VENTURE CAPITAL AND THE FINANCE OF INNOVATION

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VENTURE CAPITAL AND THE FINANCE OF INNOVATION

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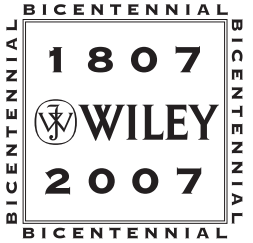

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Anniversary Logo Design *Richard Pacifico*

This book was set in Times Roman by Laserwords Private Limited, Chennai, India and printed and bound by Courier/Westford. The cover was printed by Courier/Westford.

The book is printed on acid-free paper. ♾

Library of Congress Cataloging-in-Publication Data:

Metrick, Andrew.
Venture capital and the finance of innovation / Andrew Metrick.
p. cm.
Includes bibliographical references and index.
ISBN-13: 978-0-470-07428-2 (cloth)
ISBN-10: 0-470-07428-0 (cloth)
1. Venture capital. 2. Technological innovations—Finance.
I. Title.
HG4751.M48 2006
332′.04154—dc22

2006015986

ISBN 13 978-0-470-07428-2
ISBN 10 0-470-07428-0

Printed in the United States of America

10 9 8 7 6 5 4 3 2 1

BRIEF CONTENTS

PREFACE—A READER'S GUIDE

This is a finance textbook for a venture capital (VC) course. As it turns out, VC is a wonderful vehicle for exploring all the big ideas in finance—risk and return, valuation, option pricing, capital structure—they are all here, often in subtle and fascinating ways. This book is, first and foremost, a way to explore these big ideas. But can learning more about finance make someone a better venture capitalist?

When asked, most venture capitalists will rank "finance" far down the list of important VC skills. Instead, successful venture capitalists tend to think of themselves as *company builders*. Company building is certainly more art than science. The best practitioners must possess the ability to spot great new technologies and markets, a sense of intuition about the dynamic interplay of technology and economic change, good judgment with regard to the strengths and weaknesses of a management team, and the people skills to add value across a wide variety of situations. Finance does not even appear in that list. Furthermore, few of these characteristics are things that can be learned from a book or taught in a class—and although some can be honed by years of VC practice, it is usually the case that most people either "have it or they don't", and as a result it is difficult to know which group you are in until you try it out.

So how can this book be useful to a VC practitioner? I compare finance training for a venture capitalist to free throw shooting for a basketball player. Nobody makes it to the National Basketball Association (NBA) solely because of his free throw shooting, and lots of the players outside the NBA are better free throw shooters than those who are on the inside. Nevertheless, every single NBA player would be more valuable to his team if he could improve his free throw shooting. Given that, a secondary goal of this book is be to improve that VC free throw percentage by at least a few points.

Any basketball fan can remember games where a team lost because they could not make their free throws. The VC industry had its very own free throw disaster in the years that followed the turn-of-the-century boom period. Of the $160 billion invested by VCs in 1999 and 2000, a large fraction has been lost on bankrupt and nearly bankrupt companies, and most VCs will have a negative return on their portfolio. To many observers, this abysmal performance was the direct result of a breakdown in investment discipline. Many investments were made not because of any rational expectation of future cash flows, but because the investors hoped that other investors would be willing to pay even more for the same assets. Although some investors had success with this kind of strategy in the years prior to 1999, the industry as whole may lose more dollars from its investments in 1999 and

2000 than it made in all prior years combined. After this kind of disaster, it seems worthwhile for even the best VCs to spend some time exercising their investment discipline.

There is a lot of finance in this book. I am often asked by students, "How much of this stuff do *real* venture capitalists actually use?" The answer—"Not much." Some VCs do not do any financial modeling because they think it is useless for what they do. Other VCs would like to use more finance, but they do not do so because the tools are not easily accessible. In effect, to use more finance they would need to build all their models from scratch. This book attempts to bridge this gap. Several spreadsheet models were developed specifically for the analysis described in the text. These spreadsheets, described in Appendix C, are available free of charge on the Web sites of both the author and publisher. These models can provide investors with quick-and-dirty "reality checks" for many types of transactions. The models—like all analysis in the book—is meant as a framework for analysis, not as a straightjacket. The goal of sound financial modeling is to help an investor to ask the right questions and to provide rigor and structure to a messy investment process.

THE ORGANIZATION OF THIS BOOK

The book is divided into four parts, with six chapters each. Each of these four parts has major finance theme: the theme of Part I is the relationship between risk and return; the theme of Part II is the valuation of high-growth companies; the theme of Part III is the analysis of capital structure; the theme of Part IV is the relationship between strategy and finance. Overall, Parts I and II are heavy on data and definitions and are intended to provide students with the vocabulary of VC and knowledge of the key industry facts. Although these two parts contain some new definitions and approaches, most of the material should seem familiar to a VC practitioner. In contrast, Parts III and IV are more theory based and provide a new perspective on the evaluation of VC and other high-technology investments. Although these latter two parts might seem experimental to a practicing VC, financial economists will recognize the material as a straightforward translation of well-known methods.

In Part I, "An Introduction to VC", we provide an overview of the VC industry, with discussions of history (Chapter 1), major players (Chapters 2 and 5), performance measurement (Chapters 3 and 4), and global patterns (Chapter 6). The discussion of risk and return in Chapters 3 and 4 provide a key translation between the language of VC and the language of financial economics—a translation that we rely on heavily throughout the book.

In Part II, "Total Valuation", we provide data and methods used to value a high-growth company. We first review the investment process used by VCs and provide data on their historical performance (Chapter 7). We next describe the structure of VC transactions (Chapters 8 and 9) and then demonstrate the

industry-standard technique for the valuation of VC investments (Chapter 10). This technique, known loosely as "the venture capital method", requires that analysts estimate company values far into the future. Although such estimates will always contain a fair amount of guesswork, we show how to use a "reality-check" model to frame these estimates (Chapter 11) and how to use evidence from comparable companies to provide an additional input for the investment decision (Chapter 12).

In Part III, "Partial Valuation", we take the total valuation (Part II) as given and analyze the special features of VC transactions. In most VC transactions, the investors receive preferred stock with several special features. When there are many VC investors, the capital structure of the company grows quite complex, with each investor holding a unique place in the capital-structure hierarchy of the company. In Part III, we show how to divide the total valuation of the company into its component parts (partial valuation) for each investor. The key step in this analysis is the recognition that all flavors of preferred stock can be represented as a portfolio of options. In Chapter 13, we show how the classic option-pricing analysis of Black and Scholes can be extended to VC settings. We then apply this extended analysis to the valuation of preferred stock (Chapters 14, 15, and 16). The techniques used in these chapters can also be used to refine some industry-standard measures of company valuation (Chapter 17) and to estimate the partial valuation of complex nonstandard transaction structures (Chapter 18).

Parts II and III of the book take the perspective of a venture capitalist making an investment in a high-technology company. In Part IV, we take the perspective of the company deciding what to do with VC money or other capital. Specifically, we develop a framework for modeling investment in "research and development" (R&D). Since VC-backed companies typically spend a significant fraction of their capital on R&D, an understanding of R&D finance is crucial for both VCs and for financial decision-makers at technology companies of all sizes. After introducing typical kinds of R&D investment problems (Chapter 19), we study several of the most interesting and cutting-edge techniques in finance, including Monte-Carlo analysis (Chapter 20), real options (Chapter 21), binomial trees (Chapter 22), and game theory (Chapter 23). In Chapter 24, we pull all of these tools together and solve the investment problems originally posed in Chapter 19.

Several appendices supplement the text. Appendix A lists and describes a wide variety of sources—commercial, academic, and free—that provide information about venture capital and the finance of innovation. Appendix B provides an example "term sheet" VC contract developed by the National Venture Capital Association. Appendix C provides some basic documentation for the companion spreadsheets used in the book. Appendix D is a brief primer on Crystal Ball® software, a commercial product from Decisioneering Inc. that is useful for solving some of the models in Part IV. Finally, a glossary at the end of the book gives definitions for all key terms used in the book.

WHAT THIS BOOK COVERS . . . AND WHAT IT DOESN'T

To be successful, VCs must have a broad general knowledge of business and all its disciplines: marketing, management, finance, operations, accounting, . . .In addition, most VCs must acquire specialized knowledge in one or more high-technology industries. It is not possible to cover all these areas in one textbook, nor is it advisable to even try. This book focuses almost exclusively on finance, specifically on the valuation of high-technology investments. The ideal reader is an MBA student or advanced undergraduate who is both interested in VC and intellectually curious about finance. I wrote the book for this prototypical reader. For each reader, your distance from this prototype will likely predict your satisfaction with this book. In particular, readers looking for a "how to" guide for being a successful VC are sure to be disappointed. I doubt such a book is even possible, and I am sure that I could not write it.

For instructors, the 24 chapters of the book can provide for 24 class meetings (=30 hours) for a course of the same name as the book. That is how we do it at Wharton. Alternatively, a finance course on "Venture Capital" could omit Part IV of the book and include six additional case-study classes to fill out a full semester course. For a six-week course (=15 class hours) on "Venture Capital", the first two parts of the book can provide a self-contained framework.

For any of these VC courses, many instructors may choose to combine this book with case studies. At Wharton, we use this book as the main text, with case studies from the books by Josh Lerner and Felda Hardymon of Harvard Business School used to illustrate the practical applications of the concepts. Alternatively, one could use the case studies as the main classroom topics, with this textbook as background. An companion instructor's manual suggests some cases that work well with each of the chapters.

For VC courses taught outside of a finance department, instructors will rightly want to emphasize different aspects of VC practice. At Wharton, we have a highly successful VC course taught by management faculty—a course that has virtually no overlap with this book. Furthermore, as one might expect, courses taught by VC practitioners are often much more "practical", with many class sessions dedicated to the nuts-and-bolts of working with young companies. While I believe that some chapters of this book could provide useful background for these practitioner courses, I am certain that most of the book would be useless. I have found that students can learn a tremendous amount from these practice-based courses, and have made no attempt to substitute for these valuable lessons.

There are several related topics for which this book has some imperfect overlap. For example, for courses in "entrepreneurial finance", students typically need some exposure to VC. For these students, Part I should be useful, while the other parts are likely to be overkill. This book takes the perspective of a venture capitalist—not the perspective of an entrepreneur. The latter perspective requires a

careful study of non-VC sources of capital for young companies, a perspective that this book does not cover at all. Furthermore, the financial management of young growth companies is another important topic in entrepreneurial finance. While such a topic could conceivable have been included in this book, I chose instead to focus on the valuation aspects of VC finance.

Another topic of some overlap would be a general course on "private equity". As will be discussed in Chapter 1, private equity is a broad class of investing that includes VC as well as investments in leveraged buyouts, mezzanine structures, and distressed companies. (All these terms will be defined in Chapter 1). For instructors of such classes, the usefulness of the book depends on the relative emphasis on VC. Six weeks (=15 hours) of VC can be supported by Parts I and II, supplemented with (or supplementing) case studies. For private equity courses with less than six weeks of VC, the reductions can be accomplished in Parts I and II by omitting some combination of Chapter 5, Chapter 6, Chapter 9, and combining Chapters 11 and 12 into a single class meeting.

NOTES ON TERMINOLOGY, STYLE, AND MATHEMATICS

The text assumes that readers have familiarity, but not mastery, of the basic concepts from first-year MBA courses in finance, statistics, and accounting. (For example, the book assumes that readers know the definitions for "mean" and "standard deviation",[1] but does not assume that readers have memorized formulas for the mean and standard deviation of any specific probability distributions). Most of the mathematics in the book goes no further than simple algebra. In Parts III and IV of the book, we use some basic calculus in a few places, but even there it is more important that readers know what an integral "does" rather than know how to solve any specific integrals.

The book assumes *no prior knowledge of venture capital*. All key terms are given in **bold type** in their first appearance in the text. Because this book is attempting to provide a bridge between the language of VC and the language of finance, it is sometimes helpful to introduce new terminology in order to ease the translation. Such new terminology is given in ***bold italic*** type in its first appearance in the text. All key terms are listed at the end of the chapter of their first appearance. At the end of the textbook, a glossary provides definitions for all key terms. The text uses many acronyms to shorten the exposition. Each acronym is spelled out in its first appearance, followed by the acronym given in parenthesis: for example, **venture capital (VC)**. All acronyms are also listed in the glossary.

[1]This book follows British style in the "logical" placement of some punctuation marks outside of quotation marks. This annoys some people. Sorry.

ACKNOWLEDGMENTS

This book is seven years in the making. I owe a great debt to my professional colleagues, Paul Gompers, Steve Kaplan, and Josh Lerner, who were generous with advice, encouragement, and teaching materials. Their guidance was invaluable during my first few years of teaching. Also, some of the models developed in this book have benefited from discussions with David Scharfstein, an experienced economist who was wrestling with many of the same teaching topics.

In late 1999, I sent an e-mail request of help to the alumni who comprise the Wharton Private Equity Network. These alumni stepped up with much useful advice and patiently explained to this career academic how their industry really works. Several of these alumni have continued their advice over the years, with Izhar Armony of Charles River Ventures making an especially large contribution of his time and knowledge. From another part of the industry, Susan Woodward generously made available her state-of-the-art venture capital database at Sand Hill Econometrics. Without her help, much of the analysis in Parts I and II would not have been possible.

At Wharton, we maintain a serious commitment to "coproduction" of the educational experience. For this book, such coproduction was essential, and I have benefited from the important contributions of many Wharton students. The VCV spreadsheet, used in Part III to value structures with preferred stock, was a multiyear development project that quickly outgrew my programming skills. Rebecca Yang, an undergraduate with a double major in Finance and Computer Science, and Holland Gary, an MBA student with experience as a software engineer, came to my rescue and took over the project. When Holland and Rebecca graduated and went off to conquer the world, they were ably replaced by Tony Curnes and Jonathan Reinstein, two more undergraduates from the University of Pennsylvania's Management and Technology program. I am convinced that these four outstanding Wharton students are capable of carrying out any complex task, even when given vague and confusing directions by me.

Several other members of the Wharton community provided me with invaluable assistance. MBA student Greta Lin coauthored Appendix C—a guide to the Crystal Ball® software package—and also taught me some subtleties of this Monte Carlo simulation program. Albert Cheng, one of my MBA teaching assistants, used his venture capital work experience to coauthor Appendix A, a guide to information resources about the industry. Undergraduates Christine Chou and Colleen Pontious constructed most of the diagrams in Part III of the book, and both maintained their good cheer in the face of many last-minute revisions. Yin Yin, a busy student

earning simultaneous undergraduate and MBA degrees, somehow found the time to read and edit the entire manuscript with great care. Professors David Wessels and Ayako Yasuda, my colleagues in the Wharton finance department, taught courses using the manuscript version of the book. Their instructor's perspective and careful reading of the text led to numerous revisions and corrections. Overall, in the last three years about 1,000 Wharton students were forced to be guinea pigs for various versions of this text. The helpful comments and suggestions of these students affected every part of the book, and I am very grateful for it.

At Wiley, my editors, Judy Joseph and Brian Kamins, remained patient in the face of numerous missed deadlines. Thank goodness they have experience working with first-time authors. Patty Donovan of Pine Tree Composition efficiently ushered the book through the production process on a tight deadline, where the book was gently copyedited by Karen Slaght, who is in no way responsible for the mistakes and idiosyncrasies that remain. My Wharton colleagues, many of whom warned me against taking on a book project, were nevertheless supportive as the project consumed my time for longer than I expected. Finally, the greatest debt is to my family, to whom this book is dedicated: my wife Susie, my son David, and my daughter Amy.

For Susie, David, and Amy

CONTENTS

PART IV

THE FINANCE OF INNOVATION

PART I

VC BASICS

CHAPTER 1

THE VC INDUSTRY

IN THIS chapter, we provide a definition of **venture capital** (Section 1.1), take a preliminary look at the activities of **venture capitalists** (Section 1.2), explore the history of venture capital (Section 1.3), and review a variety of statistics on the patterns of venture capital investment (Section 1.4). Throughout this text, we use the abbreviation **VC** to refer to both the venture capital industry and to an individual venture capitalist.

1.1 WHAT IS VENTURE CAPITAL?

A VC has five main characteristics:

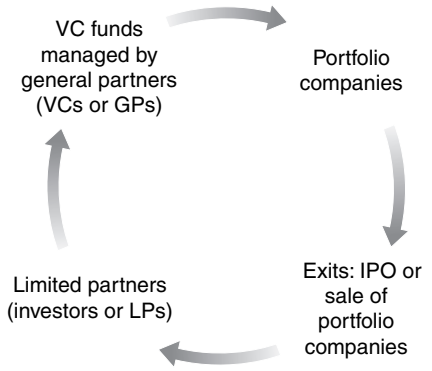
1. A VC is a **financial intermediary**, meaning that it takes the investors' capital and invests it directly in **portfolio companies**.
2. A VC invests only in private companies. This means that once the investments are made, the companies cannot be immediately traded on a public exchange.
3. A VC takes an active role in monitoring and helping the companies in its portfolio.
4. A VC's primary goal is to maximize its financial return by **exiting** investments through a sale or an **initial public offering (IPO)**.
5. A VC invests to fund the internal growth of companies.

Characteristic (1) defines VCs as financial intermediaries. This is similar to a bank because just as a bank takes money from depositors and then loans it to businesses and individuals, a VC fund takes money from its investors and makes equity investments in portfolio companies. Typically, a VC fund is organized as a **limited partnership**, with the venture capitalist acting as the **general partner (GP)** of the fund, and the investors acting as the **limited partners (LP)**.[1] If all goes well, the VC eventually sells its stake in the portfolio company, returns the money to its limited partners, and then starts the process all over again with a

[1]The organization structure of VC funds will be discussed at length in Chapter 2.

EXHIBIT 1-1

THE FLOW OF FUNDS IN THE VENTURE CAPITAL CYCLE



different company. Exhibit 1-1 illustrates the key players and the flow of funds in the VC industry.

VCs are often compared to and confused with **angel investors**. Angel investors, often just called **angels**, are similar to VCs in some ways but differ because angels use their own capital and, thus, do not satisfy characteristic (1). There are many types of angels. At one extreme are the wealthy individuals with no business background who are investing in the business of a friend or relative. At the other end are groups of angels with relevant business or technical backgrounds who have banded together to provide capital and advice to companies in a specific industry. In the latter case, the angel groups look very much like VCs, but the fact that they use their own capital changes the economics of their decisions: because they can keep all the returns to their labor, they have a correspondingly lower cost of capital and can invest in deals that would not work for a VC. Although it is difficult to get reliable figures on angel investing, the best available survey evidence for recent years suggests that total angel investments are approximately the same magnitude as total VC investments.[2] Although the total flow of capital is similar, angels tend to focus on younger companies than VCs and make a larger number of smaller investments.

Characteristic (2) defines VC as a type of **private equity**. Although the definitions of "private company" and "public company" have some nuances, the key distinction is that a public company's securities can be traded in a formal market

[2]The most comprehensive data on the angel market is maintained by the Center for Venture Research at the University of New Hampshire: http://wsbe.unh.edu/cvr/. Their annual reports on the state of the angel market provide the evidence cited in this paragraph.

like the NYSE or the NASDAQ, whereas a private company's securities cannot. Any company that is publicly traded in the United States must also file regular reports with the Securities and Exchange Commission (SEC) detailing its financial position and material changes to its business. When combined with the activities of professional traders in public markets, this requirement to file creates significant amounts of information about public companies. In comparison, information about private companies is practically nonexistent. Private equity is considered to be a category of **alternative investing**, where "alternative" stands in contrast to "traditional" investing in stocks and bonds.

Characteristic (3) is central on our list and is central to the success of any VC. Without (3), a VC would only be providing capital, and his success (or failure) would be entirely due to his ability to choose investments. Although success can, of course, be entirely built on these choices, the comparative advantage of the VC would be greatly improved if the investor could also help the company directly.

This help takes many forms. Most notably, VCs typically take at least one position on the board of directors of their portfolio firms. Having board representation allows them to provide advice and support at the highest level of the company. (More than one VC has remarked that his job could be described as being "a professional board member".) In addition to board service, VCs often act as an unofficial recruiter and matchmaker for their portfolio firms. Young companies often have a difficult time attracting high-quality talent to a fledgling operation, and VCs can significantly mitigate this problem by drawing on their reputation and industry contacts. A VC who can perform these value-added services well can possess a sustainable form of competitive advantage over other investors.

Because VCs are financial intermediaries, they need some mechanism to give money back to their investors. Thus, a savvy VC will only make an investment if he can foresee a path to exit, with proceeds of this exit returning to the VC and his investors. Exits can occur through an IPO, with a subsequent sale of the VC stake in the open market, through a sale of the company to another investor, or through the sale of the company to a larger company. Because of the need to exit, VCs avoid investments in "lifestyle" businesses (companies that might provide a good income to the entrepreneurs, but have little opportunity for a sale or IPO).

Characteristic (4), the requirement to exit and the focus on financial return, is a key distinction between venture capital and **strategic investing** done by large corporations. As a perpetual entity, a corporation can afford to take stakes in other businesses with the intention of earning income, forming long-term alliances, and providing access to new capabilities. It is possible for the corporation to maintain this stake indefinitely.

A strategic investor may satisfy all the other characteristics, but without the need to exit, the strategic investor will choose and evaluate investments very differently from a VC. In some cases, a corporation may set up an internal venture capital division. In the industry, this is referred to as **corporate venture capital**.

This label can be confusing, as only sometimes do such divisions satisfy characteristic (4). These corporate VC efforts will often have strategic objectives other than financial returns and will have neither dedicated supplies of capital nor an expectation that capital will be returned within a set time period. When (4) is not satisfied, the investment activity can take on a very different flavor than the type studied in this book.

The requirement to exit provides a clear focus to VC investing activities. There are over 20 million businesses in the United States; more than 99 percent of these businesses would meet the government definition of a "small business".[3] In general, small businesses are difficult to exit, and only "large businesses"—those in the top 1 percent of all businesses—have a realistic chance to go public or be sold in a liquid acquisition market. It is therefore typical for VCs to invest in small businesses, but they only do so when these small companies have a realistic chance to grow enough to become a large company within five to seven years after the initial investment. Such rapid growth is difficult to attain in most industries; therefore, VCs tend to focus on high-technology industries where new products can potentially penetrate (or even create) large markets.

Characteristic (5) refers to "internal growth", by which we mean that the investment proceeds are used to build *new* businesses, not to acquire existing businesses. Although the legendary VC investments tend to be those adventurous VCs who backed "three guys in a garage", the reality of VC investing is much more varied. As a simple classification, we divide portfolio companies into three **stages**: **early-stage**, **mid-stage** (also called **expansion-stage**), and **late-stage**. At one extreme, early-stage companies include everything through the initial commercialization of a product. At the other extreme, late-stage companies are businesses with a proven product and either profits or a clear path toward profitability. A late-stage VC portfolio company should be able to see a plausible exit on the horizon. This leaves mid-stage (expansion) companies, who represent the vast landscape between early-stage and late-stage. With all this territory to cover, it is not surprising that mid-stage investments make up the majority of VC investment. In Section 1.4.1 of this chapter, we give more precise definitions of these stages, along with evidence about the investment patterns by stage.

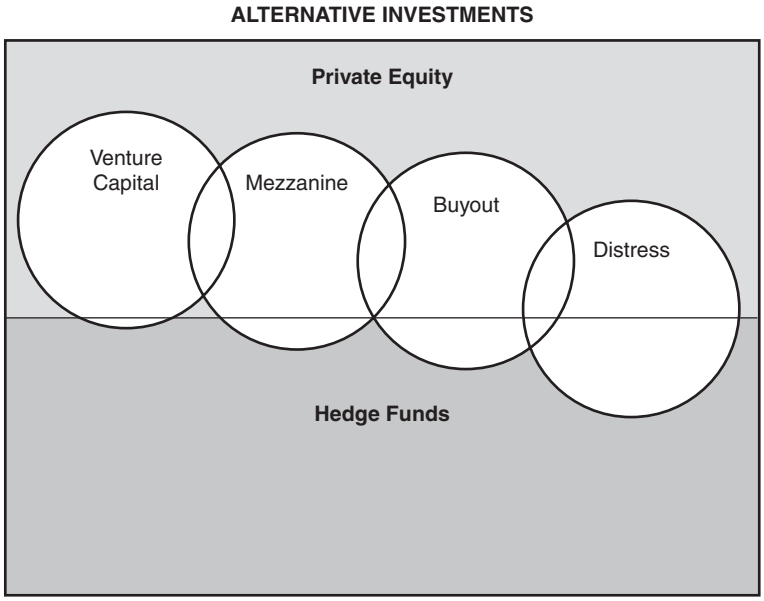
Characteristic (5) also allows us to distinguish venture capital from other types of private equity. Exhibit 1-2 illustrates the overlapping structure of the four main types of private equity investing, and also shows the intersection of these types with **hedge funds**, another category of alternative investments. The relationship between private equity and hedge funds will be discussed below.

The largest rectangle in the exhibit contains all of alternative investing, of which private equity and hedge funds are only two of many components. These components are represented by two smaller rectangles within alternative investing. The different types of private equity investing are represented by the overlapping circles within private equity, with some overlap with hedge funds. The sizes of the

[3] See http://www.sba.gov/size/

EXHIBIT 1-2

PRIVATE EQUITY AND HEDGE FUNDS



circles and rectangles are not matched to the scale of the investing categories, but rather are intended to illustrate the relative scopes of overlap.

Venture capital sits on the far left of Exhibit 1-2 and intersects with the **mezzanine** category. The term *mezzanine* has developed two distinct meanings within the private equity industry. The first meaning is a form of late-stage, often very late-stage, venture capital. Some VC funds do this kind of investing (hence the intersection), but so do other financial intermediaries, including hedge funds, banks, insurance companies, specialty finance corporations, and non-VC private equity funds. This financing is typically in the form of subordinated debt (junior to bank loans), with some additional equity participation in the form of options (warrants) to buy common stock. Some firms refer to this kind of investing as **growth capital**. The second meaning of mezzanine first arose in the mid-1980s, when investors began to use the same capital structure—subordinated debt with some equity participation—to provide another layer of debt financing for highly leveraged buyout (LBO) transactions. Today, most private equity firms with "mezzanine" in their title are doing this second type of investing.

Because the subordinated debt in mezzanine investing will often be attached to some equity ownership, mezzanine investing can also intersect with the pure equity investing done in buyouts, the next category in Exhibit 1-2. Buyout investing is the largest category of private equity, with total funds under management about three times as great as for venture capital. Buyout investors pursue a variety of strategies, but a key feature of buyout investors is that they almost always take majority control of their portfolio companies. (In contrast, VCs usually take minority stakes in their portfolio companies.) Large buyouts of public companies typically garner the biggest headlines, and the most famous buyout of all time—the $25 billion purchase of RJR Nabisco by Kohlberg, Kravis and Roberts in 1989—is still the largest of all time as of this writing. In these large buyouts, the investors put up the equity stake (these days it is usually between 20 and 40 percent of the total purchase price) and then borrow the rest from banks, public markets (noninvestment grade = "junk bonds"), and mezzanine investors—hence the term **leveraged buyouts** (**LBOs**).

Despite the publicity generated by these large buyouts, most buyout firms are engaged in more everyday deals involving the purchase of "middle-market" companies. Although some of these so-called middle-market companies may qualify among the largest 1 percent, many of them still lack the growth potential to generate much interest from public markets. This is typically because the company is in an older industry that has more stable cash flows and limited potential for internal growth. In this case, private equity investors can create liquidity for the current owners through a buyout. Such buyouts do not always include leverage. A related strategy is "buy and build", where a buyout investor will acquire a series of firms in a fragmented industry for the purpose of taking advantage of changes in the optimal industrial scale. Although buy-and-build is a growth investment strategy, the growth comes *externally* from the purchase of existing businesses.

The final category of private equity is **distress investing**, also called **special situations**. As the name suggests, distress investors focus on troubled companies. Because many distress investments are buyouts, this category intersects with the previous one. Some private equity investors do both traditional leveraged buyouts and distress buyouts, but most investors specialize in one or the other.

A separate category of alternative investing, hedge funds, is also included in Exhibit 1-2. Hedge funds are flexible investing vehicles that share many characteristics of private equity funds, including the limited partnership structure and the forms of GP compensation. The main difference, however, is that hedge funds tend to invest in public securities. A good example of this distinction can be seen in the area of distress investing, the area with the greatest overlap for private equity and hedge fund investors. The private equity funds that engage in distress investing usually do so with the intention of gaining control of the distressed company (or some subset of the company). These investors then operate and restructure the company before reselling it to another investor or to the public markets. Hedge funds also engage in distress investing, but their main strategy is to trade in the public securities of distressed companies, with the intention of making a trading

profit by quickly reselling these securities. In recent years, the distinction between hedge funds and private equity funds has grown more blurred, with some hedge funds beginning to invade the traditional private equity territory, particularly in the buyout and distress space. For now, traditional VC investing, with its long holding periods and relatively small investments, remains relatively free of hedge-fund involvement.

Although there are exceptions to this pattern, the basic distinction is that private equity funds are long-term investors, and hedge funds are short-term traders. Both strategies have the potential for outstanding returns, but the skill sets and investment approaches are different enough that it is rare that a single individual can excel at both. However, because their investments are more liquid than those for private equity investors, hedge funds can offer their investors faster access to their money, with withdrawals usually allowed on a quarterly or annual basis. This is a case of form following function: if you have an investment strategy in illiquid assets, then you need to lock up your investors for a long period of time (private equity); if you have an investment strategy in liquid assets, then you can allow for quicker withdrawals (hedge funds). Although hedge funds have occasionally crossed over to private equity, any large-scale crossover would require a change of contractual form toward a longer lockup. At that point, they would become private equity funds.

1.2 WHAT DO VENTURE CAPITALISTS DO?

VC activities can be broken into three main groups: **investing**, **monitoring**, and **exiting**. In later chapters, we will describe these activities in more detail. For now, we will give brief summaries of each group and use these summaries to define the scope of this book.

Investing begins with VCs prospecting for new opportunities and does not end until a contract has been signed. For every investment made, a VC may **screen** hundreds of possibilities. Out of these hundreds, perhaps a few dozen will be worthy of detailed attention, and fewer still will merit a preliminary offer. Preliminary offers are made with a **term sheet**, which outlines the proposed valuation, type of security, and proposed control rights for the investors. If this term sheet is accepted by the company, then the VC performs extensive **due diligence** by analyzing every aspect of the company. If the VC is satisfied by this due diligence, then all parties negotiate the final set of terms to be included in the formal set of contracts to be signed in the final **closing**. These investing activities—especially the term sheet valuation and structure—are ideal topics for financial analysis and are the main subjects of this book.

Once an investment is made, the VC begins working with the company through board meetings, recruiting, and regular advice. Together, these activities comprise the **monitoring** group. Many VCs argue that these activities provide the best opportunity for VCs to add value and are the main source of comparative

advantage for a successful VC. This argument may indeed be correct, but monitoring activities do not lend themselves well to quantitative analysis. Thus, aside from a discussion of the academic literature in Chapter 5, we will not go into monitoring in this text.

The final group of activities is **exiting**. As discussed earlier, VCs are financial intermediaries with a contractual obligation to return capital to their investors. However, the exit process itself requires knowledge and skills that are somewhat distinct from the earlier investment and monitoring activities. VCs plan their exit strategies carefully, usually in consultation with investment bankers. A typical IPO underwritten by a top investment bank will sell at least $50 million of new stock and have a total equity value of at least $200 million. Historically, the IPO has been the source of the most lucrative exits. The main alternative to the IPO is a sale to a strategic buyer, usually a large corporation. Sometimes these sales can be very profitable for the VC, but only if there is significant competition for the deal, often including the possibility of an IPO. Financial analysis is crucial for the valuation of IPO firms and acquisition candidates, and this analysis is discussed at length in the rest of this book.

1.3 THE HISTORY OF VENTURE CAPITAL

Equity investments in risky new ventures are as old as commerce itself. The modern organizational form of venture capital, however, dates back only to 1946. Bank lending rules then (and now) looked for evidence that borrowers had collateral and could make timely payments of interest and principal. Most entrepreneurial firms, however, didn't meet these standards, and so they required risk capital in the form of equity. There was usually no regular source of such capital, meaning that entrepreneurs without wealthy friends or family had little opportunity to fund their ventures. Along came George Doriot to solve this problem. General Doriot, so named for his rank in the U.S. Army quartermaster's office during World War II, recognized the need for risk capital and created a firm to supply it. His firm, American Research and Development Corporation (ARD), began operations in 1946 as the first true venture capital firm. Unlike modern funds, it was organized as a corporation and was publicly traded. In its 25-year existence as a public company, ARD earned annualized returns for its investors of 15.8 percent.[4] ARD also set a standard for generating these returns that has persisted to the present day. Excluding the $70,000 investment in their biggest "home run", the Digital Equipment Corporation, ARD's 25-year annualized performance drops to 7.4 percent. Many modern venture capitalists spend their days searching for their own home runs, now with more fanciful names like Yahoo!, eBay, and Google—all firms that started as venture capital investments and made legendary reputations for their investors.

[4]Fenn, Liang, and Prowse (1998).

Today, venture capital is a well-established business throughout the developed world, but remains quite geographically concentrated both across and within countries, with the United States still comprising about half the VC activity in the world. Because the United States represents so much of the worldwide VC industry, the data providers have followed the money, and we now know much more about U.S. VCs than we do about the rest of the world. In this chapter, we focus on the history and statistics from the well-studied U.S. market, and most of this book will refer to U.S. data and U.S. legal structures. This U.S. focus does not limit the applicability of the analysis, because most global VCs follow U.S. practices. Most importantly for our purposes, the financial concepts of VC investing are universal, and all the quantitative analysis in this book can be applied to VC investments anywhere in the world. In Chapter 6, we provide statistics on the world distribution of VC and discuss some reasons for the observed patterns.

General Doriot's innovation in 1946 did not change the world overnight, and even ten years later the VC landscape remained barren. In recognition of this problem faced by small-growth businesses, the U.S. government began its own VC efforts as part of the Small Business Act of 1958, which was legislation that created the Small Business Administration and allowed the creation of **Small Business Investment Companies (SBICs)**. Perhaps the greatest success of the SBIC program was to provide a vehicle to train a pool of professional VCs for the later decades. SBICs still exist today and share many characteristics of modern VC firms; however, regulatory restrictions affiliated with SBICs keep it from becoming the dominant institutional form.

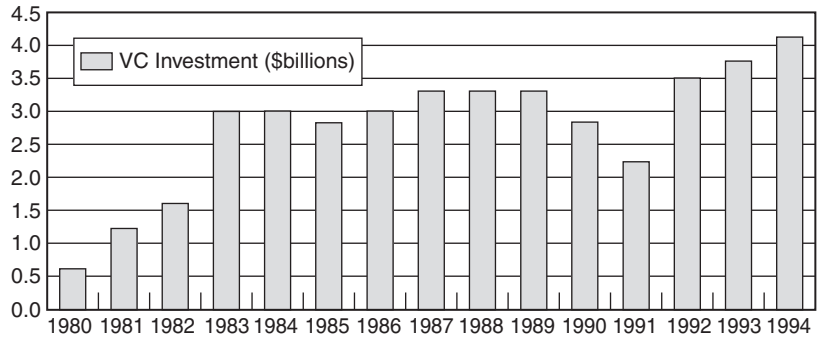
An important milestone for the VC industry came in the 1960s with the development of the limited partnerships for VC investments. In this arrangement, limited partners put up the capital, with a few percentage points of this capital paid every year for the **management fees** of the fund. The remaining capital is then invested by the general partner in private companies. Successful investments are exited, either through a private sale or a public offering, before the ten-year life of the partnership expires. The most common profit-sharing arrangement is an 80–20 split: after returning all the original investment to the limited partners, the general partner keeps 20 percent of everything else.

This profit sharing, known as **carried interest**, is the incentive that makes private equity investing so enticing for investment professionals. In recent years, the most successful general partners have demanded—and received—as much as 30 percent carried interest on new partnerships. Limited partnerships are by far the most common form of organization in the VC industry, and in Chapter 2 we will discuss these partnerships in detail.

Despite inroads made by SBICs and the new limited partnerships, total VC fund-raising in the United States was still less than $1 billion a year throughout the 1970s. The next big change for VC came in 1979, when the relaxation of investment rules for U.S. pension funds led to historically large inflows from these investors to the asset class. To this day, pension funds continue to supply nearly half of all the money for venture capital in the United States.

EXHIBIT 1-3

VC INVESTMENT, PREBOOM



SOURCE: National Venture Capital Association Yearbooks.

The participation by pension funds hastened the participation for other institutional investors, and the modern era of venture capital began. Exhibit 1-3 displays the total amount of venture capital invested by year from 1980 to 1994.

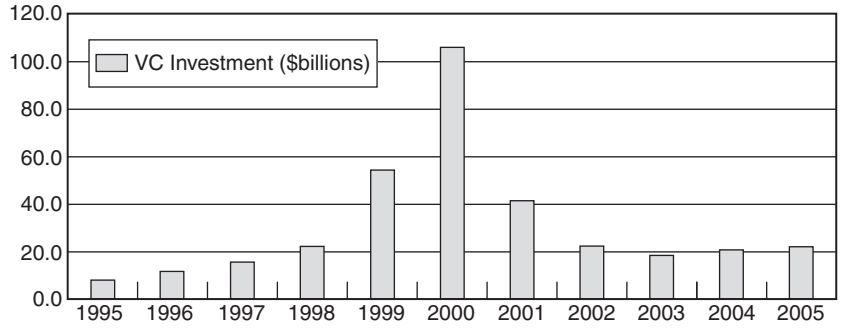
Investing activity rose sharply to $3B in 1983 and remained remarkably stable through the 1980s. After a slight drop in 1990–91, VC investment began a steady climb; from $2.2B in 1991, it rose gradually to $4.1B in 1994. We refer to these first 15 years of the modern VC industry as the **preboom period**. As shown in Exhibit 1-4, it was in 1995 that investment really began to grow quickly.

Exhibit 1-4 shows investment nearly doubling to $7.6B in 1995 (from $4.1B in 1994) at the beginning of an incredible growth period. This was the dawn of the Internet era, and some of the VC investments made in 1995 and 1996 had spectacular returns. This caused institutional investors to rush for a piece of the asset class, and investments rose to $11.5B in 1996, $14.8B in 1997, and $21.2B in 1998 before exploding to the previously unimaginable levels of $54.4B in 1999 and $105.9B in 2000. For obvious reasons, we refer to 1995 to 2000 as the **boom period**.

As the euphoria faded in the early 21st century, VCs still had large commitments from their investors, and many portfolio companies—funded in the late 1990s and 2000—were hungry for follow-on investments. Still, spending fell to $40.6B in 2001 before leveling off at about $20B in the subsequent years. We refer to the years after 2000 as the **postboom period**. Indeed, the boom period ended abruptly at the end of 2000, as investment fell by nearly half from the fourth quarter of 2000 to the first quarter of 2001.

EXHIBIT 1-4

VC INVESTMENT, BOOM AND POSTBOOM



SOURCE: National Venture Capital Association Yearbooks.

Although the postboom numbers are well below the peak of 2000, they still represent a considerable increase on investment prior to 1995. This can be seen by looking at VC investment as a fraction of GDP, where VC investment hit a new peak of 0.085 percent in 1983 and fell steadily to its modern all-time low of 0.037 percent in 1991 before rising to 0.058 percent at the end of the preboom period in 1994. The percentage jumped to 0.103 percent to mark the beginning of the boom period in 1995 and rose steadily to hit 0.587 percent in 1999 and its maximum of 1.087 percent in 2000. In the postboom period, the percentage has leveled off to 0.164 percent in 2003 and 0.182 percent in 2004, well above the levels of the 1980s and approximately the same as the percentages in 1996 and 1997.

It is difficult to put these investment levels in perspective without some model of VC's place in the economy. How can we tell if the apparently new steady state of $20B or 0.182 percent of GDP is too low, too high, or just right? One way to approach this question is to start with the definition of VC at the beginning of this chapter. There, we discussed how VCs invest in small companies that have the potential to become large quickly through internal growth. To qualify, a company usually needs some sort of product innovation, usually a novel item that can penetrate a large market. Sometimes, the proposed innovation is high tech, such as a new drug or a new type of software. Alternatively, the innovation might be in a business process, where an early mover could erect barriers to entry by competitors. Many of the Internet start-ups took this route, although most of them unfortunately ignored the requirement that there be a barrier to entry.

With this framework, we can see that it is not just an innovation that is necessary, but rather an innovation that should be made by a small company. Tremendous innovation goes on all the time in large companies, and large companies are the optimal place for the majority of high-tech innovations. With large research staffs, a stockpile of trade secrets, and decades of organizational learning, companies like IBM, Microsoft, Intel, Pfizer, and Merck are factories of innovation. If a small company proposed to develop, build, and sell a new microprocessor for personal computers, it would face almost certain failure in the face of the industry giants. If, however, a small company proposed to develop a small piece of the technology for such microprocessors, a piece that could be patented and potentially licensed across a wide range of products, then this might be (and has been) accomplished.

So how much innovation should occur in small companies? In general, this will depend on the factors that drive the optimal scale of an innovative enterprise. In the 1990s, communications technology changed radically, with development of the Internet occurring alongside large price decreases for telecommunications. This communications revolution was real, even if some potential profits from the revolution proved to be illusory. Lower costs of communication opened up new opportunities for market transactions, with lower transactions costs than traditional methods. According to the theory of the firm first introduced by Ronald Coase in 1937, a universal reduction in transactions costs should reduce the optimal scale of firms and allow for greater levels of innovation by small companies.

By this reasoning, the higher levels of VC investment that we see today—as compared to the 1980s—may indeed represent an optimal reaction to structural changes in the economy. Even the massive investments of 1999 and 2000, although clearly excessive in some respects, also appear to be at least in part a response to rapid changes in transactions costs. Prior to the Internet era, national retail brands required massive infrastructure and logistics support. With the Internet, retailers could operate from a single location, and consumers could find them from anywhere in the world.

The organizational constraints of large enterprises seemed to prevent the rapid competitive reactions that could have stifled some of these innovations. For example, large booksellers such as Barnes and Noble already possessed the brand name, the infrastructure, and the inventory to compete effectively as an online bookseller. Nevertheless, Amazon.com, a venture-backed start-up, managed to outinnovate and outcompete them, to the point that Amazon's business became far more valuable than that of its older competitor. Amazon, although among the most successful, is one of many examples of successful entrants that relied on the new communications technology.

1.4 PATTERNS OF VC INVESTMENT IN THE UNITED STATES

In this section, we provide evidence about VC investing by stage, industry, and region.

1.4.1 Investments by Stage

There are many steps, or stages, to building a new VC-backed business. In Section 1.1, we introduced the terminology for the three broad stages: early-stage, mid-stage, and late-stage. A more complete description of these stages, along with some subcategories, is found in Exhibit 1-5.

The main theme of next exhibit is the steady trend toward later-stage investing. In the early 1980s, the three categories of "seed/start-up", "other early", and "expansion" were approximately equal, and "later stage" was the smallest. This pattern reflects VCs focus on true start-ups in the early years of the industry. Gradually, new VC firms were created to focus on later stages, and some of the original firms grew so large from their successes that they needed to find larger investments to put all their capital to work. By the mid-1990s, expansion stage investments were larger than all early-stage investments (seed/start-up plus other early-stage), and later-stage investments exceeded those in seed/start-up. By the late 1990s, angel investors had largely replaced VCs at the seed/start-up stage, and expansion investments comprised more than one-half of all VC investments. Another way to see this massive shift in focus is through a direct comparison of the seed/start-up investing in 2004 and 1981: Despite a nearly 20-fold increase in total VC investing ($21.0B versus $1.2B), the dollars invested in seed/start-up companies were virtually the same in those two years ($348M versus $343M).

The definition of the company stage should not be confused with the definition of the **financing round**. The negotiation of a VC investment is a time-consuming and economically costly process for all parties. Because of these costs, neither the VCs nor the portfolio firms want to repeat the process very often. Typically, a VC will try to provide sufficient financing for a company to reach some natural milestone, such as the development of a prototype product, the acquisition of a major customer, or a cash-flow breakeven. Each financing event is known as a **round**, so the first time a company receives financing is known as the **first round** (or **Series A**), the next time is the **second round** (or **Series B**), and so on and so forth. With each well-defined milestone, the parties can return to the negotiating table with some new information. These milestones differ across industries and depend on market conditions; a company might receive several rounds of investment at any stage, or it might receive sufficient investment in one round to bypass multiple stages.

EXHIBIT 1-5

STAGES OF GROWTH[5]

Early Stages

Seed This stage is a relatively small amount of capital provided to an inventor or entrepreneur to prove a concept and to qualify for start-up capital. If the initial steps are successful, this may involve product development, market research, building a management team, and developing a business plan.

Start-up This stage provides financing to companies completing development and may include initial marketing efforts. Companies may be in the process of organizing or they may already be in business for one year or less, but have not sold their products commercially. Usually such firms will have made market studies, assembled the key management, and developed a business plan—and are now ready to conduct business.

Other Early-Stage Other early-stage financing includes an increase in valuation, total size, and the per-share price for companies whose products are either in development or are commercially available. This involves the first round of financing following start-up, which includes an institutional venture capital fund. Seed and start-up financing tend to involve angel investors more than institutional investors. The networking capabilities of the venture capitalists are used more here than in more advanced stages.

Expansion Stages (MID-Stages)

Expansion This stage involves applying working capital to the initial expansion of a company. The company is now producing, is shipping, and has growing accounts receivables and inventories. It may or may not be showing a profit. Some of the uses of capital may include further plant expansion, marketing, or development of an improved product. More institutional investors are likely to be included along with initial investors from previous rounds. The venture capitalist's role in this stage involves a switch from a support role to a more strategic role.

Late Stages

Late Capital in this stage is provided for companies that have reached a fairly stable growth rate, that is, companies that are not growing as fast as the rates attained in the expansion stages. Again, these companies may or may not be profitable, but are more likely to be profitable than in previous stages of development. Other financial characteristics of these companies include positive cash flow.

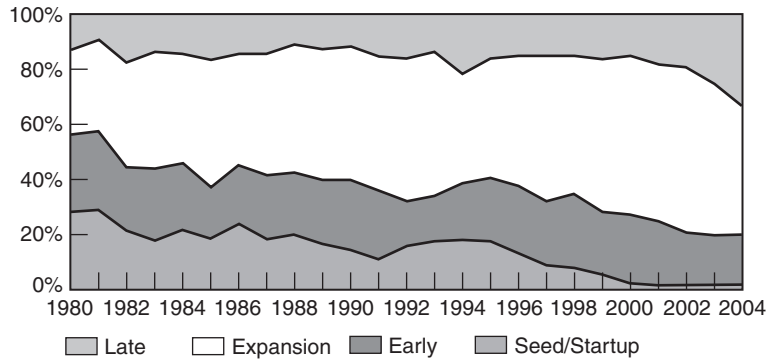
Bridge This stage is needed at times when the company plans to go public within six months to a year. Bridge financing is often structured so that it can be repaid from the proceeds of a public underwriting. It can also involve restructuring of major stockholder positions through secondary transactions.

[5]These descriptions are nearly verbatim from the 2005 National Venture Capital Association Yearbook, pp. 113–114.

With these definitions in hand, we are now ready to examine the investment patterns by stage. Exhibit 1-6 illustrates these patterns by plotting the percentage of investment each year by stage:

EXHIBIT 1-6

VC INVESTMENT BY STAGE



SOURCE: National Venture Capital Association Yearbooks.

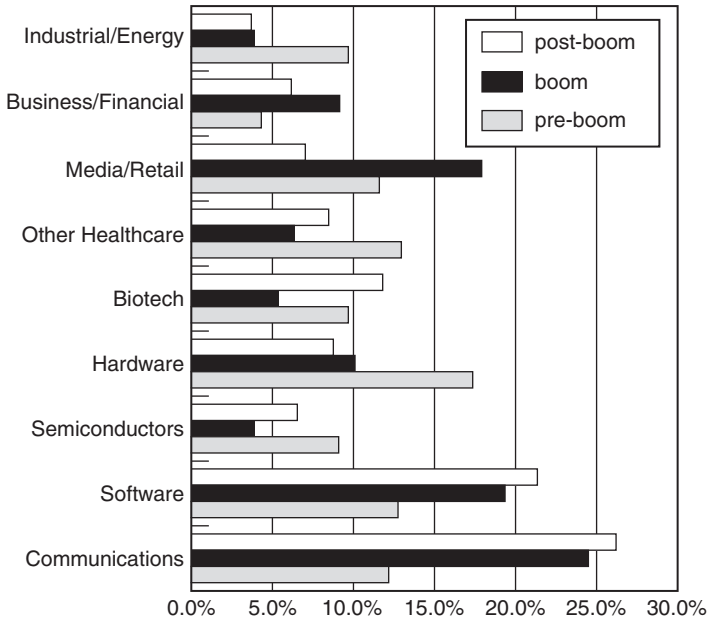
1.4.2 Investments by Industry

Traditionally, VC investments have been concentrated in two broad sectors: health care and information technology (IT), where the latter sector is defined to include the communications, semiconductor, software, and hardware industries. This concentration is no accident: because VCs invest in small companies with the potential to quickly grow large, they need to look for businesses with large, addressable markets. To make headway in such markets, a business usually needs a technological advantage of some kind—hence the VC focus on the high-tech industries of health care and IT. Of course, other industries can also provide these opportunities, particularly during times of disruptive economic change. The communications revolution of the late 1990s provided such an opportunity for Internet-based retail businesses, and periodic oil shocks provided the impetus for energy investments.

Exhibit 1-7 illustrates the industry concentration of VC investment for three periods: the preboom period of 1980–1994, the boom period of 1995–2000, and the postboom period of 2001–2004. The data show the dominance of IT (including communications, software, hardware, and semiconductors/electronics) and health care (including biotech and other health care) for VC investment; together, these two sectors comprise about 80 percent of all investment in the preboom and postboom periods. During the boom, media/retail investment had a brief (and expensive)

EXHIBIT 1-7

VC INVESTMENT BY INDUSTRY



SOURCE: National Venture Capital Association Yearbooks.

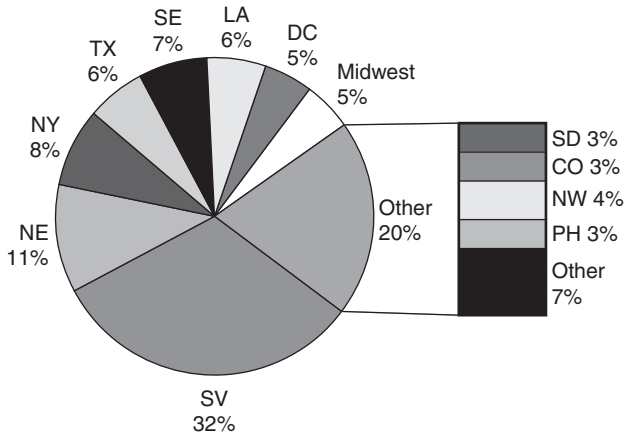
rise, but even then the main story was the enormous increase in IT relative to health care. Within the broad IT sector, the two most important industries in the boom and postboom periods were communications and software, followed by semiconductors/electronics and hardware. Within health care, the story has been a gradual emergence of biotechnology as the dominant industry, receiving almost two-thirds of total health care investment in recent years.

1.4.3 Investments by U.S. Region

With all the evidence of globalization in manufacturing and IT services, the U.S. regional concentration of VC investment is particularly striking. Since the beginnings of the industry, the Silicon Valley area of northern California has remained the epicenter of VC activity, with a consistent share of 30 percent of total U.S. VC investment per year. The area surrounding Boston has remained a secondary center for most of this time, with approximately one-half (earlier years) to one-third (later

EXHIBIT 1-8

REGIONAL DISTRIBUTION OF VC INVESTMENT



Key:
CO = Colorado
DC = DC Metro
LA = LA/Orange County
MID = Midwest
NE = New England
NW = Northwest
NY = NY Metro
PH = Philadelphia Metro
SD = San Diego
SE = Southeast
SV = Silicon Valley
TX = Texas
Other = 7 Additional Regions

SOURCE: National Venture Capital Association Yearbooks.

years) of Silicon Valley's total. Exhibit 1-8 illustrates the patterns for these centers and other U.S. regions for the combined preboom, boom, and postboom periods.

The dominance of Silicon Valley and New England (mainly Boston) hides some important globalizing forces. Although companies headquartered in these two regions receive almost half of all VC dollars, much of these funds are then reinvested in foreign operations, particularly in India, by IT companies. This is a 21st-century phenomenon that has taken the industry by storm. Although it is difficult to find hard numbers to document this trend, such outsourcing is a common topic of conversation among VCs.

SUMMARY

Venture capitalists (VCs) primarily invest in young, high-technology companies that have a capacity for rapid growth. VCs are a type of financial intermediary that performs three

main functions, which are (1) screening potential investments and deciding on companies to invest in, (2) monitoring these companies and providing value-added services for them, and (3) exiting their investments in these companies by selling their stake to public markets or to another buyer. Venture capital is a form of private equity, which is an investment that cannot be traded in public markets. Without the information flow and liquidity of public markets, VC investing offers greater opportunities for both huge gains and terrible losses.

The modern VC industry effectively began in 1946 and grew slowly for its first 35 years. Beginning in the early 1980s, new sources of capital from pension funds led to rapid growth. This period of rapid growth leveled off in the mid-1980s and resumed in the mid-1990s, culminating in a boom and crash at the turn of the century. The United States is the world leader in VC, with about half of the worldwide investment and industry-leading practices. Within the United States, information technology and health care are the dominant sectors for VC investment, and Silicon Valley and the area around Boston, Massachusetts, garner nearly half of all the domestic venture capital.

KEY TERMS

Venture capital (VC) and venture capitalists (VCs)
Screen
Monitor
Exit
Financial intermediary
Limited partnership, limited partner, general partner
Portfolio companies
Small Business Investment Companies (SBICs)
Initial public offering (IPO)
Angel investors = angels
Alternative investments
Private equity
Strategic investing
Corporate venture capital
Preboom, boom, postboom periods
Early-stage, mid-stage (expansion), late-stage
Mezzanine
Growth capital
Leveraged buyouts (LBOs)
Distress investing = special situations
Hedge funds
Term sheet
Due diligence
Management fees
Carried interest
Seed stage, Start-up stage, Bridge stage
Financing Round, First round (Series A), Second round (Series B)

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