

Should Investors Bet on the Jockey or the Horse? Evidence from the Evolution of Firms from Early Business Plans to Public Companies

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ABSTRACT

We study how firm characteristics evolve from early business plan to initial public offering (IPO) to public company for 50 venture capital (VC)-financed companies. Firm business lines remain remarkably stable while management turnover is substantial. Management turnover is positively related to alienable asset formation. We obtain similar results using all 2004 IPOs, suggesting that our main results are not specific to VC-backed firms or the time period. The results suggest that, at the margin, investors in start-ups should place more weight on the business (“the horse”) than on the management team (“the jockey”). The results also inform theories of the firm.

SINCE COASE (1937), ECONOMISTS HAVE ATTEMPTED TO UNDERSTAND why firms exist and what constitutes firms.¹ Despite the long history of theory and empirical work, there is little systematic or noncase evidence concerning what constitutes a firm when it is very young and how a young firm evolves to a mature company. In this paper, we provide such evidence by studying 50 venture capital (VC)-financed firms from early business plan to initial public offering (IPO) to public company (3 years after the IPO). We explore financial performance, line of business, point(s) of differentiation, nonhuman capital assets, growth strategy,

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¹ Both Holmström and Roberts (1998) and Gibbons (2005) describe and summarize some of this work.

top management, and ownership structure at each point in time and consider how these characteristics evolve over time. We repeat a subset of these analyses with a sample of all IPOs in 2004.

This paper has three main goals. First, we provide a systematic description of the early life and evolution of an important sample of firms. In so doing, we provide information on firms before the post-IPO period studied in Fama and French (2004).

Our second goal is to address an ongoing debate among venture capitalists (VCs) concerning the relative importance of a young company's business idea and management team to the company's success. While VCs try to invest in companies with both strong businesses and strong management (see Kaplan and Strömberg (2004)), different VCs claim to weigh one or the other more heavily at the margin. Some VCs believe that the company's business and market are the most important determinants of success while others believe the key determinant is the company's management. Our sample of successful VC-financed companies is particularly appropriate to shed light on this debate. This debate is often characterized as whether one should bet on the jockey (management) or the horse (the business/market). Quindlen (2000), Gompers and Lerner (2001), and Metrick (2007) discuss these two views.

According to Gompers and Lerner (2001), Tom Perkins of Kleiner Perkins (a prominent VC) looked at a company's technological position and asked whether the technology was superior to alternatives and proprietary. Don Valentine of Sequoia (a prominent VC) assessed the market for the product or service and considered whether the market was large and growing. For example, many VCs declined to invest in Cisco because the team was considered weak. Valentine invested in Cisco anyway because he saw a huge market.

Alternatively, Arthur Rock, a prominent VC and early investor in Apple Computers, emphasized the quality, integrity, and commitment of management. According to Rock, a great management team can find a good opportunity even if they have to make a huge leap from the market they currently occupy. In their *Venture Capital Handbook*, Gladstone and Gladstone (2002) also take this perspective, quoting an old saying: "You can have a good idea and poor management and lose every time. You can have a poor idea and good management and win every time" (pp. 91–92).

The third goal of the paper is to consider how our findings can inform and be interpreted in relation to existing theories of the firm and what new theories might try to explain. These theories are related to the VC debate concerning the importance of business and management in the sense that the theories emphasize the difference between nonhuman and human assets. For example, the basic assumption of the Hart–Moore framework is that firms are defined by their nonhuman assets. According to Hart (1995), "a firm's non-human assets, then, simply represent the glue that keeps the firm together . . . If non-human assets do not exist, then it is not clear what keeps the firm together" (p. 57).²

² Hart's analysis focuses on specific investment and the importance of hold-up problems. Holmström (1999) comes to a similar conclusion, but argues that firm ownership of nonhuman assets

Two aspects of our analysis address these theories. First, we try to identify the “glue” that holds firms together. Second, to the extent that the theories are static theories (in that they assume a nonhuman asset or glue already exists), we provide evidence as to the stage of a firm at which the glue emerges or “sticks” and how the glue evolves over a firm’s life cycle.

We also relate our results to theories of the firm such as Wernerfelt (1984) and Rajan and Zingales (2001a) that emphasize specific assets or resources critical to the firm’s evolution and growth. A critical resource may be a person, an idea, good customer relationships, a new tool, or superior management technique. According to these theories, a firm is a web of specific investments built around a critical resource or resources. “At some point, the critical resource becomes the web of specific investment itself” (Zingales (2000, p. 1646)). By examining firms’ resources (nonhuman and human assets) early in their lives and over time, we shed light on the nature of critical resources and the periods in which they are critical.

The theories above (as well as others such as Hart and Moore (1994)) also have implications for the division of rents between providers of human (founders) and nonhuman capital. Zingales (2000) and Rajan and Zingales (2001b) argue that today’s “new firms” differ from the traditional firms of the early 20th century in that specific human capital has become more important. If so, the theories suggest that the human capital providers will capture a greater share of the rents generated by the firm than they did in the past.

Finally, our results relate to a debate among sociologists as to whether populations of firms evolve by adapting or by natural selection. According to the adaptation view, firms respond to environmental change by adapting through organizational or strategic change. In contrast, the natural selection view holds that organizational inertia makes it difficult for firms to change. While individual firms do not change in response to environmental change, more efficient organizations survive and new (efficient) firms are created. Hannan and Freeman (1984) argue that creation and replacement are more important and prevalent than adaptation.

Our results are as follows. Consistent with our sample selection strategy, the sample firms experience dramatic growth in revenue, assets, and market value (although they do not become profitable). While the firms grow dramatically, their core businesses or business ideas appear remarkably stable. Only one firm changes its core line of business in the sense that the company produces a different product or service or abandons its initial market segment to serve a different one. Rather than changing businesses, firms typically maintain or broaden their offerings within their initial market segments. The firms sell to similar customers and compete against similar competitors in the three life-cycle stages we examine. This suggests that the firms’ business idea or line of business is fixed or elemental at an early stage in a firm’s life.

Almost uniformly, firms claim they are differentiated by a unique product, technology, or service at all three stages we examine. At the same time, however,

allows the firm to structure internal incentives and to influence external parties (e.g., suppliers) who contract with the firm.

the stated importance of expertise (which one might interpret as specific human capital) declines. Roughly half of the firms stress the importance of expertise at the business plan while only 16% do so by the IPO and third annual reports.

While the points of differentiation, alienable assets, customers, and competitors remain relatively constant, the human capital of the sample firms changes more substantially. Only 72% of the CEOs at the IPO were CEOs at the business plan; only 44% of the CEOs at the annual report were CEOs at the business plan. The analogous percentages are lower for founders. Similarly, only about 50% of the next four top executives at the IPO were top executives at the business plan; only about 25% at the annual report were top executives at the business plan.

In our cross-sectional analysis, we find that firms with more alienable assets at the time of the business plan have substantially more human capital turnover over time.

Next, we consider the division of rents. For their human capital assets specific to the company, our estimates suggest that founders retain from 10.8% to 19.6% of the value created by the firm just before the IPO. These estimates are much lower than those for the earlier time period in Baker and Gompers (1999), and raise some doubt regarding the claim in Zingales (2000) that “new” firms are more dependent on specific human capital and, therefore, allocate a greater fraction of the value created to founders.

To address concerns that our sample of 50 VC-backed firms might be special in some way, we repeat our analyses of line-of-business changes, top management changes, and ownership structure for all nonfinancial start-ups firms that went public in 2004—both VC and non-VC backed. We obtain qualitatively similar results to those in our primary sample. We find that 7.5% of the firms change their business lines. While this is somewhat greater than the 2% for our main sample, it is still small in an absolute sense. We find no statistical difference between changes for VC-backed and non-VC backed firms. For the few companies that change business lines, the median date of the change is 7 years before the IPO—longer than the median time to IPO for our main sample. At the same time and as with our primary sample, we find more substantial turnover of management. At the IPO, a founder is CEO of only 49% of the VC-backed firms and 61% of the non-VC-backed firms.

Our results inform the VC debate about the relative importance of the business (horse) and the management team (jockey). The results call into question the claim Quindlen (2000) attributes to Arthur Rock that “a great management team can find a good opportunity even if they have to make a huge leap from the market they currently occupy” (p. 35). The results for both of our samples indicate that firms that go public rarely change or make a huge leap from their initial business idea or line of business. This suggests that it is extremely important that a VC picks a good business. At the same time, firms commonly replace their initial managers with new ones and see their founders depart, yet still are able to go public, suggesting that VCs are regularly able to find management replacements or improvements for good businesses.

It is important to note that the results do not imply that good management is not important. The large equity incentives VCs provide to new management suggest that good management is valuable. However, the results suggest that poor or inappropriate management is much more likely to be remedied by new management than a poor or inappropriate business idea is to be remedied by a new idea. Our results and their interpretation are also consistent with a quote attributed to Warren Buffett: "When a management team with a reputation for brilliance tackles a business with a reputation for bad economics, it is the reputation of the business that remains intact" (http://en.wikiquote.org/wiki/Warren_Buffett).

We also believe that our results inform theories of the firm. The theories of Hart–Moore–Holmström assume that a firm must be organized around nonhuman capital assets. We find that nonhuman capital assets form very early in a firm's life. Identifiable lines of business and important physical, patent, and intellectual property (IP) assets are created in these firms by the time of the early business plan, are relatively stable, and do not change or disappear as specific human capital assets turn over. These can be interpreted as the "glue" discussed by Hart (1995).

This should not be interpreted as saying that specific human capital is unnecessary or unimportant. Obviously, a specific person has to have the initial idea and start the firm. In contrast to nonhuman assets, however, our results indicate that it is possible and not unusual to replace the initial human assets (founders) and find other people to run the firm. This also is consistent with the view that the human capital of VCs is important; the VCs play an important role in finding those replacements (Hellmann and Puri (2002)).

The early emergence and stability of nonhuman assets are consistent with those assets being the critical resources described in the critical resource theories.³ The instability of the human assets suggests that to the extent that the initial critical resource is a specific person or founder, the "web of specific investments" (Zingales, 2000) that forms around the founder itself becomes the critical resource relatively early in a firm's life.

The cross-sectional analysis provides further support to these interpretations of the Hart–Moore–Holmström and critical resource theories. Firms with more alienable assets at the business plan have substantially more human capital turnover over time. This suggests that specific human capital is less critical after alienable assets have formed.⁴

Finally, our results on the stability of firm business lines are supportive of Hannan and Freeman (1984), who argue that creation and replacement (or natural selection) are more prevalent than adaptation.

³ The stability of nonhuman assets is consistent with Lemmon, Roberts, and Zender (2008), who find that firms' capital structures are "remarkably stable over time." To the extent that a firm's assets remain stable over time, one might expect the way those assets are financed to remain stable as well.

⁴ Our results also are consistent with Aghion, Dewatripont, and Stein (2005). Their model studies the tradeoffs between academic and private sector research. Based on control right considerations, they predict that once an idea becomes the property of a private firm (rather than an academic institution), it will be developed along relatively narrow lines.

We view this study and methodology as an empirical step in studying the nature and evolution of firms. While we believe that the results are novel and inform the jockey/horse debate as well as theories of the firm, we acknowledge that the samples may be special in that all the firms eventually go public. We do not believe this affects our primary conclusions and inferences. We discuss the strengths and weaknesses of our sample in Section I.B. below.

Our work is related to the papers that emerged from the Stanford Project on Emerging Companies (Baron and Hannan (2002), Baron, Hannann, and Burton (1999, 2001), Beckman and Burton (2005), Hannan et al. (2000), Hellmann and Puri (2000, 2002)). As we do, they study a panel of young firms—in their case, high-tech firms in Silicon Valley—but they ask a different set of questions. Baron and Hannan (2002) summarize the findings of their papers as showing that initial employment models are important and tend to persist. When they are changed, employee turnover increases and performance declines. Beckman and Burton (2005) study the evolution of top management teams. The human capital characteristics of the founding teams of their companies do not predict venture capital financing or going public. This is suggestive that the business idea and nonhuman capital assets are relatively more important to success.

Our research is also related to Bhide (2000), who studies 100 companies from *Inc. Magazine*'s list of 500 fastest growing companies in 1989. Bhide finds that many of those companies are founded by people who replicated or modified an idea encountered in their previous employment, but did relatively little formal planning before starting the business. Partly as a result, these companies adjust their initial concepts, sometimes changing and sometimes broadening them. Our work is complementary in that it appears that Bhide's focus is more on the formation stage in which the entrepreneur is the critical resource, rather than the growth stages that we study after the firm has been formed.

The paper proceeds as follows. Section I describes our samples. Section II describes the initial financial characteristics, business idea, point(s) of differentiation, assets and technology, growth strategy, customers, competitors, management, ownership structure, and board of directors of the sample firms and their evolution. Section III presents our cross-sectional estimates. Section IV presents the results for the 2004 IPO sample. Section V summarizes and discusses our results.

I. Sample

The main sample consists of 50 firms that went public in an IPO and for which we obtain an early business plan or business description at the time of a VC financing. We obtain 30 companies from the sample of VC-financed companies in Kaplan and Strömberg (2003). We obtain 20 more companies by asking several VCs for business plans of firms they had financed that had subsequently gone public.

For all sample companies, we have copies of the business plans and/or the VC investment memos that describe the company at the time of VC funding. (We do not find meaningful differences in the two types of documents.

Accordingly, in what follows, we drop the distinction and collectively refer to them as business plans.) From these documents, we identify the early (and often initial) characteristics of these firms. We also search for company and industry descriptions from 1990 onward in Thomson's Corporate Technology Information Services and its predecessor, CorpTech Directory of Technology Companies. We refer to these as the CorpTech Directories. For all sample companies, we obtain detailed company descriptions at the time of their IPOs from S-1 registration statements or 424(b)(4) prospectuses filed with the SEC. When available, we collect the company's annual report that is closest to 36 months after the IPO—a period roughly equal to the time from the business plan to the IPO. We obtain annual report descriptions from SEC form 10-K filings. In the case of one Canadian company, we collect an "annual information form" on form 40-F. Ownership data are not provided for this firm.

For 18 firms, we do not record an annual report observation: 8 were taken over and 3 went bankrupt less than 3 years after the IPO; 7 are public, but have not filed an annual report more than 2 years after the IPO. We retain the business plan and IPO observations for all 50 firms.

We describe the sample of all 2004 IPOs in Section IV.

A. Description

Table I presents summary information for our main sample. The median company is 23 months old as of the business plan, so these documents describe the companies when they are young. As we document below, these companies are early-stage businesses at the time of the business plan; the median company had no revenue in the most recently ended fiscal year at the time of the business plan.

The median time elapsed between the business plan and the IPO in our sample is 34 months, with a further median gap of 35 months between the IPO and the annual report observations. The IPO observation is therefore quite close to the midpoint of the business plan and annual report observations (and we constructed it to be so). The median total time elapsed is 68 months; the average is 72 months.

Of the 49 companies whose founders we are able to identify, 21 have one founder, 17 have two cofounders, and 11 were cofounded by three or more individuals.

Table I also shows that the bulk of the sample companies were founded in the early to mid 1990s while the business plans describe the companies in the mid to late 1990s. Thirty-one of the 50 IPOs took place in 1998, 1999, or 2000, at the height of the technology boom. The time frame of the sample, therefore, also corresponds to the period in which "new firms" emerged as described in Zingales (2000) and Rajan and Zingales (2001b). The industry breakdown of our sample is heavily weighted toward high-technology firms: 17 in biotech, 15 in software/information technology, 3 in telecom, 5 in healthcare, 6 in retail, and 4 in other industries, of which 3 are high-tech companies.

Table I
Sample Summary

This table reports median, average, and standard deviation of (i) the age of the firm in months as of the date of the business plan (BP), (ii) the time elapsed in months between the business plan and the IPO, (iii) the time elapsed in months between the IPO and the annual report (AR), and (iv) the time elapsed in months between the business plan and the annual report for 50 VC-financed companies that subsequently went public. The table also reports frequency distributions of the number of founders; the years sample firms were founded; and the years of their business plans, IPOs, and annual reports; the industries in which they operate; and their status as of May 31, 2006.

| | Age (Months) at Business Plan | Months between Business Plan and IPO | Months between IPO and Annual Report | Months between Business Plan and Annual Report | | |
|--|----------------------------------|--|--|--|----------|-------|
| Median | 23 | 34 | 35 | 68 | | |
| Average | 40 | 40 | 36 | 72 | | |
| <i>SD</i> | 51 | 25 | 3 | 24 | | |
| Num. Obs. | 50 | 50 | 32 | 32 | | |
| Number of companies with business plan dated prior to or concurrent with first VC financing | | | | 20 | | |
| Number of companies with one founder | | | | 21 | | |
| Number of companies with two cofounders | | | | 17 | | |
| Number of companies with three or more cofounders | | | | 11 | | |
| | Number Firms Founded | Number Business Plans | Number IPOs | Number Annual Reports | | |
| 1975–1980 | 3 | | | | | |
| 1980–1984 | 2 | | | | | |
| 1985–1989 | 5 | 4 | 1 | | | |
| 1990 | 1 | 1 | | | | |
| 1991 | 4 | | | 1 | | |
| 1992 | 3 | | 2 | | | |
| 1993 | 2 | 3 | | | | |
| 1994 | 7 | 1 | | 1 | | |
| 1995 | 10 | 8 | 3 | 1 | | |
| 1996 | 5 | 11 | 3 | | | |
| 1997 | 2 | 10 | 3 | | | |
| 1998 | 6 | 9 | 5 | 3 | | |
| 1999 | | 2 | 14 | 1 | | |
| 2000 | | | 12 | 4 | | |
| 2001 | | 1 | | 3 | | |
| 2002 | | | 1 | 10 | | |
| 2003 | | | 1 | 6 | | |
| 2004 | | | 4 | 1 | | |
| 2005 | | | 1 | | | |
| 2006 | | | | 1 | | |
| Industry Breakdown | | | | | | |
| | Biotechnology | Software/IT | Telecom | Healthcare | Retail | Other |
| Num. firms | 17 | 15 | 3 | 5 | 6 | 4 |
| Status as of May 31, 2006 | | | | | | |
| | Active | | Acquired/Merged | | Bankrupt | |
| Num. firms | 25 | | 18 | | 7 | |

Finally, Table I shows the companies' status as of May 31, 2006: 25 are still active, independent companies, 18 have been acquired, and 7 have failed and gone bankrupt.

B. Sample Selection Issues

As discussed in the introduction, there are some selection issues with this sample. First, we only analyze VC-backed companies because it is from our VC contacts that we were able to obtain the necessary data. Second, the companies may not be random VC-backed companies because our VC contacts may not be representative of all VCs. Third, a majority of the companies were funded in the tech boom because we began to collect the original sample in the late 1990s. Fourth, we only analyze companies that go public.

We address the first three issues in Section IV by analyzing the sample of all start-up IPOs in 2004. These include all VC-backed and non-VC-backed IPOs in 2004. These also include firms that survived, if not thrived, after the tech bust of the early 2000s.

In our main sample, we analyze companies that go public because data are available. The 2004 IPO sample has the same selection bias. In using these samples, we exclude firms that fail, firms (some of which are successful) that are acquired by other firms, and firms that survive but do not go public.

It would be interesting to study firms that fail, but it is difficult to obtain data for such a sample. We believe it unlikely that studying failed start-up firms would change our conclusion that investors should, on the margin, bet on the horse rather than the jockey. However, it is (theoretically) possible that no firms—winners or losers—change their business models, while all losers and only half of winners change management. In that case, it would still be important to invest in a business that can succeed, but it also would be important to have a good management team at the start.⁵ While we cannot discount this scenario, we think it unlikely given the widespread belief that it is common for firms to change their business lines. Clearly, studying failed start-ups would be an interesting topic for future research.

It is similarly difficult to obtain data for firms that are acquired. That said, if there is a bias in acquired firms, we would argue that it is toward firms in which specific human capital is relatively less important. The reason for this is that acquirers generally retain the business, but do not always retain (and often let go) the top management and employees of the firms they acquire (e.g., Martin and McConnell (1991), Matsusaka (1993)). Firms that go public retain the business, top management, and employees.

Similarly, while it would be interesting to study firms that survive but do not go public, it also is difficult to obtain data for them. We suspect, however, that relatively few such firms reach significant size.

We mention one last selection issue. The industries of the 50 sample firms are representative of the industries that VCs invest in. However, investments in

⁵ We thank John Graham for suggesting this possibility.

biotech and healthcare are overrepresented—44% of our sample versus roughly 20% of the overall VC market—while investments in software, information technology, and telecom are underrepresented relative to the overall VC market (see *National Venture Capital Association Yearbook* (2004)). Because biotech firms, in particular, are oversampled and potentially different from other types of companies, we report most of our results separately for biotech and non-biotech firms. Again, this is not an issue for the sample of 2004 IPOs.

II. Results

A. Financials and Employees

Table II summarizes the financial and employment histories of our firms. Consistent with describing the firms at an early stage, revenues, assets, and employees of the sample firms are small at the time of the business plans. They increase by orders of magnitude between the business plan and the annual report.

At the business plan, the median company reports no revenue in the prior fiscal year. Average revenue is \$5.5 million, reflecting seven firms with revenues over \$10 million. Most of our firms, therefore, are very young. Our results are qualitatively identical when we restrict the sample to those firms with no revenue. At the IPO, the median and average revenue figures increase dramatically to \$7.3 million and \$42.3 million (although four companies go public with no revenue in the latest fiscal year). By the annual report, revenues increase by another order of magnitude, to a median of \$69.1 million and an average of \$252.7 million. The rapid revenue growth in our sample firms suggests that they are successful in growing market share and/or supplying products and services to quickly growing segments of the economy.

The median company has 22 employees at the business plan, 129 at the IPO, and 432 at the annual report. Retailers tend to be somewhat more labor intensive than others in our sample. The median number of employees for non-retailers is 18, 102, and 328 at the business plan, IPO, and annual report. Asset growth for the sample parallels revenue growth, suggesting the need for large investments to generate that growth.

Our companies are unprofitable at the time of the business plan—the earliest we can measure profitability. The losses increase from the business plan through the IPO and annual report. This is consistent with the patterns for recent IPOs described in Fama and French (2004), particularly for young firms. The median company's earnings before interest and taxes (EBIT) for the fiscal year prior to the business plan, IPO, and annual report is -\$0.78 million, -\$6.6 million, and -\$26.1 million, respectively.

We calculate market capitalization at the business plan as the postmoney value of the company after a VC financing that occurs within 6 months of the date of the business plan. Market capitalization at the IPO is calculated as the first trading day's closing price times the shares outstanding following the offering. Market capitalization at the annual report is the average of the high

Table II
Financials and Employees

This table reports median, average, and standard deviation of revenue, number of employees, assets, earnings before interest and taxes (EBIT), and market capitalization at the business plan (BP), IPO, and annual report (AR). Revenue, assets, and EBIT are reported as of the end of the prior fiscal year. We report statistics broken out by all sample firms, biotechnology firms, and non-biotechnology firms.

| | All Firms | | | Biotechnology Firms | | | Non-Biotechnology Firms | | |
|------------------------------------|-----------|---------|---------|---------------------|-------|-------|-------------------------|---------|---------|
| | BP | IPO | AR | BP | IPO | AR | BP | IPO | AR |
| Revenue (\$M) | | | | | | | | | |
| Median | 0 | 7.3 | 69.1 | 0 | 2.9 | 20.7 | 0.6 | 12.9 | 126.8 |
| Average | 5.5 | 42.3 | 252.7 | 0.7 | 4.9 | 30.1 | 8.2 | 61.6 | 374.5 |
| <i>SD</i> | 13.5 | 153.4 | 516.1 | 1.6 | 5.3 | 14.8 | 16.2 | 186.8 | 606.1 |
| Num. obs. | 48 | 50 | 32 | 17 | 17 | 11 | 31 | 33 | 21 |
| Number of Employees | | | | | | | | | |
| Median | 22 | 129 | 432 | 10 | 71 | 134 | 31 | 212 | 625 |
| Average | 91 | 362 | 1,669 | 17 | 87 | 195 | 134 | 504 | 2,441 |
| <i>SD</i> | 199 | 671 | 2,721 | 13 | 67 | 141 | 242 | 791 | 3,106 |
| Num. obs. | 43 | 50 | 32 | 16 | 17 | 11 | 27 | 33 | 21 |
| Assets (\$M) | | | | | | | | | |
| Median | 2.5 | 19.7 | 121.1 | 1.8 | 18.5 | 91.7 | 2.7 | 22.1 | 173.0 |
| Average | 5.8 | 44.7 | 357.3 | 3.3 | 23.7 | 96.7 | 6.6 | 55.6 | 493.8 |
| <i>SD</i> | 10.7 | 69.0 | 738.6 | 3.9 | 18.3 | 64.5 | 12.1 | 82.2 | 886.9 |
| Num. obs. | 36 | 50 | 32 | 9 | 17 | 11 | 27 | 33 | 21 |
| EBIT (\$M) | | | | | | | | | |
| Median | -0.8 | -6.6 | -26.1 | -1.4 | -10.3 | -32.8 | -0.8 | -5.1 | -24.8 |
| Average | -1.5 | -7.5 | -51.8 | -1.9 | -11.7 | -30.4 | -1.4 | -5.3 | -63.1 |
| <i>SD</i> | 2.5 | 13.5 | 104.6 | 2.0 | 7.5 | 18.1 | 2.6 | 15.4 | 128.1 |
| Num. obs. | 37 | 50 | 32 | 8 | 17 | 11 | 29 | 33 | 21 |
| % positive | 19% | 20% | 19% | 13% | 6% | 0% | 21% | 27% | 29% |
| Market Capitalization (\$M) | | | | | | | | | |
| Median | 18.6 | 233.4 | 225.4 | 14.1 | 254.9 | 265.8 | 18.7 | 232.4 | 222.5 |
| Average | 28.8 | 690.1 | 590.7 | 16.2 | 388.3 | 257.6 | 32.9 | 845.5 | 773.9 |
| <i>SD</i> | 32.5 | 1,901.3 | 1,527.2 | 11.9 | 368.2 | 216.2 | 36.0 | 2,322.5 | 1,886.4 |
| Num. obs. | 41 | 50 | 31 | 10 | 17 | 11 | 31 | 33 | 20 |

and low stock prices during the last quarter of the year covered by the annual report times the shares outstanding as of the report.

The median market capitalization increases sharply from \$18.6 million at the business plan to \$233.4 million at the IPO, and then declines to \$225.4 million at the annual report. The market capitalization figures indicate a roughly ten-fold increase in value from business plan to IPO, a period of roughly 3 years. These companies, despite their negative profits, are highly valued (consistent with generally high valuations in the booming IPO market of the late 1990s). The decline in the market capitalization after the IPO is consistent with (and likely driven by) the technology bust of 2000 to 2002.

B. Business

Table III presents a description of each company's business. For each company, we then determine if the description of the business changes from one point in time to the next. To obtain the business description and changes in the business, we examine the relevant document (business plan, S-1, annual report) for each stage for information summarizing the company's business. In the S-1 and annual report, this information is usually near the start of the document and then repeated with additional details in the section titled "Business." The business plans are more free-form, but there is often an executive summary at the beginning that contains the key information. The information always includes the company's main or intended product(s). It also describes, if applicable, the company's key technologies that contribute to the development of the product(s). It usually, but not always, describes the customer base, either to whom the company is already selling or to whom the company's products are targeted. For example, the customer base may be consumers or Fortune 500 companies or small businesses. It sometimes mentions key customers that tend to be large, well-known companies. We supplement the information in the documents by searching Lexis Nexis, Venture Source, Google, and the companies' web sites—both current and historical.

We categorize changes in two ways. First, we consider whether firms change their line of business or business idea. The line of business changes if the firm markedly changes the products or services it offers, or sells to a completely different set of customers.

Second, we consider whether firms broaden (doing the same things as before, but adding others), narrow (doing some of the same things, but dropping others), or maintain their initial line of business. If Apple Computer were in the sample, we would classify it as having the same line of business it had when it started—personal computers sold to the same customers—but with a line of business that had broadened.

These comparisons have a subjective component to them. We report the individual descriptions in Table III to give the reader a sense of the type and magnitude of these changes. The descriptions have been shortened to protect the anonymity of the companies and the VCs as well as to shorten the length of the table. The descriptions in the business plans and other documents are always at least a paragraph and usually much longer. We base our measurements and conclusions on the more detailed descriptions to which we have access. More detailed descriptions are omitted to conserve space, but are available on request.

Our analysis of firm business lines is at a finer level of detail than would have resulted had we classified firms into NAICS or SIC categories at each point in time and then asked how those classifications differed over time. For example, at the six-digit (finest) NAICS code level, a firm engaged in "Disk and diskette conversion services" receives the same code (518210) as one engaged in "Computer time rental," while we would not consider those the same lines of business.

Table III
Lines of Business

Stated business at the business plan, IPO, and annual report for companies whose lines of business stays about the same over time (Panel A), companies whose line of business broadens/narrows between the business plan and IPO but not between the IPO and the annual report (Panel B), companies whose line of business broadens/narrows between the IPO and annual report but not between the business plan and IPO (Panel C), companies whose line of business broadens/narrows between both the business plan and IPO and the IPO and annual report (Panel D), and companies whose line of business changes (Panel E). The table also reports the percentage of companies whose stated lines of business change, broaden, narrow, or stay the same over those periods (Panel F).

| Panel A: Companies Whose Line of Business Stays About the Same over Time | | | |
|--|---|---|--|
| Company | Business Plan | IPO | Annual Report |
| 1 | • Development of analgesics | • Development of analgesics | • Development of analgesics |
| 2 | • Chemical analysis instrumentation and research services | • Contract research and development services | • Contract research and development services |
| 3 | • Specialty supermarkets | • Specialty supermarkets | • Specialty supermarkets |
| 4 | • Customer information management software | • Enterprise relationship management software | • Enterprise customer relationship management software |
| 5 | • Noninvasive cardiac surgery | • Noninvasive cardiac surgery | • Noninvasive cardiac surgery |
| 6 | • Production of nanocrystalline materials | • Development and marketing of nanocrystalline materials | • Engineering and manufacturing of nanocrystalline materials |
| 7 | • Telecom service provider | • Telecom service provider | • Telecom service provider |
| 8 | • Superstore specialty retailer | • Full-line specialty retailer | • Full-line specialty retailer |
| 9 | • Office supply stores | • Office supply stores | • Office supply stores |
| 10 | • Live-virus vaccines | • Live-virus vaccines | • Disease prevention through live-virus vaccine technology |
| 11 | • Digital prepress equipment | • Digital prepress equipment | • Digital prepress equipment |
| 12 | • Maps and mapping-related products, services, and technology | • Mapping products and services | |
| 13 | • Therapeutic products for cancer and infectious diseases | • Therapeutic products for cancer and infectious diseases | |
| 14 | • Small business equipment leasing | • Small business equipment leasing | |
| 15 | • Specialty retailer | • Specialty retailer | |
| 16 | • Sales and marketing automation software | • Sales, marketing, and customer support | |
| 17 | • Category-dominant specialty retailer | • Specialty retailer | |
| 18 | • Sustained-release drug delivery systems | • Sustained-release drug delivery systems | |

(continued)

Table III—Continued

| Panel B: Companies Whose Line of Business Broadens/Narrows (B/N) between the Business Plan and IPO But Not between the IPO and the Annual Report | | | |
|---|--|---|--|
| Company | Business Plan | IPO | Annual Report |
| 19 | ● Web-based enterprise application software | (N) Live business collaboration software and services | ● Application software and services for realtime enterprise collaboration |
| 20 | ● Experimentation platform for a wide range of biological analyses | (N) Tools for large-scale analysis of genetic variation and function | ● Tools for large-scale analysis of genetic variation and function |
| 21 | ● Implantable hearing devices | (B) Implantable and semi-implantable hearing devices | ● Implantable and semiimplantable hearing devices |
| 22 | ● Drug screening and discovery | (B) Drug candidate development | ● Drug candidate development |
| 23 | ● Drug target discovery | (B) Drug target discovery and small molecule drug development | ● Small molecule drug discovery and development |
| 24 | ● Products and services to accelerate drug discovery | (B) Creating drug candidates through innovations in chemistry | ● Creating small molecule drugs through the integration of chemistry, biology, and informatics |
| 25 | ● Internet communication services | (B) Internet system and network management | ● Internet infrastructure outsourcing |
| 26 | ● Products for the treatment of abnormal uterine bleeding | (B) Surgical systems for the diagnosis and treatment of gynecological disorders | |
| 27 | ● Internet-based micropayments system and incentive currency | (B) Internet-based direct marketing and advertising services combined with programs that reward consumers with cash | |
| 28 | ● Treatment for psychotic major depression | (B) Drug development for severe psychiatric and neurological diseases | |
| 29 | ● Discovery and development of drugs for memory-related disorders | (B) Development of drugs for a broad range of central nervous system disorders | |
| 30 | ● Development of treatments for pulmonary inflammatory diseases | (B) Discovery and development of treatments for allergies, infectious diseases, and chronic inflammatory diseases | |
| 31 | ● Internet marketing software | (B) Internet marketing and data aggregation software | |
| 32 | ● E-commerce solutions | (B) E-commerce and direct marketing services | |
| 33 | ● Wireless data communications | (N) Wireless communication and information systems for health information | |
| 34 | ● Combinatorial chemistry | (N) Computational drug discovery | |
| 35 | ● Software and services to industries transformed by human genome research | (N) Software products and services to accelerate drug discovery and development | |

(continued)

Table III—Continued

| Panel C: Companies Whose Line of Business Broadens/Narrows (B/N) between IPO and Annual Report But Not between Business Plan and IPO | | | |
|---|---|--|---|
| Company | Business Plan | IPO | Annual Report |
| 36 | • Diagnostic imaging and treatment of cancer and cardiovascular disease | • Diagnostic imaging and treatment of cancer, arteriosclerosis, and other diseases | (N) New drugs to treat cancer and arteriosclerosis |
| 37 | • Internet data delivery software | • Internet data delivery software | (B) E-business infrastructure software and services |
| 38 | • Microfluidics | • Microfluidics | (B) Novel assay chemistry solutions for drug discovery and development |
| 39 | • Upscale, casual ethnic restaurants | • Upscale, casual ethnic restaurants | (B) Upscale, casual ethnic restaurants, and casual ethnic diners |
| 40 | • Novel antimicrobial compounds | • New antibacterial and antifungal drugs | (N) Prevention of ventilator-associated pneumonia |
| Panel D: Companies Whose Line of Business Broadens/Narrows (B/N) between Both the Business Plan and IPO and the IPO and Annual Report | | | |
| 41 | • Website production software | (B) Web content management software | (B) Enterprise content management software |
| 42 | • Hotel reservation and commission collection system | (B) Transaction processing services for the worldwide hotel industry | (B) Hotel reservation and representation services for the global hotel industry |
| 43 | • Market research | (B) Market research and polling | (B) Market research and consulting |
| 44 | • Semiconductor laser diodes and related systems and subsystems | (B) Semiconductor optoelectronic integrated circuits and high power semiconductor lasers | (B) Semiconductor circuits and lasers; fiberoptic systems |
| 45 | • Local switched telecommunications services | (B) Competitive local exchange carrier | (B) National communications provider |
| 46 | • Basic local telephone services | (B) Facilities-based competitive local exchange carrier | (B) Facilities-based operator of a fiber optic communications infrastructure |
| 47 | • Customer interaction software | (B) E-business infrastructure software | (B) Enterprise software vendor |
| 48 | • Sterilization systems for medical instruments | (B) Sterile processing and infection prevention systems | (B) Infection prevention and related consumables, accessories, and services |
| 49 | • Disease gene discovery | (B) Gene and drug target discovery, database, and information technology products and services | (B) Population genetics company developing drugs and DNA-based diagnostics |

(continued)

Table III—Continued

| Panel E: Companies Whose Line of Business Changes (C) | | | |
|---|--------------------------|-------------------------------|-------------|
| Company | Business Plan | IPO | |
| 50 | • New computing platform | (C) Computer operating system | |
| Panel F: Percentage of Companies Whose Stated Lines of Business Change, Broaden, Narrow, or Stay the Same | | | |
| | BP to IPO | IPO to AR | BP/IM to AR |
| All Firms | | | |
| Percent whose line of business changes | 2 | 0 | 0 |
| Num. obs. | 50 | 32 | 32 |
| All firms | | | |
| Percent whose line of business: | | | |
| Stays about the same | 43 | 47 | 34 |
| Broadens | 45 | 47 | 53 |
| Narrows | 12 | 6 | 13 |
| Num. obs. | 49 | 32 | 32 |
| Biotechnology firms | | | |
| Percent whose line of business: | | | |
| Stays about the same | 29 | 55 | 18 |
| Broadens | 47 | 27 | 45 |
| Narrows | 24 | 18 | 36 |
| Num. obs. | 17 | 11 | 11 |
| Non-biotechnology firms | | | |
| Percent whose line of business: | | | |
| Stays about the same | 50 | 43 | 43 |
| Broadens | 44 | 57 | 57 |
| Narrows | 6 | 0 | 0 |
| Num. obs. | 32 | 21 | 21 |

At the end of the table, we report the percentage of companies that fall into each category. One notable result emerges. While we observe broadening or narrowing of the business, only 1 of the 50 firms in our sample changes its line of business. Company 50 undergoes the greatest change, moving from offering a new computing platform to a new operating system (although even in this case there is a general focus on personal computing). This result suggests that the initial business idea or line of business and the accompanying attributes of the business rarely change and therefore appear to be core to our sample firms. The result also indicates that it is unusual for management teams to make huge leaps from one market to another, counter to the view of some VCs (such as Arthur Rock quoted earlier).

For the most part, companies tend to broaden or at least not reduce their offerings within markets. For the 49 companies that did not change their line of business, only 12% narrowed their lines of business between the business plan and IPO, 6% narrowed between the IPO and annual report, and only 13% narrowed between the business plan and annual report. Over the corresponding periods, 43%, 47%, and 34% of the firms keep their offerings roughly the same, while 45%, 47%, and 53% broaden. Non-biotech firms differ from biotech firms in that non-biotech firms rarely narrow while biotech firms are more likely to narrow and less likely to broaden their line(s) of business.

Because the result that firms rarely change their initial business line is potentially controversial and subjective, we attempt to confirm it using a more objective source, the Corporate Technology Information Services and its predecessor, the CorpTech Directory of Technology Companies. The CorpTech Directory's business descriptions are consistent with ours (and thereby confirm our change/no change classifications) for all 22 of our companies that are included in the Directory. Further details of this analysis are omitted to conserve space, but are available on request.

C. Points of Differentiation

In Table IV, we classify how the sample firms differentiate themselves from their competitors over the sample period. We code this by reading each document to determine whether each point of differentiation we consider is explicitly mentioned as an actual, perceived, or expected source of competitive advantage. This information is usually within the first few pages of the "Business" section of the IPO prospectus and annual report and sometimes is within its own subsection. It often has its own section in the business plan.

By far the most important factor, cited by 100%, 98%, and 91% of companies, respectively, at the business plan, IPO, and annual report, is a belief that the company offers a unique product and/or technology. A small number of firms—8%, 14%, and 16%—cite the comprehensiveness of their products as differentiating at the three relevant dates. Customer service becomes an increasingly important source of differentiation over time, increasing from 10% to 18% to 28% as a differentiating factor at the business plan, IPO, and annual report, respectively. Alliances and partnerships are of modest importance throughout

Table IV
Points of Differentiation

Percentage of companies that explicitly mention the following characteristics as those that distinguish the company: unique product, service, or technology; comprehensive product offerings; strong customer service; alliances, partnerships, and other business relationships; management and/or employee expertise; strength of scientific advisors; and reputation. We also report the percentages of companies that do or do not change what they consider their distinguishing characteristics over time (e.g., the “yes to no” column under “BP to IPO” reflects the percentage of companies that report a given item as a distinguishing characteristic in the business plan but not at the IPO).

| | | | | BP to IPO | | | | IPO to AR | | | | BP to AR | | | |
|-------------------------------|-----|-----|-----|-----------|-----|----|-----|-----------|-----|----|-----|----------|-----|----|----|
| | BP | IPO | AR | Yes | Yes | No | No | Yes | Yes | No | No | Yes | Yes | No | No |
| | | | | to | to | to | to | to | to | to | to | to | to | to | to |
| | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | No |
| Unique product/ technology | 100 | 98 | 91 | 98 | 2 | 0 | 0 | 91 | 6 | 0 | 3 | 91 | 9 | 0 | 0 |
| Comprehensive products | 8 | 14 | 16 | 6 | 2 | 8 | 84 | 9 | 0 | 6 | 84 | 3 | 2 | 13 | 81 |
| Customer service | 10 | 18 | 28 | 10 | 0 | 8 | 82 | 16 | 3 | 13 | 69 | 6 | 0 | 23 | 72 |
| Alliances/partnerships | 14 | 12 | 9 | 8 | 6 | 4 | 82 | 3 | 13 | 6 | 78 | 6 | 9 | 3 | 81 |
| Expertise | 46 | 16 | 16 | 10 | 36 | 6 | 48 | 9 | 3 | 6 | 81 | 9 | 39 | 6 | 44 |
| Scientific advisors | 4 | 2 | 6 | 2 | 2 | 0 | 96 | 3 | 0 | 3 | 94 | 3 | 3 | 3 | 91 |
| Reputation | 6 | 8 | 9 | 4 | 2 | 4 | 90 | 9 | 0 | 0 | 91 | 3 | 3 | 6 | 88 |
| Num. obs. | 50 | 50 | 32 | 50 | 50 | 50 | 50 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 |

with 14%, 12%, and 9% of the firms referring to them at the business plan, IPO, and annual report.

At the business plan, 46% of companies cite the expertise of their management and other employees as distinguishing characteristics. This suggests that specific human capital plays an important role in the early life of many of these companies. The percentage of firms that cite expertise declines to 16% at the IPO and 16% at the annual report, and the decline relative to the business plan is statistically significant at the 1% level. This result is suggestive of an increasingly important role for nonhuman capital compared to specific human capital as companies mature. A small number of firms—4%, 2%, and 6%—also cite scientific advisors, another human capital-related resource—as important. Finally, a small number of firms—6%, 8%, and 10%—cite reputation as important. This may reflect human or nonhuman capital reputation.

We also find that self-reported company distinguishing characteristics are generally stable over time. The one exception is the large reduction in firms citing management or employee expertise as a differentiating characteristic from the business plan to the IPO.⁶

Overall, self-reported distinguishing characteristics suggest that firms differentiate themselves more by nonhuman characteristics than by specific human

⁶ The Table IV results are similar for biotech and non-biotech firms, so we do not report them separately.

capital, and that the difference increases over time. We mention two caveats in interpreting these results. First, it is possible that the business plans are overly positive because the entrepreneurs are marketing their companies to the VCs. While possible, we do not find any appreciable difference between business plans (prepared by the firms) and investment memos (prepared by the VCs) with respect to the variables we analyze. Second, it is possible that the descriptions in the public documents—IPO prospectuses and annual reports—differ from those in the business plan because of legal liability concerns rather than business reasons.

D. Assets and Technology

In Table V, we describe the types of assets owned by our firms. We note whether each firm mentions patents, physical assets, and/or nonpatented intellectual property as important or central to the business. While all firms have some physical assets, those physical assets do not necessarily differentiate the business. For example, specific physical assets are generally not critical to software firms. We collect this information from the business plan and from the intellectual property section (if there is one) of the S-1 and annual report. Physical assets are considered meaningful if they are specialized to the company's operations or business. We include patents that have been applied for but not yet issued as well as issued patents.

We classify the patents and physical assets as alienable assets because they can potentially be sold or assigned to other companies. We classify nonpatented intellectual property as some kind of process, technique, or knowledge that the company believes is an important asset, but is not patented or assignable. Such nonpatented intellectual property may or may not be tied to specific human capital.

A firm can have both patented and nonpatented intellectual property. In the table, when we refer to proprietary intellectual property, this includes both patented and nonpatented intellectual property. The distinction does not affect the percentages because all firms with patented intellectual property also claim to have nonpatented intellectual property.

Table V indicates that patents and physical assets become increasingly important from the business plan through the annual report. At the business plan, 42% of companies own or are the exclusive licensees of patents; at the IPO, 60%, and at the annual report, 66%. While patents and exclusive licenses are significantly more important for biotech firms, they also are important for nonretail, non-biotech firms. Physical assets are relatively unimportant for biotech firms and always important for retailers. Physical assets become increasingly important for nonretail, non-biotech firms, going from 11% to 26% to 50% from business plan through annual report. Combining patents and physical assets as alienable assets, we find that 56%, 78%, and 84% of the firms have such assets, respectively, at the business plan, IPO, and annual report.

Proprietary intellectual property is important for almost all of the nonretail firms—both biotech and non-biotech. Intellectual property, therefore, whether

Table V
Assets and Technology
Percentage of companies that have patented technology, physical assets, alienable assets (either physical assets or patents), and proprietary intellectual property.

| | All Firms | | | Biotechnology Firms | | | Non-biotechnology Firms | | | Retail Firms | | | Non-biotechnology/ Nonretail Firms | | |
|------------------|-----------|-----|----|---------------------|-----|-----|-------------------------|-----|----|--------------|-----|-----|------------------------------------|-----|----|
| | BP | IPO | AR | BP | IPO | AR | BP | IPO | AR | BP | IPO | AR | BP | IPO | AR |
| Patents | 42 | 60 | 66 | 65 | 88 | 91 | 30 | 45 | 52 | 0 | 17 | 25 | 37 | 52 | 59 |
| Physical assets | 20 | 28 | 44 | 6 | 6 | 9 | 27 | 39 | 62 | 100 | 100 | 100 | 11 | 26 | 53 |
| Alienable assets | 56 | 78 | 84 | 71 | 88 | 91 | 48 | 73 | 81 | 100 | 100 | 100 | 37 | 67 | 76 |
| Proprietary IP | 82 | 84 | 81 | 94 | 100 | 100 | 76 | 76 | 71 | 0 | 0 | 0 | 93 | 93 | 88 |
| Num. obs. | 50 | 50 | 32 | 17 | 17 | 11 | 33 | 33 | 21 | 6 | 6 | 4 | 27 | 27 | 17 |

patented or not, is substantially more important than physical assets. This implies that the nonretail companies in the sample are based largely on ideas or knowledge rather than physical capital. This is consistent with arguments in Zingales (2000) that firms are increasingly defined by intellectual rather than physical capital.

E. Growth Strategy

We also consider the elements and evolution of the companies' growth strategies. To conserve space, we do not report the results in a table. At all times, the firms are strongly oriented toward internal growth. The most cited strategies at the business plan, IPO, and annual report are to produce new or upgraded products (59%, 80%, and 69%, respectively) and to obtain additional customers through increased market penetration or market leadership (50%, 72%, and 56%, respectively). Firms also plan to expand geographically (22%, 44%, and 22%, respectively). All three types of internal growth peak at the IPO.

External growth through alliances and partnerships or through acquisitions becomes relatively more important over time. At the business plan, 28% and 2%, respectively, of the firms look for growth through alliances or acquisitions. By the third annual report, this increases to 50% and 31%, respectively.

F. Customers and Competitors

We also consider the evolution of customers and competitors. Again, to conserve space, we do not report the results in tables. Roughly 84% of the sample firms target businesses as customers while 16% target consumers as customers. These percentages are stable through all stages, consistent with the results on the stability of the business model in Table III.

We characterize the evolution of company customer bases as broadening, narrowing, or staying the same. An example of broadening would be a firm that targets its products to medium-sized businesses at the business plan, but to both medium-sized and large (Fortune 500) businesses at the IPO. The majority of our sample firms address a similar customer base over time, consistent again with the stability of their business lines. Roughly one-third of the firms broaden their customer bases. About 25% broaden from business plan to IPO and another 13% from IPO to annual report. A small fraction of the sample narrow their customer base. These results suggest that the dramatic revenue increases in Table II are primarily driven by selling more to an initial customer type either through increased market penetration or by selling additional products rather than by selling to new types of customers.

We also characterize the competition faced by our sample companies. The type of competition named remains fairly stable with 58% of the firms claiming to face similar competitive threats over all three stages. Roughly 40% see a broadening in the types of companies they compete with while no company sees a narrowing. Again, this result seems consistent with the stability of the businesses found in Table III.

G. Management

The previous tables focus largely on the nonhuman capital elements of the sample companies. We now turn our attention to the human capital elements of the firms.

Panel A of Table VI characterizes the top five executives described in the business plan, IPO prospectus, and annual report. At the time of the business plan, the management teams are incomplete, particularly the biotech firms: Seven of the companies (14%), five of which are in biotech, do not have a CEO; only 43% list a chief financial officer (CFO) as one of the top five executives; and only 35% list a sales or marketing executive (CMO). Consistent with the importance of technology, 77% of the firms list a Chief Scientist or Chief Technical Officer (CTO) or similar, as a top five executive.

By the IPO and annual report, CFOs have become increasingly important, with 80% and 81% of the companies listing a CFO as a top five executive. The importance of sales and marketing remains fairly constant over time with 35%, 38%, and 41% of companies having a VP of marketing or similar as a top five executive at the business plan, IPO, and annual report. The importance of a chief technology or science officer is stable at the IPO (at 77%), but declines substantially (to 46%) by the annual report.

Panel A also describes the involvement of founders. Founders are heavily involved at the time of the business plan. We can identify a founder as the CEO of 66% of our 50 companies, or 77% of the 43 companies with a CEO (33 companies). We also can identify a founder as being on the board in 92% of the companies in which the founder is not the CEO and we have board information. A founder is a top five manager or on the board of all 48 companies for which we have board and management data.

Involvement of founders declines steadily over time. By the IPO, only 58% of the firms have a founder CEO although 94% still have a founder as a top executive or a director. By the annual report, 38% of the firms have a founder CEO, while only 69% still have a founder as a top executive or director. This suggests that over time, founders move from operating positions to board positions to no involvement.

In Panel B, we address human capital stability in more detail. At the IPO, 72% of the CEOs were CEO at the business plan. We consider the CEO a new CEO if the firm did not have a CEO at the business plan. By the annual report, only 44% of the CEOs are the same as the CEO at the business plan. Given the 6-year period, this amounts to turnover of roughly 10% per year, a rate that is substantial but somewhat lower than CEO turnover in large public firms.⁷ The third row of Panel B reports whether the former CEOs remain with the firm in some capacity. At the IPO and annual report, respectively, only 29% and 13% of

⁷ Kaplan and Minton (2006) find CEO turnover for large U.S. companies of 16% per year over the period 1998 to 2005. The rates are not directly comparable because turnover increases with poor performance. Because they were able to go public, all of the companies in our sample performed well before the IPO and should have experienced lower turnover.

Table VI
Management

Percentage of companies whose top five managers include a chief executive officer (CEO), a chief technologist, scientist, or similar (CTO), a chief financial officer (CFO) or similar, and a marketing or sales director or similar (CMO) for 50 VC-financed companies that subsequently went public. The table also reports whether a founder is the CEO or, if not, a director; the extent of executive turnover; and information on the future of departing founders and executives.

| Panel A: Top 5 Managers | | | | | | | | | |
|--|-----------|-----------|----------|---------------------|-----------|----------|-------------------------|-----------|----------|
| | All Firms | | | Biotechnology Firms | | | Non-biotechnology Firms | | |
| | BP | IPO | AR | BP | IPO | AR | BP | IPO | AR |
| Has a CEO(%) | 86 | 100 | 100 | 71 | 100 | 100 | 94 | 100 | 100 |
| Num. obs. | 50 | 50 | 32 | 17 | 17 | 11 | 33 | 33 | 21 |
| A founder is CEO (%) | 66 | 58 | 38 | 53 | 53 | 36 | 73 | 61 | 38 |
| Num. obs. | 50 | 50 | 32 | 17 | 17 | 11 | 33 | 33 | 21 |
| CEO is a founder (%) | 77 | 58 | 38 | 75 | 53 | 36 | 77 | 61 | 38 |
| Num. obs. | 43 | 50 | 32 | 12 | 17 | 11 | 31 | 33 | 21 |
| A founder is a director if none is the CEO (%) | 92 | 71 | 50 | 83 | 75 | 71 | 100 | 69 | 38 |
| Num. obs. | 13 | 21 | 20 | 6 | 8 | 7 | 7 | 13 | 13 |
| A founder is a top 5 manager or a director | 100 | 94 | 69 | 100 | 94 | 82 | 100 | 94 | 62 |
| Num. obs. | 48 | 50 | 32 | 15 | 17 | 11 | 33 | 33 | 21 |
| Has a CFO or similar (%) | 43 | 80 | 81 | 35 | 71 | 100 | 47 | 85 | 71 |
| Num. obs. | 49 | 50 | 32 | 17 | 17 | 11 | 32 | 33 | 21 |
| Has a CMO or similar (%) | 35 | 38 | 41 | 12 | 12 | 9 | 47 | 52 | 57 |
| Num. obs. | 49 | 50 | 32 | 17 | 17 | 11 | 32 | 33 | 21 |
| Has a CTO or similar (nonretail) (%) | 77 | 77 | 46 | 76 | 82 | 55 | 77 | 74 | 41 |
| Num. obs. | 43 | 44 | 28 | 17 | 17 | 11 | 26 | 27 | 17 |
| Panel B: Executive Turnover | | | | | | | | | |
| | All Firms | | | Biotechnology Firms | | | Non-biotechnology Firms | | |
| | BP to IPO | IPO to AR | BP to AR | BP to IPO | IPO to AR | BP to AR | BP to IPO | IPO to AR | BP to AR |
| CEO remains the same (%) | 72 | 59 | 44 | 65 | 64 | 45 | 76 | 57 | 43 |
| Num. obs. | 50 | 32 | 32 | 17 | 11 | 11 | 33 | 21 | 21 |
| CEO remains the same (%) | 84 | 59 | 48 | 92 | 64 | 56 | 81 | 57 | 45 |
| Num. obs. | 43 | 32 | 29 | 12 | 11 | 9 | 31 | 21 | 20 |
| Former CEO still at co. (%) | 29 | 23 | 13 | 0 | 25 | 25 | 33 | 22 | 9 |
| Num. obs. | 7 | 13 | 15 | 1 | 4 | 4 | 6 | 9 | 11 |
| Next 4 top execs remaining (%) | 54 | 37 | 26 | 41 | 36 | 22 | 61 | 38 | 28 |
| Num. obs. | 50 | 32 | 32 | 17 | 11 | 11 | 33 | 21 | 21 |
| Former next 4 execs still at co. (%) | 26 | 8 | 6 | 29 | 18 | 3 | 24 | 2 | 8 |
| Num. obs. | 42 | 32 | 32 | 14 | 11 | 11 | 28 | 21 | 21 |

(continued)

Table VI—Continued

| Panel C: Departing Founders and Executives | | |
|---|-----------------------------|------------|
| | All Firms: Departed between | |
| | BP and IPO | IPO and AR |
| <i>Identified next job (%)</i> : | | |
| Founders | 50 | 48 |
| Num. obs. | 6 | 14 |
| Nonfounder CEOs | 0 | 33 |
| Num. obs. | 1 | 3 |
| Nonfounder other top 5 | 38 | 37 |
| Num. obs. | 35 | 29 |
| <i>Founded new company (%)</i> : | | |
| Founders | 17 | 11 |
| Num. obs. | 6 | 14 |
| Nonfounder CEOs | 0 | 0 |
| Num. obs. | 1 | 3 |
| Nonfounder other top 5 | 10 | 5 |
| Num. obs. | 35 | 29 |
| <i>Top executive of startup company (%)</i> : | | |
| Founders | 33 | 29 |
| Num. obs. | 6 | 14 |
| Nonfounder CEOs | 0 | 40 |
| Num. obs. | 1 | 2 |
| Nonfounder other top 5 | 34 | 33 |
| Num. obs. | 35 | 29 |

the former business plan CEOs remain, suggesting that former CEOs typically leave their firms.

We next look at whether the other top four executives at the business plan remain among the top four executives at the IPO and annual report. Turnover of the other top four executives is greater with only 54% remaining as top executives from business plan to IPO, and only 26% from the business plan to the annual report. When top four executives cease to be top four executives, the last row of Panel B indicates that most leave the firm, with only 26% remaining at the IPO and only 6% remaining at the annual report.⁸

Overall, turnover is substantial. From the business plan to the annual report, only 44% of the CEOs and 26% of the other top five executives remain the same.

The relatively high incidence of founder and early executive departures is interesting. It may indicate that those founders and executives are particularly good at starting companies and providing early critical resources. Once the nonhuman capital is sufficiently established, these founders may then go on to do the same thing at other companies. We ascertain the extent to which this is

⁸ Although not reported in the table, members of the board of directors also turn over. At the IPO, 71% of directors at the business plan are still directors; at the annual report, only 46% of the directors at the business plan remain.

true by considering what the departing founders and executives do after leaving the firm.

We search for evidence of subsequent job or founder history in another young firm for the departing executives in the CapitalIQ, VentureEconomics, and VentureOne databases. If the departing executives do not appear in these databases, it is unlikely that they went to another VC-backed or high-profile young firm. Panel C of Table VI reports our results. The first part shows that we can identify subsequent jobs or activities for roughly half of the departing founders and nonfounders. The second part indicates that relatively few of these executives subsequently start new firms. The third part reports the percentage of departing founders and nonfounder top executives who become top executives of other young companies. A larger fraction, roughly one-third, of founder and nonfounders go on to do so.

These results in Panel C indicate that relatively few departing founders and executives are founders of new firms. A greater (but minority) fraction repeat their experience working for young firms and potentially provide early critical resources. Although our results may understate the true percentages because not enough time has elapsed for some of the individuals to emerge in other firms, the results are largely consistent with Bengtsson (2006), who finds a similarly low incidence of repeat entrepreneurs in VC-backed firms.

H. Ownership

In the previous section, we describe the evolution of human capital. In this section, we consider the rewards and incentives of the human capital providers. Table VII summarizes company ownership. Ownership data at the business plan reflect the 32 firms for which we have ownership data at that time.

Panel A shows the evolution of ownership by the founders (taken as a group) and the CEO at the different company stages. We report ownership at the business plan immediately after the VC financing for which we have data. We report ownership both immediately before and immediately after the IPO.

Founder ownership declines sharply from a median of 31.7% at the business plan to 12.5% just before the IPO to 9.0% immediately following the IPO. Because founders typically are not allowed to sell any shares until 6 months after the IPO, this indicates that founders give up a large fraction of their ownership stakes to attract VC financing and/or outside management talent. Founder ownership continues to decline after the IPO to a median 3.2% at the annual report. This decline reflects founder stock sales as well as issuance of additional stock.

CEO ownership also declines as the firm ages: The median CEO owns 15.8% of the company at the business plan, 7.0% pre-IPO, 5.4% post-IPO, and 3.2% at the annual report.

The six CEOs who are not founders own a median 5.5% of the company at the time of the business plan. The 21 nonfounder CEOs at the IPO own a median of 4.2% the company just before the IPO. One can interpret these results as

| | BP to IPO | IPO to AR | BP to AR | BP to IPO | IPO to AR | BP to AR | BP to IPO | IPO to AR | BP to AR | BP to IPO | Post-IPO | IPO to AR | BP to AR | BP to IPO | Post-IPO | IPO to AR | BP to AR |
|----------------------------------|-----------|-----------|----------|-----------|-----------|----------|-----------|-----------|----------|-----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|
| CEO percentage change | | | | | | | | | | | | | | | | | |
| Median | -38 | -56 | -79 | -19 | -36 | -72.2 | -38 | -64 | -81 | | | | | | | | |
| Average | -31 | -56 | -71 | -15 | -48 | -62.9 | -38 | -60 | -75 | | | | | | | | |
| SD | 37 | 23 | 24 | 45 | 27 | 32.8 | 32 | 20 | 19 | | | | | | | | |
| Num. obs. | 27 | 30 | 20 | 8 | 10 | 7 | 19 | 20 | 13 | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | BP | Pre-IPO | Post-IPO | AR | BP | BP to AR | BP to IPO | Pre-IPO | Post-IPO | IPO to AR | BP to AR | BP to IPO | Pre-IPO | Post-IPO | IPO to AR | BP to AR | BP to IPO |
| Nonfounder CEO (%) | | | | | | | | | | | | | | | | | |
| Median | 5.5 | 4.2 | 3.0 | 2.0 | 4.2 | 1.2 | 4.2 | 3.6 | 2.8 | 2.8 | 1.2 | 6.5 | 6.6 | 5.0 | 5.0 | 2.1 | 2.1 |
| Average | 5.1 | 5.0 | 4.0 | 2.1 | 4.2 | 1.6 | 4.2 | 3.5 | 2.7 | 2.7 | 1.6 | 5.5 | 6.0 | 4.8 | 4.8 | 2.3 | 2.3 |
| SD | 2.0 | 3.1 | 2.5 | 1.4 | 0.7 | 1.3 | 0.7 | 1.2 | 0.9 | 0.9 | 1.3 | 2.4 | 3.5 | 2.9 | 2.9 | 1.4 | 1.4 |
| Num. obs. | 6 | 21 | 21 | 18 | 2 | 6 | 2 | 8 | 8 | 8 | 6 | 4 | 13 | 13 | 13 | 12 | 12 |
| | | | | | | | | | | | | | | | | | |
| | BP to IPO | IPO to AR | BP to AR | BP to IPO | IPO to AR | BP to AR | BP to IPO | Pre-IPO | Post-IPO | IPO to AR | BP to AR | BP to IPO | IPO to AR | BP to AR | BP to IPO | Post-IPO | BP to AR |
| Nonfounder CEO percentage change | | | | | | | | | | | | | | | | | |
| Median | -30 | -48 | -71 | -20 | -33 | -86 | -30 | | | | | | | | | | |
| Average | -23 | -55 | -75 | -20 | -45 | -86 | -24 | | | | | | | | | | |
| SD | 27 | 26 | 18 | 50 | 37 | 20 | 20 | | | | | | | | | | |
| Num. obs. | 6 | 12 | 4 | 2 | 4 | 2 | 4 | | | | | | | | | | |

(continued)

Table VII—Continued

| Panel B: Division of Ownership Pre-IPO (%) | | | | | | | | | | | |
|--|----------|-------------------|---------------------------------------|------------|----------|--------|--|------|--------------------------|--------------------------------------|-----------------------------|
| | Founders | Nonfounder CEO | Nonfounder Other Top 5 Managers | Nonfounder | | | All Executive Officers and Directors | | Founders + Top 5 Mgrs | Founder Not a Mgr.: Top 5 Mgrs | Founder \$ Pre-IPO (\$M) |
| | | | | VCs | Partners | Others | | | | | |
| All firms | | | | | | | | | | | |
| Median | 12.5 | 4.2 | 2.1 | 53.0 | 0.0 | 22.8 | 53.2 | 16.4 | 6.2 | 19.3 | |
| Average | 14.7 | 5.0 | 3.4 | 53.1 | 3.7 | 23.1 | 55.8 | 20.3 | 6.0 | 103.2 | |
| SD | 12.3 | 3.1 | 4.4 | 16.9 | 8.2 | 12.8 | 22.3 | 12.9 | 3.4 | 394.3 | |
| Num. obs. | 50 | 21 | 50 | 50 | 50 | 50 | 50 | 50 | 6 | 50 | |
| Biotechnology firms | | | | | | | | | | | |
| Median | 4.3 | 3.6 | 1.6 | 52.6 | 0.0 | 28.0 | 48.3 | 8.0 | 6.1 | 11.7 | |
| Average | 11.4 | 3.5 | 2.2 | 51.4 | 4.7 | 28.8 | 49.7 | 15.2 | 6.1 | 29.7 | |
| SD | 12.7 | 1.2 | 1.7 | 16.4 | 7.8 | 12.7 | 17.2 | 12.5 | 3.6 | 39.2 | |
| Num. obs. | 17 | 8 | 17 | 17 | 17 | 17 | 17 | 17 | 2 | 17 | |
| Non-biotechnology firms | | | | | | | | | | | |
| Median | 13.2 | 6.6 | 2.7 | 55.7 | 0.0 | 20.1 | 56.6 | 19.6 | 6.2 | 27.2 | |
| Average | 16.4 | 6.0 | 4.1 | 54.0 | 3.2 | 20.2 | 59.0 | 22.9 | 6.0 | 141.0 | |
| SD | 11.9 | 3.5 | 5.1 | 17.3 | 845 | 12.1 | 24.2 | 12.5 | 3.9 | 482.7 | |
| Num. obs. | 33 | 13 | 33 | 33 | 33 | 33 | 33 | 33 | 4 | 33 | |

(continued)

Table VII—Continued

| Panel C: Founder and Executive Shares of Pre-IPO Net Value (%) | | | | | |
|--|----------|-------------------|---------------------------------------|--------------------------|--------------------------------------|
| | Founders | Nonfounder CEO | Nonfounder Other Top 5 Managers | Founders + Top 5 Mgrs | Founder Not a Mgr.: Top 5 Mgrs |
| All firms | | | | | |
| Median | 14.8 | 5.3 | 3.0 | 20.6 | 9.8 |
| Average | 18.6 | 6.6 | 4.3 | 25.8 | 9.2 |
| SD | 16.1 | 3.9 | 4.9 | 16.9 | 4.4 |
| Num. obs. | 49 | 21 | 49 | 49 | 6 |
| Biotechnology firms | | | | | |
| Median | 8.7 | 4.8 | 2.9 | 15.5 | 11.7 |
| Average | 14.6 | 5.3 | 3.2 | 20.4 | 11.7 |
| SD | 14.6 | 2.3 | 2.4 | 13.8 | 3.5 |
| Num. obs. | 16 | 8 | 16 | 16 | 2 |
| Non-biotechnology firms | | | | | |
| Median | 17.1 | 7.8 | 3.0 | 21.2 | 8.1 |
| Average | 20.6 | 7.4 | 4.8 | 28.4 | 7.9 |
| SD | 16.6 | 4.5 | 5.6 | 17.8 | 4.6 |
| Num. obs. | 33 | 13 | 33 | 33 | 4 |

indicating that VC-financed companies allocate roughly 5% of the company's equity to attract and provide incentives to an outside CEO.

Panel A also breaks out the firms by biotech and non-biotech. Biotech and non-biotech founders own roughly the same percentage at the business plan. At the IPO, however, biotech founders own significantly less than non-biotech founders. Biotech CEOs own significantly less than non-biotech CEOs both at the business plan and the IPO. These results suggest that specific human capital is less important in biotech firms. There are at least two possible explanations. First, it may be easier to patent or assign the intellectual property of these firms. Second, these firms may require more financial capital.

The CEOs in our sample own an average of 9.8% of the pre-IPO (7.5% of the post-IPO) equity of the sample firms. This is less than the 19.1% pre-IPO (14.0% post-IPO) reported in Baker and Gompers (1999) for 433 VC-backed firms that went public between 1978 and 1987. Part of the reason for the difference is that our sample includes relatively more biotech firms, which have relatively fewer founder CEOs. However, even for non-biotech firms, the CEO only owns an average of 10.6% pre-IPO (8.2% post-IPO). Contrary to the prediction or argument in Zingales (2000), specific human capital in our sample of "new" firms captures less, not more, of the rents than the specific human capital in the earlier sample.

Panel B of Table VII reports how firm ownership is divided immediately before the IPO. VCs own 53.0% of the median company at the IPO. Founders retain a median 12.5%. Nonfounder CEOs own a median 4.2%; nonfounder managers other than the CEO collectively own a median 2.1%. Business partners, such as original parent companies and strategic alliance partners, own none of the median firm and 3.7% of the average firm. Others, which include non-VC investors and nonfounder employees, collectively own a median of 22.8%. Panel B also shows that the founders and the management team own significantly smaller equity positions in biotech firms than in non-biotech firms.

The last column of Panel B calculates the dollar value of the founders' equity stakes using the first trading day's closing price, finding a median value of \$19.3 million and an average of \$103.2 million.

Using the ownership stakes just before the IPO in Panel B, we can obtain three estimates of the percentage of value that founders retain for their specific human capital, as opposed to ownership that is related to ongoing incentives. The first is the founders' average ownership percentage of 14.7% (median 12.5%). This is an upper bound because some of this ownership is present for incentive purposes and would be given to nonfounding managers. It is also an upper bound because the founders may have contributed nonhuman capital.

The second estimate begins with the ownership of founders and the top five managers at an average of 20.3% (median 16.4%). In the six cases in which there are no founders among the top five managers, their average ownership is 6.0% (median of 6.2%). The 6.0% stake provides an estimate of how much equity is

required to attract a replacement management team. The 14.3% difference provides another upper bound estimate of the value of the specific human capital that the founders provided.

A third measure calculates the equity needed for ongoing incentives by adding the average ownership of nonfounder CEOs, 5.0%, to that of other nonfounder, non-CEO top managers, 3.4%, for a total of 8.4%. Subtracting this 8.4% from the ownership of founders and top five managers (20.3%) yields an estimate of 11.9% as the value of the specific human capital provided by the founders.

In an unreported regression, we regress pre-IPO founder ownership on a constant and a dummy variable equal to one if a founder is CEO at the IPO. The coefficient on the dummy variable provides an estimate of the ownership needed for incentive purposes for the CEO. The coefficient on the dummy variable likely overstates the true value needed for incentive purposes because if the founder is still CEO, the CEO's value may be unusually high and the ownership may include some compensation for specific human capital. The constant term can therefore be considered a lower bound on compensation for the idea or specific human capital. In this regression, the constant term is 10.8%.

In estimating the value accruing to specific human capital, we use the total market value of the firm's equity. This overstates the value created by the firm because it ignores the financial capital invested in the company, particularly by the VCs. Panel C of Table VII presents an analysis similar to that in Panel B for pre-IPO ownership, except that it measures the founders' share of total value created before the IPO. We measure the total value created before the IPO as the value of the pre-IPO shares outstanding at the post-IPO stock price less the amount of outside financing raised by the firm before the IPO. The analysis assumes that the founders did not invest any money to obtain their shares and do not need to invest any money to exercise any options they may have. As a result, the analysis in Panel C overstates the fraction of value accruing to founders (while Panel B understates the fraction). One firm did not create any value—pre-IPO outside capital exceeded the value of the pre-IPO shares at the IPO price. We exclude this firm from the analysis.

Panel C indicates that the founders receive an average of 19.6% (median of 14.8%) of the value created. Again, this is an upper bound because some of this ownership is present for incentive purposes. The other two methods of calculating the value founders retain for nonincentive purposes generate estimates of 16.6% and 14.9%.

Overall, the calculations in Panels B and C indicate a range of 10.8% to 19.6% as the value of the firm that founders retain for their ideas or initial contributions that is not related to ongoing incentives.

III. Cross-sectional Analysis

In this section, we describe the results of two cross-sectional analyses.

First, we consider the relation of human capital turnover to the nature of a firm's assets. One can interpret the theories of the firm considered above as

Table VIII
Determinants of Founder Remaining CEO at the IPO or Annual Report

Probit regressions of the likelihood of the founder remaining CEO of the company either at IPO or at the annual report closest to 3 years after going public. The independent variables are as follows. "Alienable assets at BP" is a dummy variable taking the value of one if the firm has either significant physical assets or patents at the time of the business plan (BP). "Physical assets at BP" is a dummy variable taking the value of one if the firm has significant physical assets at the time of the BP. "Patents at BP" is a dummy variable taking the value of one if the firm has patents or patent applications at the time of the BP. "Non-pat. IP at BP" is a dummy variable taking the value of one if the firm has no patents or patent applications but has proprietary intellectual property at the time of BP. "Age (months) at BP" is the age of the firm at the time of the BP in months. "Fdr ownership at BP" is the founder's ownership stake in percentage at the time of the BP. Reported coefficients are marginal effects of independent variables. Heteroskedasticity-robust standard errors are in parentheses. *, **, and *** indicate that the coefficients are statistically significantly different from zero at the 10%, 5%, and 1% level, respectively.

| Panel A: Founder Remains CEO at the IPO | | | | | | | |
|---|--------|-----------|--------|------------|--------|-----------|-----------------|
| Alienable assets at BP | -0.232 | (0.132)* | -0.422 | (0.189)** | | | -0.351 (0.194)* |
| Physical assets at BP | | | | | -0.498 | (0.347) | |
| Patents at BP | | | | | -0.707 | (0.205)** | |
| Non-pat. IP at BP | | | -0.246 | (0.234) | -0.528 | (0.270)* | -0.130 (0.247) |
| Age (months) at BP | 0.002 | (0.002) | 0.002 | (0.002) | 0.004 | (0.003) | 0.001 (0.001) |
| Fdr ownership at BP | | | | | | | 0.004 (0.004) |
| Num. obs. | 50 | | 50 | | 50 | | 32 |
| Pseudo R^2 | 0.05 | | 0.06 | | 0.14 | | 0.12 |
| Panel B: Founder Remains CEO at the Annual Report | | | | | | | |
| Alienable assets at BP | -0.440 | (0.194)** | -0.588 | (0.256)** | | | -0.466 (0.309) |
| Physical assets at BP | | | | | -0.300 | (0.326) | |
| Patents at BP | | | | | -0.567 | (0.198)** | |
| Non-pat. IP at BP | | | -0.202 | (0.267) | -0.233 | (0.266) | -0.225 (0.314) |
| Age (months) at BP | 0.005 | (0.003)** | 0.006 | (0.003)*** | 0.006 | (0.004)* | 0.005 (0.003) |
| Fdr ownership at BP | | | | | | | 0.008 (0.005)* |
| Num. obs. | 32 | | 32 | | 32 | | 24 |
| Pseudo R^2 | 0.20 | | 0.21 | | 0.25 | | 0.26 |

predicting that founders and specific human capital will be less important or critical when a firm has built up its nonhuman capital. In Table VIII, we test this by estimating the determinants of the likelihood of a founder remaining CEO after the business plan.

In Panel A, the dependent variable equals one if a founder is CEO at the IPO; in Panel B, the dependent variable equals one if a founder is CEO at the annual report (we obtain qualitatively similar results if we use CEO turnover, regardless of whether the CEO was a founder). As independent variables, we use the results in Table V to create three dummy variables that equal one if, respectively, alienable assets, physical assets, or patents or patent applications are cited as significant assets at the business

plan. We also create a dummy variable equal to one if the firm has no patents or patent applications and nonpatented intellectual property (IP) is significant.

The regressions show a clear pattern. Firms with more alienable assets at the time of the business plan subsequently experience more founder turnover. All of the relevant coefficients are negative; the majority, statistically significant. This suggests that specific human capital is more critical before alienable assets have formed, consistent with both the critical resource and the Hart–Moore–Holmström theories. The strong cross-sectional relations also corroborate our interpretation of the descriptive data.

The presence of nonpatentable IP at the business plan is also negatively related to the likelihood that the founder will remain as CEO later on. One interpretation of this result is that even unpatented know-how may be part of alienable organizational capital rather than tied to a specific founder.

Two other variables are also significant although they are more difficult to interpret. The age of the firm at the business plan tends to be positively related to the likelihood of retaining the founder as CEO. The founder ownership stake at the business plan also is positively related to retaining the founder as CEO. Although this is an endogenous variable, it can be thought of as a proxy for the bargaining power of the founder, which in turn should be correlated with the value of the founder's specific human capital.^{9,10}

Our second cross-sectional analysis considers the determinants of pre-IPO founder ownership. The theories of the firm imply that founders' bargaining power should decrease in the alienability of a firm's assets. To the extent that founder ownership measures bargaining power and rents, founder ownership should decrease in alienability (tangibility and patents). The dependent variable is pre-IPO founder ownership. The independent variables are the asset dummies used in Table VIII and firm age at the business plan. Unlike the results in Table VIII, none of the asset dummy variables is significant in the regressions.¹¹ While the results may reflect too few observations or that there are other determinants of founder ownership, they do not provide support for the hold-up theories.

⁹ Alternatively, it could be a proxy for the control rights that the founder retains in the venture. However, in regressions using a more direct measure of control, the fraction of founder board seats, the variable is not significant.

¹⁰ The results in Table VIII are qualitatively similar and often statistically stronger if we do not include patent applications in our patent dummy variable. In one specification, we control for the founder's ownership stake at the time of the business plan. In unreported regressions, we include several other control variables: biotech and retail industry dummies; a dummy variable taking the value of one if the firm's line of business did not narrow, broaden, or change between the business plan and the IPO or annual report; and the number of months between business plan and IPO or annual report. All of these specifications yield qualitatively similar results.

¹¹ Because none of the variables is significant and to conserve space, we do not report these regressions in a table.

IV. Robustness: Nonfinancial Start-Up IPOs in 2004

As we mention earlier, there are several reasons that our main sample may be special in some way. All the firms are VC-backed by VCs with whom we have a relationship and most went public during the tech boom of the late 1990s. In this section we consider the robustness of our main sample results by repeating the analyses of business idea, top management, and ownership structure for all “start-up” IPOs in 2004.

A. Sample

Panel A of Table IX describes how we obtain the sample of 2004 start-up IPOs. We begin with all 306 IPOs in 2004 listed in the Securities Data Corporation database. We eliminate 200 of these for the following reasons: 4 companies are already listed on a foreign exchange at the time of their U.S. IPO and are not “true” IPOs; 122 are REITs, closed-end funds, trusts, or other purely financial companies; 21 are holding companies, some of which were formed solely to acquire other companies; 1 was formed as a joint venture; 1 is controlled by a foreign government; 21 are spinoffs of existing companies; and 30 are IPOs of companies that had undergone a buyout at some point in their histories. The latter two groups—spinoffs and reverse buyouts—are excluded because they are not directly comparable to start-ups and it is very difficult to follow their histories from founding. The omissions leave 106 nonfinancial start-up IPOs. Interestingly, 88, or 83%, are VC-backed, indicating that a very large fraction of start-up IPOs are VC-backed.

The median time from founding to IPO for the 2004 sample is 7 years, longer than the 5 years for our main sample. This implies that the typical 2004 company existed before the tech bust and then survived it.

Panel B of Table IX presents financial information on the entire sample and separately for VC- and non-VC-backed firms. The financial measures are economically similar for VC- and non-VC-backed firms although non-VC-backed firms have statistically significantly higher EBIT and lower market capitalization. Compared to our main sample of 50 VC-backed firms, both sets of firms in the 2004 IPO sample have greater revenues, more book assets, and greater (i.e., less negative) EBIT. This is consistent with the posttechnology bust 2004 sample representing a set of companies with different characteristics from our prebust sample. The equity market capitalizations and the median number of employees are similar in magnitude.

B. Line-of-Business Changes

For the 106 start-up IPOs from 2004, we identify whether they changed their original line of business at some point in their histories. We do so by reading the company business descriptions and histories provided in their S-1 (IPO) filings. We then compare the descriptions at the IPO to earlier information gleaned from Lexis Nexis, Venture Source, Google, the CorpTech Directories, and the companies’ web sites. The earlier information considers any

Table IX
Sample Selection, Financial Data, and Line-of-Business Changes for
106 Nonfinancial Start-Up IPOs in 2004

Information on the construction of the sample; revenue, EBIT, assets, number of employees, and equity market capitalization at the IPO; and line-of-business changes for 106 nonfinancial start-up IPOs in 2004.

| Panel A: Sample Selection | | | | | |
|---|----------|-----------|---------------|-----------|-------------------|
| Total number of IPOs in SDC = 306: | | | | | |
| 4 companies already listed on a foreign exchange | | | | | |
| 122 REITs, closed-end funds, trusts, other financials | | | | | |
| 21 holding companies (including companies formed solely to acquire other companies) | | | | | |
| 1 company formed as a joint venture | | | | | |
| 1 company controlled by foreign government | | | | | |
| 21 spinoffs (some of which had buyouts in their histories) | | | | | |
| 30 buyouts | | | | | |
| Total 106 IPOs of nonfinancial start-ups. | | | | | |
| VC funded = 88 (83%) | | | | | |
| Non-VC funded = 18 (17%) | | | | | |
| Median 7 years from founding to IPO | | | | | |
| Panel B: Financial Data at IPO (\$ Million) | | | | | |
| | Revenue | EBIT | Assets | Employees | Equity Market Cap |
| All firms | | | | | |
| Median | 25.1 | -1.7 | 34.4 | 137 | 261 |
| Ave. | 121.6 | -0.5 | 122.5 | 928 | 705 |
| Num. obs. | 106 | 106 | 106 | 106 | 106 |
| VC-backed firms | | | | | |
| Median | 25.1 | -3.1 | 35.2 | 145 | 300 |
| Ave. | 95.3 | 0.5 | 114.9 | 728 | 784 |
| Num. obs. | 88 | 88 | 88 | 88 | 88 |
| Non-VC-backed firms | | | | | |
| Median | 27.6 | 1.3 | 23.2 | 72 | 190 |
| Ave. | 250.2 | -5.0 | 159.8 | 1,901 | 320 |
| Num. obs. | 18 | 18 | 18 | 18 | 18 |
| Panel C: Line-of-Business Changes in IPOs of Nonfinancial Start-Ups | | | | | |
| | All IPOs | VC-Backed | Non-VC Backed | | |
| Number of line-of-business changes | 8 | 7 | 1 | | |
| Percentage of line-of-business changes | 7.5% | 8.0% | 5.6% | | |
| Num. obs. | 106 | 88 | 18 | | |
| Median time from change to IPO | 7 years | | | | |

changes from the company's birth to the IPO. When we apply this methodology to our main sample of 50 VC-backed firms, we are able to identify the one (and only the one) change we can identify using our more detailed business plan documents.

We report the results of this methodology in Panel C of Table IX. We find that 8 (7.5%) of the 106 firms changed their original line of business or business idea. While greater than the 2% in our main sample, 7.5% seems small in an absolute sense. Furthermore, for the eight companies that change, the median date of the change is 7 years before the IPO. When we distinguish between VC-backed and non-VC-backed IPOs, we find qualitatively and statistically similar results for both groups: 7 of the 88 VC-backed firms (8.0%) and 1 of the 18 non-VC-backed firms (5.6%) changes their lines of business.

The results in Table IX are consistent with the results in our main sample concerning the stability of business lines. This suggests that the business line results generalize beyond the specific time period of the main sample and beyond the universe of VC-backed firms.

C. Management

Panel A of Table X provides statistics on the management teams at the IPO of the 106 nonfinancial start-up firms that went public in 2004. A founder is the CEO in 54 companies, or 51%. This figure is similar to the 58% for our main sample. While the point estimates suggest that non-VC-backed firms are more likely to have a founder CEO than VC-backed firms (61% vs. 49%), the difference is not statistically significant. Clearly, founder departures over time are not unique to VC-backed firms.

A founder is CEO or a director in 78% of firms, and is an employee or a director in 84%. Both figures are virtually identical across the VC-backed and non-VC-backed subsamples. The corresponding figures for our main sample (from Table VI) are 88% and 94%.

Again, the turnover results are consistent with the results in our main sample that specific human capital is less stable than the business idea. These 2004 sample results also suggest that the main sample results generalize beyond the specific time period of the main sample and beyond just VC-backed firms.

D. Ownership

Panel B of Table X shows statistics on the firms' ownership structure just before their IPOs. In general, the ownership percentages for VC-backed firms in 2004 IPOs are similar to those for the VC-backed firms in our main sample. While the median founder ownership is 10.0% and the average is 20.5%, there is a large and statistically significant difference between VC-backed (median of 8% and average of 15.9%) and non-VC-backed firms (median of 44.4% and average of 42.6%). The VC-backed ownership numbers are similar in magnitude to those for our main sample of 50 companies (median of 12.5% and average of 14.7%).

Panel B also reports that the CEOs of VC-backed firms own a median 5.7% and average 11.8% of their firms' equity. These figures are similar in magnitude to the CEO ownership in our main sample of 50 firms (median 7.0% and average 9.8%). The 52 nonfounder CEOs own a median 3.5% and average 6.1%. The

Table X
Management and Ownership for 106 Nonfinancial Start-Up IPOs in 2004

Summary statistics on the management teams and ownership structure of 106 nonfinancial start-up IPOs in 2004 at the IPO.

| Panel A: Human Capital | | | | | | | | | | | |
|---|-----|-----|-----|--|--|--|--|--|--|--|--|
| Overall | | | | | | | | | | | |
| VC-Backed | | | | | | | | | | | |
| Not VC-Backed | | | | | | | | | | | |
| A founder is CEO | 51% | 49% | 61% | | | | | | | | |
| A founder is CEO or is a director | 78% | 78% | 78% | | | | | | | | |
| A founder is employed or a director | 84% | 84% | 83% | | | | | | | | |
| Has a CFO as a top 5 manager | 90% | 88% | 94% | | | | | | | | |
| Has a CTO or similar as a top 5 manager | 64% | 67% | 47% | | | | | | | | |
| Has a CMO or similar as a top 5 manager | 41% | 44% | 22% | | | | | | | | |
| Obs. (other than CTO) | 106 | 88 | 16 | | | | | | | | |
| Obs. (CTO. excludes retail) | 99 | 82 | 17 | | | | | | | | |

| Panel B: Division of Ownership Pre-IPO (%) | | | | | | | | | | | |
|---|----------|----------------|---------------------------------|------|----------|--------|-----------|------------|------------|------|---------|
| All Executive Officers and Founders + Founder Not | | | | | | | | | | | |
| a Mgr: | | | | | | | | | | | |
| Top 5 Mgrs | | | | | | | | | | | |
| Top 5 Mgrs | | | | | | | | | | | |
| CEOs | | | | | | | | | | | |
| Pre-IPO | | | | | | | | | | | |
| All firms | Founders | Nonfounder CEO | Nonfounder Other Top 5 Managers | VCs | Partners | Others | Directors | Top 5 Mgrs | Top 5 Mgrs | CEOs | Pre-IPO |
| Median | 10.0 | 3.5 | 2.0 | 43.5 | 0.0 | 22.8 | 59.3 | 15.9 | 6.8 | 6.2 | 17.3 |
| Average | 20.5 | 6.1 | 3.0 | 41.7 | 4.2 | 27.7 | 57.6 | 26.5 | 9.7 | 16.1 | 160.9 |
| SD | 24.3 | 7.4 | 4.7 | 29.7 | 11.6 | 23.2 | 23.7 | 24.8 | 10.5 | 21.9 | 813.8 |
| Numer. obs. | 106 | 52 | 106 | 106 | 106 | 106 | 104 | 106 | 34 | 106 | 106 |
| VC-backed firms | Founders | Nonfounder CEO | Nonfounder Other Top 5 Managers | VCs | Partners | Others | Directors | Top 5 Mgrs | Top 5 Mgrs | CEOs | Pre-IPO |
| Median | 8.0 | 3.4 | 2.1 | 51.1 | 0.0 | 20.3 | 57.7 | 14.7 | 6.0 | 5.7 | 19.5 |
| Average | 15.9 | 5.7 | 2.6 | 50.2 | 3.8 | 24.5 | 57.6 | 21.4 | 9.0 | 11.8 | 164.6 |
| SD | 19.0 | 6.3 | 2.7 | 25.1 | 9.4 | 18.9 | 21.9 | 19.3 | 8.9 | 15.4 | 884.3 |
| Numer. obs. | 88 | 45 | 88 | 88 | 88 | 88 | 86 | 88 | 28 | 88 | 88 |
| Non-VC-backed firms | Founders | Nonfounder CEO | Nonfounder Other Top 5 Managers | VCs | Partners | Others | Directors | Top 5 Mgrs | Top 5 Mgrs | CEOs | Pre-IPO |
| Median | 44.4 | 4.6 | 1.2 | 0 | 0.0 | 43.2 | 62.6 | 53.2 | 7.7 | 30.5 | 13.4 |
| Average | 42.6 | 8.9 | 5.1 | 0 | 6.0 | 42.9 | 57.8 | 51.2 | 12.9 | 36.9 | 142.9 |
| SD | 34.1 | 12.7 | 9.5 | | 19.1 | 34.6 | 31.5 | 33.7 | 16.9 | 34.7 | 296.7 |
| Numer. obs. | 18 | 7 | 18 | 18 | 18 | 18 | 18 | 18 | 6 | 18 | 18 |

45 nonfounder CEOs of VC-backed firms own a median of 3.4% and average of 5.7%. These ownership percentages are similar to the median 4.2% and average 5.0% of nonfounder CEOs in our main sample.

Furthermore, as in our main sample, the CEO and founder ownership percentages are certainly not higher than the ownership percentages reported in Baker and Gompers (1999) for VC-backed IPOs in the 1980s. Again, these results do not support the notion that CEO human capital has become more important to “new” firms.

V. Summary and Discussion

In this paper, we study the evolution of firm characteristics from early business plan to initial public offering to public company for 50 VC-financed companies. We repeat some of the analyses for all “start-up” IPOs in 2004 and obtain qualitatively similar results. This exercise has three goals: to provide a systematic description of the early life and evolution of an important sample of firms, to inform an ongoing debate among venture capitalists (VCs) concerning the relative importance of the business and management to a company’s success, and to inform existing theories of the firm.

At the same time that the companies in our samples grow dramatically, their core business lines and ideas remain remarkably stable. Within core businesses, firm activities tend to stay the same or broaden over time. The firms also sell to similar customers and compete against similar competitors in the three stages of the life cycle we examine. Almost uniformly, firms claim that they are differentiated by a unique product, technology, or service at all three stages. The points of differentiation also tend to be stable over time. Firms stress the importance of proprietary IP, patents, and physical assets in all three stages. Alienable assets—patents and physical assets—become increasingly important over time.

While the business ideas, points of differentiation, alienable assets, and customers remain relatively constant, the stated importance of expertise declines and the firms’ human capital changes substantially.

Our results inform the VC debate about the relative importance of the business/horse and the management team/jockey. The results call into question the claim of Arthur Rock that a great management team can find a good opportunity even if they have to make a huge leap from the market they currently occupy (in Quindlen (2000)). The results for the main sample and the 2004 IPO sample indicate that firms that go public rarely change or make a huge leap from their initial business idea or line of business. An initial strong business, therefore, may not be sufficient, but appears to be necessary for a company to succeed. On the other hand, it is common for firms to replace their founders and initial managers and still be able to go public, suggesting that VCs are regularly able to find management replacements or improvements for good businesses. We interpret our results as indicating that on the margin, VCs should spend more time on due diligence of the business rather than management.

Some readers might question our conclusions with the example of someone like Steve Jobs, who is identified with Apple's success. While he is a possible exception, it also is true that Apple is still in the same business it was when it started, but has obviously broadened. Apple is still built around technology and firm expertise that dates from Apple's early days. And Apple survived Jobs's first departure. In our view, it also is easier to point to well-known firms that fit our results, that is, are driven by their nonhuman assets, than it is to point out firms that may be dependent on a specific person like Steve Jobs. For example, eBay, Cisco, and, arguably, Google, are in the same businesses they started in and have been led by nonfounders since early on. Once the founders established the nonhuman assets, the founders were expendable and competent replacements drove the companies to success using those nonhuman assets. We should add that this paper is useful precisely because it does not rely on anecdotes and a few examples, but instead creates the largest extant sample to address these issues.

We believe that our results also are useful in understanding theories of the firm. Consistent with the Hart–Moore–Holmström view that a firm must be organized around nonhuman capital assets, our results suggest that nonhuman capital assets form very early in a firm's life. Identifiable lines of business and important physical, patent, and IP assets are created in these firms by the early business plan, are relatively stable, and do not change or disappear as specific human capital assets turn over. These arguably constitute the “glue” that holds firms together.

These findings also are relevant for the critical resource theories. The early emergence and stability of nonhuman assets are consistent with those assets being critical resources. The instability of the human assets suggests that to the extent that the initial critical resource is a specific person, the “web of specific investments built around the founder(s)” itself becomes the critical resource relatively early in a firm's life.

The cross-sectional analysis provides further support to these interpretations of the Hart–Moore–Holmström and critical resource theories. Firms with more alienable assets at the time of the business plan have substantially more human capital turnover over time, suggesting that specific human capital is more critical before alienable assets have formed.

Finally, our results on the stability of firm business lines are supportive of Hannan and Freeman (1984), who argue that creation and replacement (or natural selection) are more prevalent than adaptation.

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