Topics in Corporate Finance

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9 NUMBER

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ISBN 90-805728-9-6
ISSN 1567-7664

PREFACE

Academics and practitioners readily admit the importance of entrepreneurs for the wealth of nations. However, the relationship between the economic and social environment, entrepreneurship and value creation is not yet well understood. Moreover, at the micro-level, the optimal organization of the entrepreneurial firm and its access to human and financial capital is continuing to be an important public policy issue.

Against this backdrop the Amsterdam Center for Corporate Finance (ACCF) has decided to devote this issue of its discussion series "Topics in Corporate Finance" to entrepreneurship, covering the economic relevance of entrepreneurship and its organizational, strategic and financial challenges. The preeminent researcher in this case, Professor Amar Bhidé of Columbia University, has provided four excellent articles that each form a chapter in this booklet. The first chapter addresses the relationship between entrepreneurship and economic growth, and thus discusses the economic relevance of entrepreneurship. The second chapter discusses the origin and evolution of successful entrepreneurs and their strategies. The third chapter focuses on the access of entrepreneurs to external finance, in particular venture capital. The final chapter discusses the importance of control of honest mistakes and its effect on the financing of novel projects.

Amar Bhidé offers an intriguing perspective on the key success factors of entrepreneurs. Perhaps most surprisingly, several of the most successful entrepreneurial companies offer "me too" products in rather turbulent and small niche markets, and have entrepreneurs that are rather inexperienced. But many more insights emerge. "Entrepreneurship and Venture Capital", issue 9 in the discussion series "Topics in Corporate Finance", is a joyful blend of theory, anecdotes, survey based evidence and historical insights from economic thought. It shows how complex the issues are, partially explaining the lack of specific guidance that comes from economic theory.

We hope that you enjoy reading it, and that this publication may contribute to bridging the gap between theory and practice.

A.W.A. Boot
C.M. van Praag
October 2004

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Summary

"Entrepreneurship and Venture Capital" is a collection of four related articles written by Professor Amar Bhidé from Columbia University. All four provide interesting stories, claims and theories about the origin and evolution of many entrepreneurial firms. In this way, they help disclose the myths of entrepreneurship.

The first chapter "Entrepreneurship and Growth" discusses the economic role of entrepreneurship. Three common misunderstandings, or myths, are reviewed and put into perspective. The first myth, "Unitary Models", bridges the gap between the early and later works of Joseph Schumpeter, one of the founding fathers of the economics of entrepreneurship. In his early work, Schumpeter claims that entrepreneurs and their small and new firms are the source of technological change and innovation. However, in his later work he attributes these important economic functions to big and existing firms and their R&D departments in particular. Bhidé unifies these views by making plausible that small and large firms do not necessarily compete but play complementary roles: small entrepreneurial firms undertake projects with relatively low complexity but with high risk and low funding needs whereas large corporations occupy the opposite position of the spectrum.

The second myth, the "Growth Imperative" claims that entrepreneurial firms that enter the market "creatively" destroy incumbent and large firms. But as Bhidé argues, the magnitude of the "destruction" brought about by new combinations is often exaggerated as is the rate at which it occurs. Only some businesses succumb to new combinations. Other factors such as incompetence and over-confidence likely play a more significant role in the failure and contraction of businesses.

The third myth is about the determinants of the structures of new industries. Bhidé argues convincingly that new industries do not follow a predetermined path: the goals and abilities of entrepreneurs have a profound impact on the structure of markets.

The second chapter, "The Origin and Evolution of New Businesses" demystifies the being of entrepreneurs in general. Based on a sample of 100 very successful startups (that made the *Inc.* 500 list) Bhidé observes that the typical successful new venture confronts serious limitations. The founders of businesses usually start without an original idea, and they often lack deep business or industry experience. These limited endowments preclude most entrepreneurs from raising much capital and force them to bootstrap their ventures with personal funds or small amounts raised from friends or relatives.

Entrepreneurs can most easily cope with such lack of original ideas, experience, and capital if they start businesses in niches with high uncertainty i.e., unsettled market conditions and nearly total dependence on the entrepreneur's personal ability to satisfy fuzzy customer needs. Although the most likely payoff in such business isn't large, it provides the entrepreneur with a chance to make a significant return. Competing in small, uncertain niches also allows the bootstrapped entrepreneur to avoid competing against well-capitalized rivals.

Concerning entrepreneurs' strategies, Bhidé sketches the following progression in the evolution of the strategies of promising ventures. Entrepreneurs start their businesses in an ad hoc way, without any systematic effort to find the best possible opportunity. Through a determined, but usually not systematic search, some entrepreneurs find larger opportunities that provide a platform for building a coordinated system of assets that can sustain a long-lived firm. The development of the system is neither random nor fully planned; rather, it evolves through experiments conducted within the framework of the firm's strategy. Entrepreneurs make *a priori* choices about the type of firm they would like to build and the rules they adopt to do so. The entrepreneur conducts many experiments within the guidelines of long-term rules and also experiments to refine and expand the rules.

Whereas the first part of the book discusses the role, origin and evolution of new businesses, the second part of the book is devoted to the funding, monitoring and control of new and entrepreneurial businesses.

Chapter three discusses the essentials of the most typical form of entrepreneurial finance: venture capital investment. Bhidé writes: "During the Internet boom, the venture capital model seemed omnipotent. Now, after scores of dotcoms backed by blue-chip venture capitalists have gone bust, it is time for a sober evaluation: in normal times, what are the advantages and limitations of the venture capital model?"

Investors in start-ups have an incentive to provide considerable monitoring and oversight. In public markets, the diversified investor's incentive to monitor and intervene is low. Also, companies might find it difficult to discuss strategy and performance with widely dispersed investors, so stockholders lack the confidential information to monitor managers and distinguish between their luck and skill. In (small) private companies however, investors are fewer, have a higher incentive to monitor and can demand access to information they need to evaluate performance. Professional venture capitalists, who invest others' funds rather than their own, might have less of an ownerships stake but their incentives are optimized by the introduction of systematic procedures and criteria for evaluating and monitoring investments.

The limit to the number of deals venture capitalists can manage sets a higher threshold for the returns they require. Instead of dividing their time between many small opportunities, they concentrate on a few ventures that have the potential to make substantial returns. The threat of failures and limited time horizons reinforce this preference.

In trying to identify big winners, venture capitalists look for companies that serve large markets with a proprietary technology or process. Venture capitalists also favor seasoned founding teams who can significantly increase a venture's chances of becoming large quickly. Many ventures whose prospects are too small or uncertain at the outset qualify for venture capital financing only later, as their business models and management capabilities are proven.

In the final chapter, "Taking Care: How Concerns about Prior Knowledge Affect the Financing of Novel Projects", Bhidé discusses the importance of the control of *honest* mis-

takes and its effect on investment behavior, particularly in entrepreneurial firms and projects. Many economists have studied and modeled the control of "dishonest mistakes", i.e. moral hazard. However, the topic of the control of honest mistakes is rather new and has an immense field of practical applications. Concern about these honest mistakes encourages principals to examine track records of the agents' prior use of the same required knowledge. But such records cannot exist for novel projects. Therefore entrepreneurs may fail to obtain outside financing. This argument helps explain why highly novel ventures are initially self-financed and can subsequently attract outside financing. Standard moral hazard theories cannot explain this sequence of self-financing and external finance at a later stage of the business. The framework also provides new insights about the differences in the novelty and other attributes of projects financed by self-financed entrepreneurs, "angel" investors, venture capital partnerships and large public companies.

1 Entrepreneurship and Growth

1.1 Introduction

The current interest in the societal contribution of new and transitional businesses has its roots in Schumpeter's challenge to conventional economic theory. Schumpeter argued that new technologies and "combinations" that disrupted the prevailing equilibrium, rather than say, the steady accumulation of capital stock, led to the long term growth and development of capitalist economies. Economist Robert Solow's 1956 and 1957 papers seemed to bear out Schumpeter's claim. They reported, according to the economist Stiglitz (1990), the "shocking" empirical finding that "most of the growth of the economy over the past century had been due to technological progress" (p. 53). According to Solow (1957), an increase in the use of capital accounted for only 12.5 percent of the doubling of gross output per man hour from 1909 to 1949; the remaining 87.5% was due to "technical change" (p. 320).

Solow's results "have held up remarkably well to more than three decades of extensive and thorough investigation" (Stiglitz (1990), p. 53). According to some scholars, the so-called Solow "productivity residual" points to the critical role played by entrepreneurs. According to Baumol (1993), any technical change or innovation "will require entrepreneurial initiative in its introduction". By "ignoring the entrepreneur we are prevented from accounting fully for a very substantial portion of our historic growth" (p. 4). Although many formal models of growth do not contain an explicit entrepreneurial variable, many scholars of technological change such as Stanford economist Nathan Rosenberg, as well as popular writers, such as George Gilder, and policy makers share Baumol's viewpoint.

I hesitate to add to the discourse. I have little expertise in the field of technological innovation and just a faint acquaintance with growth theory and models. I have not undertaken research with the intention of drawing inferences about the "macro" effects of entrepreneurship. That said, my analysis of several hundred entrepreneurs and scores of established firms did lead to propositions that conflict with prevailing beliefs about how entrepreneurship affects economic activity. In the rest of this chapter I question common myths about a unitary model of entrepreneurship, creative destruction and the determinism of industry structures. This material is adapted from my book, *The Origin and Evolution of New Businesses,* (2000).

1.2 Myth 1: Unitary Models

What is the "right" model for entrepreneurship? The answer to this question has changed over time. Schumpeter's 1911 book, The *Theory of Economic Development* credited capitalist innovation to entrepreneurs with the "dream and will to found a private kingdom" and the "will to conquer". Then in his 1942 work, *Capitalism, Socialism and Democracy* Schumpeter declared that entrepreneurs had eliminated their own function.

The "perfectly bureaucratized giant industrial unit" could automatically discover and undertake the "objective possibilities" for innovation. It had "come to be the most powerful engine of progress".

Following the second world war the "perfectly bureaucratized giant", or what Chandler (1990) called the "large managerial business enterprise" became ubiquitous. In 1967 Galbraith observed that the five hundred largest corporations produced nearly half the goods and services annually available in the United States. Galbraith (1967) wrote: "Seventy years ago the corporation was still confined to those industries - railroading, steam-boating, steel-making, petroleum recovery and refining, some mining - where, it seemed, production had to be on a large scale. Now it also sells groceries, mills grain, publishes newspapers, and provides public entertainment, all activities that were once the province of the individual proprietor or the insignificant firm." (p. 1).

Large corporations undertook entrepreneurial functions remarkably well. They brought us jet engines, television sets, plastics, pharmaceuticals, mainframe computers, and a host of new products to market. Domestic companies ventured overseas and became multinational. They also experimented with and adopted new forms of decentralized organizations to accommodate their increasing size and scope. Schumpeter's "perfectly bureaucratized giant industrial units", to use Chandler's words, "provided a fundamental dynamic or force for change in the capitalist economies" ((1990), pp. 3-4).

Events in the 1970s shook common beliefs about the omnipotence of large corporations. "The big corporations", Galbraith (1967) wrote, "do not lose money". In the recession of 1957 he noted, "not one of the largest U.S. Corporations failed to turn a profit. Only one of the largest 200 finished the year in the red". Subsequently, however, large firms were no longer immune to losses. Penn Central filed for bankruptcy; Lockheed and Chrysler were spared this fate by federal bailouts. In the recession of 1982, eight of the top 100 industrial companies and 21 of the largest 200 ended the year with a deficit.

In the 1980s large Japanese companies that emphasized market share, life-time employment and consensus management appeared to provide the right model. "Japan as Number 1" written by Ezra Vogel a professor at Harvard University, became a best-seller. Then the Japanese economy fell into a prolonged recession. After that the Internet boom created a wave in favor of the Venture Capital (VC) model. Management gurus suggested that large corporations should emulate startups - "bring the Silicon Valley inside" was the message of an award winning article in the *Harvard Business Review*. This mantra too has duly fallen out of favor.

In fact, all models have their strengths and weaknesses. In June 1981 - about 10 years before the Japan bubble burst - I co-authored an article in the Wall Street Journal entitled "The Crucial Weaknesses of Japan Inc". In it, I wrote:

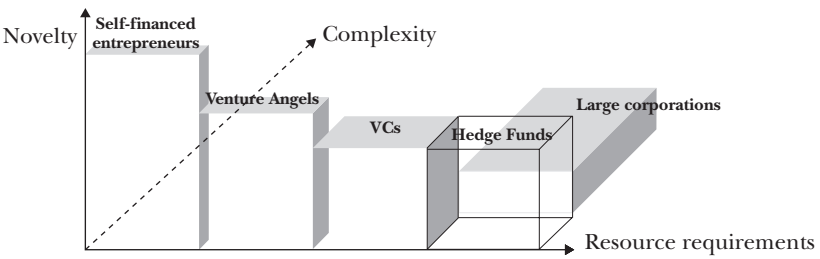
> Japanese aircraft and aircraft engines do not traverse the skies as Japanese ships sail the seas. Japanese pharmaceuticals do not minister to the illnesses of the world… the adventurous oil driller speaks English, even in the South China Sea.

> This tapestry of success and failure is understandable if it is acknowledged that like other forms of human organization, Japanese society has both strengths and weaknesses…
>
> Consensus smothers mavericks. Homogeneity breeds ethnocentricity… Capital is cheap for the project that is acceptable to a like-minded group of managers and bankers but can be altogether denied to a visionary entrepreneur….
>
> Consultation among salesmen, engineers and production workers may lead to a fine long-term plan to offer a cheaper, better quality TV set every six months.
> But it takes a highly individualistic Hong Kong entrepreneur to succeed in the rapidly changing, boom or bust market for high fashion garments or electronic toys.

With the benefit of hindsight at least, we should recognize that the growth of large corporations in the 20th century represented an increase in this diversity rather than a displacement of the entrepreneurial firm. Very roughly the large corporation went from a negligible share of GDP in 1890 to about half in 1950. But over that period, quality adjusted GDP, more than quadrupled. So the total output of the smaller firms must also have increased substantially.

The debate about whether Schumpeter was right in his claim that large firms are better equipped to innovate than startups and small firms misses the larger point about why both forms have prospered side-by-side. Companies on the Fortune 500 list and startups that go on to make the *Inc.* 500 list play complementary rather than overlapping roles. The David versus Goliath image misrepresents reality - startups like Compaq and Netscape that take on IBM and Microsoft are exceptions, because the typical entrepreneur does not have the resources to take on the giants. Rather, promising startups typically pursue small opportunities whose novelty[1] makes information about the risks and returns highly incomplete. In contrast, the comparative advantage of the Fortune 500 lies in undertaking larger, more complex and less uncertain projects where decision makers have access to more complete information (Figure 1).

Figure 1



1 The novelty may arise in a variety of ways: The good or service sold, or the manufacturing process may be totally new. Or, the business itself could be mundane but the circumstances novel - as would be the case when an entrepreneur opens the first bookstore in a suburb. Or, the success of the enterprise may depend on the untested abilities of the entrepreneur - as would be the case if an investment banker decides to open a gourmet restaurant.

Companies like IBM enjoy several advantages in undertaking initiatives with large resource requirements. The most obvious one derives from their capacity to mobilize significant capital from investors. Besides capital, large initiatives usually also require significant irreversible commitments by many customers, employees and other resource providers. An established corporation's base of tangible and intangible assets provides advantages in securing such commitments. Cash flows from existing businesses and access to capital markets allow the established corporation to offer credible contractual safeguards to the resource providers. Prior reputations help engender the confidence that the corporation will not behave opportunistically in matters that cannot be contracted for and honor promises that are necessarily vague - for example, to not "punish" employees for failed initiatives or to provide the "good" after-sales service.

Established corporations also have an advantage in solving the coordination problems involved in launching complex initiatives. Major projects, which seek to exploit economies of scale and scope, involve securing the joint effort of many personnel and solving conflicts among the providers of specialized resources. Established companies with well-developed coordination mechanisms have obvious advantages in doing so.

The microcomputer revolution illustrates the important contribution of established corporations. According to Steffens (1993), the entry of large established companies from the computer, office products and consumer electronics industries (like, IBM, Xerox, DEC, NEC and Sanyo) between late 1981 to the end of 1982 "legitimized" personal computers. IBM utilized its "enormous market power and committed significant resources" (Steffens (1993), p. 197). The company established "a highly automated, high volume assembly plant which provided significant economies of scale". It encouraged third party software houses to develop higher performance applications. It "made use of bulk discounting to switch the purchasing channel from individual users to corporate buyers". IBM, which then accounted for sixty-one percent of worldwide general-purpose mainframe computer market, "effectively legitimized the personal computer in the minds of data processing managers in large organizations". It broke down a "major psychological marketing barrier, namely the attitude that had existed within many DP [data processing] departments that personal computers were an unfortunate nuisance and certainly not part of the corporate management information system". IBM's penetration of the corporate market was so successful that the company could not satisfy demand for approximately eighteen months. This created an opportunity for many startups to develop IBM compatible machines or "clones" (Steffens (1993), pp. 179-181). IBM's entry also led to "increasing professionalism in the industry" and forced competitors to "invest in marketing activities, especially in advertising, distribution and service support" (Steffens (1993), p. 197).

Substantial investments by Intel, and after the late 1980s, by Microsoft, have sustained on-going improvements in performance and reductions in costs. Intel spent more than $4 billion to develop the Pentium family of microprocessors. Development costs for the Merced (P7) chip are expected to exceed $8 billion.[2] Intel has also invested heavily in

2 Estimates supplied by Joanne Guiniven, Electronics Consultant, McKinsey & Co.

making and marketing its microprocessors. One new semiconductor fabrication facility costs well in excess of $1 billion to build, and in 1997, the company spent $3.5 billion in the Sales, General and Administration (SG&A) category. Microsoft has spent similar amounts in developing and marketing software. In 1997 for instance the company spent $2.5 billion on R&D, slightly under 20% of the $13 billion it booked in revenues.[3]

Individual entrepreneurs complement the role of large corporations by undertaking initiatives that the governance structures and long-term orientation of large companies preclude them from undertaking**.** The checks and balances required to meet the directors' "duty of care" and to secure the trust of diffused stockholders gives the executives of companies like IBM access to large amounts of capital. The checks and balances also limit however a firm's capacity to pursue small, uncertain initiatives with highly incomplete information. By filling this opportunity space, bootstrapped entrepreneurs help incubate technologies whose promise is initially unknown. Many new "disruptive" technologies, according to Christensen (1997), cannot initially compete in mainstream markets and can only be sustained in out-of-the way niches. In 1975, for instance, the personal computer was a poor substitute for mini- and main frame computers and was of interest mainly to hobbyists. Corporate decision-makers (or any other objective analysts for that matter) cannot predict which offbeat products and technologies will enter the mainstream; individual entrepreneurs who have the capacity and incentive to pursue uncertain, niche projects help select and develop the "fittest" ones. Between 1975 and 1980, for instance, tinkers and enthusiasts conducting low-cost, and not particularly scientific, experiments with personal computers, refined the technology and developed commercial applications that broadened its appeal. The cumulative efforts of a diffused band of individual entrepreneurs reduced the uncertainty about the size of the potential market and paved the way for IBM to enter the business. A similar pattern, we may note, later emerged with Internet technologies.

The willingness to pursue niche opportunities helps propagate innovations after they have become recognized. New businesses provide complementary goods and services whose revenue potential is too small to interest established companies. In the 1980s for instance, startups provided services such as installation and maintenance, and products such as "add-on" hardware and software, educational books and videos that both took advantage of and helped advance IBM's efforts to make the PC a mainstream product.

Opportunistic entrepreneurs relieve the inflexibility that arises because of the tendency of established companies to adhere to long-term strategies. Large companies build valuable know-how and reputations by steadfast adherence to rules about the markets they will serve and the services that they will provide. These rules can sometimes lead to sub-optimal practices. When IBM introduced its PC, for instance, it offered standard levels of service and support. For some sophisticated customers the standard was too high and for some technical novices it was too low. Similarly, when PCs were in short supply IBM's policy of treating dealers "equitably" led to a geographic distribution of machines that did not reflect differences in demand. IBM would not ship more products to regions

3 Correspondence with Joanne Guiniven, Electronics Consultant, McKinsey & Co.

where customers placed a high value on PCs and who were prepared to pay a premium to obtain them. New businesses that took advantage of such misallocations helped mitigate their consequences. Some sold PCs at a low cost to customers who did not need much hand holding and service; others (the so called "Value-added-resellers") charged premium prices to customers who did. Upstart businesses also operated "gray" markets, buying surplus machines from authorized IBM dealers and selling them in territories where PCs were in short supply. Thus IBM could maintain its reputation for treating authorized dealers equitably while entrepreneurs helped place its computers in their highest valued use.

Entrepreneurs similarly help mitigate the costs of standardized employment policies that large corporations adopt. Corporations try to recruit individuals who will fit their culture and norms in order to promote cooperation and teamwork. Such policies however, limit their ability to employ the best individual for a given task, especially in the early stages of a technology, when many of capable individuals lack the backgrounds and temperaments that suit the organizational climate of a large corporation. Corporations can reduce this problem by contracting out tasks to startups that can "make do" with difficult staff and where there isn't much teamwork or organizational climate for quirky individualists to disrupt. IBM can secure the use non-conformist programmers without compromising its culture by turning to startups who can best utilize their talents.

Startups can also help established corporations, whose employment policies are optimized for long-term relationships, fill their transient needs for labor.[4] Companies like IBM have historically adopted policies such as a commitment to promote from within and to provide job and income security in order to encourage employees to internalize organizational objectives and acquire "firm specific" skills that have limited value to other employers. The effectiveness of such policies depends on the constancy of their application. Unlike the firm promises in written contracts, these policies often have an ambiguous "best efforts" quality: for instance, corporations "favor" internal promotions but do not rule out hiring outsiders; unless the circumstances are clear cut, deviations impair credibility. Moreover, in order to promote solidarity and teamwork, the policies have to be uniformly applied: corporations cannot easily offer job security just to employees from whom they wish to elicit high "specific" investment in human capital.

The difficulty of discriminating between employees poses an acute problem in the development of new technologies and markets. In the early stages of a product or industry, firms have needs for labor that disappears later. For instance, marketing personal computers initially required considerable hand holding and missionary selling; as consumers gained experience and comfort with the product, their need for such service declined. Established companies that employ staff for these transient services who they later dismiss, risk tarnishing their reputations as good employers. They can instead rely on startups, whose staff do not expect much job security and often lack many employment alternatives, to satisfy these needs.

4 The discussion on sub-contracting draws on and extends an unpublished working paper by Bhidé and Stevenson (1986).

1.3 Myth 2: Creative Destruction

According to Schumpeter "a perennial gale of creative destruction" is an "essential fact about capitalism. It is what capitalism consists in and what every capitalist concern has got to live with" (Schumpeter (1942; 1961), pp. 81, 83-84). Destruction is the price of innovation: the automobile must displace the buggy makers and mass merchandisers must put the country store out of business. The innovator combines the roles of Shiva the Destroyer and Brahma the Creator, of the mobs of the French revolution who overthrew the *ancient regime* and Napoleon who founded an empire on its remains.

Although Schumpeter's vivid metaphor has become commonplace, the underlying proposition has not received much scrutiny. The evidence, in fact suggests that new combinations usually displace existing structures gradually rather than through a sudden cataclysmic gale. And, a variety of other factors overshadow the importance of new combinations in engendering business terminations and job losses.

First, the trial and error involved in the development of new technologies limits the rate at which they displace existing products and processes. The automobile did not displace the stagecoach and horse buggy overnight. Karl Benz and Gottlieb Daimler built a gasoline-powered vehicle in Germany in 1885. Armand Peugeot built a workable automobile in France soon thereafter. Automobile manufacture began in the United States in 1893 when the Duryea brothers of Springfield Massachusetts built a carriage powered by a one-cylinder motor. Six years later, in 1899, many individuals and about thirty American companies had built a grand total of some 2,500 vehicles (McCraw and Tedlow (1997), pp. 267-268). Ten years later, reports the U.S. Bureau of the Census, total car registrations reached 32,900 vehicles, with 11,200 passenger vehicles sold in 1903 (U.S. Department of Commerce, Bureau of the Census (1975), p. 716). The "unification" phase of the automobile industry in the United States, which according to historians McCraw and Tedlow led to the development of a mass market, did not begin until the introduction of Ford's Model T. This was in 1908, fifteen years after the Duryea brothers and nineteen years after the Daimler-Benz vehicles.

Moreover, unlike urban redevelopment projects that must first level decrepit structures, most innovations start out on virgin ground. Cost and unreliability often preclude new technologies from serving existing mainstream needs. The early automobiles were too unreliable a substitute for stage-coaches to deliver mail and too expensive to satisfy mainstream transportation needs; like the early PCs, they appealed instead to the enthusiasms of a few individuals for trendy products.[5] Customers' switching costs and prior investments make them unwilling to adopt new technologies for current needs. For instance, after the 1980s personal computers became cheap and reliable enough to migrate from the fringe hobbyists market into commercial use. But even as PCs sprouted in offices everywhere, they did not displace many traditional main-frame applications, because of the great cost that turning over the installed base entailed, not to mention the reluctance of many MIS personnel to obsolete their personal human capital. Spread-

5 Schumpeter himself noted that innovations create the needs they satisfy rather than fill pre-existing needs. In Business Cycles ((1939), p. 73) he cited the example of automobiles.

sheets, the "killer application" that created a commercial market for personal computers allowed users, many of whom had not previously used computers extensively, to perform analyses and simulations which they would not have otherwise performed.

The "growth imperative" faced by large, well-established companies often helps channel innovations towards serving new needs and markets rather than attacking existing ones. The desire to expand revenues, profits, personnel, market power and so on represents the main impetus in large corporations for undertaking new investments and initiatives; they generally back technologies that cannibalize existing businesses with reluctance, when it becomes clear that if they don't competitors will. Robert Cringely, who has written a popular history of the industry, suggests that IBM executives backed its PC initiative in 1980 because they thought personal computers would not reduce the demand for IBM's other products. "Every sales dollar brought in to buy a microcomputer", writes Cringely (1996), "would be a dollar that would not otherwise have come to IBM" (p. 125-126). The substantial assets and resources of large corporations and their dominance of some markets suggest that their bias against displacement[6] likely has a significant effect on the evolution of technologies.

The role of PCs in expanding the pie rather than destroying existing technologies, apparently represents a common feature of the so-called "digital revolution". New communications services - E-mail, newsgroups, and "chat" - have provided a critical mass of users for the Internet and on-line services such as AOL. These services do not seem to have significantly eroded the demand for traditional phone and mail communication. Nor is it obvious what products or services are threatened by the dissemination of information on web-sites and Intranets or the upsurge in web-surfing. To be sure, some new technologies have attacked existing products from the outset. Sun and other microcomputer based engineering workstation manufacturers targeted their products against mini-computers. The new on-line services such as Travelocity, Amazon, and E-trade compete against traditional travel agencies, bookstores and stockbrokers. It seems implausible to me, however, that the growing importance of information technology in the economy derives, to any significant degree, from displacement effects. According to a 1998 U.S Department of Commerce report, the share of the information technology (IT) sector (computing and communications) grew from 4.2% of the gross domestic product of the United States in 1977 to 6.1% in 1990 to 8.2% in 1998 (U.S. Department of Commerce (1998), p. 4). This is probably not because computers have displaced traditional goods and services. Rather, IT has accounted for a disproportionate share of growth: according to the Department of Commerce IT industries have been responsible for more than one quarter of real economic growth (U.S. Department of Commerce (1998), p. 6) that is, about three times their share of the economy.

Of course, new combinations can undermine older businesses without competing for their customers, by drawing away capital, labor and other inputs. Fast growing companies offer investors and talented individuals opportunities for capital gains and excitement

6 The so-called "planned obsolescence" we see in durable goods is consistent with this principle. Detroit's annual model introductions and new versions of software represent attempts to stimulate new purchases of long-lived or indestructible goods.

that firms in slower growing fields cannot. The stock market provides a striking indicator of the appeal of IT companies. The Department of Commerce report on IT notes that the collective market capitalization of five large companies - Microsoft, Intel, Compaq, Dell and Cisco, grew to over $588 billion in 1997 from under $12 billion in 1987.[7] IT industries also offered workers higher compensation. The Department of Commerce estimates that the 7.4 million people employed in the sector earned about $46,000 a year compared to an average of $28,000 in the private sector (U.S. Department of Commerce (1998), p. 6). Such differentials do sap the vitality of slow growing companies and industries, but the process is insidious and gradual.

Similarly, in the long run, technologies that initially serve "new" needs can take over traditional markets. Automobiles and trucks did replace buggies and stagecoaches and packet-switched Internet telephony may someday make the existing circuit based telecommunications obsolete.[8] But the displacement often takes place at a much slower rate than the hype about the obsolescence suggests. In 1938, the New York Times observed that the typewriter was "driving out writing with one's own hand", yet Petroski (1990) reports the sale of 14 billion pencils in 1990. The introduction of word processors in the 1970s in turn led to predictions of the imminent demise of typewriters. As I discovered in the course of a consulting study for a typewriter manufacturer, in spite of a fourteen-fold growth in the shipment of word processing units between 1977 and 1981, the demand for typewriters in the United States had remained steady at around a million units a year.

Newer computer architectures have taken away share from mainframes, but, over 30 years after the introduction of minicomputers and more than 20 years after the introduction of microcomputers, the mainframe remains an important category. Total worldwide revenues of large-scale computer processors (or mainframes) amounted to $16 billion in 1997 compared to $16.2 billion in 1982. Their share of the total computer market dropped considerably in that period, from about 42% in 1982 to about 9% in 1997 as total demand grew from $38 billion to $183 billion. Although its share of total revenues has declined considerably, IBM's mainframe business continues to be large and profitable. In 1997, mainframes and their associated storage devices generated $5.7 billion for the company. Networks of smaller processors may eventually make mainframes extinct but their destruction will not be the consequence of a cataclysmic "gale of creative destruction".

The magnitude of the "destruction" wrought by new combinations is sometimes as exaggerated as the rate. Only some businesses (such as stagecoach builders and typewriter manufacturers) succumb to new combinations. Other factors such as incompetence, over-confidence and the growth imperative likely play a more significant role in the failure and contraction of businesses.

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7 As of this writing the stock market has placed nearly twice as great a valuation on the stock of the virtual bookseller Amazon than on the Barnes and Noble, the leading chain of conventional bookstores. Barnes and Noble which has recorded "solid" profits for the last three years has nineteen times the revenues as Amazon, which has never booked a profit (Mayer (1998)).

8 We should note however that the rapid growth of cellular phones has not had this effect.

Small businesses apparently turn over at a rapid rate - a roughly similar number (around three-quarters of a million) of businesses are started and terminated in the United States every year. Most of these entries and exits have little to do with creative destruction. Most new businesses are started in fields such as lawn care, beauty salons and construction, all of which require little technology, specialized skill, or capital. Kirchoff and Philips (1989), estimate for instance that there are five times as many "low innovation" startups as "high innovation" startups. The termination of such businesses cannot be attributed to their displacement by a new combination. Indeed, except to their proprietors, exits have little significance. For instance, according to Dun and Bradstreet's estimates, nearly 90% of terminations do not involve losses to creditors: apparently, suppliers and banks do not regard these businesses as creditworthy.

Some high growth companies, particularly in high technology industries, do get leapfrogged by competition from the next generation of innovation. Henderson (1993) has studied this phenomenon in the photolithography equipment business and Christensen (1997) in disk drives. The high flying manufacturers of dedicated word processors of the 1970s such as Wang, CPT and NBI, lost out in the 1980s to PC-based software that could provide the same functionality at a much lower cost. But a superseding innovation represents only one of the factors that can lead to the termination of promising businesses. Many promising startups exploit opportunities that are inherently transitory. Unless their proprietors can find a more sustainable follow-on source of profit, they have to wind up the enterprise. The inability to manage growth can also jeopardize a business. The entrepreneur may run out of cash because of inadequate financial controls, dissipate effort by failing to formulate a coherent strategy, or engender organizational turmoil through ill-defined reporting relationships.

New combinations represent even less a threat to the survival of mature, well established corporations. The diversified assets of companies like IBM protect them from adverse innovations such as the displacement of punchcard based data processing by mainframe computers. Innovations usually cause mortal harm only in conjunction with protracted obstinacy and denial. I can think of few examples from the last two decades where a large corporation has failed to survive because of an innovation from which it could not defend itself. Moreover, the destructive force of new combinations represents but one, arguably minor, cause of the demise of large corporations. Many fail because of "internal" management lapses. My former employer, E.F. Hutton, was forced to merge into its competitor Shearson Lehman, because poor internal controls led first to a check kiting scandal and then, in the stock market crash of 1987, to de facto insolvency. International Harvester is no longer with us because in 1980, management took a strike to get out of a contract with the United Automobile workers. According to Flint (1998), the strike "lasted six months and wrecked the company". And, companies can fail because of the financial policies they adopt. "The high leverage incurred in the eighties", Jensen (1993) writes, "contributed to an increase in the bankruptcy rate of large firms in the early 1990s" (p. 838).

Creative destruction also seems to have played a modest role in the recent "downsizing" of large corporations. According to Jensen (1993), the "Third Industrial Revolution" that started after 1973 generated significant "excess capacity and thus the requirement for exit" (p. 835). As one manifestation of this phenomenon, Jensen notes that *Fortune* 100 firms eliminated 1.5 million jobs or 14 percent of their workforce in the decade from 1979 to 1989 (p. 841). Technological changes helped generate some of the excess capacity eliminated. For example, radial tires lasting three to five times longer than the older bias ply tires created excess capacity in the tire industry. Improvements in the design of objects such as bridges and cars reduced the intensity of consumption of metals. Minimills increased the productivity of steel making.

Technology represents but one of the factors behind the sharp reductions in capacity in mature industries such as oil, chemicals, steel, aluminum and automobiles. We find little evidence in these sectors of cataclysmic or unforeseeable changes. Radial tires displaced the older technology gradually. The consumption of metals and energy grew more slowly but did not actually decline because economic growth outweighed the increased efficiency in their use. And, we cannot easily relate technological innovation to the widespread cutbacks in what Jensen calls "white collar corporate bureaucracies" ((1993), p. 841). Some large companies, as report Bartlett and Ghoshal ((1993), cited in Nohria (1996), p. 22), nearly halved the number of layers of their middle management.[9]

The pressure to grow faced by the managers of large companies in the United States and overseas was at least as important a factor as technological changes in generating excess capacity. These pressures led to investments in new capacity, in the face of slow or declining demand. They also fostered the growth of managerial positions: between 1970 and 1980, report Caves and Kreps, executive, administrative and managerial occupations in the median industry grew 20.6% faster than real output ((1993), cited in Nohria (1996), p.22). The profitability of their core franchises helped mask the excess physical and managerial capacity carried by large corporations. Jensen's analysis suggests that many factors forced companies to reduce this capacity after 1973. These factors included the oil shock, which lead to a ten-fold increase in prices between 1973 and 1979; changes in tax policies; deregulation of transportation, telecommunications and financial services in the United States; the globalization of world trade; and, the movement of formerly communist and socialist economies to more market-oriented capitalist economies. Technology of course contributed, but per the previous discussion, many of its dramatic advances had as much to do with creating new markets as with generating excess capacity in existing ones.

9 We do not have good aggregate estimates of the white collar positions eliminated in the "downsizings" and "restructurings" of large corporations; announcements by companies like AT&T, IBM and Exxon in the 1980s suggest they were significant. Nohria ((1996) p. 24) reports that about 75% of the layoffs by Fortune 100 firms between 1978 and 1992 involved white collar employees.

1.4 Myth 3: The Determinism of the Structures of New Industries

According to Scherer's (1980) text, standard industrial organization theory (IO) posits that "market structures [i.e., the number and size of competitors in an industry] are the more or less determinate result of variables such as technology [and] the receptiveness of consumers to advertising" (p. 145). Cross country comparisons of concentration ratios (usually measured as the market shares of the top 4 firms) in different industries seem to support this assumption. "Sufficient similarity in concentration patterns exists among nations to suspect that some common cluster of concentration determining forces is at work", writes Scherer ((1980), p. 72). Sutton's (1991) review also notes that "the ranking of industries by concentration level tends to be closely similar from one country to another: an industry that is dominated by a handful of firms in one country is likely to be dominated by a handful of firms elsewhere, too. The large majority of studies argue in favor of such regularity and interpret it as a reflection of the fact that the pattern of technology and tastes that characterize a given market may be expected to be similar across different countries" (p. 3).

Business historians echo the claim of IO research that exogenous factors such as technology determine the size and longevity of firms. Consider, for instance, Alfred Chandler's (1990) observations about the "clustering" of the large modern industrial enterprise in "industries having similar characteristics" (p. 18). In his 1990 book, *Scale and Scope*, Chandler analyzed the distribution of all the industrial corporations in the world that employed more than 20,000 workers in 1973. Of 401 such companies, 289 (72%) were clustered in food, chemicals, petroleum, primary metals, machinery and transportation equipment industries. Just under 23% were in cigarettes, tires, newsprint, plate and flat glass, cans, razor blades and cameras. Only 5.2% were drawn from textiles, apparel, lumber, furniture, leather, printing and publishing industries (Chandler (1990), p. 20). The clustering of large companies in certain industries, according to Chandler, reflects the invention or vast improvement in "processes of production" that led to "unprecedented" opportunities to realize "cost advantages of the economies of scale and scope" (Chandler (1990), pp. 22-23). In apparel, lumber, furniture, printing and other such industries in which "the large modern firm remained relatively rare" improvements in equipment and plant design did not bring "extensive" economies of scale. Large companies could not enjoy "striking" cost advantages over smaller competitors in these industries (Chandler (1990), p. 22).

Another historian, McCraw, writes:

> Only certain kinds of industries lend themselves to large operations. Such industries either have major economies of scale (electric utilities, steel, oil refining, chemicals, automobile manufacturing) or economies of scope (pharmaceuticals, discount retailers, branded snack foods). Throughout American history, entrepreneurs have tried, sometimes desperately, to create big businesses out of naturally small-scale operations. It has not worked. Everyone knows about National Biscuit (RJR Nabisco) but

> few people have ever heard of National Novelty, National Salt, National Starch, National Wallpaper, and National Cordage, all of which perished soon after they were incorporated. Standard Oil became one of the world's largest companies, but Standard Rope and Twine quickly dropped from sight. United States Steel prospered, but United States Button came and went in a flash. (McCraw (1997), p. 324).

Below I make the opposite case: I argue that the apparently exogenous determinants of industry structure often result from the efforts of entrepreneurs. Differences in the technology and tastes that lead to differences in production, marketing or other such economies across industries reflect the ambition and talent of the entrepreneurs who sought to build their business in their industries.

1.4.1 Production Economies

As mentioned, Chandler contrasts industries where new processes of production led to the realization of significant economies through large scale production with industries where the processes of production did not allow steep reductions in costs with increasing scale. But where did the new processes of production in the former category come from? The research of Chandler and other historians points to the efforts of ambitious entrepreneurs with multi-faceted talents.

Henry Ford, for instance, transformed the manufacturing of automobiles from a batch process to mass production on an assembly line. Ford was more than a "mechanical genius". Historians McCraw and Tedlow (1997) note a variety of his innovations and talents that made mass production a success. Ford introduced the five-dollar day for his workers - more than twice the prevailing wage - in order to reduce worker turnover, which sometimes reached 300-400 percent per year because of "the strength-sapping and mind-numbing character" of assembly line work (p. 275). Ford had a "brilliant" intuition about "the nature of a car for the masses", and saw that "the proper *design* of the car must precede all other considerations" (p. 273).

For his time, we may also credit Ford with an unusual capacity for organization. McCraw and Tedlow (1997) write that Ford "had great difficulty in delegating authority to anyone" (p. 272). They contrast his "impulsive entrepreneurship" with the temperament of Alfred Sloan - the "patient, persuasive and systematic organization man" - who built General Motors (p. 288). But we should note that Ford's company grew from making 40,000 cars in 1911 to 1.4 million in 1925 which it sold through a distribution system comprising 6,400 dealers. In 1997 Ford produced 1.68 million passenger cars in North America, or only about 20% more than in 1925 (Automotive News 1998 Market Data Book). In 1925 Ford's workforce exceeded 100,000 employees, of whom 58,000 worked at the River Rouge plant. Historian David Lewis (1976) writes that in the mid 1920s, the Rouge facility, which occupied over 1,115 acres, was "easily the greatest industrial domain in the world" (pp. 160-161). Even today, with our considerable knowledge of large organizations, a deep pool of professional managers, and sophisticated information technology, it is difficult to imagine an entrepreneur creating an enterprise on the

scale of the Ford Motor Company without a considerable talent for organization. Given the conditions prevailing in the 1920s, we might fairly characterize Ford's organizational capacities both as unusual and necessary for realizing economies of mass production.

Exceptional entrepreneurs also stimulate scale-increasing innovations by their eagerness and capacity to utilize new technology. Eric Von Hippel's (1988) research suggests that in many industries, the users rather than the producers often drive product innovation. Ambitious entrepreneurs who want to dominate their markets may therefore push their suppliers to develop equipment that increases the minimum efficient scale. In the steel industry, for instance, Andrew Carnegie, "fanatically focused on achieving cost leadership by investing heavily in process improvements" whereas his competitors "focused on making and breaking price-fixing covenants".[10] His firm was the first to adopt several innovations like the Thomas process. If Carnegie had had the same approach as his competitors, these innovations might well not have been developed for commercial use to the degree they were.

There is perhaps something intrinsically different about automobiles and steel that permits greater economies of scale than in the production of lumber and furniture. To my knowledge, arguments about natural economies of scale do not make this difference clear. Rather, such arguments implicitly assume that if furniture could be mass-produced in the same way as automobiles, someone would have done so already. This Darwinian premise, I believe flies in the face of the historical evidence about the crucial role exceptional entrepreneurs have played in bringing about product and process innovations.

1.4.2 Marketing and Distribution Economies

In many industries ranging from soft-drinks to main-frame computers, the economies of scale and scope derive more from the marketing and distribution functions than from a production process where unit costs decline steeply with output. As mentioned, some scholars argue that these economies derive from exogenous factors such as consumer "tastes" or "receptiveness to advertising": in product categories where customers are more receptive, we find greater economies and barriers to entry.

The inherent attributes and function of buttons and twine may doom efforts to realize marketing and distribution on a national scale. Differences in product attributes cannot easily explain why the chewing gum company, Wrigley, could build a global brand while lollipop companies did not. It is not obvious that the inherently greater receptiveness of consumers to advertising for cola drinks and diamonds allowed Coke and DeBeers to achieve many times the revenues of companies marketing ginger-ale or rubies. Or, to use a recent example, we cannot plausibly attribute the national expansion of Starbucks's coffee shops to a spontaneous change in the tastes of U.S. consumers, several centuries after the availability of the beverage.

Just as Henry Ford played a critical role in the mass production of automobiles, William Wrigley, Asa Candler (of Coca-Cola) and Howard Schultz (of Starbucks) helped create marketing and distribution economies in chewing gum, cola-drinks and coffee

10 Unpublished paper by Mark Casey.

Starbucks and the Coffee Connection

Starbucks traces its origins to a business started in 1971 by three coffee aficionados. By 1998, Starbucks had become the leading coffee retailer in the US with over 1600 locations, with a new store being opened almost every day. Its evolution illustrates the nature of the entrepreneurial effort and talent involved in realizing economies in marketing and distribution. Coffee retailing has traditionally been a local or regional business. Like other firms in the field, Starbucks operated in just one city, Seattle, from 1971 to the mid-1980s. In 1982, the founders of Starbucks hired Howard Schultz to "bring marketing savvy to the loosely run company". A year later, after a buying trip to Milan, Schultz became determined to build a national chain of cafes modeled after Italian coffee bars. Schultz's bosses resisted the idea because they "wanted to be in the coffee bean business, not the restaurant business". In April 1986, Schultz left to open his own coffee bars, which turned out to be instant successes. The following year, in 1987, Schultz bought out his former bosses at Starbucks.

From 1987 to 1993, Starbucks grew from 11 stores to over 270, expanding from Seattle to cities in the west like Portland, to the mid-west (in Chicago) and then to the East Coast. In each market, Starbucks followed a strategy of placing multiple locations close to each other in high-traffic, high visibility locations, acquiring competitors when it could. "Designed to be sophisticated and inviting", York writes, Starbucks stores were "fairly spacious, well-lighted places featuring lots of burnished wood, gleaming espresso machines, art work and opera music". Starbucks also published a direct mail catalog offering its coffees and coffee-making equipment that it believed supported its new retail stores and reinforced brand recognition in existing markets. In 1992, Starbucks went public.

Schultz hired experienced executives from companies like Pepsi Co. to establish the organizational base of the company. He claimed that Starbucks had two sources of "competitive advantage" - "Our coffee and our people". To ensure high quality coffee, Starbucks ran a vertically integrated operation and gave its staff 25 hours of training before they worked behind the counter. Investments in employees took the form of an unusual level of health care and other benefits and stock options for all employees, including part timers.

Starbucks' evolution may be contrasted with that of The Coffee Connection (TCC), launched by George Howell on the opposite coast, in Boston. In 1975, Howell, his wife and a partner, started a store in Harvard Square with the purpose of teaching customers how to "appreciate and care for a good cup of coffee". Started as a retailer of coffee beans, the Harvard Square store developed into a coffee bar. In 1976, Howell opened a second Boston store. Subsequent growth was slow, however. Fastlich, Knakowski, and Lesser (1993) attribute TCC's slow growth to "a lack of systems and controls and dependence on constant supervision from Howell [whose] time was split between management, recruiting, site selection, supervision, broker relationships and purchasing". Unlike Schultz who hired executives from PepsiCo, Howell "tried to develop some key operations people from within" because he felt that outsiders wouldn't have "the coffee background and education required to serve TCC's unique clientele".

In contrast to Starbucks's sophisticated marketing and merchandising, the Coffee Connection "persisted in maintaining a strategy that stressed quality above all else and had practically no marketing program in place". It was managed in a "loose, hippie-style" manner. The stores had very little in common other than the superior quality coffee and the Huichol Indian art displayed on the store walls.

In 1989, Starbucks approached Howell with an offer to acquire the Coffee Connection stores. Howell initially refused and, as a defensive measure intended to keep Starbucks out of the Boston market, formed a joint venture with Au Bon Pain, an East Coast bakery restaurant chain. Eventually, however, after the Seattle based company decided to open its own stores in Boston, The Coffee Connection was sold to Starbucks.

shops. These entrepreneurs did not merely have a "talent for marketing". Like Ford, they performed a variety of tasks, involving a variety of qualities. They envisioned building large businesses in previously fragmented markets, took considerable personal risks, formulated strategies, mobilized resources, recruited and motivated talented employees and built effective organizations. As the insert, "Starbucks and the Coffee Connection" suggests, without Howard Schultz's ambition and capacity to build a large enterprise with a broad base of coordinated assets (such as good locations, a brand name, and buying and merchandizing capabilities) coffee retailing would have remained a "naturally" local or regional business.

1.4.3 Network Economies

We can extend the argument about entrepreneurial ambition and ability to firms that capitalize on "network economies". W. Brian Arthur and others have in recent years highlighted the phenomenon of increasing returns to scale enjoyed by certain technologies and standards. As is now well known, the value of Internet standards or computer operating systems grows with the number of users and suppliers of complementary software. These network effects can lead a technology such as the VHS format for video recorders or Qwerty keyboards to dominate the market even if the alternative beta format or Dvork keyboard is technically superior. The benefits of network economies are not "inevitably" realized however. For instance in the heyday of mainframe and minicomputers, hardware manufacturers developed their own operating systems. Correspondingly, word-processing and other applications in the 1970s generated files that could not be used across different systems. When dominant technologies or networking standards do emerge, there is no compelling reason that they be owned or controlled by a single firm; rather we should expect that users would more likely adopt as standards, technologies that were as close to a public good as possible. Indeed, many of the frequently cited examples of network economies - VHS, computer languages like Fortran, the Qwerty keyboard, the Internet, IBM's PC architecture, and the UNIX operating system - are based on standards that are more or less in the public domain.

An entrepreneur must have exceptional abilities to create and control a significant networking standard. Microsoft's hold over personal computer operating systems (and some applications software) represents an out-of-the-ordinary outcome akin to a typewriter manufacturer's exclusive control over the layout of a keyboard. It ultimately derives, according to my analysis, from the ability of Microsoft's founder Bill Gates and (from 1980) top lieutenant Steve Ballmer, to establish a nearly mythical reputation for invincibility. As discussed in the insert, "Self-fulfilling Prophesies", Microsoft has been able to establish and own crucial standards because it has convinced users, hardware manufacturers and suppliers of complementary goods that it will almost inevitably prevail in any market it chooses to dominate.

Self-fulfilling Prophesies

The perception that Bill Gates holds little back in his drive to win has played a valuable role in Microsoft's domination of PC software. Bill Gates' reputation in the media and computer industry is reflected, report Wallace and Erickson (1992), in headlines such as "The Whiz They Love to Hate" in Newsweek, "One Day, Junior Got Too Big" in the Sunday New York Times and "From Computer Whiz to Bullying Billionaire" in the Seattle Post-Intelligencer (p. 380). Wallace and Erickson write that as "far as Bill Gates is concerned, business is war" (p. 381). Gates looks for "any business opportunity that lets Microsoft win", they continue. Complaints about how Microsoft does business are common not just from competitors like Phillppe Kahn, Chairman of Borland, and John Warnock, CEO of Adobe Systems, but from erstwhile collaborators and partners:

> Bob Metcalf, founder of 3Com Corporation, likened a disastrous joint marketing venture with Gates in the late 1980s to "black widow spiders mating - you'd be lucky to get out alive". Metcalf said Microsoft double-crossed 3Com and precipitated his company's first multi-million dollar quarterly loss in 1991.

Gates' reputation for ruthlessness may well derive just from the jealousy of less successful individuals. Whatever its origins, the widespread belief that he will not allow Microsoft to lose and may visit "negative inducements" on those who stand in his way have helped the company survive attacks not just from giants like IBM. The perception of invincibility rather seems to have been the critical factor behind the success of Microsoft's Windows 95 over IBM's 32-bit operating system OS/2. IBM's OS/2 was fully compatible with existing Windows 3.1 programs and available in a robust state nearly two years before Windows 95. IBM management repeatedly affirmed their intent to support OS/2 for the long term and demonstrated their commitment by spending over a billion dollars in marketing and promotion. Nevertheless, the once much-feared IBM (which like Microsoft, had been the target of Justice Department investigations for anti-competitive practices) seemed unable to overcome the perception of being a spent force in personal computer software. Customers and independent software vendors were prepared to wait for Windows 95 rather than commit to an operating system they believed would ultimately lose.

To summarize: It is widely acknowledged that entrepreneurial activity has a significant impact on long-run economic performance, but the process by which this occurs is often mis-understood. In this chapter I have argued that:

I. Economic development requires complementary entrepreneurial initiatives of many types of players - no one model is by itself sufficient.
II. Entrepreneurship rarely leads to "gales of creative destruction".
III. New industries do not follow a predetermined path: The goals and abilities of entrepreneurs have a profound influence on the structures of markets.

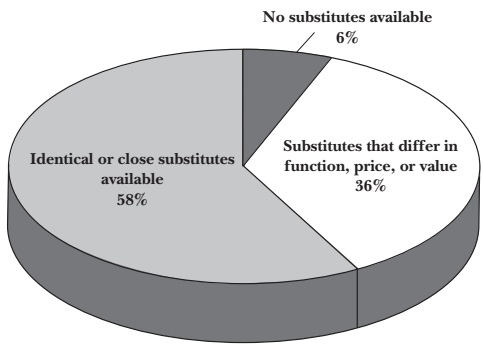
2 The Origin and Evolution of New Businesses[11]

2.1 The Typical New Venture

2.1.1 Concepts

The typical *Inc.* company starts with products or services that are quite similar, at least in their tangible attributes, to the products or services offered by other companies. Of the 100 *Inc.* founders we interviewed, only 6 percent even claimed to have started with unique products or services. As indicated in Figure 2, 58 percent said that identical or very close substitutes were available for their product or service, and the rest indicated slight to moderate differences between their offerings and those of their competitors. Another survey of all *Inc.* 500 founders, from 1982 to 1989, also suggests that most promising new ventures do not start with a unique or proprietary product. Only 12 percent of the founders attributed the success of their companies to "an unusual or extraordinary idea", and 88 percent reported their success was mainly due to the "exceptional execution of an ordinary idea".

Figure 2: Availabillity of Substitutes
Percentage of 1989 *Inc.* 500 founders Surveyed
Source: Author's survey



The *Inc.* founders we interviewed typically imitated someone else's ideas that they often encountered in the course of a previous job. Any innovations were incremental or easily replicated; they were too obvious to qualify for a patent and were too visible to protect as a trade secret. To illustrate:

Sean Ropko and his wife founded Excel to sell used copier equipment to wholesalers. Ropko had previously performed the same function for Xerox but started his own firm after Xerox decided to shut down its in house operation. "People have been buying and selling for years", Ropko told us. "We simply do it better than anyone else".

11 Professor Jan W. Rivkin selected these excerpts from my book The Origin and Evolution of New Businesses (Oxford: Oxford University Press, (2000)).

Carol Sosadian and Atul Tucker started Attronica Computers as a franchisee of Byte Computers, a retail chain. Byte went bankrupt two weeks later. The founders then became a World of Computers franchisee, which also folded. Attronica then became an independent dealer, primarily of AT&T's products, and grew their business by gaining more technical proficiency with the line than AT&T's own direct sales force.

Robert Grosshandler and two partners started the Softa Group because they saw opportunities for "a simple software product". Their first product, Total Recall, gave the partners "market knowledge" but was otherwise not a great success. On the side the Softa Group operated another mundane business - selling hardware and peripherals - to generate cash flow.

Ken Dougan, who had previously worked in the military and as a longshoreman, started Unique Transportation Systems. Notwithstanding the name, its business was simply to provide trucking services with "one straight truck and two vans". Dougan was one of the truck drivers. "I'd talk to people in shipping and I'd do anything they'd ask me to do".

Carol Russell and Rosalind Katz started Russell Personnel Services to provide temporary and full-time workers to employers in San Francisco - a business Russell had previously worked in for nineteen years. Asked what was special about their enterprise, Russell told us that the company gradually differentiated itself in three ways: "First, we introduced the idea of a spokesperson - Carol Russell. If you have a strong personality and credibility, people will buy from you. Second, we took a new approach to advertising - humor. In 1983, nobody did. Third, our counselors became salaried, not commissioned".

John Katzman started the Princeton Review, an SAT preparation service, by conducting classes at Hunter College in New York. Over time, Katzman differentiated his company's services by offering smaller classes, more computer support, and "clever teaching techniques" acquired by recruiting Adam Robinson, a highly regarded tutor.

My students' papers on successful entrepreneurs, too, indicate that imitation or mundane adaptation is the rule for start-ups that go on to become household names and blockbuster successes, not just for the average company on an *Inc.* 500 list. Of the two hundred or so entrepreneurs that my students wrote papers on, only a very small proportion started with a significant innovation. Like the *Inc.* 500 founders, most of the entrepreneurs started by imitating or slightly modifying someone else's idea and introduced breakthrough products or new ways of doing business many years later. To illustrate:

Alan Ashton and Bruce Bastian started WordPerfect in 1978. They first tried to develop a word-processing software package for mini- and mainframe computers, but they couldn't raise the capital they needed: VCs turned them down because Wang and other competitors already offered such products. Ashton and Bastian then became contract programmers and secured a project to write a customized word-processing package for the city of Orem, Utah, on a Data General minicomputer. The Orem project helped fund a word-processing package for the IBM PC, which WordPerfect released in January 1983. Their product wasn't the first on the market, however; it was introduced almost one year after WordStar' program. WordStar continued to be the market leader until 1985, when it stumbled in its introduction of WordStar 2000. WordStar 2000 was more

difficult to use than the previous-generation product WordStar 3.1 and did not easily read files created in the 3.1 version. At about this time Word Perfect released a new version of its software that was "easy to use, provided a seamless conversion from WordStar 3.1, and most of all, it was a technically superior product". More than six years after launch, Word Perfect finally had its "first 'killer' application", which made it the number one vendor of word-processing software for several years thereafter. (In 1994 Novell acquired WordPerfect for $885 million).

Another example is *Rolling Stone*. Jann S. Wenner's magazine followed several other publications that emphasized rock and roll. Paul Williams had previously started *Crawdaddy!*, which billed itself as "a magazine of rock and roll criticism". It "was the first to take rock seriously as a cultural phenomenon but failed to recognize the need to cater to a popular audience. *Crawdaddy!* was elitist in nature and could secure only limited readership. *Mojo Navigator R&R News* was the first to target a broader market and included celebrity interviews and industry gossip. It also was the first of its genre to secure advertising from the rock and roll industry. In England there were several popular rock and roll newspapers such as *Melody Maker*, which served as a model for *Rolling Stone*. Wenner's goal was simply to do "a more popular and commercial magazine" that would take rock and roll "seriously on the terms that it was then coming out".

2.1.2 Prior Experience

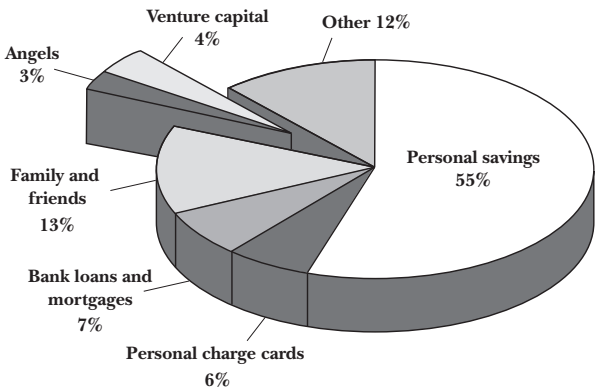
Many individuals who have the initiative and the incentive to start their own business often lack deep business experience. Cringely (1996) describes the entrepreneurs who built the personal computer industry as "amateurs" who had "little previous work experience and no previous success". Steve Wozniak, who built the first Apple computer, "was an undistinguished engineer at Hewlett-Packard". His partner, Steve Jobs, had just "worked part-time at a video game company", and neither had graduated from college. Bill Gates dropped out of Harvard in his sophomore year to start Microsoft, and Michael Dell quit the University of Texas in his freshman year to start Dell Computers. Substantial businesses have been started by inexperienced founders in other fields as well. Richard Branson, founder of the Virgin Group, was just sixteen when he started his first magazine. Jann S. Wenner, a dropout from the University of California at Berkeley, was a twenty-one-year-old when he started *Rolling Stone* in 1967. Wenner says he "knew nothing about the magazine business", so "the business aspects of how you created such an enterprise didn't even occur to me".

Besides lacking business or managerial experience, entrepreneurs often have limited knowledge of or contacts in the industry they enter. In some cases this is because the industry is so new that no one has deep prior knowledge. We also find individuals who want to leave the mature or declining fields in which they have previously worked to enter new fields that offer more opportunity but where they lack personal experience. About 40 percent of the *Inc.* founders I interviewed had no prior experience in the industry in which they launched their ventures, and among those who did, the experience often did not seem deep or well rounded.

2.1.3 Capital Constraints

The widespread lack of innovative ideas, often accompanied by limited business or industry experience, preclude typical entrepreneurs from raising much capital from investors. To issue equity in a start-up that does not have an ongoing stream of cash flow, an entrepreneur has to convince investors that the enterprise has intangible assets that can generate cash flow in the future. To borrow terms from the VC industry, investors have to believe that the start-up merits a positive "pre-money" valuation deriving from some intellectual property or human capital that the entrepreneur has contributed to the venture. Most start-ups, however, don't have the assets that an objective investor would consider valuable. The founders, therefore, have to rely on their own resources or raise funds from relatives or friends who are willing to overlook the founder's me-too strategies and inexperience. (See Figure 3).

Figure 3: Primary Source of Initial Funding
Percentage of 1996 *Inc.* 500 Companies
Source: *Inc.* magazine



Many entrepreneurs don't have significant personal means (or rich and trusting friends), so ventures that turn out to be out-of-the-ordinary successes often start with the same limited means as the typical lawn care or painting business. As we might expect, most of the hundreds of thousands of businesses launched in the United States every year start with little capital. The Census Bureau's 1987 survey of businesses showed that 30 percent of all companies were started with less than $5,000, and only a third had more than $50,000. Promising ventures like the *Inc.* 500 companies also start with similar amounts. As previously mentioned, most of the founders of companies on the 1989 *Inc.* 500 list that I interviewed bootstrapped their ventures with meager personal savings and borrowings or funds raised from families and friends; 26 percent started with less than $5,000; only 21 percent raised more than $50,000, and just two raised more than $1 million. Most founders did not even try to raise outside equity for their start-ups; about a quarter tried to raise venture capital funds and failed.

2.1.4 Niche Opportunities

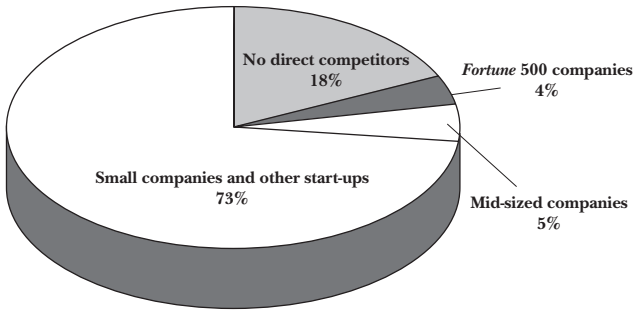
Entrepreneurs who don't have a significant innovation or access to much capital cannot pursue opportunities likely to generate large profits. They cannot, for instance, contemplate high-volume production, where they would have to incur substantial costs in advance of the realization of revenues. They cannot make large up-front investments - to develop a major drug or oil field or to build a national brand, for instance. Nor can they easily withstand the competition from large, well-established companies that they would likely encounter if they tried to take a significant share of a large market. Instead, most entrepreneurs start in niche markets where they cannot realistically expect million-dollar profits but do not need much working capital or up-front investment in R&D, manufacturing plant, or marketing, and where they do not have to confront large rivals.

Most of the *Inc.* companies I studied started off by serving local markets or a small number of customers with specialized needs. For instance, Sosadian and Tucker's Attronica Computers served the Washington, D.C., market; Russell Personnel Services restricted itself to San Francisco clients; and Katzman started the Princeton Review offering SAT preparation classes using the premises of Hunter College, on the Upper East Side of Manhattan. More than 60 percent of *Inc.* companies I interviewed started out serving just local or regional markets; just over a third served national markets, and only two reported overseas customers. Moreover, many of the start-ups that ventured outside local or regional markets often provided specialized or even customized solutions to the problems of a few customers. For instance, Roxy Westphal and Bob Davis's Corporate Resource Associates designed and developed customized training programs (e.g., for sales staff, users of new accounting or bank teller systems) for large companies such as the Bank of America, Hewlett-Packard, and AT&T. Electrotek, started by Bud Miles and two partners, provided consulting studies and developed software systems for electric utilities around the country.

In some cases the *Inc.* companies served customers who were both local and had special needs. The first client for Inter-Ad, a manufacturer of public access computer information systems, was the city of Rochester. Inter-Ad's founder, James Odorczyk, recalled: "The city was about to celebrate its 150th birthday, and they needed a system to put in City Hall to talk about Rochester. We were offering touch screens and high-resolution graphics, which attracted a lot of people. And the city wanted someone local and they had budgets and timelines, which didn't allow them to do a lot of shopping. We were the only game in town then, and we did a complete system, with custom programming included, for $25,000".

By serving local or specialized customers, the *Inc.* start-ups avoided competition from large, well-established companies: As Figure 4 shows, fewer than 5 percent of the *Inc.* 500 start-ups I studied competed against large *Fortune* 500-type companies; 73 percent competed against small companies or other start-ups, 5 percent against midsize companies, and the rest reported no direct competitors.

Figure 4: Competitors Faced by 1989 *Inc.* 500 Start-ups
Percentage of 1989 *Inc.* 500 Founders Surveyed
Source: Author's survey



2.1.5 Turbulent Markets

Capital and other constraints, we have seen, usually force the founders of promising ventures to pursue small-scale opportunities. But small-scale by itself cannot explain the unusual profitability of such start-ups; after all, the popular marginal ventures also operate in small, localized markets. The distinguishing characteristic of promising niches, we will see next, is uncertainty. Uncertainty does not, of course, assure attractive returns, but it does allow entrepreneurs with meager initial resources a better chance of making a profit than the typical popular business with predictably poor returns. Although promising businesses have the same low most likely payoff, they come with a valuable option or lottery ticket attached.

One important source of uncertainty derives from unsettled market conditions - about half the *Inc.* founders I studied started businesses in fields that were in a state of flux or turbulence because of a new technology, regulatory regime, fashion, or other such external change. Turbulence improves a start-up's prospects in several ways. Starting a profitable business in a stable market, where competitive forces have long shaken out weak technologies and firms, requires a significantly better approach or new "combination". In highly competitive fields such as house painting or lawn care, providing the same products or services as everyone else can yield only low industry average returns. In businesses where long-standing relationships, reputations, and other such barriers to entry generate high profits for the incumbents, imitation or small modification of existing products and technologies leads to returns that are worse than industry average.

In a new or changing market, however, entrepreneurs often do not require a significant innovation or insight to make a profit. Customers and suppliers lack information about their alternatives, so many firms, all offering the same products and using the same technologies, can make a profit. We commonly attribute such profits to "shortages" or an "excess of demand over supply"; in fact, entrepreneurs do not need the foresight or the luck to acquire a good that later becomes scarce. They can exploit the lack of *informa-*

tion, buying inputs cheap from uninformed suppliers and selling them dear to uninformed customers. They do not even need to discover the opportunity themselves or realize they are engaging in a form of arbitrage. As long as buyers and sellers remain ill informed, they can simply follow the example of others.

Changing customer tastes and regulatory regimes, like technological discontinuities, can create opportunities for entrepreneurs to profit from uninformed buyers and sellers. Bob Reiss, for instance, started a profitable watch business by taking advantage of the "fashion watch" trend. Until the 1980s, watches sold in the United States comprised three main categories: expensive, high-fashion such as Piaget and Rolex; conservative, moderately priced such as Seiko and Citizen; and "popular"-priced, functional such as Casio and Timex. Sales growth in this mature market was in line with GNP growth. In the 1980s the Swiss company Swatch stimulated an increase in watch ownership by introducing moderately priced watches marketed to consumers as fashion accessories. Unit sales more than doubled as consumers began to own several watches with artistic designs, licensed characters such as Mickey Mouse, the logos of professional sports teams, and Christmas motifs. Swatch, the innovator, was only one of several companies to profit. Entrepreneurs would use freelance artists to design watch-faces, secure a license from companies like Disney, or simply copy someone else's design. Factories in Hong Kong and China made the watches, and mail order catalog companies, home shopping TV networks, mass merchandisers such as Wal-Mart, and specialty watch chains handled the sales. Without any proprietary assets or technology, an entrepreneur could realize $10 or more for a watch that would cost about $5 to make and enjoy rapid growth. For instance, Bob Reiss launched Valdawn in 1988, several years after the trend toward fashion and fun watches had been in place. By 1994 Valdawn's annual revenues had growth to more than $7 million, with pretax profit margin exceeding 15 percent. The company made the *Inc.* 500 list three years in a row.

Changing tastes and sensibilities also created an opportunity for *Rolling Stone*. Founder Jann Wenner recalls that when he launched the magazine in 1967, "it was the beginning of a new era in rock and roll. The nature of what musicians and bands were doing was changing. They began to really take themselves seriously, and we wanted to write about these serious, meaningful things. There was a big cultural shift taking place. We were at he beginning of it. We caught it, we withstood it, and we rode it". As described previously, *Rolling Stone* was not the first or the only rock and roll magazine of the time. The twenty-one-year-old self-described "amateur journalist" had raised all of $7,500 from sympathetic individuals who, according to Wenner, "figured they weren't going to ever get any of it back". Wenner says that he had "no clue whatsoever about where the first issue was shipped: In fact, six months later, we found out that most of the boxes [containing the first issue] weren't even opened". The start-up missed four publishing dates in its first year. But because *Rolling Stone* was tapping into a new market, it didn't have to compete with a Time or a Newsweek; it simply had to deliver higher quality and reliability than only slightly older rivals who faced similar organizational problems. "As amateurish as some of the first issues were", Wenner says, *Rolling Stone* could "set itself

apart" through "serious in-depth interviews and exclusive articles on major artists and issues".

Entering a turbulent unsettled market does not, of course, ensure large profits. Notwithstanding the tailwind of a "new era in rock and roll", the objective best-guess return from starting *Rolling Stone* could not have been much greater than zero. Even where imbalances create opportunities for riskless arbitrage, the profits tend to be small and transitory. The main contribution of market turbulence is to create a small chance of noteworthy success. The entrepreneur who started a rock and roll magazine in the sixties had some hope of building a *Rolling Stone*. Taking advantage of transitory opportunities to assemble clones of IBM PCs in the early eighties provided a springboard for a college student such as Michael Dell to then build a more substantial enterprise.

To summarize this section, the typical new venture confronts serious limitations. The founders of businesses usually start without an original idea, and they also often lack deep business or industry experience. These limited endowments preclude most entrepreneurs from raising much capital and force them to bootstrap their ventures with personal funds or small amounts raised from friends or relatives.

Entrepreneurs can more easily cope with their lack of original ideas, experience, and capital if they start niche businesses with high uncertainty due to unsettled market conditions or nearly total dependence on the entrepreneur's personal ability to satisfy fuzzy customer wants. Although the most likely payoff in such businesses isn't large, they provide the entrepreneur with a chance to make a significant return. By contrast, in popular fields for start-ups such as beauty care salons and lawn maintenance, competition between businesses of roughly equal capabilities forces all businesses to subsist at a very similar and low level of profitability. Competing in small, uncertain niches also allows the bootstrapped entrepreneur to avoid competing against well-capitalized rivals.

2.2 Revolutionary Ventures

2.2.1 Initial Conditions

A revolutionary venture requires major new insight about customer needs; often these needs are latent or not well articulated. Revolutionary ventures also typically involve creative new processes or technologies; opportunities to provide valuable products or services are rarely overlooked unless there are serious technological problems in providing them. For instance, the recognition of an untapped market for a reliable overnight delivery service was a necessary but not sufficient condition for starting Federal Express. To serve a large network of cities reliably with a relatively small fleet of planes, Smith and his associates also had to design a nonlinear hub-and-spoke logistics system.

Founders of revolutionary ventures require considerable personal wealth, contacts, and credibility to fund their ventures. Revolutionary ventures require substantial capital to develop and refine new technologies; to acquire dedicated assets or infrastructure (radical innovations often preclude the use of standardized or off-the-shelf inputs); to

educate consumers and distributors about the benefits of the offering; and to cover losses until the venture attains critical mass. As one example, Smith had to raise substantial amounts of capital because Federal Express could not use commercial flights. To provide its unique service of overnight delivery, the company acquired a dedicated fleet of jets. The jets, a central hub, operations in twenty-five states, and several hundred trained employees had to be in place before the company could open for business. The venture also had to absorb losses (amounting to more than $29 million in its first twenty-six months of operations) before revenues became large enough to cover the high fixed costs of the enterprise.

2.2.2 Type of Opportunity

Revolutionary ventures have to hold the promise of very large profits to justify the substantial initial investments. For instance, to raise capital for launching Federal Express, Frederick Smith had to demonstrate the potential for securing a significant share of an untapped $1 billion market. Billionaire Daniel Ludwig started on his Jari forestry venture anticipating a worldwide shortage of wood that would yield him profits on the scale of the fortune he had already accumulated in shipping. Revolutionary ventures also involve significant uncertainty vis-à-vis customer preferences, whether the new technologies and processes developed will work, and sometimes, because of the size of the project, regulatory issues. In the case of Federal Express, for instance, the customers surveyed by market researchers said they wanted the option of reliable overnight delivery; but it was impossible to determine how many would actually pay a premium for the service and whether the hub-and-spoke transportation system would provide the reliability that was central to the idea. The willingness of the Civil Aeronautics Board (CAB) to grant the regulatory waivers Federal Express needed to fly its jets was also a source of uncertainty.[12]

2.2.3 Planning and Adaptation

Revolutionary ventures require extensive prior research and planning to attract capital on a large scale and to coordinate the deployment of heterogeneous resources; Frederick Smith commissioned two consulting firms to undertake independent studies of the feasibility of the Federal Express concept. Unlike the founders of promising businesses who launch their business in weeks or months of getting their idea, it took Smith about eight years from the time he conceived of a business that would provide overnight delivery to the time it became operational.

The scope for adapting or changing the basic concept is very limited after the business is launched. If the core assumptions of the Federal Express plan had been mistaken, the start-up would have failed. But given the high irreducible uncertainty that cannot be eliminated through prior research, the entrepreneur often has to change important elements of the plan; for instance, Federal Express had to adopt a new marketing approach to generate adequate revenues.

12 Unlike many promising or VC-backed start-ups, revolutionary ventures usually do not, however, seek to capitalize on exogenous turbulence. In fact, with great external uncertainty, customers and investors may be hesitant to back a radical product and technology until the environment settles down.

2.2.4 *Securing Resources*

Revolutionary ventures face significant hurdles in securing resources of sufficient quantity and quality. They have to attract a large number of customers to cover fixed costs. The large size and high uncertainty also demand highly talented and motivated employees. To secure such employees, the entrepreneur has to rely on the potential of large long-term financial payoffs, as well as on the psychic benefits of participating in a revolutionary enterprise.

2.2.5 *Requirements for Success*

To succeed, a revolutionary venture must fulfill requirements much more demanding than those met by the other types of start-ups we have discussed. The founder of a revolutionary venture must start with the right basic concept and cope with serious unexpected problems. Success requires highly skilled and cohesive teams as well as entrepreneurs with exceptional qualities and talents. The entrepreneur must have a high tolerance for uncertainty and for risk. Entrepreneurs who dedicate themselves to a grand plan face huge personal losses if they fail.

Vision, tenacity, and charisma also are critical qualities for revolutionary entrepreneurs. Founders of promising businesses, we have seen, often start with a short-term opportunity rather than a long-term plan. Persistence with a failing concept can impair their chances of success. And as long as they can make a few critical sales, they do not need great charisma. In contrast, the revolutionary entrepreneur has to have an audacious vision and the fortitude to stay the course through serious crises and setbacks. The entrepreneur also needs an evangelical ability and personal magnetism to attract and retain investors, employees, customers and other resource providers.

2.3 The Importance of Strategy

Many entrepreneurs start their businesses in an improvised way and rely on imitation or small modification of existing ideas to serve niche markets. Their subsequent search for a more differentiated and larger business also tends to be ad hoc rather than systematic. The entrepreneur may find a new combination that is closely related to the initial business or only very tangentially so. The discovery may be immediate, take several years and false starts, or the entrepreneur may never find a better business model. Factors such as luck, the intensity of dissatisfaction with the current situation, and the willingness to take a chance on an unconventional perspective rather than a strategy play a determining role. In Karl Popper's terms, finding a source of differentiation tends to be an inductive rather than a deductive process.

Whenever or however the entrepreneur establishes a venture's first differentiation, it will usually be of limited scope.[13] The subsequent broadening of the firm's assets and the development of routines require a more systematic effort than the typically opportunistic search for the initial source of differentiation. Investing in opportunities with positive

13 Entrepreneurs lack the capital to acquire a portfolio of complementary resources in one shot as well as the foreknowledge of the components and their linkages.

expected returns without regard to their interactive effects may make an entrepreneur rich. Many individuals have prospered through a sequence of unrelated transactions in real estate and other such deals. But barring an extraordinary coincidence, one-off investments will not create a firm with a system of complementary assets. To build such a system, entrepreneurs have to formulate a strategy. As we will see next, strategies complement the role that an entrepreneur's goals play in building complementary assets. They promote consistency and coherence across multiple initiatives, help develop intangible assets such as expertise and reputation, and help solve coordination problems by fostering cooperation and teamwork.

2.3.1 Coherence of Initiatives

Firms develop new assets through an ongoing process of searching for and experimenting with new initiatives. A strategy defines the boundary conditions or envelope within which new initiatives are more likely to result in complementarities or synergies than if they were randomly selected. For instance, the Wal-Mart system is the result of many years of continuous change. Sam Walton was an avid innovator and imitator who quickly tried out many new ideas. But his experiments all fit a long-term strategy of low-cost, mass-market, discount distribution and thus cumulatively provided Wal-Mart with significant competitive advantages. The evolution of McKinsey's system is similarly characterized by considerable experimentation within the framework of a long-term strategy of providing independent, high-quality advice to the top managers of prestigious companies. The partners discarded or modified initiatives and activities that fell outside the framework and kept those that fit. For example, in 1951 McKinsey abandoned a profitable executive recruiting practice after twelve years when the partners concluded it might compromise the objectivity of their consulting services.

Thomas J. Watson, Sr. (who came to be known as "T.J.") introduced a variety of innovations at IBM. These included, according to Olegario (1997), "providing professional training for all new sales recruits, giving sales people exclusive rights to their territories, and implementing sales quotas". Although he was not an engineer, "T.J. played the key role in developing new products" and through the 1920s and 1930s "moved IBM's focus away from low-tech machines and into that period's state-of-the-art tabulating instrument, the punch-card machine". He added printers to IBM's line so that the tabulating instruments "could be adapted for use in every large office in America". He implemented a policy of leasing rather than selling products to customers. Under T.J., IBM expanded overseas, opening offices in 78 countries by the end of World War II. T.J. adopted a "decentralized approach by establishing wholly owned national companies that were managed and staffed primarily by local citizens".

These varied initiatives did have a common theme, however. Through the 1940s T.J. focused on punch-card machines. A memorable consequence of what Olegario (1997) calls a "stubborn adherence" to punch-card technology was that T.J. turned down the chance to buy the patents for xerography. T.J's son, Thomas J., Jr., recalls in his memoirs that "the inventor Chester Carlson came over from Queens and offered [the patents] to

Dad. That was the biggest opportunity my old man ever missed". Thomas, Jr., also notes that although "sometimes Dad stuck to his last a little too closely", without his "devotion to punch cards, IBM would have lost its focus; it might have become a hodgepodge conglomerate like Remington Rand".[14] (And as we previously discussed, the cash flow and complementary assets from punch cards allowed IBM to make a late but successful entry into computers in the 1950s.)

2.3.2 Reputations and Expertise

Besides promoting synergies across different initiatives and investments, rules and boundary conditions also help firms develop assets such as know-how and reputations that require repetition and constancy of effort. McKinsey's policy of serving top managers of prestigious companies entailed turning down profitable assignments that fell outside this definition. Over time this focus enabled McKinsey to build a reputation and ability in the field of top-management consulting that rivals who were more opportunistic in the assignments they chose to pursue have found hard to match. Similarly, HP developed technological expertise by focusing its product development efforts. David Packard (1996) writes that as the company expanded its product line during World War II, it stuck with instruments "designed to test electronic equipment. They reflected our strategy to concentrate on building a group of complementary products rather than becoming involved in a lot of unrelated things". Accordingly, HP turned down some big production contracts during the war; Packard felt the company should build a "solid base [in] designing and manufacturing high-quality instruments".

2.3.3 Cooperation

Organizational policies can promote cooperation and mitigate a firm's coordination problems in both direct and indirect ways. Many long-lived companies, such as HP, adopt policies directly intended to promote what David Packard (1996) calls "commonness of purpose and teamwork". In the early years, according to Packard, the company did not need explicit policies because "we were all working on the same problems" and "each employee felt that he or she was a member of the team". But as the company grew "we could no longer take teamwork for granted. We had to emphasize and strengthen it". HP developed personnel policies whose "underlying principle", writes Packard, "became the concept of sharing - sharing the responsibilities for defining and meeting goals, sharing in company ownership through stock purchase plans, sharing in profits, sharing the opportunities for personal and professional development, and even sharing the burdens created by occasional downturns in the business".

As the above discussion suggests, effective strategies have an optimal level of precision. Broad strategies provide the latitude to adapt to unexpected setbacks and opportunities and guide the search for complementary assets. For instance, the decision by a tent manufacturing company to define itself as a provider of "high-performance outdoor equipment" can stimulate the development of a line of products sold through the same

14 In the 1920s, Remington Rand and IBM had shared leadership of the U.S. tabulating equipment market.

channel and a versatile brand name. At the same time, defining goals and rules too broadly limits their utility in coordinating the firm's efforts. A useful strategy precludes not just palpably unprofitable activities but also ones that could be reasonably undertaken by a firm following a different strategy. A strategy that is so broadly defined that it encompasses anything a company does is tantamount to not having a strategy. For instance, claiming to be in the leisure and entertainment business does not preclude a tent manufacturer from operating casinos or making films and therefore does not provide much focus to the company's efforts.

2.4 Distinctive Strategy Features

2.4.1 Goals and Prior Experiences

Formative experiences that shape the worldview of the entrepreneur play an important role in determining firm strategies. The origins of Wal-Mart's strategy of serving out-of-the-way markets can be traced back to chance events that led the founder, Sam Walton, into discount retailing in rural Arkansas. Walton worked briefly in the department store business for JC Penney, before joining the United States Army. When he returned to civilian life in 1945, he and a friend decided to become partners in a franchised store in St. Louis. But because Walton's wife insisted they live in a town with fewer than ten thousand inhabitants, he bought a franchised store in Newport, Arkansas, instead. When the landlord declined to renew the lease three years later, Walton decided to move to Bentonville, another small town, in northwestern Arkansas. Bentonville was closer to his wife's family, and its location allowed Walton to more fully satisfy a passion, acquired from his father-in-law, for quail hunting. By 1960 Walton had fifteen stores with total sales of $1.4 million in and around Arkansas. If circumstances had let Walton start in St. Louis or if he had developed different recreational tastes, he might have adopted a different strategy for Wal-Mart; perhaps he might have developed a chain of upscale specialty stores in large cities like the Nordstrom chain.

John Chambers's prior experiences influenced Cisco Systems' technology strategy. In 1991 Cisco's then CEO, John Morgridge, recruited Chambers to succeed him. Chambers had worked at Wang Laboratories, where he witnessed "a painful downsizing". One lesson he drew from the experience was to avoid relying on a single technology. Wang was a company built around minicomputers. When Chambers assumed the leadership of Cisco, he sought to diversify its portfolio of technologies through acquisitions of or minority investments in small firms. Between 1993 and 1996 Cisco made seventeen such acquisitions or investments. In 1996, according to its chief technical officer, Cisco's technological base comprised about a dozen technologies.

Many of the policies Marvin Bower adopted at McKinsey & Co. derived from a previous stint at Jones, Day & Co., a leading law firm in Cleveland. When he joined Jones, Day in 1930, Bower recalls, he got "a chance to work for Mr. Ginn, the senior partner. Because I had heard so much about him and the firm he had shaped, I made it an imme-

diate objective to learn why it had been so successful. From observation and analysis during my Jones, Day years began the formulation of the program that I later brought with me to McKinsey". Bower made note of Jones, Day's professional approach, recruiting standards, and the prominence of its partners in Cleveland's charitable, social, and cultural organizations. If Bower had worked at an advertising or accounting firm instead of Jones, Day, he might not have emphasized the prestige and standing of McKinsey and its partners as much.

McKinsey's organizational principles likewise reflect Bower's dissatisfaction with the discord and authoritarian leadership he had witnessed at the antecedent firms, James O. McKinsey & Co. and McKinsey Wellinton. Bower's distaste for the "controlling type of leadership" practiced by McKinsey Wellington's managing partner (and to a certain extent by James O. McKinsey) led to the adoption of a consensual form of governance. Similarly, his unhappiness with interoffice rivalries at McKinsey Wellington led to McKinsey's one-firm policy.

2.4.2 Adaptation

Entrepreneurs do not formulate their strategies all at once - they adapt and expand the scope of their policies in response to unforeseen problems and opportunities. HP's founders, for instance, did not formulate explicit organizational policies for nearly twenty years. Packard (1996) writes: "We did not much concern ourselves with organizational matters until well into the 1950s. There was no need to. We had a well-defined line of related products, designed and manufactured in one location, sold through an established network of sales representatives, and had a highly centralized company in which management was organized on a fundamental basis with vice presidents for marketing, manufacturing, R&D and finance". Continued growth and diversification of product lines "brought to light some organizational weaknesses" and led the founders to "consider some sort of decentralized strategy". In 1957, they divided the ninety engineers engaged in product development into four groups, each of which concentrated on a family of related products. The formation of product development groups was followed by further "divisionalization steps" spurred by geographic expansion of manufacturing operations in Colorado and Germany and by the acquisition of new businesses. By the mid-1960s HP had more than a dozen "integrated, self-sustaining" operating divisions responsible for developing, manufacturing, and marketing their own products (Packard (1996)).

Hewlett and Packard also codified organizational norms in response to the company's growth and diversification. In 1957 the company held its first off-site meeting of senior managers. A group comprising about twenty people reviewed and studied a set of corporate objectives that Packard had previously drafted and discussed with Hewlett. As Packard (1996) describes it: "Bill and I often thought about how a company like ours should be organized and managed. We thought that if we could get everybody to agree on what our objectives were and to understand what we were trying to do, then we could turn them loose and they would move in a common direction". The principles discussed

in 1957 were subsequently refined based on experience and on changes in the business environment.

Limited growth opportunities in the businesses it had initially concentrated on lead HP to change its product-market focus. "By the late 1950s", Packard (1996) writes, "the need for diversification was clear. We were becoming the largest supplier in most of the major segments of the electronic-instrumentation business. But these segments, in total, were growing at only 6 percent per year, whereas we were growing out of profits, at 22 percent. Obviously, that kind of growth could not continue without diversification". HP subsequently established an operation to engage in solid-state research and development. It entered the medical field by acquiring the Sanborn Company, and the field of instrumentation for chemical analysis by acquiring F&M Scientific. These strategy-defining acquisitions provided a base for entering new markets where HP could exploit and extend its capacity for developing technology-based products. Similarly, important elements of Wal-Mart's strategy evolved over several decades, in response to unanticipated problems and opportunities. Distribution centers or warehouses have been a cornerstone of the company's expansion: Wal-Mart grew from state to state, methodically saturating markets surrounding distribution centers with its stores. With each store located within a day's drive of a distribution center, Wal-Mart could replenish store inventories, Walton estimated in 1992, more than twice as fast and at about a 35-40 percent lower cost than its competitors. The strategy was born out of necessity. The company started building its first center in 1968, according to Walton (1993), because "we didn't have distributors falling over themselves to serve us like our competitors did in larger towns. Our only alternative was to build our own warehouses so we could buy in volume at attractive prices".

Investments in computer and communications systems have been another important critical element of the retailer's strategy. Abe Marks, the first president of the National Mass Retailers Institute, writes that without computerization, it would have been impossible for Walton to "have built a retailing empire the size of what he's built, the way he built it. He's done a lot of other things right, too, but he could not have done it without the computer". For many years, however, Walton relied on rudimentary, labor-intensive systems. He writes:

> By the early sixties, we had eighteen variety stores and a handful of Wal-Marts…We kept a little pigeonhole on the wall for the cash receipts and paperwork of each store. I had a blue binder ledger book for each store. When we added a store, we added a pigeonhole. I know we did that at least up to twenty stores. Then once a month, Wanda Wiseman and I would close those books - enter the merchandise, enter the sales, enter the cash, balance it, and close them. (Walton (1993)).

In 1966, Walton enrolled in an IBM course for retailers. He recognized that Wal-Mart "had to get better organized" and that "quite a few people were beginning to go into computerization". After this course, Walton began to recruit the personnel who would

develop Wal-Mart's systems. In 1968 Wal-Mart hired Ron Mayer, and from that point on, Walton writes, "we as a company have been ahead of most other retailers in investing in sophisticated equipment and technology". So it was more than two decades after Walton had opened his first store that a critical element of Wal-Mart's strategy was put in place. The principle of "treating employees as partners" through profit sharing and other benefit programs was adopted even later. Initially, Walton (1993) writes, "I was so obsessed with turning in a profit margin of 6 percent or higher that I ignored some of the basic needs of our people". Subsequently, after skirmishes with unions led Walton to start "experimenting with this idea of treating our associates [employees] as partners, it didn't take long to realize the enormous potential it had for improving our business".

Although policies often result from adaptation, this does not mean that effective strategies are in a state of constant flux: Rules need some stability to guide a firm's activities. At the same time, effective strategies for building a long-lived firm are not static either. Goals and prior experiences shape the initial policies. External developments such as a union organization or the availability of cheap computing power cause entrepreneurs like Sam Walton to reformulate their initial strategies. As the example of HP shows, firms may also develop new policies because they outgrow their target markets and their organizational structures and routines. Thus we find fledgling firms undertaking two kinds of initiatives. Some initiatives, such as HP's efforts to develop new electronic instruments, fall within the framework of the existing strategy. Other initiatives, such as HP's search for new markets, attempt to modify the framework. Successful frame-modifying initiatives lead to new policies - for instance, HP's acquisition of the Sanborn Company lead to a long-term commitment to the medical products market. Like a system of common law, effective strategies are both consistent and responsive to changing circumstances.

To conclude this section, we may thus sketch the following progression in the evolution of the strategies of promising ventures. Entrepreneurs start their business in an ad hoc way, without any systematic effort to find the best possible opportunity. They serve small markets and often rely on their personal efforts and market disequilibria to turn a profit. Through a determined, but usually not systematic, search, some entrepreneurs find larger opportunities that provide a platform for building a coordinated system of assets that can sustain a long-lived firm. The development of the system is neither random nor fully planned; rather, it evolves through experiments conducted within the framework of the firm's strategy. Although the long-term rules, which comprise the strategy, provide a consistent, systematic structure for the firm's initiatives and investments, the formulation of the strategy itself is arbitrary and evolutionary. Entrepreneurs make *a priori* choices about the type of firm they would like to build and rules they will adopt to do so. The entrepreneur conducts many experiments within the guidelines of long-term rules and also experiments to refine and expand the rules.

3 The Essentials of Venture Capital Investment

3.1 Introduction

During the Internet boom, the venture capital model seemed omnipotent. Now, after scores of dotcoms backed by blue-chip venture capitalists have gone bust, it is time for a sober evaluation: in normal times, what are the advantages and limitations of the venture capital model?

Venture capitalists occupy an important niche as investors. Businesses backed by venture capital have profoundly influenced high-technology fields such as semiconductors and genetic engineering. Capital and advice provided by venture capitalists have helped propel companies such as Sun Microsystems and Compaq to global leadership. But such cases are not typical. Contrary to popular belief, only exceptional entrepreneurs can secure start-up venture capital. Of nearly a million businesses formed each year in the US, venture capitalists fund a few hundred. Most companies, exemplified by Hewlett-Packard, Microsoft, Cisco and Dell, start with limited funds provided by founders or by their families and friends.

This chapter examines the attributes of companies in which venture capitalists tend to invest. As shown in Figure 1 in Chapter 1, entrepreneurs pursue opportunities with high novelty and low resource requirements. When public companies mature they undertake projects that require substantial capital and managerial resources. Failure can lead to substantial losses but such projects do not involve much subjective uncertainty, because decision makers have the information required to assess the risks and returns.

Venture capitalists use criteria that lead them to investments with medium resource requirements and novelty. Only a few, unusual entrepreneurs meet these criteria. Some businesses, such as Cisco, that cannot raise venture capital at the outset can do so later, after the subjective uncertainties deriving from the novelty of the business has declined and resource requirements have increased. The venture capital industry typically gives about two thirds of its funds to companies which are not start-ups. As these businesses prove themselves further, uncertainty continues to decline and their resource requirements increase. Further development would make them suitable for accessing public capital markets. Thus venture capital is a source of medium-term, "bridge" financing.

3.2 Evaluation and Monitoring

Investors in start-ups have an incentive to conduct more due diligence than investors in public companies. Investors in publicly traded stocks are not rewarded for assuming company-specific risk. They diversify risks by holding a portfolio of stocks. The "market" or "systematic" risk of the portfolio, rather than astuteness in choosing individual securities, determines an investor's long-term return. Efforts to analyze a company's prospects carry little reward because market prices already account for all available infor-

mation. Investing in start-ups is different. Discrimination among opportunities is crucial, because investors cannot depend on free research and due-diligence reflected in market prices. Prudence demands some diversification but this is no substitute for choosing each investment carefully.

Buying 20 listed stocks at random eliminates most company-specific risk and provides a return that tracks the overall stock market. Historically, this return has been about 10 per cent a year. Providing venture capital to 20 random entrepreneurs will likely provide, given the dubious prospects of most new businesses, a return of close to zero. Moreover, backing randomly selected ventures makes investors vulnerable to opportunistic or self-dealing founders.

Investors in start-ups have an incentive to provide considerable monitoring and oversight. In public markets, the diversified investor's ability to monitor and intervene is low. Companies cannot discuss strategy and performance with widely dispersed investors, so stockholders lack the confidential information to monitor managers and distinguish between their luck and skill. Free-rider problems also undermine incentives for stockholders to intervene - the stockholder who incurs the costs of inducing a company to change must share the benefits with other stockholders who did not make the effort. Unhappy stockholders therefore sell stock rather than incur these costs. In small, private companies, however, investors can demand access to information they need to evaluate performance. And, investors cannot avoid intervention by selling their holdings in a liquid market.

3.3 Partnership Terms

Professional venture capitalists, who invest others' funds rather than their own, face additional incentives to institute systematic procedures and criteria for evaluating and monitoring investments.

Wealthy individuals, pension funds and other entities that have the capital to invest in start-ups often lack the resources (or confidence) to evaluate and monitor such ventures. Instead, they invest in limited partnerships organized by venture capital companies. In such partnerships, venture capitalists have discretion over the funds under management. At or before the end of the life of the partnership, usually within 10 years, venture capitalists sell the illiquid holdings of the partnership for cash or convert them into marketable securities and return the proceeds to clients. For this service, venture capitalists receive an annual fee (usually 1-2 per cent of assets managed) as well as a "carried interest" or share (around 20 per cent) of profits generated for clients.

The terms of their deals with clients encourage venture capitalists to formalize investment processes. Limited partnership structures allow venture capitalists to avoid delays and the leakage of information that might result from having to raise funds for individual investments. However, they also require clients to cede full control over investment decisions for an extended period. The "carried interest", which gives venture capitalists a share of the profits but not of the losses, creates an incentive to invest in excessively

risky projects. Venture capitalists therefore have procedures to reassure clients that they will not abuse their discretion by making reckless investments.

Evidence suggests that venture capitalists devote considerable effort to due diligence, structuring deals and providing counsel and oversight. Partners in venture capital companies, Professor William Sahlman (1990) reports, usually have responsibility for just under nine investments and sit on five boards. They visit each company 19 times a year and spend 100 hours either on site or in contact by phone. They "help recruit and compensate key individuals, work with suppliers and customers, help establish tactics and strategy, play a major role in raising capital, and help structure transactions such as mergers and acquisitions. They often assume more direct control by changing management and are sometimes willing to take over day-to-day operations themselves" (Sahlman (1990)).

3.4 Typical Criteria

The limit to the number of deals venture capitalists can manage sets a high threshold for the returns they require. Instead of dividing their time between many small opportunities, they concentrate on a few ventures that have the potential - based on objective or verifiable data - to make substantial returns. Significant failure rates and limited time horizons reinforce this preference. Even after extensive due diligence and monitoring, many venture capital investments yield disappointing returns. One study of venture capital portfolios by Venture Economics reported that about 7 percent of investments accounted for more than 60 percent of profits, while a third resulted in a partial or total loss (Sahlman (1990)). Venture capitalists therefore avoid small opportunities where even substantial returns on a percentage basis will not cover the opportunity costs of their time or compensate for failures in their portfolios. Every venture must hold the promise of returns of millions of pounds, rather than in the tens or even hundreds of thousands.

The attractiveness of a company also depends on how long venture capitalists expect it will take them to "harvest" or cash out of their investment. Venture capitalists have to cash out before their partnership expires. In a 10-year fund, a venture that does not fold is taken public or sold to another company typically within five years. This consideration leads venture capitalists to favor investments with the potential for large payoffs: small companies cannot afford to go public and conform to regulatory and reporting requirements.

3.4.1 Unusual Ventures

In trying to identify big winners, venture capitalists look for companies that serve large markets with a proprietary technology or process. A small company can be profitable as a result of its founders' drive, energy, relationships and so on, but a significant payoff, realized through the sale of the company or a public issue of its stock, generally requires something inherently proprietary in its products or processes. Venture capitalists also

favor seasoned founding teams who can significantly increase a venture's chances of becoming large quickly.

Some entrepreneurs who start niche businesses without a proprietary model may discover large markets and build sustainable advantages. Similarly, inexperienced founders may learn how to manage rapidly growing companies. But it is difficult to predict which entrepreneurs will be able to do so. The absence of a specific plan or technology and verifiable credentials puts the subjective uncertainty of the venture above the venture capitalist's acceptable threshold.

My research suggests that most start-ups, including those that make *Inc.* magazine's list of the 500 fastest growing private companies in the US, do not meet the criteria used by venture capitalists. Most entrepreneurs do not have a proprietary product or service capable of generating significant revenues. They are often not the first or second entrants in their markets. Often, they copy from other companies or develop an idea independently but at the same time as other entrepreneurs.

Usually the revenue potential of an initial concept is limited. Most entrepreneurs start in niches that cannot justify the million-dollar investment thresholds of venture capitalists. For example, Microsoft co-founders Bill Gates and Paul Allen launched the company in 1975 by writing a version of the Basic programming language for the Altair, a computer sold to a tiny market of hobbyists. Even if such companies can find larger markets, their growth tends to fall short of the size necessary to meet venture capital standards of success. An investment in Microsoft in 1975 would probably not have produced an attractive return over the usual three- to five-year venture capital horizon. Five years after launch, Microsoft had sales of $5m. Microsoft took nine years to book the same revenues as the software company Lotus, which was backed by venture, did in its first year, and 10 years to go public.

Most entrepreneurs don't have the experience that venture capitalists believe is necessary to build and manage large companies. The founders of Compaq had been senior managers at Texas Instruments before they launched the company. Michael Dell and Bill Gates were students when they started. In exceptional cases, an inexperienced founder may team up with a seasoned manager and venture capitalists can help entrepreneurs create such teams. This requires, however, a high potential idea or technology. If, as is often the case, entrepreneurs start off with a me-too concept or a differentiated product for a small market, they cannot recruit partners or employees with the experience that venture capitalists consider necessary.

3.5 Later-Stage Financing

Many ventures whose prospects are too small or uncertain at the outset qualify for venture capital financing later, as their business models and management capabilities are proven. And indeed venture capitalists tend to provide more funds to these later stage businesses than to start-ups. The National Venture Capital Association's annual report shows that in 1996, 77 percent of companies receiving venture capital funding were three

years or older and 80 percent had more than 25 employees. Similarly, data collected by Fenn, Liang and Prowse (1995) shows only about a third of investments are "early stage".

Cisco illustrates how the fit with venture capital increases as novelty and subjective uncertainty declines. Sandy Lerner and Len Bosak started Cisco in 1984. They raised money by running up bills on their credit cards and persuaded friends and relatives to work for deferred pay. Although the business was consistently profitable it faced persistent cash shortages and at one point in 1986, Lerner took a job as a data processing manager to provide more cash. In 1987 Cisco received funding from Sequoia Capital - the 77th venture capital company the founders approached.

By then the company's products had proven themselves - Cisco had sales of between $250,000 and $350,000 a month, without a professional sales staff and marketing campaign. But not only did Cisco lack capital, it also lacked professional management. Sequoia partner Donald Valentine helped provide these. He hired an experienced manager, John Morgridge to run Cisco in 1989. Morgridge installed a professional management process and paved the way for a public offering in February 1990.

After going public, Cisco became the leading supplier of routers that link computer networks. Last year, it took revenues of nearly $19bn and profits of $874m.

3.5.1 Symbiotic Relationship

Cisco's evolution exemplifies the symbiotic relationship between venture capitalists and the public markets. Markets provide exits for venture capitalists and the venture capitalists create a "product" for public investors. Public companies can then undertake projects whose resource requirements and time horizons lie outside the scope of venture capitalists. For example, the research and marketing costs of a drug compare with the total capital of many venture capital funds and the time taken just for regulatory approval typically exceeds their investment horizon.

Public companies such as Merck have an obvious advantage in undertaking such large and complex projects because of their extensive management structures. Investors are also more prepared to entrust funds for an indefinite time to organizations with well-developed management systems rather than to a few talented individuals. The use of management systems and procedures however makes public corporations more averse to novelty than venture capital companies.

3.5.2 Mania and its Aftermath

The IPO mania that started in earnest with the 1996 floatation of Netscape distorted this natural order. Investing in any growth stock turns on the optimism that small profits will turn into large profits. With Netscape and subsequent offerings, investors were betting on a fundamental change in trajectory, believing that companies making significant losses would, one day, make substantial profits.

New economy optimism did wonders for venture capitalists. Before, they had to wait for ventures to establish a record of profitability over several years. And they had to write off investments in many businesses that, in spite of star-studded founding teams, could

not develop profitable business models. As the IPO market became less discriminating, venture capitalists faced fewer write-offs, holding periods shrank and exit values multiplied.

Contrast Sun Microsystems incorporated in February 1982 with Chemdex incorporated in September 1997. Both started with concepts that could lead to substantial long-term profits, had exceptionally capable founders and secured financing from Kleiner-Perkins. The difference? It took four years for Sun to go public and only two for Chemdex. In its pre-IPO fiscal year, Sun booked revenues of $115m on which it earned $8.5m in net income. Chemdex booked $29,000 in revenues and lost $8.5m. By design, Sun turned profitable in its first quarter and has remained so ever since. Chemdex (now renamed Ventro) has never made a profit. Its stock, which peaked at $243 last February, now trades for about $1. But as far as its venture capitalists are concerned, what might once have been a write-off counts as a winner.

By my calculations, returns from venture capital funds between 1981 and 1996 were indistinguishable from those of publicly traded stocks. Between 1996 and 1999 many funds sported triple-digit returns each year. These returns enabled venture capitalists to raise huge funds and attracted many new entrants and substitutes. The investment banks that underwrite IPOs moved up the value chain and put billions into their venture capital activities. All of the top consulting and accounting companies set up incubators. And as the money poured in, venture capital had neither the time nor the incentive to apply traditional criteria and due diligence procedures.

What happens next? The boom and bust in biotechnology provides a good preview. In the early 1990s financial markets seemed to take the view that genetic engineering would help cure every disease. Companies whose name included some part of the words biology, technology, or genetics could issue stock without any obvious route to profitability. To replenish the IPO pipeline, venture capitalists courted academics and medics with implausible business plans. Then the bottom fell out. According to Professor Josh Lerner and Alexander Tsai's (2000) data, the external financing raised by US bio technology companies halved in two years - from over $5bn in 1992 to under $2bn in 1994. Biotechnology stocks had a wilder ride. The Amex biotechnology index peaked at 250 and in the next two and a half years lost 80 percent of its value. It would take almost another decade to regain that peak.

But, it is worth remembering, research into new drugs and therapies, and the formation of new companies did not end. It merely reverted to more sensible patterns. And although biotechnology did not meet the extravagant initial expectations, it will continue to make significant contributions to medicine. So it will be with the new economy. Valuations and expectations will fall, but not forever. The party is over, but it isn't the end of the world. Once they have recovered from their hangovers, investors in private and public equities will resume their distinctive roles.

4 Taking Care: How Concerns about Prior Knowledge Affect the Financing of Novel Projects

4.1 Introduction

Imagine an entrepreneur who wants to start a chain of espresso bars. The entrepreneur can rely on self-financing or approach wealthy individuals (the so-called "angel" investors), professional venture capitalists (VCs) or a large corporation. How does the entrepreneur decide?

Principal-agent models usually frame such questions in terms of concerns about dishonesty. The models suggest for example that access to outside financing will depend on the willingness of the entrepreneur to invest her own capital (Leland and Pyle (1977)) and on the observability or verifiability of her effort (See Hart (1995)). In fact, financiers worry about both dishonesty and mistakes. VCs try to uncover facts that entrepreneurs have an incentive to conceal, such as a criminal record. They also try to verify assumptions (for instance, about technologies and markets) that entrepreneurs make in good faith.

Furthermore, concerns about mistakes can outweigh concerns about dishonesty. For instance, entrepreneurs who commit all their wealth to a venture may dispel concerns about adverse private information but not about their judgment. Therefore, inexperienced entrepreneurs like Sandy Lerner and Len Bosack, the founders of Cisco, may not be able to secure outside financing, in spite of committing all their savings and taking out large personal loans. In contrast "repeat" entrepreneurs like Jim Clark who commit a small portion of their wealth to start-ups like WebMD and Healtheon may be able to raise outside VC financing.

Economists have not paid much attention to controlling honest mistakes however. Erroneous judgment plays a central role in Knight's (1921) theory, but in the modern economic literature, papers by Sah and Stiglitz ((1986), (1988)) and by Sah (1991) on fallibility, represent notable exceptions to the relative neglect of the topic. More recently, behavioral economists have done extensive research on whether defective reasoning leads to the "anomalous" pricing of securities.

I analyze errors that arise because of defective prior knowledge rather than defective reasoning. I thus examine errors of "correspondence" - estimates that deviate from true probabilities - and exclude errors of "coherence" - failing to conform to rational standards (Hammond (1996)). The failure of physicians (before the early 1990s) to use antibiotics to treat peptic ulcers exemplifies the kind of errors I have in mind. Physicians "underestimated" the benefits of antibiotics because of defective prior knowledge rather than defective reasoning - they simply didn't know that many peptic ulcers resulted from bacterial infections rather than poor diets or stress.[15]

15 The errors caused by defective knowledge include "overconfidence". The behavioral literature has shown a relationship between overconfidence and faulty reasoning; but, in fact, defective knowledge can also lead to overconfidence in perfectly rational individuals. Consider for instance, physicians' "overconfidence" in what we now know to be ineffective treatments for peptic ulcers such prescribing antacids. A behavioral explanation might attribute this to an irrational avoidance of disconfirming evidence. It is also possible that physicians did revise their estimates, but that these revisions did not eliminate their "overconfidence" until research data on bacterial information became available.

I also focus on principal-agent interactions rather than the anomalous pricing of securities. Specifically I analyze principals' concerns that the estimates of agents who solicit resources for their projects may have a positive bias, because agents tend to drop projects if they underestimate the returns. Landier and Thesmar (2003) model this problem, which closely resembles the winner's curse in auction theory, under the assumption that "over-optimistic" agents suffer from "base rate neglect". For instance optimists observe that an idea has promise but ignore the rate at which promising ideas fail. But subjective misestimates of base rates can also lead to winner's curse like problems. And, my analysis suggests that concerns about subjective misestimates discourage principals from financing novel projects. Concerns about an agent's illogical neglect of base rates do not have this effect.

This chapter is organized as follows: The next section presents a simple illustration of how an investor's concerns about an entrepreneur's judgments affect the types of projects the investor will finance. Section 4.3 examines what happens when investors delegate the responsibility of controlling an entrepreneur's mistakes to an agent and section 4.4 examines the delegation of control to large agent teams. Sections 4.5, 4.6 and 4.7 provide applications. They show how my framework provides new insights about the differences in the investments made by self-financed entrepreneurs, angel investors, VCs and large public corporations. Section 4.8 discusses implications for further research. The last section concludes.

4.2 An Example

Imagine a set of locations in Seattle available for opening espresso bars. It is common knowledge that: opening a bar requires an investment "I"; bars produce a one-shot "gross" return of zero if they fail and "R" $\geq I$ if they succeed; and, that most bars fail, so the expected gross return is always less than I.

An entrepreneur believes that bars in prosperous neighborhoods in Seattle have a higher than average probability of success. She estimates this probability, in the following manner. She first conducts an extensive study of espresso bars in Italy. Then using her knowledge of the difference between Italian cities and Seattle, she forms a preliminary estimate that p^{I} (the probability of success of a bar in a prosperous Seattle neighborhood) follows a beta distribution with parameters s and $n - s$ and a mean value $\overline{p}^{I} = s/n$. Finally, the entrepreneur updates her preliminary estimate (in accordance with Bayes rule) after observing that S out of N bars started in prosperous neighborhoods in Seattle have been successful. Accordingly, her posterior estimate p^{II} has a beta distribution with parameters $s+S$ and $(n+N) - (s+S)$, and a mean, $\overline{p}^{II} = (s+S)/(n+N)$.

This estimate leads the entrepreneur to adopt the following decision rule: "Go if the bar is in a prosperous location and $\overline{p}^{II} \times R \geq I$ (i.e. $R/I \geq 1/\overline{p}^{II}$)".

If the entrepreneur decides to go ahead but the capital requirements are large the entrepreneur may request an investor to finance the difference between I and her personal wealth. In support of her funding request the entrepreneur submits a "business plan" containing p^{I} and p^{II}, her preliminary and posterior estimates of the probability of

success. The entrepreneur does not however fully specify how she estimated $\bar{p}'$ i.e. the details of her study of Italian espresso bars and how she adjusted for the differences between Seattle and Italy. This is both because the costs of doing so are prohibitive and because she simply cannot communicate some of the tacit knowledge she has used in forming her preliminary estimate.

The investor knows that most espresso bars fail, and before he receives the entrepreneur's business plan has no views of how the prosperity of a neighborhood might affect the success of an espresso bar. The investor decides whether to invest just on the basis of the information contained in the entrepreneur's business plan i.e. without any independent research or further discussions with the entrepreneur. The investor's decision rule has the same general form as the entrepreneur's decision rule: the investor will provide the requested funds only if, $R/I \geq 1/\bar{q}''$ where $\bar{q}''$ equals the investor's posterior mean estimate (formed after he has examined the entrepreneur's business plan) of the probability that the bar will be successful.

The investor does not worry about the entrepreneur's honesty, private benefits, defective reasoning or an over-optimistic disposition. He is however concerned that the entrepreneur's preliminary mean estimate $\bar{p}'$ may be biased because the entrepreneur relied on the wrong prior knowledge (for instance about the differences between Italy and Seattle). In particular, the investor believes that $\bar{p}' \neq$ P, where P is the "true" probability of success of an espresso bar in a prosperous Seattle neighborhood.

But why should the investor expect a bias in $\bar{p}'$? This stipulation, which is crucial to my analysis, cannot be explained simply by the entrepreneur's inability to fully communicate how she estimated $\bar{p}'$. After all, if the investor trusts the entrepreneur's "rationality", shouldn't he expect that had the entrepreneur been able to communicate all her information, this would have persuaded him that $\bar{p}'$ had no bias? But in fact to form such an expectation, the investor must also anticipate that he would have *interpreted* the entrepreneur's information in exactly the same way as the entrepreneur did. This, in turn, requires the investor to expect that he has exactly the same prior beliefs as the entrepreneur (Savage (1972), Aumann (1976)). But suppose instead that the investor expects at least some differences in their prior beliefs. Now, the investor will expect *differences* in his interpretation and the entrepreneur's interpretation of the information that the entrepreneur could not communicate. Therefore, where the entrepreneur expects zero bias in $\bar{p}'$, the investor expects at least some bias.

The investor's expectation that $\bar{p}' \neq$ P in turn leads to the proposition that his mean estimate of the probability of success of the bar proposed by the entrepreneur will be lower than the entrepreneur's estimate (i.e. $\bar{q}''$ will be less than $\bar{p}''$) This is because:

I. If $\bar{p}' \neq$ P, then the entrepreneur's posterior estimate $\bar{p}'' \neq$ P.

Let $e = \bar{p}' - \text{P} = \text{s}/n - \text{P}$. If the entrepreneur subsequently examines the outcomes of N bars in Seattle, she will observe NP successes and N(1-P) failures. Her mean posterior estimate, $\bar{p}''$ will now equal $(s + N \times \text{P})/(n + N) = \text{P} + (e \times n)/(n + N) \neq$ P.

II. The entrepreneur's decision rule will lead her to propose more projects if she has overestimated the probability of success ($\overline{p}^{\prime\prime} > P$) than if she has underestimated this probability.

Every project selected by an entrepreneur whose estimate is too low will also be selected by an entrepreneur whose estimate is too high but not the other way around. In particular, if $\overline{p}^{\prime\prime} > P$, the entrepreneur will proceed with some "bad" projects ($R/I \leq 1/P$) that she would reject if $\overline{p}^{\prime\prime} \leq P$. She will also accept all "good" projects ($R/I \geq 1/P$) whereas if $\overline{p}^{\prime\prime} \leq P$, she would reject some good projects.[16]

Now because the investor anticipates more $\overline{p}^{\prime\prime} > P$ than $\overline{p}^{\prime\prime} < P$ in the proposals he receives and $\overline{p}^{\prime\prime}$ cannot exceed P if $e < 0$, the investor should expect that $e > 0$. Accordingly whereas the entrepreneur (who believes that $e = 0$) forms a posterior estimate $\overline{p}^{\prime\prime} = (s+S)/(n+N)$ the investor's estimate of the probability of success $\overline{q}^{\prime\prime}$ has a lower value of $\overline{p}^{\prime\prime} - (n \times e)/(n+N)$.

Recall that the investor only accepts proposals where $R/I \geq 1/\overline{q}^{\prime\prime}$; therefore, if $\overline{q}^{\prime\prime} < \overline{p}^{\prime\prime}$, the investor will reject proposals where $1/\overline{q}^{\prime\prime} \geq R/I \geq 1/\overline{p}^{\prime\prime}$. Now if the entrepreneur's business plan contains a long "track record" of bars opened in prosperous neighborhoods in Seattle (i.e. $N \approx \infty$), then $\overline{q}^{\prime\prime} = \overline{p}^{\prime\prime} - (n \times e)/(n+N) \approx \overline{p}^{\prime\prime}$ and the "unacceptable range" of R/I (from $1/\overline{p}^{\prime\prime}$ to $1/\overline{q}^{\prime\prime}$) in which the investor rejects the entrepreneur's proposals will be small. In other words, a long track record makes the investor's concerns about $\overline{p}^{\prime} \neq P$ irrelevant; the investor will expect that an entrepreneur who has observed a large number of outcomes will have eliminated any positive bias in $\overline{p}^{\prime\prime}$.

If N is small, however, the investor will reject proposals over a wide range of values of R/I. This will obviously occur if the entrepreneur's proposal is highly *novel*. For instance, if no one has previously started any espresso bars in Seattle, N will equal zero and $\overline{q}^{\prime\prime} << \overline{p}^{\prime\prime}$. So the investor will fund the entrepreneur's proposal only if R/I exceeds $1/\overline{p}^{\prime\prime}$ (the entrepreneur's own cutoff value) by a wide margin.

Even if the project itself is mundane or routine, unobtainable data that the entrepreneur normally uses can make her proposal appear novel to the investor. Suppose for instance that the entrepreneur normally uses information about local rents to assess whether a neighborhood is "prosperous" but this information happens to be unobtainable in a particular location. To decide whether to open a bar in this location the entrepreneur may apply her usual rule after using some other data to estimate the probability that the neighborhood is prosperous. But, the entrepreneur cannot provide any track record in support of this "modified" estimate, because unobtainable values of rents represent a "novel" condition.

The investor may also treat a proposal for a routine project as novel if the entrepreneur lacks personal experience with a decision rule that requires the exercise of "tacit" knowledge that cannot be easily communicated (Polanyi (1962)). For instance, different

16 In the Landier and Thesmar (2003) model, "overoptimistic" entrepreneurs who neglect base rates are more likely to propose projects than "realistic" entrepreneurs who take base rates into account. In my example, the entrepreneur does not neglect base rates (as would be the case if her decision rule was "Go if R/I ≥ 1" instead of "Go if $R/I \geq 1/\overline{p}^{\prime\prime}$). This mitigates (because $\overline{p}^{\prime\prime} \leq 1$) but does not eliminate the winner's curse type problem (to the extent that the entrepreneur misestimates $\overline{p}^{\prime\prime}$)

entrepreneurs who use the rule "Go if $R/I \geq 1/\bar{p}''$ and the proposed location is in a prosperous neighborhood" may obtain different results because they use different tacit knowledge in determining whether a neighborhood is prosperous. So even if an entrepreneur provides data about a large number of bars in neighborhoods that someone else has determined to be prosperous, this data may not carry much weight with the investor.

Notice that the bias against novelty turns on the nature of the investor's concerns. Suppose the investor is concerned only about overestimates that result from the entrepreneur's overall reasoning capacities (e.g. base rate neglect) or a general disposition towards over-optimism. Then the investor will examine the entrepreneur's track record to assess whether she knows that that base rates matter or has an excessively optimistic disposition. But track records that provide reassurance about the entrepreneur's overall reasoning ability may derive from any domain. Therefore, the entrepreneur's generic inexperience - the absence of a *general* track record - rather than the novelty of her specific proposals will impair her ability to raise outside capital.[17] Similarly, suppose that the investor is concerned just about the entrepreneur's honesty or the pursuit of private benefits. Then the investor will examine the entrepreneur's overall track record for evidence of past dishonesty or the likelihood that a particular project will provide large private benefits to the entrepreneur. This examination too does not involve any direct bias against novelty.

4.3 Delegation to an Agent

Investors (such as venture angels) control entrepreneurs' mistakes by personally selecting investment proposals, whereas other investors delegate the responsibility to agents (such as professional VCs). Agents enjoy well-known advantages in financing projects with large capital requirements. Below, I argue that agents also have a lower tolerance for novelty and are also more likely to use well-codified rules to screen proposals than do investors who screen proposals on their own.

4.3.1 Bias against Novelty

Investors who delegate control to agents face the same winner's curse type problem as investors who screen their own proposals. As discussed, in the previous section, investors worry that even honest reasonable entrepreneurs tend to overestimate the probability of success of the projects they choose to pursue. The same logic suggests that investors will also be concerned about a positive bias in the estimates of agents: defective prior knowledge can lead agents to misestimate the probability that their rules for screening proposals will lead to good choices; and, agents who over-estimate this probability are more likely to solicit funds than agents who underestimate this probability.

17 The *degree* of the bias against novelty may however vary with the investor's beliefs about the entrepreneur's overall disposition. Suppose for instance the investor believes that the entrepreneur tends to form "strong" preliminary estimates i.e. her estimates of "s" and "n - s" tend to be large. Such an entrepreneur will tend to "correct" her biases at a relatively low rate as she observes more outcomes. Therefore, the difference in the "unacceptable range" of R/I (from $1/\bar{p}''$ to $1/\bar{q}''$) in which the investor rejects the entrepreneur's proposals between "novel" and "routine" projects will be relatively small.

Suppose for instance an agent forms a preliminary estimate that the average espresso bar he selects will succeed with probability q', and after N actual selections revises this estimate to q''. If the agent has relied on the wrong prior knowledge, both $\bar{q}'$ and $\bar{q}''$ will have a bias. And, ceteris paribus, an agent is more likely to approach an investor if his estimate of $\bar{q}''$ is too high than if it is too low. Therefore, if the agent (who cannot fully communicate how he estimated q') approaches an investor, the investor will expect that $\bar{q}''$ is too high.

Concerns about agents' overestimates in turn will affect investors' choice of agents as well as the conditions under which investors cede control. Following the logic of the previous section, investors will favor agents with long track records in screening similar projects: If the agent's track record for screening espresso bars is short, the investor will expect a larger bias in $\bar{q}''$ than if the track record is long. Concerns about overestimates of $\bar{q}''$ will also encourage investors to restrict the discretion of agents to situations in which the agent has established his track record.[18]

These restrictions obviously limit the agent's ability to finance "novel" proposals that fall outside the agent's "normal" prior experience. Moreover, the limitation is absolute in that the restrictions require an agent to reject novel proposals regardless of his estimate of the returns. In contrast, an investor who screens his own proposals may place a very low probability on the success of a novel project. He may nonetheless provide funds, if the return conditional on success is substantial (i.e. if a high value of R/I offsets a low expected probability of success).

Agents also have concerns about establishing track records that will help them attract capital. These concerns encourage agents to favor routine proposals over novel proposals, because success with a routine proposal enhances an agent's track record for selecting "similar" projects whereas success with a novel proposal does not.

Notice that (as in the previous section) the agent's bias against novelty turns on the nature of the investor's concerns. Agents would not face restrictions and incentives that limit the novelty of their projects if investors were concerned only about the overall abilities or dispositions of agents. If investors were only concerned about general ability, they would select agents with good overall track records and not restrict the kinds of projects the agents could select. Similarly, suppose investors were only concerned about the honesty of the agent. The restrictions that investors concerned about honesty might impose (e.g. prohibiting agents from financing the proposals of family members) would also not have a direct effect on the novelty of agents' selections.

4.3.2 Codification of Screening Rules

Rules used to screen proposals may vary in the extent to which the decision-maker has to rely on tacit or personal knowledge, rather than explicit or codified knowledge. For instance, the rule, "Go only if the espresso bar is located in a prosperous neighborhood" requires more tacit knowledge than the rule, "Go only if average rents in the neighborhood exceed $30 per square foot." And, the greater the tacit knowledge required, the

18 Alternatively investors may retain veto rights over the agent's selections. I discuss the trade-offs of this type of control in Appendix 3 (under the sub-head, "Alternative Mechanisms to Control Agents")

greater the likelihood that agents who think they can use a rule effectively may not in fact be able to do so. Therefore, agents will have an incentive to favor "hard", well-codified rules, because if they use "soft" rules whose implementation requires the extensive use of tacit knowledge, they have to provide more data about their "personal" track records to win the confidence of investors.[19]

4.4 Delegation to Large Agent Teams

Investors can delegate control to individual agents or small agent teams (e.g. the general partners of a VC fund) or to large teams of agents (e.g. the managers of large companies). For simplicity, I compare a "small team" comprising a single agent and a large team comprising a "head-agent" assisted by one or more experts. The experts have knowledge that may help the head-agent select more good proposals and reject more bad proposals. But the large team also faces higher costs (e.g. because of the compensation for the experts' effort.) These costs and benefits, I argue below, encourage large teams to specialize in projects with less novelty and greater complexity than small teams.

4.4.1 Bias against Experts' Novelty

Just as investors have concerns about the misestimates of head agents, head agents have concerns about the misestimates of experts. Experts' track records mitigate the head agent's concerns but only vis-à-vis specific domains and decision-making rules. So the head agent will avoid novel projects where the experts may not provide decision-making benefits commensurate with their costs. Similarly, the use of experts also makes the head agent sensitive to the "novel" absence of information about more variables. For instance suppose that in the espresso-bar illustration, the head agent hires an expert who knows how the local median age affects the probability of success. This encourages the head agent to avoid projects where information about median ages is unavailable because otherwise the costs of the expert don't produce any benefits.

4.4.2 Complexity

In my illustrative example the entrepreneur offered potential financiers a simple choice of whether or not to invest in her espresso bar. A more complex choice would involve a proposal that allows agents to choose from a range of seating capacities. Even greater complexity arises when choices involves many, interdependent decision variables. For instance, the entrepreneur may offer the investor a choice between formats for the espresso bar that allocate different amounts of space to coffee, sandwiches, juices and other items with inter-dependent demand functions. Ceteris paribus, the head agent of a large team will expect that the broad knowledge of his experts is more likely to provide benefits commensurate with the costs when the choices are complex.[20]

19 Stein (2002) offers a moral hazard based explanation for the use of hard rules. According to his model hard rules protect agents from "winner picking" by their bosses. The model only however applies to hierarchies, where the "boss" is also an agent rather than a principal.

20 Note that per my usage, complexity is uncorrelated with novelty. The "routine" problem of buying a car may be much more "complex" than the "simple" decision faced by an investor in 1985 about whether or not to finance Starbucks founder, Howard Schultz's, first espresso bar.

4.4.3 Correlation with Capital Requirements

Assuming that the costs of using experts are fixed, the improvement in selection accuracy required to justify these costs will decrease as the capital requirements of the projects they review increase. Therefore, the head agent of a large team will favor projects with large capital requirements. This does not however imply that head agents who specialize in projects with large capital requirements will always rely on large teams. Head agents will prefer small teams if they specialize in simple projects that do not require broad prior knowledge regardless of the capital requirements of these projects. For instance, the managing partner of a hedge fund that uses simple trading rules to make multi-billion dollar currency bets may not recruit a large team.

4.4.4 Codification of Rules

As argued in the previous section, well-codified ("hard") rules help agents overcome the misgivings of investors about their agents' tacit knowledge. The following extension of this argument implies that large teams of agents will use well codified rules to a greater degree than small teams: Investors who delegate control to the head agent of a large team will have concerns about whether the head agent knows how to pool the knowledge of the experts on his team. Codified rules for pooling knowledge help mitigate these concerns. When investors delegate control to individual agents, the question of using such rules does not arise.

Large teams also face greater incentives to use well codified rules because of the greater difficulty of selecting good experts from their track records. Head agents will select experts from a pool of candidates who have specialized in projects undertaken by teams. But it is difficult to form accurate inferences about individuals from the performance of their team. And, as mentioned, codification mitigates the selection problems that arise when selectors have limited data about an individual's prior performance.[21] Conversely, when investors delegate to small teams, they can place greater reliance on the past records of the decision makers.

4.5 Application 1: Self-Financed Start-Ups

Investors' concerns about mistakes help explain why many entrepreneurs who self-finance their businesses subsequently raise outside financing. Some self-financed start-ups are low-growth sole-proprietorships that do not require much capital. But self-financing is also common in high-growth businesses. For instance, Bhidé (2000) studied 100 businesses formed between 1981 and 1983 that appeared on *Inc.* magazine's list of the 500 fastest growing privately held companies in the United States. The companies in his sample recorded a more than eighteen-fold median increase in revenues between 1984 and 1988

21 Organizations optimized for complex projects have obvious similarities to the bureaucratic model discussed by Weber. The idealized bureaucracy comprises experts who have duties and rights within a "specified sphere of competence" and make decisions "according to *calculable rules*" (Kalberg (1980)). Although its procedures can impede "the discharge of business in a manner best adapted to the individuality of each case," Weber argued that in its perfectly developed form, bureaucracy eliminates "love, hatred, and all purely personal, irrational and emotional elements which escape calculation" (Weber (1947)).

and more than an eight-fold increase in employees. Of these ventures, 80% were financed principally by the founders' personal savings and borrowings; another 8% relied on the family and friends' of the founders as their principal source of funds and only 12% used funds provided by arm's length individual investors or professional venture capitalists.

The data also suggests that the founder's capital often represents a form of "bridge financing" - many start-ups that are initially self-financed subsequently do raise outside equity. For instance, about three quarters of the *Inc.* 500 companies surveyed by Bhidé (2000) used "follow on" debt and equity financing from outside investors to finance their growth.

Standard moral hazard theories do not easily explain these patterns. The Leland and Pyle (1977) model for instance suggests that the unwillingness of entrepreneurs to commit their capital makes it difficult to secure outside financing because it signals that entrepreneurs have adverse private information about their ability. But, self-financed entrepreneurs do invest their own capital - sometimes to a greater degree than entrepreneurs who secure outside financing.

Similarly, the "stealing theories" reviewed by Kaplan and Stromberg (2003) suggest that the availability of capital for a start-up depends on the observability and verifiability of an entrepreneur's effort. Entrepreneurs who start businesses where they can secure "private benefits" at the expense of their investors in a manner that investors cannot easily detect or prove in a court of law face more significant capital constraints. This does not offer a plausible explanation for why the founders of companies like Compaq, Lotus and Juniper Networks financed their start-ups with outside equity when the founders of its direct competitors, Dell, Microsoft and Cisco, did not.

More crucially, moral hazard problems do not easily explain why entrepreneurs who cannot raise funds to start their ventures can subsequently raise outside funds to finance growth. It seems unlikely that the founders of Cisco, who had to self-finance their start-up in 1984, could raise capital from investors in 1987 because investors' concerns about lying, inadequate effort, or the pursuit of private benefits declined. If anything, we should expect such concerns to increase in the later stages of a business where entrepreneurs have greater opportunities and incentives to misrepresent the value of company assets and to slack off. And if entrepreneurs can get later-stage financing without any decrease in moral hazard problems, such problems cannot provide a plausible explanation for their inability to raise start-up funds from investors.

The discussion in section 4.2 suggests that the binding financing constraint faced by many start-ups derives from novelty rather than asymmetric information. Entrepreneurs fail to secure outside financing because their track record in undertaking "similar" projects simply doesn't exist, rather than because investors are concerned that the entrepreneur is hiding adverse information. Therefore entrepreneurs have to rely on their own capital, perhaps by scaling back their projects to fit their wealth constraints. Later, as more information about their capabilities and projects becomes available, (i.e. "novelty" declines) entrepreneurs can easily raise the capital they require to achieve economies of scale, even if moral hazard problems also concurrently increase.

This explanation conforms to Bhidé's (2000) findings about high-growth (and overwhelmingly self-financed) start-ups. At the outset, no one had much information about whether the businesses would survive or the returns they would earn if they survived. The founders did not start out with proprietary ideas or valuable intellectual property whose value a prospective investor could assess in advance. Only 6% claimed to have started with unique products and services and only 3% had patents. Many founders also did not have deep business or industry experience and lacked ex-ante information about factors (such as their capacity to persuade customers to purchase undifferentiated products from an undercapitalized start-up) that seemed to play a significant role in the subsequent performance of their business. The founders did not devote many resources to research or planning either; apparently they obtained critical information about markets and competitors after starting their ventures.

4.6 Application 2: VCs vs. Angels

The propositions in section 4.3 about agents and independent investors help explain differences in the investments and evaluation procedures of VCs and angel investors. Researchers have documented the following stylized facts: VCs receive a very large number of funding requests from which they select a very small number of projects. Historically, VC firms have provided start-up financing to less than one percent of new businesses formed in the United States each year.

The criteria that VCs use to select investments vary by firm, but most VCs have a strong preference for start-ups that serve large and growing markets rather than unproven niche markets that may or may not grow (e.g. personal computer software companies like Lotus and Intuit in the 1980s rather than Microsoft in 1975). VCs avoid businesses started by inexperienced founding teams. And, VCs favor "later stage" investments. The National Venture Capital Association's annual report shows that in 1996, 77% of companies receiving VC funding were three years old or older. Similarly, the Association's more recent annual reports (which do not report the ages of companies receiving VC funding) classify only 22% of total VC disbursements in 1999, and 23% in 2000, as "early stage".

Venture angels apparently conduct less extensive due-diligence and use less stringent criteria than do VCs. Freear, Sohl and Wetze (1995) report that a median time of 2.5 months elapses between an angel's first meeting with an entrepreneur and the receipt of funds. The equivalent time for comparable VC investments is 4.5 months. Angels are more willing to provide capital to inexperienced entrepreneurs and to "pre-revenue" businesses with unproven markets and technologies (Freear, Sohl and Wetze (1992), Wong (2002)). Overall, Freear et al. (1992) estimate that angels finance ten times as many businesses as do VCs.

Researchers who have studied the VC industry through a moral hazard lens suggest that the raison d'être of VCs lies in their ability to solve information asymmetry problems. As Kaplan and Stromberg (2002) observe however, tests of this hypothesis have

been indirect. For instance, Gompers (1995) shows that VCs concentrate investments in "high technology industries" where he assumes that "informational asymmetries are highest". Gompers seems to rely (although he doesn't explicitly state this) on the low debt ratios and high irreversibility of investment to justify the assumption of severe information asymmetries in high technology industries. But Gompers's data also suggests that VCs avoid the restaurant industry. And there is no evidence - direct or indirect - that the information asymmetry problems involved in starting a restaurant are materially different than in high-technology start-ups. Furthermore the asymmetric information framework does not easily explain why VCs are less willing than angels to finance inexperienced entrepreneurs, businesses serving unproven markets, and early stage projects. Gompers, for instance, only compares VCs to commercial banks.

The propositions in section 4.3 help explain the differences between VCs and angel investors. VCs invest the funds provided by "passive" limited partners. And as agents, VCs have lower tolerances for novelty than angels who invest their own funds. VCs are therefore more likely to avoid untested business models and inexperienced entrepreneurs. Moreover, novelty does not merely affect the pricing of capital - e.g. charging unproven models a risk-premium to reflect their lower expected success rates. VCs apparently reject projects with high novelty instead of charging a risk premium.[22]

My propositions also help explain why angel investors are more likely than VCs to finance new restaurants. The evaluation of plans for new restaurants involves the assessment of subjective variables, and as discussed in section 4.3, agents tend to use hard rules to evaluate projects. Therefore VCs avoid restaurants and favor ventures where patent filings and the price-performance of competing technologies lend themselves to some objective analyses.[23]

VCs' may also devote more effort to solving asymmetric information problems than do angel investors. But this does not mean that VCs seek out ventures with information asymmetry problems the way pawnbrokers target individuals with impaired credit histories. Kaplan and Stromberg's (2002) empirical data (and my propositions) suggest the causality runs in the opposite direction. Kaplan and Stromberg show that VCs use investment criteria with a direct bias against novelty. This bias likely leads VCs to undertake projects where they face more severe information asymmetries. For instance the experienced entrepreneurs that VCs favor are more likely to have adverse evidence about their true capabilities that they wish to conceal than inexperienced entrepreneurs (who have no track record, good or bad). Similarly, entrepreneurs who seek later stage financing have lower incentives to make truthful forecasts and maximize effort than entrepreneurs who seek seed funds and face the prospect of more financing rounds. Therefore, VCs may devote more effort to checking references, monitoring, and aligning incentives.

22 Could it be that angel investors are just friends and relatives who provide funding for emotional reasons or because they have access to better information about the entrepreneur's true ability than do VCs? This may sometimes be true, but many angels are cashed-out entrepreneurs (Sohl (1999)). Like VCs, angels often have no prior relationships with the entrepreneur; indeed Andrew Wong's interviews (reported to me in personal correspondence) suggest that VCs sometimes pass on investment opportunities they consider "immature" to angel investors.

23 Note that Stein's (2002) winner picking model does not explain the use of hard rules by VCs, because VCs receive irrevocable commitments of capital from their limited partners. The Stein model has more relevance in large hierarchical organizations that I discuss in the next section.

4.7 Application 3: Large Public Companies vs. VCs

The propositions in section 4.4 about large agent teams help explain why large firms often reject opportunities to license technologies that VC-backed entrepreneurs may exploit. Stanford University, for instance, assigned the rights to a workstation technology to Andrew Bechtolsheim, a graduate student who had been developing the technology, after established computer companies showed no interest. Bechtolsheim licensed the technology to several VC-backed start-ups. Eventually he contributed it to Sun Microsystems (that was also VC-financed) where he became a co-founder (Bhidé (1989)).

This is not an isolated case: Shane's (2001) study of MIT's technology licensing suggests that new firms are more likely than existing firms to license a novel technology. Similarly, Kalamas, Pinkus and Sachs (2002) argue that deals by large pharmaceutical companies to license new drugs from bio-technology companies "are often struck too late to generate maximum value". Only a third of deals occur in the preclinical stage; according to Kalamas et al.'s simulations, this proportion reflects "overdiscounting for the uncertain prospects of deals made early in the development process."

According to Bankman and Gilson's (1999) model, large firms cannot provide adequate incentives for all employees to develop their ideas within the firm, so some leave to start new firms. But, Klepper's (2001) evidence suggests that employees often start businesses after their employers have rejected their projects. Bankman and Gilson's model also does not explain why large companies prefer to license more mature technologies.

The proposition (discussed in section 4.4) that large teams of agents have low tolerances for novelty can help explain the apparent conservatism of large public firms. Investors in both VC funds and public companies delegate control for evaluating proposals to agents. In VC funds, however, the number of agents who screen proposals is much smaller. For instance, when US Venture Partners (USVP) evaluated a proposal to provide seed financing to Sun Microsystems in 1981, the firm comprised just three general partners. Sun's founders made their case to a single partner, Robert Sackman (Bhidé (1989)). Sackman then persuaded the founding partner, Bill Bowes; this secured a two-thirds majority of USVPs general partners in favor of the investment (personal correspondence with Bowes). In contrast, when Bill Lowe, head of IBM's Entry Systems Division proposed that IBM enter the personal computer business in 1980, Lowe had to navigate many layers of the IBM hierarchy and ultimately persuade the members of the Corporate Management Committee (Cringely (1992)).[24]

Consistent with my propositions, companies like IBM also specialize in complex projects. The launch of the IBM PC in 1981 for instance involved many coordinated activities including hardware and software design, licensing (of the operating system and the likeness of Charlie Chaplin's character from *The Little Tramp*), development of ISV (Independent Software Vendor) and office product dealer networks, training and deployment of the in-house sales force and a national advertising campaign. In contrast,

24 Large companies sometimes try to form small sub-units to undertake more novel projects. Appendix 2 discusses the trade-offs involved.

VCs finance relatively "simple" projects. For instance, in its early years Sun focused on a few functions - hardware design, enhancement of the UNIX operating system and direct sales and support. Sun did not have any large scale manufacturing and did not develop a dealer network or mount public relations or advertising campaigns (Bhidé (1989)).

Bankman and Gilson's (1999) model has been followed by several other incentive based theories about the investment preferences of large companies. Notably, according to Stein's (2002) model, the problem of "winner picking" encourages hierarchical organizations to specialize in projects with hard information. Other recent papers also rely on winner picking to explain differences between the projects financed by large companies and VCs. I cannot sharply distinguish my explanation from all these incentive based theories. Nor can I prove the negative - that there does not exist some combination of moral hazard problems that fully accounts for the projects that large firms undertake.

The historical evidence however suggests that my explanation isn't simply the result of a spurious correlation. The historical accounts of scholars like Chandler and the memoirs and legal testimonies of executives like Sloan and Cary (reviewed in Appendix 2) do not support the hypothesis that large companies developed hard rules just to, or even primarily to, solve incentive problems. Rather the evidence suggests that as large companies undertook more complex projects they faced the problem of effectively pooling the knowledge of many experts. The top executives of companies like General Motors consciously designed systems and procedures to control these problems and with knowledge of the trade-offs (e.g. a bias against novelty) that their designs entailed. Chandler's histories, Sloan's memoirs and Cary's testimony also do not provide much evidence of concern about winner picking problems - whatever consequences organizational choices may have had on such problems appear to be the fortuitous but unintended consequence of efforts by top executives to effectively deploy large teams against complex projects.

4.8 Implications for Research

4.8.1 Interactions with Moral Hazard and Cognitive Biases

Although my analysis assumed away moral hazard, my discussion of its applications did offer some conjectures about the interaction of moral hazard and mistakes. For instance, the discussion in section 4.5 suggests a life-cycle hypothesis: in start-ups, when no one has much information to conceal, investors' concerns about mistakes often represent a binding financing constraint. As a business matures, entrepreneurs secure more information but may not be able to credibly communicate it to investors. Now the costs of controlling moral hazard may become the binding constraint for outside financing. Similarly, in section 4.6 I suggested that biases against novelty may increase the expenditures agents incur to control moral hazard - VCs devote more resources to checking references because they favor experienced founders and experienced founders have longer employment histories available for verification than inexperienced founders.[25]

25 Efforts to control moral hazard and mistakes do not however, always interact. For instance, the control of moral hazard by providing "carried interests" to VCs (Gompers and Lerner (1996)) may not affect the control of mistakes.

My analysis also assumed that investors are only concerned about specific defects in entrepreneurs' prior knowledge rather than overall defects in their reasoning abilities. But in fact, investors also worry about overall defects. And, as mentioned investors who are only concerned about overall defects may not have a bias against novelty.

Such ad-hoc conjectures are of course only a starting point. The development of a formal theory that incorporates moral hazard, mistakes due to defective prior knowledge, and mistakes due to defective reasoning, will provide more systematic predictions.

4.8.2 Differences within Organizational Types

I compared small and large organizations but I did not analyze the differences within these two types. Variations in the structures and decision-making rules of large organizations have been the topic of extensive prior research; incorporating these findings into my framework could also provide important insights. Similarly, research opportunities also exist to analyze differences within small organizations, for instance by comparing VCs that specialize in early stage and later stage investments.

(Appendix 3 contains other applications and research issues raised by my framework.)

4.9 Conclusions

Figure 1 in chapter 1 summarizes my propositions about the specialization of different sources of financing. These propositions suggest answers to the question raised in the introduction about how an entrepreneur should finance her proposed chain of espresso-bars. For instance, if her proposal is very novel she will be unable to raise capital from VCs or public companies, and approaching angels will be optimal only if she can show that the returns (conditional on a successful outcome) are high. The choice between angels and professional VCs turns on the degree of novelty and capital requirements: more novelty favors angels and large capital requirements favor VCs. And large public companies are optimal for complex projects with very low novelty. My propositions also suggest that certain combinations (e.g. high capital requirements and high novelty) make some projects infeasible. In this case the entrepreneur may have to redesign the project (e.g. by starting with a single self-financed bar rather than a chain).

Appendix 1 Tradeoffs between Specialization and Complementarities in Multi-Unit Organizations

In section 4.4 I examined the differences between large and small teams but not between large and small organizations. And there was nothing in my analysis that would preclude an organization from having some large teams and some small teams reporting to a single CEO. My assumptions about the source of errors and the nature of investor skepticism however imply that such co-mingling can impair the actual or perceived quality of the CEO. To the extent that CEOs face different tasks in managing large and small sub-units they rely on different kinds of prior knowledge. Co-mingling hinders the development of this knowledge. Differences between sub-units also make it difficult for top executives to win the confidence of investors - as previously stipulated, individuals who repeatedly perform the same tasks face less skepticism. Complementarities due to the reduction of transaction costs may however offset the disadvantages of co-mingling units. For instance, an in-house VC unit may help a large firm realize more value from opportunities that are too novel for its existing units and selling the right to exploit the opportunities involves high transaction costs.

The trade-off between complementarities across sub-units and reductions in the efficiency of top-management decision-making is consistent with Gompers and Lerner's (1999) data. They find that in-house VC units are more likely to survive within large firms if they can take advantage of the parent's technologies and relationships than if their investment activities are stand-alone. We may further note that the extent of co-mingling seems relatively modest: Thus in-house venture capital apparently represents a peripheral activity for large U.S. corporations. At their peak in 2000, in-house VCs invested $17.4 billion, an amount representing approximately 17% of the aggregate VC disbursements in the U.S. In 2001, in-house VCs invested less than $1 billion. In contrast, Intel alone invested $11 billion in R&D and other capital expenditures in 2001. Skunk works and other freewheeling forms of entrepreneurship also appear to have limited staying power in large companies.[26]

26 See for instance: Bartlett and Mohammed's (1995) case study on the retreat of "individualized entrepreneurship" at 3M; former CEO Vagelos's account (Nichols (1994)) of his introduction of "rational drug discovery" process at Merck; and co-founder Moore's (1996) description of R&D budgeting and planning at Intel.

Appendix 2: Historical Evidence about the Evolution of Organizational Structures of Large Companies.

The historian Alfred Chandler's accounts of the evolution of large public companies suggest a close nexus between project complexity and the development of their control mechanisms. Prior interpretations of Chandler's work by Williamson (1975) and other theorists have emphasized the ability of large corporations to control conflicts of interest. An alternative reading suggests that the problem of pooling the knowledge of many individuals that firms encountered as they undertook increasingly complex projects played an equally important role in the development of their internal control systems.

According to Chandler, firms initially grew by increasing the volume of their outputs using innovative labor saving technologies. These technologies stimulated the development of mechanisms to control conflicts of interest and mistakes. In the prior "putting out" system of production, workers were paid according to a piece rate (Chandler (1977)); assembly line manufacturing required the control of effort through time and motion studies and the employment of foremen and supervisors. The greater complexity of the new technologies also increased the problem of pooling information. In the railroads, the failure to pool information effectively sometimes had fatal consequences, as in the collision of two passenger trains in 1841. "The resulting outcry", according to Chandler (1977) "helped bring into being the first modern, carefully defined, internal organization structure used by an American business enterprise."

High volume production encouraged firms to grow through vertical integration. General Motors (GM) for instance acquired some of its "up-stream" suppliers such as the Fisher Body Company (Chandler and Salsbury (1971)). According to Williamson (1975) vertical integration mitigates problems of opportunistic behavior by placing specialized up-stream and downstream units under common ownership. Common ownership however does not by itself eliminate the problem of information pooling. For instance, an upstream unit may build excess capacity because it overestimates the requirements of the downstream unit. By the 1920s, most large U.S. companies adopted "functional" organizational structures to control such problems (Chandler (1962)).

Growth through diversification followed growth through vertical integration. Diversification further increased the problems of information aggregation and placed an "intolerable strain on existing administrative structures." The problems of manufacturing and marketing a number of product lines "made the tasks of departmental headquarters exceedingly difficult to administer… The coordination of product flow through several departments proved even more formidable" (Chandler (1962)). These problems led large diversified companies to establish "divisions" with dedicated resources. For instance, after a financial crisis in 1920-1, General Motors formed the Cadillac, Buick, Oakland, Olds, and Chevrolet divisions. Between 1921 and 1925 GM created divisional offices, considerably expanded its central office staff, formed inter-departmental committees, and "worked out highly rational and systematic procedures" to coordinate the operating divisions and plan policy for the organization as a whole. By 1925, the divi-

sional and general office staffs "were drawing up comprehensive over-all plans for all operating units" based on "carefully thought-out, long term forecasts" (Chandler (1962)).

According to Alfred Sloan, who served as the chief executive from 1923 to 1946, GM also developed a "tradition of selling ideas, rather than simply giving orders." All levels of management had to "make a good case" for their proposals; the manager who wanted to "operate on a hunch" would "find it hard to sell his ideas to others". But the sacrifice of possibly brilliant hunches was compensated for by the "better-than-average results" of policies that could be "strongly defended against well-informed and sympathetic criticism." GM's approach provided a safeguard against "ill-considered decisions by assuring that basic decisions were made only after thorough consideration by all parties concerned" (Sloan (1964)).

IBM, according the historian Olegario (1997), developed its system of collective decision-making during the 1950s and 1960s when it faced the "critical problem" of building consensus between engineers and marketers. According to an IBM executive's testimony in the company's 1969-1982 antitrust lawsuit, IBM developed an organization that was "based on checks and balances, which provide a structure to insure the representation… of staff, line, product division, subsidiaries and headquarters viewpoints." The testimony of Frank Cary (who later served as the company's CEO) emphasized the information aggregation role played by the 2500 staff officers in planning new products. According to Cary the staff was responsible for understanding the product and the marketplace and presenting proposals that had "been reviewed, and checked and balanced against Manufacturing, Engineering, Service, [and] both the Domestic and the World Trade Marketing Divisions, before they came forward to have it further reviewed by the Corporate Staff and the Management Review Committee" (cited in Olegario 1997).

Appendix 3: Extensions

The framework discussed in the main text suggest further hypotheses and questions about the following subjects:

A.3.1 Design of Contracts

Contractual terms can help mitigate the parties concerns about each others' mistakes and not just their conflicts of interest. One example is the use of "milestone" or "benchmark" compensation provisions in VC financing contracts. Milestone provisions typically give the entrepreneur a higher share of the firm's equity upon the attainment of some previously agreed upon goal, such as reaching a revenue target. Although such arrangements often are used, they do not represent a routine feature of VC-entrepreneur contracts - for instance, they were found in less than half the cases studied by Kaplan and Stromberg (2003) - and were more prevalent in early stage financings than in later stage financings.

Incentives do not provide a convincing explanation for why milestone provisions are used in some contracts but not others, and more importantly, why they are used more often in early stage financings. As discussed in section 4.6, problems of shirking and deliberate misrepresentation should increase in later round financings and lead to a more frequent use of milestones. A subsequent study by Kaplan and Stromberg (2002) also raises questions about an incentive-based explanation. They find "a significantly positive relationship between external risk and benchmark compensation, which is contrary to the theoretical predictions" of traditional agency based models.

The concerns of VCs and entrepreneurs about each other's estimation errors help explain these patterns. My interviews with VCs suggest that VCs try to avoid milestone provisions because they can lead to conflicts and perverse incentives. For instance, if the entrepreneur is on the verge of attaining a revenue milestone, the VC has an incentive to withhold help; or the entrepreneur may over-invest in sales and marketing to reach the milestone even when sacrificing profitability for revenue reduces the total value of the firm. VCs said they reluctantly use milestones to "bridge the gap" between their estimates of the value of the venture and the entrepreneurs' estimates, rather than to discourage slacking or the pursuit of "private benefits". Such gaps, we expect will be wider in the early stages of a venture.

A.3.2 Duration of Control Ceded to Agents

Hard rules encourage investors to delegate control of their resources for extended periods by protecting investors against the departure or the impairment of the judgment of particular individuals. An organization's reliance on individual judgment instead of hard rules will encourage investors to reserve the right to withdraw funds after appropriate notice or to delegate control for shorter, fixed periods. Control for extended duration

in turn gives organizations advantages in sharing a common asset across projects with different start and finish dates.[27]

Differences between large public firms and VCs conform to this hypothesis. The charters of public companies like Merck anticipate perpetual life and thus encourage managers to undertake projects whose development testing and marketing can span several decades. These companies also seek to exploit "synergies" across projects, for instance, by using common sales and marketing staff for multiple products. Venture capital partnerships, in contrast, usually have a fixed term of about ten years that gives VCs a four to six year exit horizon for investments. VCs therefore tend to use the ease of exit as an investment criterion (MacMillan, Siegal and Subbanarasimha (1985)) and include liquidation provisions in their financing contracts with entrepreneurs (Kaplan and Stromberg (2003)) that facilitate exit. VC funds also make less of an effort to exploit synergies across projects - each tub in their portfolio stands on its own bottom. Some VC firms (e.g. Kleiner, Perkins) may occasionally try to facilitate mutually beneficial transactions between portfolio companies; but VCs usually do not require one portfolio company to choose an option that would cause it to incur a small loss in order to produce a larger gain for the other company.[28]

According to Black and Gilson (1998) the liquidation of investments helps capital providers identify VCs with superior skills. My hypothesis suggests a different interpretation: VCs believed to have superior skills can raise funds from investors without instituting "hard" rules, but only for limited periods. Some venture capitalists have tried to adopt structures to extend the duration of their control over investors' funds. For instance, in the 1960s American Research and Development operated as a closed-ended publicly traded fund and other VCs have used "evergreen" partnership structures. These alternatives did not catch on. Apparently the same set of institutional investors who cede perpetual control to the managers of public companies have been unwilling to do so to the general partners of VC firms.

A.3.3 Alternative Mechanisms to Control Agents

Instead of restricting the discretion of agents, as discussed in section 4.3, investors may retain veto rights over the agent's selections. This occurs in "knock out" venture funds where each investor can decide whether to accept or reject the VCs proposals. Similarly in the private placement market, investment banks play the role of screening agents, but their recommendations are subject to the approval of each investor. This alternative mechanism involves a trade-off. It does curtails the novelty of agent financed projects: following the logic of section 4.2, investors are more likely to veto an agent's "novel" selections - i.e. selections made in situations that lie outside the agent's prior experience.

27 Financing practices of the British East India Company illustrate the problems that arise with limited durations of control. In the early years, the Company raised capital for individual voyages; however its "permanent" trading posts provided services to all voyages. The difficulty of valuing these services and conflicts of interests that arose between voyages eventually led the Company to secure "permanent" capital. (Baskin and Miranti (1997))

28 It might be argued that the reluctance to maximize the joint value of the two companies derives from fiduciary restrictions faced by the VCs rather than concerns about exit. Note, however, that the fiduciary restriction reflects a choice made by the VCs to own less than 100 percent of the equity of their portfolio companies. Moreover, LBO partnerships that do own all of the equity of their portfolio companies also avoid co-mingling assets and activities.

But the limit on novelty is not absolute - investors may approve novel projects if the upside from a successful outcome is sufficiently high. At the same time, the veto mechanism undermines an advantage that agents enjoy in financing large projects, namely their capacity to mobilize capital from investors who don't have the time or the self-confidence to review individual proposals. Thus we can expect agents operating under veto control to specialize in projects with larger capital requirements and less novelty than active investors and smaller capital requirements and greater novelty than agents who make investments in pre-specified domains

A.3.4 Innovation

According to Rosenberg (1976), Schumpeter's "model has become the accepted one for all innovative activity". My propositions raise questions about a key element of this model, namely Schumpeter's ((1911), (1942)) attribution of economic growth to radical or discontinuous innovation. Rosenberg's (1976) work suggests that technological progress is often incremental, although he does not rule out the possibility of large discontinuities. My analysis buttresses Rosenberg's research: great leaps forward usually do not occur because individual entrepreneurs lack the capital to undertake radical innovations on a large scale, and organizations that have the capital don't have the necessary tolerance for incomplete information. Significant innovations are more likely the accretive consequence of small, highly novel projects as well as larger, less novel projects. This analysis also suggests that the debate (also inspired by Schumpeter) about whether large or small companies are more innovative is beside the point; in modern economy, different organizations make different kinds of contributions to the innovative process. Research that focuses on the complementarities across organizations and on incremental rather than discontinuous change may therefore have more value than research based on Schumpeter's model.

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