
13. The Origins of High-Tech Venture Investing in America

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The United States has developed an unparalleled environment for the provision of high-tech investment finance. Today it is reflected in the strength of agglomeration economies in Silicon Valley, but historically its origins lay in the East Coast. Notably, immediate post-WWII efforts to establish the American Research and Development Corporation created a precedent for “long-tail” high-tech investing. This approach became institutionalized in the United States over subsequent decades in a way that has been difficult to replicate in other countries. The role of history helps to explain why.

Introduction

The development of high-tech investment finance is intertwined with the history of the venture capital (VC) industry in the United States. America has created what amounts to an almost unassailable advantage in the deployment and management of risk capital. VC investment increased to \$49.3 billion in 2014, the third highest amount in history (after 1999 and 2000), with around 90% of this total being deployed in high-tech sectors. Within the United States, Silicon Valley stands out with the state of California accounting for 57% of total investments (National Venture Capital Association 2015). Moreover, the United States dominates in a global context. According to one estimate, it accounts for more than double the level of venture investment in Europe, China, India, and Israel *combined* (EY 2014). Given that innovation is a key driver of economic growth (e.g., Romer 1990), it is reasonable to assume that this long-standing leadership position in the provision of high-tech finance has had a profound effect on aggregate economic activity.

From very early on in its history, the United States has been characterized by an auspicious link between finance and innovation. Venture-style investing can be seen in the way that the early whaling industry was structured in the 18th century—with its emphasis on capital pooling, partnerships, principal-agent relationships, and long-tail investments (Nicholas and Akins 2012). The birth of the US industrial revolution in New England textiles owed much to a group of investors known as the Boston Associates, who were willing to finance risky technological development (Dalzell 1987). The rise

of midwestern cities like Cleveland as entrepreneurial hotspots in the 19th century depended on such financiers as Andrew Mellon (1855–1937), who selected entrepreneurs and actively participated in governing his investments (Lamoreaux, Levenstein, and Sokoloff 2006). For all its relevance today, US exceptionalism in the high-tech venture area should be placed in a deeper historical context.

The relevance of a historical perspective can be vividly illustrated through an important post-World War II breakthrough. A group of local elites, who were members of The New England Council (NEC), which had been formed in 1925 to promote regional economic activity, decided in 1946 to incorporate in Massachusetts what was ostensibly a venture capital firm, American Research and Development Corporation (ARD). A French émigré, Georges Doriot, a well-known Harvard Business School professor, became president. With an ultimate focus on high-tech ventures and “creative capital,” ARD marked a turning point in the institutionalization of US VC (Ante 2008). ARD’s 1957 investment in a risky nascent computer start-up, Digital Equipment Corporation (DEC), returned a sizeable multiple, verifying that this type of payoff strategy could work. ARD’s DEC investment was one of the most important in VC history and set a precedent for what would follow. The remainder of this chapter draws on Nicholas and Chen (2012) to provide a summary of how ARD and the DEC investment came about and then elaborates on the significance more generally.

The Pathway to ARD: Formation and Structure

As a consequence of military expenditure, World War II was a catalyst to technological advancements in such areas as radar detection and microelectronics. On the demand side, however, it was not the best time to be seeking investment capital for start-up innovation. For example, during testimony to a subcommittee of the Committee on Banking and Currency in 1939, Edward E. Brown, a well-known banker from Chicago, stated: “In my opinion it has always been difficult for small business to get risk capital. I think the difficulties today, for a variety of causes, are greater in getting proprietary risk capital for small- and moderate-size businesses, than was the case in former years” (Stoddard 1940). Although large corporations could finance innovation through retained earnings, entrepreneurial firms were more likely to be starved of capital.

Against this backdrop and a general malaise in the regional economy, a group of prominent New Englanders including Ralph Flanders, who would become a Senator for Vermont, and Karl Compton, then-president of MIT, responded by engaging in discussions at the NEC in an effort to support

existing industries in the region and promote new directions. Because around three-quarters of the immediate post-war growth in New England derived from metal working, much of the NEC's efforts went into promoting the region as a steel-making cluster (Warren 1987, p. 324). However, on 6 June 1946, a key step toward facilitating high-tech investing was made when ARD was incorporated in Massachusetts.

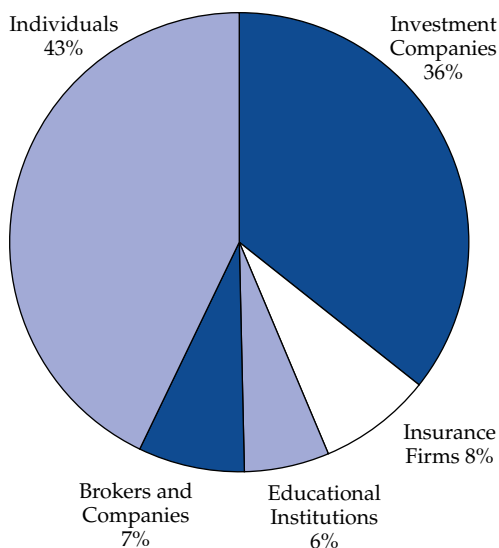
ARD was not intended to be a substitute for bank financing; instead, it represented a new approach to the provision of entrepreneurial finance. Doriot, who was named president in December 1946, stated: "ARD does not invest in the ordinary sense. Rather, it creates by taking calculated risks in selected companies in whose growth it believes" (Ante 2008, p. 112). Governance was a primary objective of the new investment entity. ARD's first report states: "research and development, new technical ideas, and young small businesses are not in themselves the certain keys to great success. They must be supplemented by sound management, adequate financing, competent production methods, and aggressive merchandising" (Doriot 1971).

ARD had a number of important organizational characteristics. Unlike modern VC firms, which are mostly organized as limited partnerships with fund lives of approximately seven to twelve years, ARD was formed as a closed-end fund. That is, it raised permanent capital by selling a limited number of public shares. This structure was aligned with Doriot's objectives to select investments and govern them effectively over the long run. Writing several years after ARD's initial founding, Doriot explained, "It should again be emphasized that American Research is a 'venture' or 'risk capital' enterprise. The Corporation does not invest in the ordinary sense. It creates. It risks. Results take more time and the expenses of its operation must be higher, but the potential for ultimate profits is much greater" (Doriot 1951).

Given the risk profile of its potential investments and the desire for long-term stakeholders, ARD's founders aimed to secure at least half of the initial capital from institutions. However, legal constraints militated against this objective and, in principle, also constrained ARD's ability to function as an investment entity. Specifically, the Investment Company Act of 1940 restricted investment companies from owning more than 3% of another investment company's voting stock. The Act, however, allowed an exception for companies that were engaged "in the business of underwriting, furnishing capital to industry, financing promotional enterprises, and purchasing securities of issuers for which no ready market is in existence." Through lobbying efforts, ARD was permitted to have institutional investors, who could each acquire up to 9.9% of its stock (Ante 2008, p. 110).

ARD was able to acquire capital from nonfamily sources, which was a source of its distinctiveness. Other private equity firms that formed around this time, including J.H. Whitney & Company and the Rockefeller Brothers Company, mostly relied on individual families for capital. For ARD, casting a wider net for capital was seen to be advantageous. Ralph Flanders stated, “There are in particular two large-scale repositories of wealth [life insurance companies and investment trusts] which have a stake in the Nation’s future and who should be concerned with a healthy basis for the prosperity of these postwar years.”¹ **Figure 13.1** illustrates the mix of investors in ARD in 1947 and includes such investment companies as Massachusetts Investors Trust, such insurance firms as John Hancock Mutual Life Insurance, and such educational institutions as MIT, Rice Institute, University of Pennsylvania, and the University of Rochester. ARD intermediated because it was difficult for such investors to go to portfolio companies directly. In 1947, over half of the shares were owned by institutional investors broadly defined, although it is

Figure 13.1. The Composition of ARD Investors, 1947



Source: Compiled from data in Hsu and Kenney (2005, p. 591).

¹Martha L. Reiner, “Innovation and the Creation of Venture Capital Organizations,” *Business and Economic History*, Vol. 20, papers presented at the thirty-seventh annual meeting of the Business History Conference (1991), pp. 206–207.

important to note that ARD (unlike most VC firms today) was still heavily reliant on financing provided by individuals.

Finally, ARD established an internal structure to facilitate deal flow and select investments. ARD maintained an eminent technical advisory board populated with MIT talent, including Karl Compton; Edwin R. Gilliland, a professor of chemical engineering; and Jerome Clarke Hunsaker, a professor in aeronautical engineering. Like Doriot, all were well respected as educators and practitioners, and their presence created a strong network at the intersection of MIT and Harvard. ARD's board of directors reflected a blend of legal, financial, and technology expertise, and a small staff undertook due diligence and publicized ARD to potential entrepreneurs. ARD maintained high standards for filtering projects, insisting on pursuing those that were commercially practicable, had patent protection, and had high profit potential (Etzkowitz 2002). In principle, the structure established by ARD was commensurate with both effective *ex ante* investment selection and the effective governance of portfolio companies.

Initial Investments

Yet, this ostensibly favorable strategy and structure did little to attract investors. ARD aimed to raise \$5 million in the public markets, and although falling short of its goal, it began immediately deploying the \$3.5 million it had raised in the search for new opportunities. ARD made three initial investments. It invested \$150,000 in Cleveland-based Circo Products, which made automobile tools; \$200,000 in High Voltage Engineering Corporation, which was developing a special, high-powered generator; and \$150,000 in Tracerlab, a manufacturer of radiation detectors. The latter two firms had strong links to MIT.

A total of five investments were made in the first year. Although none were spectacular from the standpoint of returns, Tracerlab became a modest success story. In 1948, Tracerlab had sales of \$700,000, giving it a profit of \$30,000. It then underwent an IPO in March 1948 that raised \$1.3 million. In reference to the governance mechanisms associated with ARD, William E. Barbour, Jr., the company's founder and president, commented on how Doriot's guidance had been essential to growth and development: "[Doriot] provides the two things that a young scientific organization most needs: enthusiasm and appreciation. Like all the others, I started out with a hatful of ideas and a lot of long-range plans. In a couple of years, I got bogged down in detail. Doriot stepped in just in time to pull me out of a rut" (Ante 2008, p. 119).

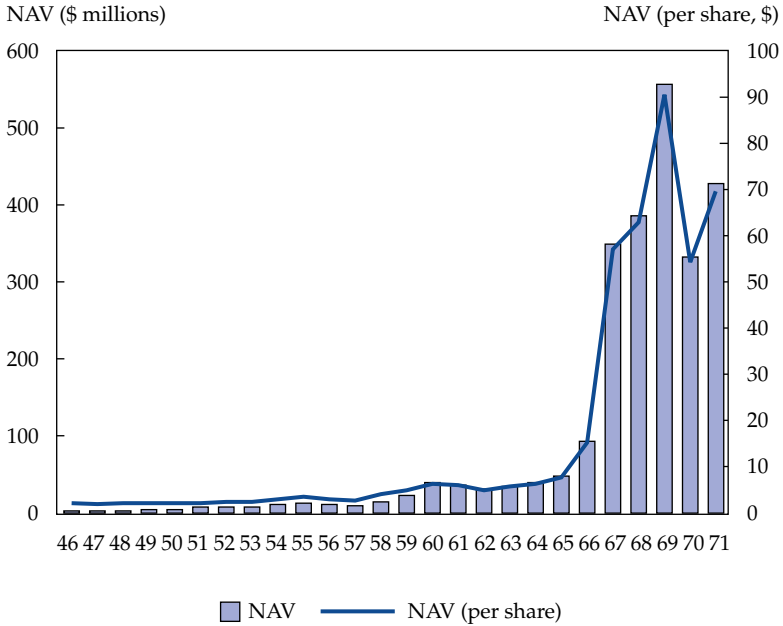
Because the demand for capital at this time was so high, ARD received an abundance of project proposals. In keeping with its restrictive investment

criteria, ARD never invested in more than 4% of the project proposals that it received each year; frequently, the percentage was much lower (Hsu and Kenney 2005, p. 593). This selectivity enabled ARD to negotiate favorable terms for its investments. By early 1949, ARD had acquired a controlling interest in 13 companies in a wide variety of industries, including Cleveland Pneumatic Tool Company, Ionics Incorporated, and Snyder Chemical Corporation. At that point, ARD began running low on capital, so it offered another 153,000 shares of stock to raise \$4 million. Despite encouraging returns from its portfolio companies, however, ARD could not convince investors to buy. By late 1949, the company had sold only around 44,000 of its shares, raising roughly \$1 million. That year, ARD reported an operating loss of \$38,000 (Ante 2008, p. 114).

Even with these setbacks, ARD continued taking risks on unproven companies, and sometimes the strategy paid off. One of ARD's first investments, Flexible Tubing, proved to be a lucrative one. In 1948, Doriot had assigned an ARD employee—a former student—to be the struggling tubing manufacturer's director, treasurer, and manager. Within a year, the company began reporting profits thanks to supply contracts with several large organizations. ARD's investment in Baird Associates, a company that specialized in chemical analysis instruments, also bore fruit; its sales grew significantly after 1947. Still, ARD was not immune to losses. Island Packers, a tuna company in which ARD had invested \$250,000, went bankrupt after the company determined that it would not be able to catch the amount of fish necessary to sustain itself. This led to a \$239,000 write-off by ARD. Nonetheless, by 1951 ARD had invested in 26 companies and employed over 3,000 people. Twenty-one of these companies were profitable (Ante 2008, p. 114). ARD had also begun charging consulting fees to portfolio companies in an attempt to raise revenues and further reinforce its business model.

During the 1950s, ARD continued to have difficulty attracting investors, even after issuing its first dividend of \$0.25 per share in 1954. Deal flow slowed down from an average of 382 proposals per year between 1947 and 1951 to just 127 projects in 1954. Partially as a result of this and partially due to several key members of the firm going on leave, ARD did not invest in a single new project in 1954. Notably, that year ARD's shares fell to \$16 from a high of \$29, even as its net asset value (NAV) remained at \$28 per share (Ante 2008, p. 138). Although it is not unusual for closed-end funds to be marked down relative to NAV, this amounted to a steep discount. **Figure 13.2** shows that ARD's stock price did rebound during the late 1950s and into the early 1960s; however, it had not systematically proven out its new investment model.

Figure 13.2. Net Asset Value and Net Asset Value per Share of ARD, 1946–1971



Note: All dollar values are given in nominal amounts.
Source: Compiled from data in Doriot (1971).

Digital Equipment Corporation

ARD was revitalized by a single investment, which also helped to spur the development of US VC in general. In 1957, Kenneth Olsen, a US Navy veteran and MIT engineer, co-founded with his colleague Harlan Anderson a new start-up—Digital Equipment Corporation (DEC)—to develop circuit board modules and then later, fast and efficient computers.

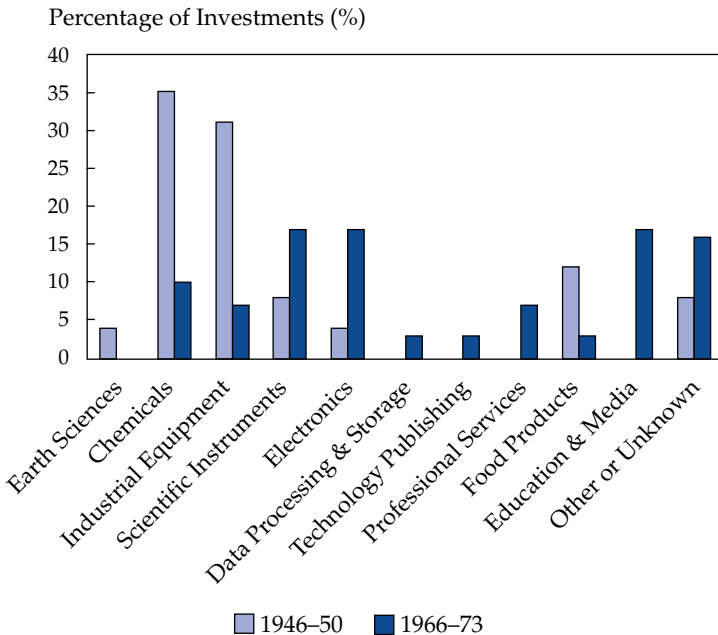
Prior to the PC revolution of the late 1970s and early 1980s, computers were bulky and expensive. Olsen started to work with transistors, a relatively new technology that yielded faster and more efficient processing. He helped to design and build the TX-0, a room-sized computer that was much smaller than other similarly capable computers at the time. The TX-0 was popular with MIT students, and Olsen became convinced that he could build a business around such computers. Olsen and Anderson planned to make circuit boards for use by research institutions and small businesses that needed high-powered but cost-effective solutions. ARD founders struggled to access

funding because of the risks associated with the new technology, the failure of a number of similar companies, and an economic recession.

Olsen and Anderson sent a proposal to ARD that outlined their need for a \$100,000 investment, and they were invited to pitch it. Impressed by the founders and their idea, ARD offered \$70,000 for a 78% equity stake and promised additional loans. Olsen and Anderson accepted, knowing they were operating in a risky high technology area where further funding would be needed for R&D and commercialization. DEC was soon incorporated and began shipping its first products, which were instantly popular. By the end of 1958, DEC sold \$94,000 worth of modules and was already profitable. ARD provided additional financing as DEC met milestones. That year, the rest of ARD’s portfolio companies also performed well, and its stock price reached a high of \$38. As **Figure 13.3** illustrates, ARD’s portfolio shifted away from such traditional areas as chemicals and industrial equipment and toward such high-tech sectors as electronics.

In 1960, DEC started to sell its first computer, the PDP-1 (Programmed Data Processor-1). It was approximately the size of a refrigerator and

Figure 13.3. ARD’s Portfolio Investments: Comparing 1946–50 with 1966–73

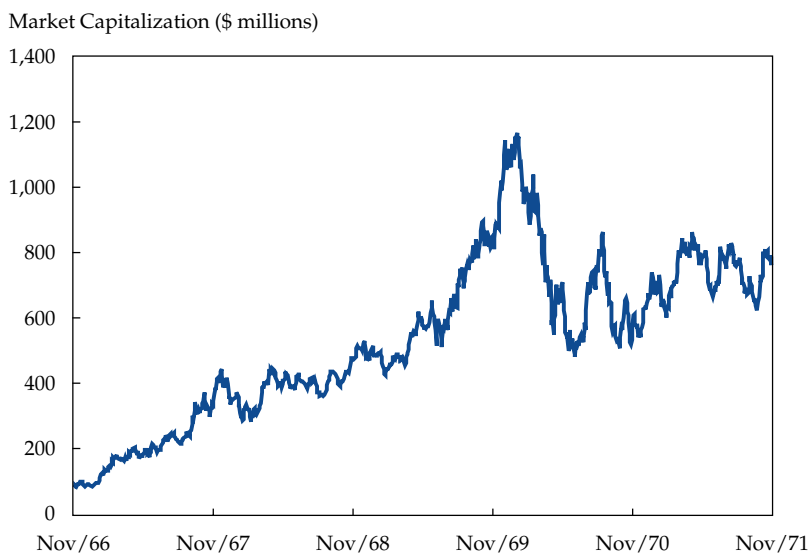


Source: Compiled from data in Hsu and Kenney (2005, p. 593).

revolutionary in terms of functionality. Although it cost \$120,000, IBM's mainframes frequently cost in excess of \$1 million. Users could observe graphical displays, input commands, and receive results interactively rather than having to wait for processing to be completed in the customary batch queue environment. The PDP-1 could also be configured for specialized applications, including basic word processing. In 1962, DEC earned \$6.5 million in sales and continued to be profitable.

The PDP-1 spawned subsequent generations, each with slightly different configurations and prices. In 1963, the PDP-5 was introduced at a price of \$27,000. Introduced in 1965, the PDP-8 became the first mass production minicomputer at an \$18,000 price point. DEC sold 50,000 PDP-8s over the device's lifespan. As Chandler, Hikino, and Von Nordenflycht (2005, p. 104) point out, "the strategy of low price/high performance succeeded brilliantly. In the single year, 1966, DEC's revenues ascended from \$15 million to \$23 million, and from 1965 to 1967 its profits rose sixfold." DEC underwent an IPO in August of 1966, selling 375,000 shares at a price of \$22, and it subsequently experienced strong growth in market capitalization (see **Figure 13.4**). DEC became ARD's most significant asset. By the time the value of

Figure 13.4. DEC Market Capitalization, 1966 to 1971



Source: Compiled from data provided by CRSP (Center for Research in Security Prices).

the DEC stock was fully distributed to ARD's investors in 1971, it was worth \$355 million (Liles 1977, p. 83; Hsu and Kenney 2005, p. 599).

Venture Capital Supply and Entrepreneurial Demand Implications

To understand the significance of ARD's investment in DEC for the development of the VC industry and high-tech investing, it is helpful to think of the main implications of supply and demand factors. First, the DEC investment showed that one could systematically build a portfolio of long-tailed investments; the return of the few that hit the long tail would offset the losses and mediocre gains of the others. Although the precise figures are open to some debate, Liles (1977) estimated that from 1946 to 1971, ARD achieved a compound annual return of 7.4% without DEC and 14.7% with DEC included. By comparison, the DJIA (Dow Jones Industrial Average) returned 12.8% over the same period (Hsu and Kenney 2005, p. 599). Such was the impact of DEC on ARD's portfolio that it provided a spur to the supply of new venture firms seeking to also generate outsized returns from high-tech investments. Ironically, as new entities started to compete with ARD, it became increasingly difficult for the firm to retain its best employees. With its closed-end fund structure, ARD was essentially displaced around 1970 as a new era of VC limited partnerships began to operate. By the late 1970s, at least 250 venture capital firms were operating in the United States; two decades later, that number had risen to over 1,000 (Etzkowitz 2002, p. 99).

Second, ARD supplied both capital and governance. That is, it was not only selective about the initial investments it chose to make, but it also actively participated in the management of those investments. A long-standing question in the VC literature revolves around the extent to which venture capitalists add value simply by screening effectively *ex ante* for investments versus professionalizing entrepreneurial firms *ex post* (Hellman and Puri 2002). ARD identified and deployed professional managers, and it utilized its technical advisory group and staff to help monitor the performance of portfolio companies. ARD placed five trusted and dependable advisers on the DEC board (Ante 2008, p. 151). Doriot was the archetypal networker.

Third, ARD specifically and Doriot more generally shaped a pool of talent that entered the industry over subsequent decades. In 1965, William Elfers, a senior vice president at ARD, left the firm to found Greylock in Massachusetts, which then became a top-tier venture capital firm. Unlike ARD, which operated as a closed-end investment fund, Elfers organized Greylock as a series of limited partnerships, each of which pooled the

investment capital that its general partners and limited partners committed for finite lifetimes. Furthermore, as a professor at Harvard Business School, Doriot instructed, mentored, and/or influenced a generation of future venture capitalists. These included Arthur Rock, who started his first investment partnership in 1961 with Thomas Davis in San Francisco; Tom Perkins, who helped establish Kleiner Perkins Caufield & Byers in 1972 in San Francisco; and Charles Newhall and Richard Kramlich, who co-founded (with a Princeton graduate, Frank Bonsal, Jr.) the bi-coastal VC firm New Enterprise Associates in 1977.

Finally, although it is difficult to establish causality, by creating opportunities for wealth accumulation, ARD probably created an entrepreneurial demand-side spur to venture capital. When DEC underwent its IPO, Ken Olsen's ownership of the company translated into a \$7 million valuation (Ante 2008, p. 196). This would have provided powerful incentives from the standpoint of occupational choice. Around the time of the DEC IPO, the number of business plans evaluated by ARD doubled when comparing the period 1961–1965 to 1966–1973 (Hsu and Kenney 2005, p. 593). Although demand conditions may also have played a role (the stock market boomed during the late 1960s), the fact that there was an environment in which high-tech ventures could be financed and governed to generate long-tail payoffs must have positively affected the number of entrepreneurs who decided to start new firms.

Regional Advantage, Investment Cycles, and Bubbles

Beyond the specifics of the relationship between ARD and DEC, this episode in history has a broader significance for understanding the conditions under which high-tech investment finance can flourish. DEC was an East Coast firm, yet, over time, regional comparative advantage became firmly established in Silicon Valley. At least one explanation for the shift was cultural. The Route 128 agglomeration in the Boston area reflected conservative East Coast values, while Silicon Valley prospered on the basis of what might be described as an open collaboration-mixed-with-competition culture that was symbiotic to the development of high-tech entrepreneurship. According to Saxenian (1994), electronics entrepreneurs ventured west because of “a distrust [of] established East Coast institutions and attitudes” and a related desire to be out in the more culturally and physically open West. Route 128 had ephemeral computer manufacturers like DEC and Wang, whereas Silicon Valley produced enduring firms like Hewlett Packard and Intel. Cultural characteristics tend to be persistent over time, and high-tech is a fundamentally important sector in terms of its contribution to long-run

economic growth. Thus, it is hard to imagine a world in which Silicon Valley's superiority in tech-based VC finance will not be maintained.

It could be argued that VC investing in high-tech firms in the United States evolved to be complementary to public markets. DEC was financed through ARD specifically because it was a high-risk, nascent start-up; its founders were unable to raise capital through alternative bank-based channels. By adopting a portfolio approach, selecting entrepreneurs on expected success, and governing investments to fruition, ARD assumed that it would be able to capture future outsized returns. More generally, empirical evidence reveals that from the 1970s to the early 1990s, VC-backed IPOs performed better over the long run than non-VC-backed IPOs (Brav and Gompers 1997). Although this finding is sensitive to time period specification and even tends to be reversed for the modern era (Ritter 2015), one implication is that VC firms can relax credit constraints for firms that ultimately drive the performance of the high-tech sector. As Brown (2005) put it, "the true legacy of venture capital finance extends well beyond the IPO."

At the same time, VC activity may lead to the creation, or amplification, of productive or destructive investment cycles. Venture capital firms exit their positions through a sale or an IPO in order to return capital to their limited partners over the duration of a fund. Experience in the timing of exits tends to matter. Gompers (1996) finds that inexperienced VCs take their firms public earlier, their IPOs are more underpriced, and the VC equity stake they hold is significantly smaller relative to their more experienced VC counterparts. Doriot's experience was instrumental to the favorable pricing of ARD's IPO from DEC's perspective. While the underwriter Lehman Brothers aimed to price the shares at \$17, DEC held out for \$22 (Ante 2008, p. 195). DEC's stock price accelerated during the stock market run-up of 1969 (see Figure 13.4). Other run-ups, such as 1998–2000, were inextricably linked to investments in high-tech firms.

Although run-ups can lead to bubbles and the destruction of capital (the stock market lost \$5 trillion in market value between 2000 and 2002), they can also create the type of financing environment that leads to the production of especially valuable innovations. Nanda and Rhodes-Kropf (forthcoming) argue that during "hot" markets, more experimental and ultimately innovative projects receive funding because capital freely flows to these ideas. In "cold" markets, by contrast, capital dries up because there are (in expectation) insufficient funds to carry these types of projects to full fruition. In other words, the type of technologies being developed at certain junctures depends on financing risk.

These types of financing dynamics and complexities underscore why the US model of VC financing in high-tech industries is difficult to imitate. For example, in European capital markets in which VC is not institutionalized to the same degree, alternative risk-sharing channels have become prominent. These include angel investing, crowdfunding, and the use of public funds to support entrepreneurship. These channels, however, tend to be weak substitutes because they do not always lead to the supply of capital being optimally matched to the distribution of new ideas (Lerner 2009). Better start-ups may self-select into the VC channel, or effective selection and governance of investments by VCs may lead to superior start-up performance. Either way, the US financing environment has evolved to establish a strong advantage in the intermediation of risk capital.

Conclusion

The preeminence of US VC in high-tech investment finance is a reflection of a long-standing historical process. The basic logic behind ARD's DEC investment—to screen multiple investments and govern the best ones with the expectation of a large payoff through a liquidity event—is something that all venture firms today aim to imitate. Of course, the pathway from the past to the present is not always seamless. Notably, ARD got the organizational model wrong as venture firms quickly gravitated away from the closed-end form to the limited partnership, which had tax advantages and was more suited to the creation of high-powered compensation incentives (Sahlman 1990).

Furthermore, such related developments as the rise of Silicon Valley, cultural predispositions toward entrepreneurship and risk taking, and the liberalization of investment rules permitting pension funds to increase the flow of funds to venture capital—all helped to create an environment in which VC investing could flourish. Yet, the significance of history and ARD's place in it is nonetheless profound. Other countries have attempted to develop ecosystems for high-tech venture finance or alternative financing with limited success. Given the importance of stage-setting by ARD and the breakthroughs made by the venture capital firms that followed in the 1970s and 1980s, it is perhaps no accident that the US model has been so hard to replicate.

I am very grateful to Robert Shulman, David Chambers, and Elroy Dimson for comments and to the Division of Research and Faculty Development at Harvard Business School for funding.

References

- Ante, Spencer E. 2008. *Creative Capital: Georges Doriot and the Birth of Venture Capital*. Boston: Harvard Business Press.
- Brav, Alon, and Paul A. Gompers. 1997. "Myth or Reality? The Long-Run Underperformance of Initial Public Offerings: Evidence from Venture and Nonventure Capital-Backed Companies." *Journal of Finance*, vol. 52, no. 5 (December): 1791–1821.
- Brown, James R. 2005. "Venture Capital and Firm Performance over the Long-Run: Evidence from High-Tech IPOs in the United States." *Journal of Entrepreneurial Finance*, vol. 10, no. 3: 1–33.
- Chandler, Alfred D., Takashi Hikino, and Andrew Von Nordenflycht. 2005. *Inventing the Electronic Century: The Epic Story of the Consumer Electronics and Computer Industries*. Cambridge, MA: Harvard University Press.
- Dalzell, Robert F. 1987. *Enterprising Elite: The Boston Associates and the World They Made*. Cambridge, MA: Harvard University Press.
- Doriot, Georges F. 1951. "American Research and Development Papers." Boston: Baker Library Historical Collections, Baker Library|Bloomberg Center, Harvard Business School.
- . 1971. "ARD Annual Report." Boston: Baker Library Historical Collections, Baker Library|Bloomberg Center, Harvard Business School.
- EY. 2014. *Adapting and Evolving: Global Venture Capital Insights and Trends, 2014*. EYGM Limited.
- Etzkowitz, Henry. 2002. *MIT and the Rise of Entrepreneurial Science*. London: Routledge.
- Gompers, Paul. 1996. "Grandstanding in the Venture Capital Industry." *Journal of Financial Economics*, vol. 42, no. 1: 133–156.
- Hellman, Thomas. and Manju Puri. 2002. "Venture Capital and the Professionalization of Start-Up Firms: Empirical Evidence." *Journal of Finance* vol. 57, no. 1 (February).
- Hsu, David H., and Martin Kenney. 2005. "Organizing Venture Capital: The Rise and Demise of American Research & Development Corporation, 1946–1973." *Industrial and Corporate Change*, vol. 14, no. 4: 579–616.

- Lamoreaux, Naomi R., Margaret C. Levenstein, and Kenneth L. Sokoloff. 2006. "Mobilizing Venture Capital during the Second Industrial Revolution: Cleveland, Ohio, 1870–1920." *Capitalism and Society*, vol. 1.
- Lerner, Josh. 2009. *Boulevard of Broken Dreams: Why Public Efforts to Boost Entrepreneurship and Venture Capital Have Failed—and What to Do About It* Princeton, NJ: Princeton University Press.
- Liles, Patrick R. 1977. *Sustaining the Venture Capital Firm*. Boston: Management Analysis Center.
- Nanda, Ramana, and Matthew Rhodes-Kropf. Forthcoming. "Financing Risk and Innovation." *Management Science*.
- National Venture Capital Association. 2015. *2015 National Venture Capital Association Yearbook*. Thomson Reuters.
- Nicholas, Tom, and Jonas Peter Akins. 2012. "Whaling Ventures." Harvard Business School Case 813-086 (October).
- Nicholas, Tom, and David Chen. 2012. "Georges Doriot and American Venture Capital." Harvard Business School Case 812-110 (January).
- Ritter, Jay R. 2015. "Growth Capital-Backed IPOs." *Financial Review*, vol. 50, no. 4 (November): 481–515.
- Romer, Paul. 1990. "Endogenous Technological Change." *Journal of Political Economy*, vol. 98, no. 5.
- Sahlman, William A. 1990. "The Structure and Governance of Venture-Capital Organizations." *Journal of Financial Economics*, vol. 27, no. 2 (October): 473–521.
- Saxenian, AnnaLee. 1994. *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*. Cambridge, MA: Harvard University Press.
- Stoddard, William. 1940. "Small Business Wants Capital." *Harvard Business Review*, vol. 1, no. 8.
- Warren, Kenneth. 1987. *The American Steel Industry, 1850–1970: A Geographical Interpretation*. Pittsburgh: University of Pittsburgh Press.