

4 THE FINANCIAL AGENT

The sale of Eberstadt to Robert Fleming & Company in the autumn of 1985 represented release from an intractable dilemma. But as a senior partner of Eberstadt I had perforce signed on to a three-year contract with Flemings, although neither my brain nor my heart was in it. Flemings was rigidly structured between an asset management business and an investment banking (still called merchant banking) business. I had spent some fifteen years in the internal migration from investment banker to principal investor within Eberstadt's loose framework; within Flemings I was placed irrevocably in the agency business of corporate finance. Working my way up to running four marathons per year on a training base of seventy to eighty miles per week provided one outlet during this time. Reading economic theory and engaging with Hy Minsky's maverick economics provided another.

The near-death experiences of BRL and MicroPro prepared my mind to understand in a deeper and more connected way what I had formerly experienced only as anecdotes: access to cash in case of crisis is the only effective hedge against ontological uncertainty. This resonated with what I had learned at Cambridge, at the theoretical level from Keynes and at the level of empirical analysis from the failure of economic policy in the face of financial crisis and economic collapse in 1931. It was also the central message of Minsky's post-Keynesian work.

Furthermore, engagement with the world of computing had introduced me to a crucial institutional aspect of the Innovation Economy. This was the upstream dependence on prior investment in the enabling science, investment that was necessarily made independent

of any concern for quantifiable return. The role of the Defense Department remained evident in the IT sector, and the NIH were sponsoring the emergence of biotech as a second focus for venture capitalists. Through these instrumentalities, the federal government funded research whose economic relevance could be discovered only in retrospect.

To understand how such relevance is revealed in practice by repeated trials and errors, I found an unlikely guide in the great French historian Fernand Braudel. I encountered Braudel and his three-volume discourse *Civilization and Capitalism, 15th–18th Century* in 1985, just after my partners and I sold the Eberstadt firm. Braudel’s meditations on what capitalists do generated a shock of recognition that I can still feel. Although the domain and context in which Braudel’s financiers operated is vastly different from the world of today’s working venture capitalist, yet the activity remains recognizable: putting surplus cash to work, again and again, wherever the potential return is unlimited by either institutional structures or competition.

The Financial Capitalist at the Venturesome Frontier

I have found it useful to interpret the doing of capitalism at the venturesome frontier within Braudel’s frame – a frame that intersects other salient analyses of the core drivers of capitalism at the scale of the human agent, those of Marx, Schumpeter and Keynes.

In Braudel’s comprehensive view, the “unlimited flexibility” of capitalists in their search for profit is the “essential feature” that established “a certain unity in capitalism from thirteenth century Italy to the present day West”:

One’s impression . . . is that there were always sectors in economic life where high profits could be made, *but that these sectors varied*. Every time one of these shifts occurred, under the pressure of economic developments, capital was quick to seek them out, to move into the new sector and prosper.¹

¹ F. Braudel, *Wheels of Commerce*, trans. Sian Reynolds, vol. 2 of *Civilization and Capitalism, 15th–18th Century*, 3 vols. (New York: Harper & Row, 1982), pp. 433–434; emphasis in original.

The telling point is Braudel's grasp of the capitalist's unchanging goal: to escape from the "world of transparency and regularity," as he defines the market economy, where the potential for profit is constrained by the regulations of the traditional market or the competition of the emerging free market. In the premodern, preindustrial era that is Braudel's subject, "the capitalist game only concerned the unusual, the very special, or the very long distance connection."² It was in long-distance trade that Braudel's capitalists flourished:

Long-distance trade certainly made super profits; it was after all based on the price difference between two markets very far apart, with supply and demand in complete ignorance of each other and brought into contact only by the activity of middlemen . . . If in the fullness of time competition did appear, if super-profits vanished from one line, it was always possible to find them again on another route with different commodities.³

Unlimited flexibility to arbitrage across vast geographical space: this is Braudel's defining attribute of the premodern capitalist. And the search for "super-profits" prefigures the canonical search by venturesome investors for opportunities with "asymmetric distributions of outcomes": limited downside ("we can't lose more than all our investment") and unbounded upside.

The notion of arbitrage as the essence of the capitalist transaction has powerful resonance. For the modern venture capitalist, the arbitrage is typically between a technological innovation and the commercial product or service that can be derived from it. My own experience suggests that too much weight is often given to management of the process of technical transformation – "research and development" – and too little to the selection of the target market and the establishment of a channel to that market.

A prime example of this misfocus lies at the heart of the most apparently relevant theoretical effort to capture the dynamics of innovation: Schumpeterian Growth Theory.⁴ At their core, the formal mathematical models constructed to explore the process define a competitive battle to introduce a novel – cheaper, faster, better – "intermediate product" that will earn monopoly profits until superseded. But the

² *Ibid.* 456 ³ *Ibid.* 405.

⁴ The canonical text is P. Aghion and P. Howitt, *The Economics of Growth* (Cambridge, MA: MIT Press, 2009), Introduction and chaps. 4 and 5.

market for that innovation is known in advance by construction. What's more, that market's perfectly competitive nature feeds back to enable the innovating entrepreneur to know in advance the return she will earn if she is successful and so equip her to optimize her investment in innovation against its cost. The exercise is all about success in addressing technology risk under the characteristic neoclassical "pretense of knowledge"⁵ that assumes the market participant knows more than it is possibly available to know. And, with respect to the subject at hand, it utterly ignores the existence of market risk.

For Braudel's capitalist, the question asked of the sea captain would be: Why are you setting your course there? For the modern venture capitalist interrogating the entrepreneur, the corresponding question would be: Whose problem are you proposing to solve? It took me twenty years to absorb this principle fully. Modern growth theory has yet to address it.

In Marx's vision of the capitalist project, the entrepreneur and the financier are one. The capitalist directs the process of accumulation by inverting the circulation of commodities from commodity–money–commodity (selling in order to buy) to money–commodity–money (buying in order to sell).⁶ The concept of the capitalist as the embodiment of accumulation crosses the nominal phases of economic evolution:

Buying in order to sell, or more accurately, buying in order to sell dearer, M-C-M', appears certainly to be a form peculiar to one kind of capital alone, merchants' capital. But industrial capital too is money that is changed into commodities and by the sale of those commodities is re-converted into more money. The events that take place outside the sphere of circulation, in the interval between the buying and the selling, do not affect the form of this movement.⁷

But those events do affect the substance of the movement: they constitute the very reason for the circulation of industrial capital. The increase in money arises from the capitalist's purchase and exploitation of that alone which can create value in the world of classical economics that

⁵ The term was deployed by Friederich Hayek in his 1974 acceptance lecture for the Nobel Prize for Economics. Available at http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/1974/hayek-lecture.html.

⁶ K. Marx, *Capital*, vol. 1, trans. S. Moore and E. Aveling (Moscow: Foreign Language Publishing House, 1961 [1887]), pp. 152–153.

⁷ *Ibid.* 155.

runs from Smith through Ricardo to Marx – namely labor. So the capitalist exists as the omnipotent human link in the endless chain of accumulation, converting cash into “means of production and labor-power” in order to produce commodities that the capitalist then sells for cash “over and over again.”⁸

The power that Marx’s capitalist enjoys to command labor power in order to create surplus value distinguishes him from Braudel’s capitalist, who finances a venture that literally sails beyond his control. Yet on the frontier of capitalist evolution, where “the law of the tendency of the rate of profit to fall”⁹ asserts itself, Marx finally allows entry to the uncertainty inherent in the capitalist process of investment and production. There is in *Capital* one remote yet intriguing reference to what might dimly be recognized as venture capital, albeit in most unflattering guise:

If the rate of profit falls . . . there appears swindling and a general promotion of swindling by resource to frenzied ventures with new methods of production, new investments, new adventures, all for the sake of securing a shred of extra profit which is independent of the general average and rises above it.¹⁰

Behind the potential for speculative excess, Marx’s simple and profound dialectic remains: from money to commodity to more money. Substitute “company” for “commodity” and you have, in brief, the charter of the professional venture capitalist.

For Schumpeter, the entrepreneur is the driving force of capitalist development, freed more or less completely from the responsibilities of the financier. As Carlota Perez has written of the Schumpeterian tradition:

In Schumpeter’s basic definition of capitalism as “that form of private property economy in which innovations are carried out by means of borrowed money,” we find his characteristic separation of borrower and lender, entrepreneur and banker, as the two faces of the innovation coin. This is not, however, as his legacy has been interpreted and enriched by the great majority of neo-Schumpeterians. The accent has almost invariably been on the

⁸ *Ibid.* 564.

⁹ K. Marx, *Capital*, vol. 3 (Moscow: Foreign Language Publishing House, 1962 [1894]), p. 207.

¹⁰ *Ibid.* 253–255.

entrepreneur to the neglect of the financial agent, no matter how obviously indispensable this agent may be to the innovation.¹¹

Overstated as this emphasis by his followers may be, it is there in Schumpeter's work. Innovation – “any ‘doing things differently’ in the realm of economic life”¹² – drives the course of economic evolution. And innovations, in turn, are embodied in new plants, new firms and, above all, new people, the entrepreneurs who carry out innovations:

The entrepreneur may, but need not, be the person who furnishes the capital . . . In the institutional pattern of capitalism there is machinery, the presence of which forms an essential characteristic of it, which makes it possible for people to function as entrepreneurs without having previously acquired the necessary means. It is leadership rather than ownership that matters.¹³

The capitalist, in the prime role of owner of surplus cash available for investment, is relegated in remarkable fashion:

Risk bearing is no part of the entrepreneurial function. It is the capitalist who bears the risk. The entrepreneur does so only to the extent to which, besides being an entrepreneur, he is also a capitalist but *qua* entrepreneur *he loses other people's money*.¹⁴

Now here was a message – a warning – to which I could relate after surviving the BRL and MicroPro dramas. Those experiences prompted me to formulate what I call the First Law of Venture Capital: “All entrepreneurs lie.” That is, entrepreneurs begin by proposing to change the world through their own efforts. The promises they make to their financiers, customers and employees are sufficiently unlikely to be realized for confident assertion that they will be achieved to challenge any conventional definition of reasonable truth.

Even when there is no dishonest act of commission on the part of the entrepreneur, the Second Law of Venture Capital obtains: “No news is never good news.” After more than forty years in the game, I have yet to meet the entrepreneur who dallies in delivering

¹¹ C. Perez, “Finance and Technical Change: A Neo-Schumpeterian Perspective,” in H. Hanusch and A. Pyka (eds.), *Elgar Companion to Neo-Schumpeterian Economics* (Cheltenham: Edward Elgar, 2007), p. 776.

¹² J. A. Schumpeter, *Business Cycles: A Theoretical, Historical and Statistical Analysis of the Capitalist Process*, 2 vols. (London: McGraw-Hill, 1939), vol. 1, p. 84.

¹³ *Ibid.* 103. ¹⁴ *Ibid.* 104 (emphasis added).

word that “the product works” or “the sale has closed.” When communication ceases, then the venture capitalist can expect to discover that “the product needs another rev” or that “we lost the order.” The venture capitalist’s responsibility, therefore, is to follow the cash with intense focus in order to observe in timely fashion when the entrepreneur’s vision and the recalcitrant reality of the market deviate too far from each other.

Schumpeter himself was aware of “how important it is for the functioning of the system . . . that the banker should know and be able to judge what his credit is used for.”¹⁵ And Schumpeter also understood the challenge presented by innovation, whether the financial agent is a banker or a venture capitalist:

It is but natural that since such failure primarily shows in dealing with novel propositions – where judgment is most difficult and temptation strongest – an association has developed between financing innovation and miscarriage or misconduct.¹⁶

Schumpeter is at pains to separate the entrepreneurial function from the variety of individuals who may fill the role. In the old “competitive capitalism,” it was easy to find the entrepreneur “among the heads of firms” – as, indeed, remains the case in the start-ups that populate the Innovation Economy, where venture capitalists live. But in the modern capitalism of “giant concerns,” the entrepreneur’s identity as manager or salaried employee or major stockholder becomes problematic. Schumpeter extends his search further, finally touching on what appears to be the proto-venture capitalist:

Although company promoters are not as a rule entrepreneurs, a promoter may fill that function occasionally and then come near to presenting the only instance there is of a type which is entrepreneur by profession and nothing else.¹⁷

The very process that transforms, historically and conceptually, the aggressive owner of surplus wealth into the passive candidate for

¹⁵ Schumpeter himself failed disastrously as a venture investor in the context of the efforts to rebuild an economy in radically reduced post-World War I Austria. See M. Penender and A. Reich, “Schumpeter and Venture Finance, Radical Theorist, Broke Investor, and Enigmatic Teacher,” *Industrial and Corporate Change*, 24(6) (December 2015), pp. 1315–1352.

¹⁶ *Ibid.* 116–117. ¹⁷ *Ibid.* 103.

entrepreneurial exploitation creates the space into which the professional venture capitalist can move.

Against the grain of decades of work, Schumpeter came to imagine that the maturation of capitalism would entail the death of the entrepreneur:

On the one hand, it is much easier now than it has been in the past to do things that lie outside familiar routine – innovation itself is being reduced to routine. Technological progress is increasingly becoming the business of teams of trained specialists who turn out what is required and make it work in predictable ways . . .

On the other hand, personality and will power must count for less in environments which have become accustomed to economic change . . .

The perfectly bureaucratized giant industrial firm not only ousts the small or medium-sized firm and “expropriates” its owners, but in the end it ousts the entrepreneur.¹⁸

Schumpeter was not wholly wrong. There are domains of innovation where only the large-scale enterprise has the resources to develop innovative technology to the point of commercial readiness and to discover relevant commercial applications. The realm of materials science offers examples. From the iconic plastics of *The Graduate* to nanotechnology, the cost in money and time to reduce innovative manufacturing processes to reliable and low-cost production and to find applications where new materials offer competitive advantages of compelling commercial significance has meant that companies such as General Electric and DuPont – not venture-backed start-ups – have been the pioneers.

In fact, both Richard Nelson and Kenneth Arrow in their respective seminal articles on why profit-seeking firms in competitive markets will invest too little in R&D suggest a reason why the large enterprise may more closely approach the social optimum. For Nelson, the relevant factor is that “a firm producing a wide range of products resting on a broad technological base may well find it profitable to support research toward the basic end of the spectrum.”¹⁹ For Arrow, the problem can be minimized by “large corporations with many

¹⁸ J. A. Schumpeter, *Capitalism, Socialism and Democracy*, 4th edn. (London: Allen & Unwin, 2010 [1943]), pp. 132–134.

¹⁹ R. R. Nelson, “The Simple Economics of Basic Scientific Research,” *Journal of Political Economy*, 67(1959), pp. 302–303.

projects . . . , each small in scale relative to the net revenue of the corporation . . . [which] then acts as its own insurance company.”²⁰ But all too often the broad-based firm with multitudes of established market positions and ample financial resources has failed to lead, even when its own laboratories have been primary sources of the very innovation in question. In my world of information technology, this has been the predominant condition.

For Keynes, the maturing of capitalism is represented by the distance between the entrepreneur’s investment decision and that of the financier, mediated by markets in which titles to ownership and to debt can be traded. The consequent separation of ownership and control has turned the capitalist into a passive investor, and the way in which securities markets work has almost invariably turned the investor into a speculator. Against speculation, “the activity of forecasting the psychology of the market,” stands enterprise, “the activity of forecasting the prospective yield of assets over their whole life.”²¹ For the capitalist engaged in financing enterprise,

the outstanding fact is the extreme precariousness of the basis of knowledge on which our estimates of prospective yield have to be made . . . If we speak frankly, we have to admit that our basis of knowledge for estimating the yield ten years hence of a railway, a copper mine, a textile factory, the goodwill of a patent medicine, an Atlantic liner, a building in the City of London amounts to little and sometimes to nothing; or even five years hence.²²

Embedded in a market infused with “imperfect knowledge,” Keynes writes, investors must be

largely concerned, not with making superior long-term forecasts of the probable yield of an investment over its whole life, but with foreseeing changes in the conventional basis of valuation a short time ahead . . . For it is not sensible to pay 25 for an investment of which you believe the prospective yield to justify a value of 30, if

²⁰ K. Arrow, “Economic Welfare and the Allocation of Resources for R&D,” in K. Arrow (ed.), *Essays in the Theory of Risk-Bearing* (New York: American Elsevier, 1971 [1962]), p. 153.

²¹ J. M. Keynes, *The General Theory of Employment, Interest and Money*, in E. Johnson and D. Moggridge (eds.), *The Collected Writings of John Maynard Keynes*, vol. 7 (Cambridge University Press and Macmillan for the Royal Economic Society, 1976 [1936]), p. 158.

²² *Ibid.* 149–150.

you also believe that the market will value it at 20 three months hence.²³

Derived in response to the failure of capitalist enterprise to spur economic recovery from the Great Depression, Keynes's characterization of the investor who is constrained to operate within the casino of the stock exchange has remarkable resonance for the modern venture capitalist. In fact, the entire process out of which the activities of a small number of professional venture capitalists emerged as an industry between 1980 and 2000 was intimately entangled with and ultimately driven by the greatest bull market in the history of capitalism.

Evolution of the Venture Capital Industry

In 1980, following amendment of the Employee Retirement Income Security Act (ERISA) regulations to permit pension funds to invest in such risky assets as venture capital, the total capital committed to member firms of the National Venture Capital Association (NVCA) was \$2 billion, about \$6 billion in 2017 dollars. Twenty years later, in 2000, the flow of funds to venture capital peaked at no less than \$105 billion, having risen to that level from a relatively stable range of \$5–10 billion (in then-current dollars) from 1985 to 1995. Access to the stock market for new, venture-backed companies was almost continuous, punctuated by several hot IPO markets and culminating in the great dotcom/telecom bubble of 1998–2000. To provide some sense of scale, the total amount of capital raised in all venture-backed IPOs in the mini-bubble year of 1983 was \$3.8 billion, slightly less than \$9 billion in 2000 dollars. The amount raised in 1999 and 2000 was \$21 billion and \$26 billion, respectively.²⁴

Here we have a flag for identifying the factor that dominated venture returns over a generation – namely, the state of the public equity markets. Looking across the entire span from 1980 to the post-bubble

²³ *Ibid.* 154–155. A useful interpretation of Keynes's nuanced understanding of the context of “imperfect knowledge” in which investors function is provided by R. Frydman and M. Goldberg, *Beyond Mechanical Markets: Asset Price Swings, Risk, and the Role of the State* (Princeton University Press, 2011), pp. 121–127.

²⁴ National Venture Capital Association, *2010 Yearbook* (New York: Thomson Reuters, 2010), pp. 15, 19, 28, 43–46, 49–54.

era, the dependence of venture capital returns on access to the IPO market is clear. My own research, in collaboration with the late Dr. Michael McKenzie, characterizes each quarter from the start of 1980 through 2005 by the number of venture-backed IPOs and the proportion of them that were for companies not yet profitable; McKenzie and I employed these figures to generate an index of IPO market speculation. We found that when distributions back to the investors coincided with IPO market conditions characteristic of a bubble, the median internal rate of return (IRR) for the funds in our sample was no less than 76 percent; when exits occurred under poor IPO market conditions, the median return was only 9 percent.²⁵

Dependence on the public equity markets creates perverse incentives. Perhaps the most tempting path to perdition for a modern venture capitalist has been to attempt to read from current market signals the appropriate loci for new venture investments. Keynes explicitly cites the “inducement” to invest an “extravagant sum” if the project “can be floated off in the Stock Exchange at an immediate profit.”²⁶ But, almost invariably, the latency in the venture investment process is too great. New ventures were conceived and offered to the public market within the span of the bubble of 1998–2000, but the reckoning generally came too soon for the venture investors to liquefy their paper gains before first the shares and then the project they represented collapsed.

Yet the impact of the bubble and its aftermath on the profile of venture capital returns is enormous. As shown in Figure 4.1, from the incipient emergence of a venture capital industry in 1981 through funds launched in 1994, the aggregate distributions of venture capital firms to limited partners (net of fees and carried interest) amounted to 3.24 times the capital they had committed to the funds. For the 1995 vintage, the multiple reached 6.19 times, and it was 4.97 for the 1996 vintage. However, the 1998 vintage, at 1.38 times, was the last to generate a positive cash-on-cash return to limited partners through the first decade of the twenty-first century.²⁷

²⁵ M. D. McKenzie and W. H. Janeway, “Venture Capital Funds and the Public Equity Market,” *Accounting and Finance*, 51(3) (2011), pp. 764–786.

²⁶ Keynes, *General Theory*, p. 151.

²⁷ Cambridge Associates LLC and National Venture Capital Association, “Difficult Q3 2011 Did Not Slow Improvements in Long Term Venture Performance,” press release, January 24, 2012. Available at www.nvca.org/index.php?option=com_content&view=article&id=78&Itemid=102.

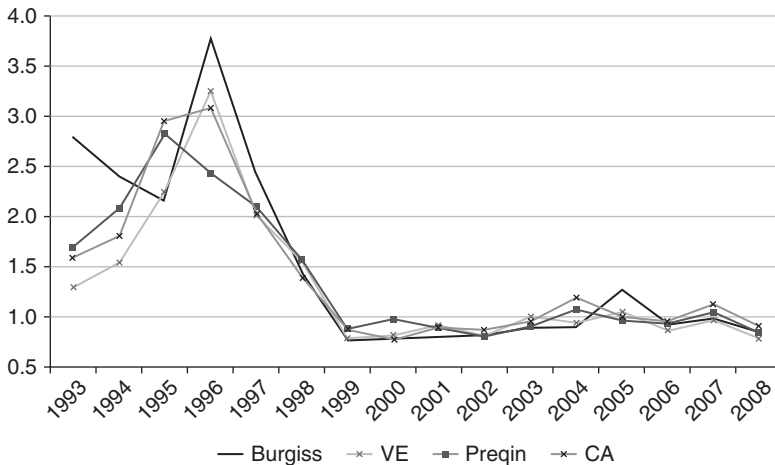


Figure 4.1 Actual and estimated PMEs.

Source: R. S. Harris, T. Jenkinson and S. N. Kaplan, “Private Equity Performance: What Do We Know?” *Journal of Finance*, 69(5) (October 2014), pp. 1851–1882, Figure 2.

The definitive academic analysis of “Private Equity Performance: What Do We Know?”²⁸ graphically illustrates the extraordinary out-performance of venture capital against the public equity markets during the bull run that fostered the industry’s growth to maturity. “PME,” or “public market equivalent” is a metric that has become universally applied in evaluating private equity since it was invented by Steve Kaplan and Antoinette Schoar.²⁹ For every fund, match the cash flow from limited partners and the disbursements back to the limited partners by amount and date with the same amounts invested in and recovered from a public market index: then compare the fund’s actual performance after fees and carried interest with what the limited partners would have received from that index. VC performance for the fund vintages that had the privilege of riding the bubble were extraordinary, peaking at more than 3.5 times what the public market delivered.

It was the herd-following movement of the major state pension funds that generated the approximately tenfold increase in the value of

²⁸ Harris, Jenkinson and Kaplan, “Private Equity Performance: What Do We Know?” The paper principally relies on data received from Burgiss, which is the heavy black line; the chart also shows comparable returns for other data sources: Venture Economics (VE), Preqin and Cambridge Associates (CA).

²⁹ See S. V. Kaplan and A. Schoar, “Private Equity Performance: Returns, Persistence and Capital Flows,” *Journal of Finance*, 60(4) (2005), pp. 1791–1823.

funds under management by members of the NVCA between the early 1990s and the mid-2000s, from an average of \$22 billion in the years 1989–1992 to a peak of \$240 billion in 2006. An immediate consequence was a comparable inflation in the scale of individual venture funds: firms went from raising \$100 million funds to raising \$1 billion funds. Sufficient opportunities to put that amount of capital to work in the classic venture capital model were simply not available, but a tenfold increase in management fees provided a powerful incentive against returning to pre-bubble scale.

A number of firms extended their mandate from funding early-stage ventures to acquisition of minority positions in established businesses and even to participation in leveraged buyouts. Each of these strategies has distinctive characteristics, and success in each depends on quite different disciplines that can be mastered only the hard way, through extended periods of learning by doing. Other firms have sought and found investment opportunities of sufficient scale to absorb multiples of the capital traditionally committed to start-ups: the ranks of failed alternative-energy ventures are testimony to their efforts.³⁰

A growing number of venture capitalists have reckoned that, in the prolonged absence of an active IPO market accessible by emergent companies prior to their reaching sufficient scale to launch a \$100 million issue, the rational strategy is to scale back both resources and commitments in order to focus on funding distributed research and development for large companies, with the explicit intent to hold an auction as soon as a venture has proven its concept and, thereby, forgo the risk and the opportunity entailed in trying to build a sustainable, independent business. Yet other firms have scaled back even further, backing consumer-oriented web start-ups whose odds of sustainable success may be very low but whose capital requirements for launch are also minimal, given the availability of free open source software, clouds of rentable computing resources, and the web itself as the channel for marketing and distribution.

³⁰ For a detailed analysis of this boom and bust, see B. Gaddy, V. Sivaram and F. O’Sullivan, “Venture Capital and Cleantech: The Wrong Model for Clean Energy Innovation,” MIT Energy Initiative Working Paper (July 2016). Available at <https://energy.mit.edu/publication/venture-capital-cleantech>.

Venture Capital's Dependence on Speculation

The bubble of 1998–2000 revealed the financial dynamic of the downstream phase of the Innovation Economy at its most extreme. The host of hopeful monsters, the vast majority of which failed, could be funded precisely because those who provided the financing needed to have only minimal concern for the fundamental economic value of the ventures. The investment decisions, by the founding venture capitalists as by the willing IPO purchasers, were not informed by evaluation of the future cash flows of the projects. The decisions were driven by the hope, indeed the expectation, that well before any cash flows would be generated, the shares would be sold to yet more hopeful – or foolish – buyers. Here too, as with upstream investments in scientific discovery and technological invention, the Innovation Economy turns on the ability of the economic system to tolerate waste. The systemic cost is less to the extent – as was largely the case in 1998–2000 – that speculative excess is limited to the equity markets and does not spill over to infect the credit system on which routine economic activity relies.

Since the Global Financial Crisis, venture capital has entered a new regime. On the one hand, fundraising has recovered to \$35–40 billion per year, about \$20–24 billion in mid-1990s dollars, or slightly more than twice the amount of funds raised then. But the IPO market has remained stubbornly stuck well below the average of 176 venture-backed IPOs per year during the 1990s. Over the sixteen years since the bubble burst, through 2016, the average number of venture-backed IPOs has been only 53; excluding the plague years of the Global Financial Crisis, 2008 and 2009, which each saw only 10, merely raises the average to 59, about one-third of the previous normal.³¹

The decline in IPOs was not only a function of the bursting of the dotcom/telecom bubble, then extended by the Global Financial Crisis. Since the end of fixed brokerage commissions in 1975, a series of reforms aimed at improving the transactional efficiency of the equity markets succeeded in reducing the profit from trading stocks to a minimum – especially in the case of thinly traded stocks with relatively small market capitalization. Not only was the subsidy to fundamental

³¹ *National Venture Capital Yearbook* for 2017. Available at <https://nvca.org/research/research-resources>.

investment research eliminated, a core source of revenues for independent investment banks was liquidated³²

The post-bubble imposition of enhanced reporting and accounting requirements on public companies has increased the cost of going and staying public. But the more fundamental yet neglected transformation has been in the architecture of the equity markets: consolidation of the investment banking industry reflects in good part the fact that the business model for the venture-focused investment banking firm no longer exists. During the climactic years of the bubble, all of the entrepreneurial investment banking firms aligned with the venture capital industry declared victory at premium prices by selling themselves to major institutions which, in turn, lost interest in the franchises they had acquired when the bubble burst. The cutely named Jumpstart Our Business Startups (“JOBS”) Act, passed into law in March 2012, will not reverse this institutional reality. By reducing regulatory oversight and transparency while sanctioning retail “crowd-sourcing” to finance speculative start-ups, however, the JOBS Act does have the potential to regenerate the unethical dynamics that characterized the IPO market prior to the 1970s.

This new regime has several observable characteristics. First, the average size of IPOs has risen substantially, to more than \$100 million in most years from less than half that in the 1990s. The global banks that now control access to the public markets need to deal in scale. Moreover, the median time to an IPO for venture-backed companies now exceeds eight years and, of course, only creates the opportunity for the venture investors to exit through subsequent sale or distribution. This is substantially longer than the five to six years typical since 2000, let alone during the bubble years when the median time was less than three years. Given that internal rate of return is the metric of choice for limited partners in evaluating the funds and firms in which they invest, and given that IRRs decline exponentially with increased time to realization, this limited and delayed access to the public market inevitably pushes VCs to choose exit by acquisition. In that channel, median time to complete exit has remained steady at about four years.³³ As discussed in Chapter 8, an

³² IPO Task Force, “Rebuilding the IPO On Ramp: Putting Emerging Companies and the Job Market Back on the Road to Recovery,” presented to the US Department of Treasury, October 20, 2011.

³³ 2Q 2017 Pitchbook NVCA Venture Monitor. Available at https://files.pitchbook.com/pdf/2Q_2017_PitchBook_NVCA_Venture_Monitor.pdf.

additional factor has been the massive shift of retail and institutional investors from actively managed funds to index funds, including ETFs, which do not buy unseasoned, newly issued shares and thus do not participate in IPOs.

The most distinctive new phenomenon has been the rise of the Unicorns: the ventures that have attracted continuing flows of investment at escalating valuations above \$1 billion while remaining private. As discussed in Chapter 1, the Unicorn Bubble will fade even as it has reaffirmed the propensity of investors to speculate at the frontier of innovation. It is, indeed, the case that the maturation of the digital environment through global deployment of the internet has created market spaces at a scale never before known: the commercial and financial success of Amazon and Google and Facebook – and of Alibaba and Baidu and Tencent in China – are real phenomena. These are the existence proofs that motivate the “fear of missing out” (FOMO) that has driven this bubble.

The core contradiction of the Unicorn Bubble, however, is the willingness of conventional, public market-oriented institutional investors to pay premium prices for *illiquid* investments. Such speculation has been augmented by capital coming from other unconventional sources, of which the largest is the Japanese cross between a more or less conventional, Asian-style holding company and a “Bet a \$100 Billion” player at the roulette wheel of technology: Softbank and its entrepreneurial founder and boss, Masayoshi Son. Softbank’s Vision Fund, assembled from a variety of sovereign wealth funds and corporate investors, signaled the breadth of Softbank’s range and Son’s ambition, investing no less than \$500 million in an early-stage software start-up appropriately named Improbables and serving as a receptacle for 25 percent of Softbank’s ownership of the leading semiconductor company, ARM.³⁴

At the other extreme, retail investors have discovered new channels for their speculative lust. Beyond Kickstarter and similar platforms for crowdfunding projects, an entirely novel vehicle emulating the dynamics of the South Sea Bubble has emerged. The innovative development of “distributed ledger” networks such as the Bitcoin blockchain

³⁴ See J. Mannes, “A Running List of Every Company Backed by the \$93B SoftBank Vision Fund.” Available at <https://techcrunch.com/gallery/a-running-list-of-every-company-backed-by-the-93b-softbank-vision-fund>.

bifurcated rapidly. On the one hand are the “dark” environments for reciprocal exploitation between scam operators and the suckers who are rarely given even breaks. On the other, established institutions, in pursuit of the potential benefits of reduced costs and increased flexibility subject to transparent oversight, are experimenting with the technology in a wide range of environments, from trade finance³⁵ to marine insurance³⁶.

One of these novel use cases has raised the game of speculative opportunism to a new level. “ICOs” – initial coin offerings – are a truly imaginative innovation for creating financial transactions in which everyone has the chance to lose. The issuer receives an amount of one form or another of existing, illiquid crypto-currency, which the investor will have purchased with “real” cash, while the investor receives a token in what may become yet another illiquid crypto-currency or potentially the output of a project whose descriptions typically evoke the fine exactitude of the ventures funded in the South Sea Bubble of 1720, as explored in Chapter 7.³⁷ No doubt some issuers are turning their proceeds back into cash as rapidly as possible, while others are playing the crypto-currency on-and-off-again ride, strong in the faith they share with their investors. As of this writing, some \$2.5 billion has been committed to ICOs: all that remains necessarily uncertain is the distribution of prospective losses between issuers and investors (less those who have gamed the arbitrage from cash to cash effectively).

For the extreme libertarians as well as for pedestrian pigeon investors, an important source of attractiveness is that ICOs have been outside of the regulatory net, advertised as not subject to the securities laws. In late July 2017, however, the SEC issued an Investor Bulletin to

³⁵ C. R. W. De Maijer, “The Digital Trade Chain: The Blockchain Train is Rolling,” July 16, 2017. Available at <https://www.finextra.com/blogposting/14296/the-digital-trade-chain-the-blockchain-train-is-rolling>.

³⁶ J. Kelly, “EY Teams Up with Maersk, Microsoft on Blockchain-based Marine Insurance,” *Reuters*, September 6, 2017. Available at <https://www.reuters.com/article/us-blockchain-insurance-marine/ey-teams-up-with-maersk-microsoft-on-blockchain-based-marine-insurance-idUSKCN1BG3B6>.

³⁷ For two enthusiastic celebrations of the phenomenon, see <https://blockgeeks.com/guides/what-is-an-initial-coin-offering>, and Tomio Geron, “How Blockchain and ICOs Are Changing the Funding Game for Startups,” *Wall Street Journal*, September 24, 2017. Available at <https://www.wsj.com/articles/how-blockchain-and-icos-are-changing-the-funding-game-for-startups-1506304861?mg=prod/accounts-wsj>.

warn of potential risks³⁸ and simultaneously ruled that tokens offered by one “virtual” organization known as DAO are, in fact, securities and subject to all the rules and regulations related to securities offerings.³⁹ As of this writing, the SEC proposes to deal with ICO offerings and issuers on a case-by-case basis: in September it charged two issuers with fraud.⁴⁰ The Chinese authorities have gone a step further, declaring all such offerings illegal, and have been followed by the South Koreans.⁴¹ Given the problematically emergent state of the Chinese financial system and its regulatory environment, this move can be marked on the side of maturity and responsibility.

As long as such extremely speculative funding is available, whether from passive institutions or equally passive retail investors, it is entirely understandable that entrepreneurs and their VC backers will take the cash and maximize growth while staying private, postponing the confrontation with Fred Adler’s definition of corporate happiness: positive cash flow from operations. Of course, the operational and cultural ability to adopt the requisite discipline must be problematic. In the meantime, measures of VC performance are radically distorted by the requirement of the Financial Accounting Standards Board that illiquid assets be marked to “fair value,” thereby driving up reported returns in advance of actual distributions of realized capital back to the limited partners.

A compounding measure of the unique and unsustainable character of the Unicorn Bubble is the deference that investors have paid to the founding entrepreneurs. The precedent was set by Google and reinforced by Facebook: each of these giants of the digital revolution went public with the founders holding shares that carried extra votes to ensure effective control and freedom from the need to respond to short-term pressures from public stockholders. In those cases, all investors – including the original venture capitalists – enjoyed the liquid opportunity to trade out of the stock at their own volition. Granting equivalent privileges to the founders of companies determined (or condemned) to stay private is another matter altogether. The melodramatics of the unfolding saga of

³⁸ https://www.sec.gov/oiea/investor-alerts-and-bulletins/ib_coinofferings.

³⁹ <https://www.sec.gov/litigation/investreport/34-81207.pdf>.

⁴⁰ <https://www.sec.gov/news/press-release/2017-185-0>.

⁴¹ A. Woodhouse, “PBoC Declares Initial Coin Offerings To Be Illegal,” *Financial Times*, September 4, 2017. Available at <https://www.ft.com/content/d261b7bb-cb36-3236-9a8a-f9e2a6b825ao>.

Uber are literally unprecedented: here one of the most successful of Silicon Valley venture firms, Benchmark Capital Partners, has found it necessary to sue the founder in order to construct a path to operational stability, financial responsibility and ultimate liquidity.⁴²

The historic dependence of venture capital returns on the state of the IPO market at time of exit is one of four stylized facts about venture capital. The second one, widely recognized, is the extraordinary skew in such returns: a very small number of venture capital funds and firms drive the aggregate returns for the industry as a whole. In the database of 205 venture funds that McKenzie and I analyzed, the mean internal rate of return was 47 percent. However, the mean rate of return realized by the top decile of funds was an extraordinary 215 percent; excluding these twenty funds from the sample dropped the mean return to 27 percent.⁴³

The third stylized fact of venture capital is that – in contrast with all other asset categories – persistence can be detected in the returns of individual managers. Analysis of our data confirmed the findings of a survey of a broader sample of funds conducted by Steven Kaplan and Antoinette Schoar: performance of a given fund is a significant predictor of the returns realized by the next fund of the same managers.⁴⁴ Persistence in the success rate of serial entrepreneurs can also be discerned,⁴⁵ confirming the intuition that superior venture capitalists and superior entrepreneurs establish a self-reinforcing positive feedback loop. Recently the “persistence of persistence” in VC returns for the post-bubble era has been documented by an authoritative academic study:

Post-2000, we find that performance in venture capital funds remains as persistent as pre-2000. Partnerships whose previous venture capital funds are below the median for their vintage year

⁴² M. Isaac, “Uber Investor Sues Travis Kalanick for Fraud,” *New York Times*, August 10, 2017. Available at <https://www.nytimes.com/2017/08/10/technology/travis-kalanick-uber-lawsuit-benchmark-capital.html>.

⁴³ McKenzie and Janeway, “Venture Capital Funds and Public Equity Market,” p. 8.

⁴⁴ M. D. McKenzie and W. H. Janeway, “Venture Capital Fund Performance and the IPO Market,” Centre for Financial Analysis and Policy, University of Cambridge Working Paper 30 (2008), p. 21 and table ix.

⁴⁵ P. A. Gompers, J. Lerner, D. Scharfstein and A. Kovner, “Performance Persistence in Entrepreneurship and Venture Capital,” *Journal of Financial Economics*, 96(1) (2010), pp. 18–32.

subsequently tend to be below median and have returns below those of the public markets (S&P 500). Partnerships in the top two quartiles tend to stay above the median and their returns exceed those of the public markets.⁴⁶

Venture Capital's Dependence on the State

The fourth stylized fact of venture capital (largely neglected in the academic literature, unlike the first three) is that professional venture capitalists have concentrated their activities and earned their returns in a very small number of industrial domains. As set forth in Figure 4.2, over more than thirty-five years since 1980, the ICT sector has accounted for 50 percent to 75 percent of all dollars invested by members of the NVCA, with its average share usually hovering around 60 percent.⁴⁷ The ICT and biomedical sectors together have consistently accounted for 80 percent of all dollars invested by venture capitalists.⁴⁸

Amount (\$billion)	1980	1985	1990	1995	2000	2005	2010	2015
ICT	0.2 (44%)	1.9 (70%)	1.4 (53%)	4.0 (54%)	75.4 (75%)	13.6 (60%)	10.8 (49%)	42.1 (71.2%)
Healthcare/ Biotech	0.1 (16%)	0.4 (13%)	0.7 (26%)	1.8 (23%)	7.6 (8%)	6.6 (28%)	6.3 (29%)	10.9 (18.4%)
Other	0.2 (39%)	0.4 (16%)	0.5 (20%)	1.6 (21%)	17.6 (17%)	2.7 (12%)	4.9 (22%)	6.1 (10.3%)
<i>Total</i>	<i>0.5</i>	<i>2.6</i>	<i>2.6</i>	<i>7.4</i>	<i>100.5</i>	<i>22.9</i>	<i>22.0</i>	<i>59.1</i>

Figure 4.2 Limited scope of VC investments.

Source: NVCA 2016 Yearbook.

⁴⁶ R. S. Harris, T. Jenkinson, S. N. Kaplan and R. Stucke, “Has Persistence Persisted: Evidence from Buyout and Venture Capital Funds?” August 2014. Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2304808.

⁴⁷ The standard deviation of the time series is only 0.09 over the period.

⁴⁸ National Venture Capital Association, 2010 Yearbook, p. 31, and 2017 Yearbook, p. 21. The ICT sector includes Media and Entertainment, which did not become a significant category until the mid-1990s. By that time (for venture capitalists, at least), it was embedded in the world of the internet. Also, in 2017 the NVCA switched its data provider from Thomson Reuters to Pitchbook, whose coverage is greater but whose time series only dates from 2004. However, the distribution of investments by sector is broadly comparable.

In Chapter 2, I discussed the extraordinary endowment that federal funding of scientific research and technological development provided to the nascent venture capital industry, with the Defense Department as a customer for the products of ICT. Biotechnology, too, was fostered by research funding from the NIH. This history is central to addressing a question that should have been confronted – but very rarely has been – by anyone who evaluates the phenomenon of the venture capital industry of the past generation. Just why has it been in the world of information technology and, secondarily, biomedicine that venture capitalists have been so successful, in striking contrast with the nearly continuous record of failure across so many other frontiers of scientific discovery and technological innovation? In brief: only in these sectors of research did the state invest at scale in the translation from scientific discovery to technological innovation. Through the Defense Department and the NIH, that is, the federal government funded construction of platforms on which entrepreneurs and venture capitalists could dance.

Biotech demonstrates most clearly the critical role for venture capitalists of access to the public equity markets and confirms the distinctive persistence in returns. As my partners at Eberstadt and I realized at the birth of the industry in the late 1970s, the prospective fate map of a biotech start-up is very different from that of a new software or semiconductor company: it is not possible to imagine how a biotech venture will generate revenues from the sale of products (versus from the sale of rights to those possible revenues) within the lifetime of the investing venture fund. The industry's historical economic performance has manifestly fulfilled this expectation.

Gary Pisano provides an authoritative analysis of the biotech industry over its first thirty years of existence:

From 1975 to 2004 . . . while revenues have grown exponentially . . . profit levels essentially hover close to zero throughout the life of the industry. Furthermore, the picture becomes even worse if we take the largest and most profitable firm, Amgen, out of the sample. Without Amgen the industry has sustained steady losses throughout its history . . . The analysis includes no privately held firms, almost all of which lose money. Therefore, the data presented here are just for the most profitable part of the industry populations.⁴⁹

⁴⁹ G. Pisano, *Science Business: Promise, Reality, and the Future of Biotechnology* (Boston, MA: Harvard Business School Press, 2006), p. 117.

Pisano calculates that “the average time to first year of positive cash flow” for public biotech companies “was approximately eleven years,” and this lag was from the date of their IPO, not from their actual inception as enterprises some substantial number of years earlier.⁵⁰ But he overstates his intuition when he writes:

It is virtually impossible to find other historical examples, at least at the industry level, for which such a large fraction of new entrants can be expected to endure such prolonged periods of losses and for which the vast majority may *never* become viable economic entities.⁵¹

There are other sectors where comparably long and variable time to positive cash flow has stunted venture capital activity. For example, there is no successful record of venture investment in industries derived from materials science other than the state-sponsored silicon semiconductor industry. Plastics, that touchstone of entrepreneurial possibility, was no place for a venture capitalist, however patient. As I learned from Ed Giles at Eberstadt, it took DuPont and General Electric each at least twenty years and more than \$1 billion of then-current dollars to commercialize the new generation of engineered plastics.

That history is in the process of repeating itself in the domain of nanoscience and nanotechnology: again, it will require the ability to mobilize very large financial resources over decades to identify what potential applications serve economic needs and to work down the learning curve to reliable and efficient production – both tasks appropriate for established businesses and simply not available to start-ups.

Both Nelson’s and Arrow’s arguments for the greater ability of large, multi-product firms to invest in long-term R&D appear relevant. In this context, recent academic research that suggests substantial reduction in the commitment to basic science by those corporations is troubling: we shall revisit the issue of systemic short-termism in Chapter 12.⁵² In another domain requiring massive investments extended over many years, and in the face of a massive incumbent industry embedded in the political and regulatory system, the premature

⁵⁰ *Ibid.* ⁵¹ *Ibid.* 118 (emphasis in original).

⁵² See A. Arora, S. Belenzon and P. Pataconi, “Killing the Golden Goose? The Decline of Science in Corporate R&D,” National Bureau of Economic Research Working Paper 20902 (January 2015).

efforts by venture capitalists to promote clean tech and green tech ahead of the required public investment in the enabling science and technologies failed to ignite the desired speculative response from the financial markets.⁵³ Here, the exceptional American resistance to acceptance of climate change as legitimizing state underwriting of frontier innovation from research to deployment, equivalent at least to the commitments that birthed the digital revolution, requires the extended consideration it also receives in the Conclusion.

The question remains: Why have venture capitalists continued to fund biotech ventures despite their disappointing prospective and realized operating performance, and done so in increasing absolute amounts? Commitments to biomedical ventures were approximately \$500 million per year from 1985 through 1994 and rose with the scale-up of venture capital generally to \$4 billion at the peak of the bubble. Since 2004, venture capitalists have invested more than \$4 billion in biotech companies every year through 2016, with investment peaking at almost \$10 billion in 2015 and holding at almost \$8 billion in 2016.⁵⁴

The puzzle is resolved by the fact that, through the early years of this century, the returns venture capitalists have earned from biotech compare reasonably well with the returns from ICT. And, unsurprisingly, these returns have been a function of access to the IPO market. There were more than ten IPOs for biotech companies in fifteen of the thirty years from 1980, with hot activity clustered in 1983, 1991–1993, 1996–1997 and 2000–2010. Remarkably, from 2004 to 2007, relatively dismal years for venture-backed IPOs, there were seventy-seven biotech IPOs, substantially more than the aggregate of all the ICT sectors combined.⁵⁵ And since the Global Financial Crisis, biotech IPOs have routinely accounted for more than half of all VC-backed IPOs, a substantially larger proportion than had been the case previously. This helps to explain why the rates of return to funds concentrated on biotech have approximated those of the venture capital industry as a whole.⁵⁶

⁵³ For a deeply informed analysis of the daunting challenges involved in bringing innovation to “legacy” industries, most notably the energy sector, see W. B. Bonvillian and C. Weiss, *Technological Innovation in Legacy Sectors* (Oxford University Press, 2015).

⁵⁴ National Venture Capital Association, 2017 *Yearbook*. ⁵⁵ *Ibid.* 51.

⁵⁶ Pisano, *Science Business*, p. 113.

But why have public investors stood ready to buy into such IPOs? Pisano offers an explanation:

While the aggregate returns to biotechnology are poor, investors are focusing on the “tails” of the distribution. The phenomenal stock returns for a company like Amgen provide a beacon for investors . . . Never mind that the probabilities are very low and, on a risk adjusted basis, it may not be a good bet. The promise is there.⁵⁷

There is another, deeper reason, as touched on in Chapter 3. When a molecule is identified as a potential therapeutic response to a disease state, the population of potential patients – the “addressable market” – is known. So is the approximate charge per treated patient based on drugs already in the market. And because demand is funded by third-party payers and is consequently inelastic, a plausible forecast of revenue can be projected contingent, of course, on successful clinical trials and approval by the Federal Drug Administration.

Thus, a biotech start-up is unique: only in this instance is it possible to estimate a fundamental value, the present value of the net cash flows from the investment, *if* – and it is a huge *if* – the scientific and regulatory hurdles to market entry are overcome. The fact that investors have repeatedly chosen to bet on that contingency demonstrates, as well, the weight that market risk bears versus scientific and technological risks: the biotech exception exemplifies the value attached to the minimization of market risks in a domain where scientific and technological risks are enormous.

Against the odds, in biotech there are a few repeatedly successful venture investors: Brook Byers of Kleiner Perkins and Tony Evnin of VenRock established extraordinary track records over more than thirty years. Their records confirm my lived experience and the weight of my own and others’ academic research. Rather than allocate capital to venture funds as if they were an independent asset class that can be expected to yield returns reliably and significantly higher than those available in the public equity market, investors should seek access to that small number of professional venture capitalists who have demonstrated their distinctive skill over multiple funds and across diverse

⁵⁷ *Ibid.* 129.

market conditions. If such access is not available, the lesson is simple and absolute: move on.

In the late 1980s, my academic research into venture capital returns was two decades in the future. But the underlying intuition, informed by practical experience of the contingent nature of venture returns, was becoming established in my mind. The central focus of my investment activity was the computing complex, broadly defined. There, dependence on the haphazard appetite of the public equity market was not as decisive as elsewhere because it was plausible that positive cash flow from operations could be achieved within the investment horizon of the founding venture capital funds. And this was largely because the government's sunk investment in the underlying science and technology positioned venture investments far enough along the road from invention to commercially realized product or service.

And so at that very specific intersection of professional experience and techno-economic evolution, the dynamic of the Three-Player Game as applied to the Innovation Economy could be already discerned, even if the words to express it were yet unknown to me. The effort to extract Braudel's super-profits from technologically driven disruption in the market economy was subsidized by the state's unprecedented commitment to the sector. The realization of such gains, however, would be a function of speculative interest, even excess, on the part of the broader financial markets.

Starting at Warburg Pincus

I joined Warburg Pincus on July 5, 1988, soon after completing my obligation to Flemings. I had known John Vogelstein, the firm's President and Chief Investment and Operating Officer, for almost a decade. By far the largest member of the NVCA, Warburg Pincus had always appeared on the list of potential investors for the post-venture private placements that had been the core of Eberstadt's corporate finance business. But the firm's investment strategy cut right across the grain of what we were offering. Never a passive investor in any situation, Warburg Pincus always sought to act as the strategic financial partner of management, generally buying senior securities with governance rights and protections and invariably securing a seat on the board of directors. I had grown to admire John's extraordinary investment

acuity from afar as, time and again, he would analyze a proposed deal in depth and explain why – as attractive as it was as a business – it was not an investment opportunity for Warburg Pincus.

Since the 1960s, Warburg Pincus had been a pioneer in the professionalization of what had been known as the “deal business” in old Wall Street. Investment banking firms had long constructed private, illiquid investments for themselves and their clients, the substance ranging from oil wells to movies to black box antigravity machines that cured cancer, also known as high technology. The deal business was very much a hit-or-miss activity, although there were some stand-out practitioners, including Laurance Rockefeller, Benno Schmidt of J. H. Whitney, André Meyer of Lazard, and Ferdinand Eberstadt. As a young investment banker in the early 1960s, Lionel Pincus had imagined the possibility of building a firm exclusively dedicated to such investments and had enticed his friend John Vogelstein to join him in the endeavor.

Lionel enjoyed a critical jump start in implementing his vision because of his association with Eric Warburg, son and heir of the great Max Warburg, Germany’s leading financier from the end of the nineteenth century through the 1920s. By the time the Nazis seized control of M. M. Warburg & Company, Eric was established in New York. His family ties there were deep: one uncle, Paul Warburg, had been a leading architect of the Federal Reserve System, and another, Felix Warburg, was in the process of establishing an international network of philanthropies from his mansion at 92nd Street and Fifth Avenue, now the Jewish Museum. The two brothers had forged a dynastic alliance through marriage with the daughters, respectively, of Solomon Loeb, founder of New York’s leading Jewish investment bank – Kuhn, Loeb – and of Jacob Schiff, the bank’s dominant force.

In 1971, Warburg Pincus had made the critical transition from ad hoc deal-making to establishing an institutional base. Lionel and John raised their first fund, EMW Ventures, with \$41 million in capital. “It seemed like all the money in the world,” Lionel used to say. Through shrewd reading of a stock market whose valuations were being undermined by the financial and economic consequences of the Vietnam War even before the first oil shock in September 1973, they kept their powder dry. In the subsequent bear market, the firm made strategic investments in deeply discounted public companies, notably Twentieth Century-Fox and the predecessor to Humana, and funded the construction of a major waste-disposal business.

Overcoming the mathematical burden of having taken down all its capital at inception, EMW Ventures delivered a net internal rate of return of 15 percent over a decade (half of the 30 percent it would have earned had the funds been taken down as needed, in line with what shortly became standard practice). Lionel and John also managed to ignore the increasing frustration of Eric Warburg's second cousin Siegmund Warburg. Even as he constructed the leading investment bank in London, Siegmund never reconciled himself to the reality that there was an American firm with equal right to his family name but in whose success he played no role and over which he exercised no influence.

Lionel and John built on their investment success to scale the firm's resources substantially. The world's first ever private equity \$100 million fund in 1980 was followed by a \$341 million fund in 1983 and the first ever \$1 billion fund in 1986. Throughout, the firm remained true to its core strategy: bringing active but patient equity capital to back exceptional operating executives in order to build or rebuild significant and sustainable businesses. With this broad investment mandate, Warburg Pincus was prepared to operate across the life-cycle of the enterprise, from funding early-stage start-ups, to making minority investments in growth companies, to acquiring part or all of established but undervalued businesses. Always on the side of Keynes's enterprise in working to evaluate "the prospective yield of assets over their whole life," the firm also had a powerfully contrarian view relative to speculation. With the decade-plus life of its funds, Warburg Pincus could afford to invest against the current mood of the market. By the late 1980s, the firm had become a master player of the game between financial capitalism and the market economy.

As the firm grew and matured, it began to develop deep expertise in selected industry sectors where early investment success fostered an understanding of the longer-term industry dynamics. The first of these, following on the success of Humana, was in healthcare services, broadening out progressively into medical devices and biotechnology. But even though the firm was the largest founding member of the NVCA, Warburg Pincus kept its distance from high-technology ventures. This was the one sector where it was a follower, taking positions in later rounds behind such leading venture firms as Kleiner Perkins and Asset Management. Now, with a \$1 billion fund to invest, John had decided, with Lionel's support, that it was time to explore whether the

firm could invest successfully in the most rapidly growing sector of the economy in its own distinctive fashion, not as a secondary member of a syndicate but as the lead – even the sole – investor.

In conversation over lunch in April 1988, John and I spontaneously discovered a shared sense of opportunity. Over the previous fifteen years, evolving as a hybrid investment banker and venture capitalist, I had extracted several strategic lessons. The first began as an observation: at any point in time, there is more technology available than anyone knows what to do with. Its corollary was that merely contributing to the stock of available technology creates no economic value. Identifying market needs and delivering products and services that would meet those needs – that was the source of value. Contrariwise, if a market need was obvious and the technology was available, multiple products from multiple ventures would surely be launched simultaneously. I had observed the notorious disk drive battle of the early 1980s from afar: twenty venture-backed start-ups attacked the market, of which no more than two delivered a positive return.⁵⁸ This was followed closely by the JAWS (“just another workstation”) war, in which a dozen start-ups competed and from which only Sun Microsystems and Silicon Graphics emerged as winners.⁵⁹

A second and closely related lesson was that the best technology was not destined to win; in fact, there were precedents for believing that it was likely to lose. At three critical turning points, the companies that had developed the best implementation of state-of-the-art information technology were run over by those who solved the business challenges of marketing and sales. Too often those who had developed the best technology – and knew it was the best – acted as if they believed that the commercial components of the business were of secondary significance. In their path-breaking work in evolutionary economics, Nelson and Winter had modeled the competition between innovators and imitators: “In our model world, an imitative strategy may, if supported by luck early in the industry’s evolution, be a runaway winner. And certainly imitators will have good luck at least some of the time.”⁶⁰

⁵⁸ P. A. Gompers and J. Lerner, *The Venture Capital Cycle*, 2nd edn. (Cambridge, MA: MIT Press, 2004), p. 165.

⁵⁹ H. Kressel and T. V. Lento, *Investing in Dynamic Markets: Venture Capital in the Digital Age* (Cambridge University Press, 2010), p. 24.

⁶⁰ R. R. Nelson and S. G. Winter, *An Evolutionary Theory of Economic Change* (Cambridge, MA: Belknap, 1982), p. 344.

At the end of the 1970s, Zilog Semiconductors, which had owned the market for first-generation microprocessors that handled data 8 bits at a time, designed the best microprocessor for handling data 16 bits at a time. But the new Z8000 was incompatible with the host of software applications programmed to run on the Z80. As Zilog stranded its customer base, both Motorola and Intel invested in building technically inferior 16-bit microprocessors that were compatible with their respective previous-generation devices. Intel especially exemplified the triumph of marketing: its Operation Crush campaign not only won position as the engine of the IBM personal computer but established Intel's x86 architecture as the standard for a generation to come.

As it happened, Zilog's loss became our opportunity: a decade later, one of our first successful IT investments at Warburg Pincus was to back a management team that knew how to apply Zilog's legacy technology to low-cost consumer electronics. Jointly, we constructed the first ever leveraged (actually, very underleveraged) buyout of a technology company when Exxon, Zilog's original sponsor and then owner, completed the liquidation of Exxon Enterprises, its utterly failed effort to divert excess cash flow from oil and gas to information technology.⁶¹

The second example of the best technology losing was also centered on the IBM PC, when IBM belatedly recognized the controlling significance of the operating system, the software that manages the resources within a computer. In its rush to market with its original PC, IBM had sanctified Microsoft's Disk Operating System (MS-DOS), itself kludged together from the work of others. Now IBM developed its own proprietary alternative, OS2, with robust features informed by a long generation of advanced research and operational experience from operating systems built for mainframe and mid-range computers. But Microsoft's hold on the PC market was never shaken, rooted as it was in the enormous and ever-growing base of third-party tools and applications and user-implemented extensions tied to DOS and to its fragile but compatible successor, Windows.

Third, by the late 1980s, it was becoming apparent that Oracle was winning a dominant position in the market for relational databases. This technology, initially conceived at IBM but with a variety of

⁶¹ For a summary of the Zilog investment experience, see Kressel and Lento, *Investing in Dynamic Markets*, pp.148–155.

implementations emerging from university computer science departments, was becoming the software platform of choice for business applications developed outside the centralized mainframe datacenters dominated by IBM. Again, Oracle's version was generally recognized as technically inferior to other implementations of the relational model. But Oracle combined a determination to adapt its technology to every existing computer and operating system with a uniquely aggressive domestic sales force and an imaginative and highly successful approach to building an international presence. In the USA, Oracle succeeded in cutting off the oxygen – that is, cash receipts – of its competitors, while overseas the company learned how to integrate consulting services with technology to deliver working solutions to customers.

The overriding lesson went back to BRL and MicroPro. The lesson could be relearned through the problematic maturation of every start-up. In information technology, just as much as in the life sciences and every other industry, corporate happiness is positive cash flow. Mainstream venture capitalists were focused on launching projects to build the fastest, cheapest, best version of what the underlying science and technology would allow, one or possibly two of which might develop legs as a sustainable business. But an alternative model and strategy offered itself. This involved reading major markets for discontinuities, then looking backward to identify the relevant components of a business dedicated to exploiting the discontinuity. In this context, technology and the products and services it enabled were only one set of needed components. Also important were a customer base, channels to market, marketing itself, and customer implementation and support services. Given the goal of reaching positive cash flow from operations as rapidly as possible, my mantra was “Buy what you can; build what you must.”

This investment philosophy fit extraordinarily well with Warburg Pincus's approach. From its beginning, the firm had refused to limit the scope of its investment activities to any one style: by 1988 it had made money from start-ups, from buyouts and from all manner of investments in growth and turnarounds. Its strategy was as eclectic as that of Braudel's canonical capitalist. From my perspective, this opened the door wide to exploring alternative approaches for exploiting market discontinuities. If an existing business with an established competitive position, positive cash flow and strong operational management were available for acquisition at an attractive valuation, we had the mandate

to do so. On the other hand, the firm possessed both the financial resources and the cultural discipline to commit to building a business from scratch, knowing that it could take three to five years for it to achieve the intermediate goal of positive cash flow and as many as another three to five years for the firm to realize the rewards from the investment.

This prospectively allowed for resolution of what I had come to think of as the start-up paradox. On the one hand, as I had learned more than once, start-ups suck. So much work has to go into so many ancillary activities – leasing space, creating a chart of accounts and on and on – that generate no distinctive value. And the layers of uncertainty are daunting. Will the product light up when you plug it in, as Pike Sullivan used to ask? Will anyone pay for it if it does? Will management exercise minimally requisite levels of discipline and judgment? And yet, on the other hand, there are markets so compelling that one must participate, even if there is no mode of access other than a start-up. In direct contrast to the classic venture capital model, from my perspective doing a start-up is a last resort. But now in such a project, as in all others, I would be aligned with a firm that possessed the resources to assure access to cash and maintenance of control at the outset and throughout the life of any investment.