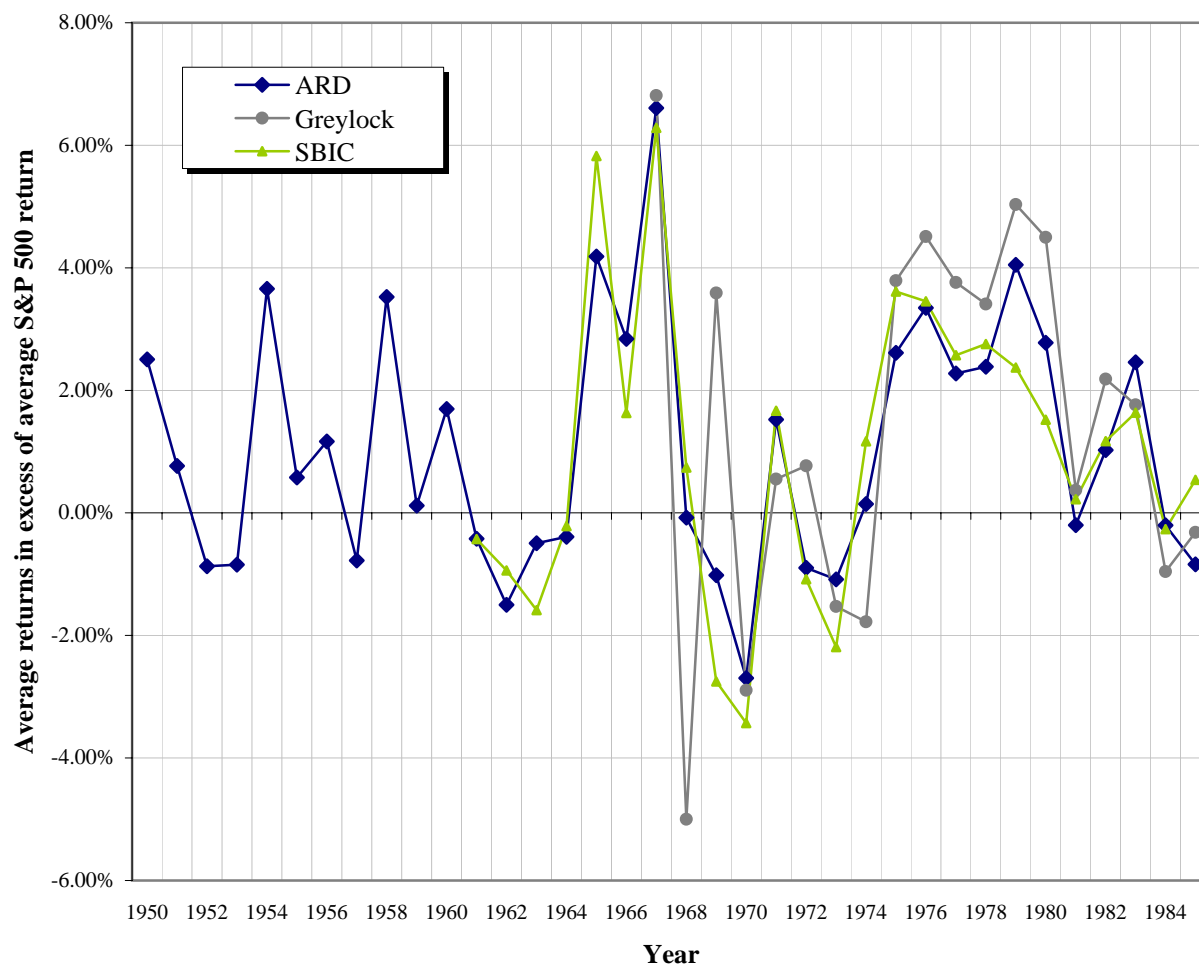


Figure 6. Average Monthly Excess Returns on Venture-Backed Firms



Note : excess returns are averaged over all firms and months each

Figure 7. Average Cummulative Returns on Venture-Backed Stocks

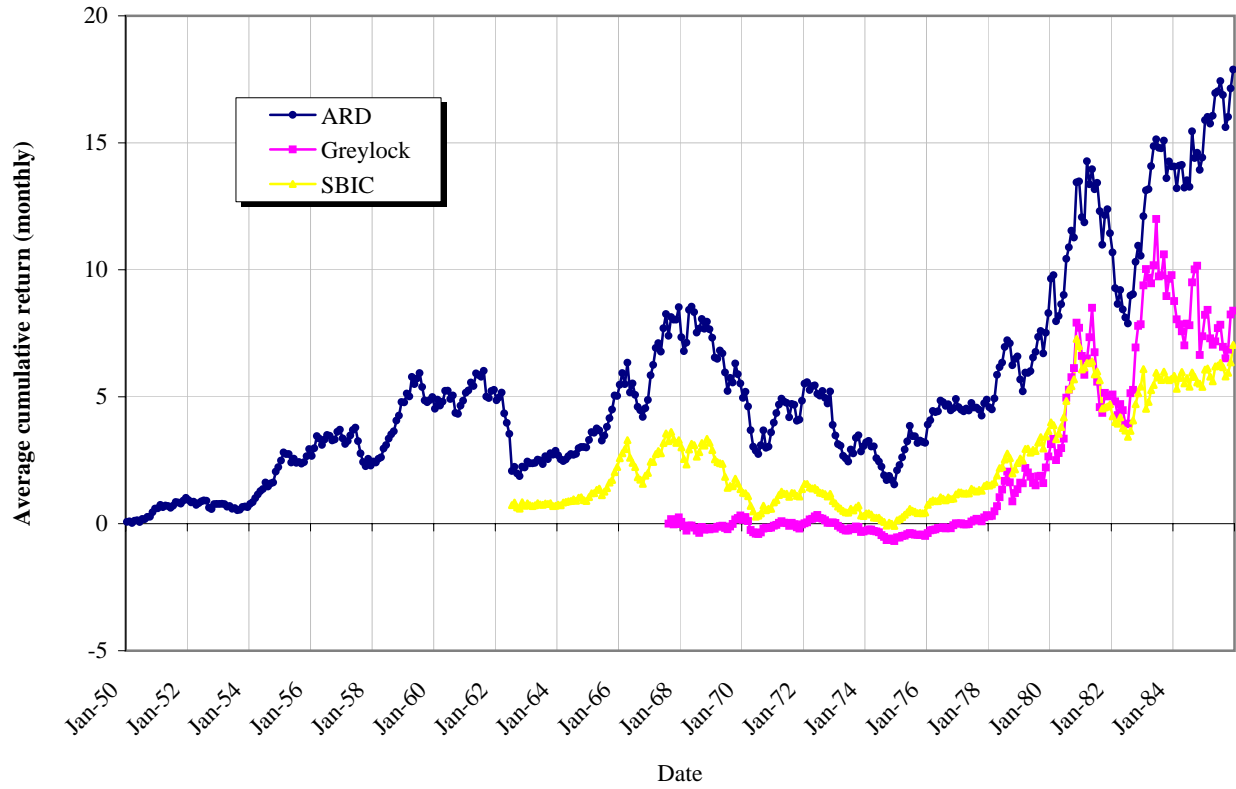


Figure 8. Average Monthly Excess Returns on Venture-Backed Firms

