The path-to-profitability of Internet IPO firms ☆

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Abstract

Extant empirical evidence indicates that the proportion of firms going public prior to achieving profitability has been increasing over time. This phenomenon is largely driven by an increase in the proportion of technology firms going public. Since there is considerable uncertainty regarding the long-term economic viability of these firms at the time of going public, identifying factors that influence their ability to attain key post-IPO milestones such as achieving profitability represents an important area of research. We employ a theoretical framework built around agency and signaling considerations to identify factors that influence the probability and timing of post-IPO profitability of Internet IPO firms. We estimate Cox Proportional Hazards models to test whether factors identified by our theoretical framework significantly impact the probability of post-IPO profitability as a function of time. We find that the probability of post-IPO profitability increases with pre-IPO investor demand and change in ownership at the IPO of the top officers and directors. On the other hand, the probability of post-IPO profitability decreases with the venture capital participation, proportion of outsiders on the board, and pre-market valuation uncertainty.
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1. Executive summary

There has been an increasing tendency for firms to go public on the basis of a promise of profitability rather than actual profitability. Further, this phenomenon is largely driven by the increase in the proportion of technology firms going public. The risk of post-IPO failure is particularly high for unprofitable firms as shifts in investor sentiment leading to negative market perceptions regarding their prospects or unfavorable financing environments could lead to a shutdown of external financing sources thereby imperiling firm survival. Therefore, the actual accomplishment of post-IPO profitability represents an important milestone in the company's evolution since it signals the long-term economic viability of the firm. While the extant research in entrepreneurship has focused on factors influencing the ability of entrepreneurial firms to attain important milestones prior to or at the time of going public, relatively little is known regarding the timing or ability of firms to achieve critical post-IPO milestones.

In this study, we construct a theoretical framework anchored on agency and signaling theories to understand the impact of pre-IPO factors such as governance and ownership structure, management quality, institutional investor demand, and third party certification on firms' post-IPO path-to-profitability. We attempt to validate the testable implications arising from our theoretical framework using the Internet industry as our setting. Achieving post-issue profitability in a timely manner is of particular interest for Internet IPO firms since they are predominantly unprofitable at the time of going public and are typically characterized by high cash burn rates thereby raising questions regarding their long-term economic viability. Since there is a repeated tendency for high technology firms in various emerging sectors of the economy to go public in waves amid investor optimism followed by disappointing performance, insights gained from a study of factors that influence the path-to-profitability of Internet IPO firms will help increase our understanding of the development path and long-term economic viability of entrepreneurial firms in emerging, high technology industries.

Using a sample of 160 Internet IPO firms that went public during the period 1996–2000, we estimate Cox Proportional Hazards (*CPH*) models to analyze the economic significance of factors that influence the post-IPO path-to-profitability. Consistent with agency explanations, we find that a higher proportion of inside directors on the board and the change in pre-to-post-IPO ownership of top management are both significantly positively related to the probability of attaining post-IPO profitability. These results support arguments in the governance literature pointing to the beneficial impact of the presence of more insiders on the boards of high technology companies as well as the signaling value of the ownership stake of top management in the post-IPO firm. Additionally, we find evidence to indicate that higher institutional investor demand serves as an effective signal of the ability of Internet firms to attain post-IPO profitability, while greater pre-IPO valuation uncertainty reflects higher divergence of opinion about the future prospects of the IPO firm, and serves as a negative signal of the ability to achieve post-IPO profitability. Finally, we find that while underwriter prestige is unrelated to the probability of post-IPO profitability, VC participation decreases the probability of post-IPO profitability. Our results regarding the impact of VC participation on the probability of post-IPO profitability support arguments in the literature that VCs during the Internet boom period had incentives to grandstand by

taking their companies public prematurely and that their monitoring role in the post-IPO period was rather limited since they cashed out earlier due to shorter lock-up periods.

Our study makes several contributions. First, we construct a theoretical framework based on agency and signaling theories to identify factors that may influence the path-to-profitability of IPO firms. Second, we provide empirical evidence on the economic viability (path-to-profitability and firm survival) of newly public Internet firms. Third, our study adds to the theoretical and empirical literature that has focused on factors influencing the ability of entrepreneurial firms to achieve critical milestones during the transition from private to public ownership. While previous studies have focused on milestones during the private phase of firm development such as receipt of VC funding and completion of a public offering, our study extends this literature by focusing on a post-issue milestone such as attaining profitability.

2. Introduction

The past few decades have witnessed the formation and development of several vitally important technologically oriented emerging industries such as disk drive, biotechnology, and most recently the Internet industry. Entrepreneurial firms in such knowledge intensive industries are increasingly going public earlier in their life cycle while there is still a great deal of uncertainty and information asymmetry regarding their future prospects (Janey and Folta, 2006). A natural consequence of the rapid transition from founding stage firms to public corporations is an increasing tendency for firms to go public on the basis of a promise of profitability rather than actual profitability.[3] Although sustained profitability is no longer a requirement for firms in order to go public, actual accomplishment of post-IPO profitability represents an important milestone in the firm's evolution since it reduces uncertainty regarding the long-term economic viability of the firm. In this paper, we focus on identifying observable factors at the time of going public that have the ability to influence the likelihood and timing of attaining post-IPO profitability by Internet firms. We restrict our study to the Internet industry since it represents a natural setting to study the long-term economic viability of an emerging industry where firms tend to go public when they are predominantly unprofitable and where there is considerably uncertainty and information asymmetry regarding their future prospects.[4]

The attainment of post-IPO profitability assumes significance since the IPO event does not provide the same level of legitimizing differentiation that it did in the past as sustained profitability is no longer a prerequisite to go public particularly in periods where the market is favorably inclined towards investments rather than demonstration of profitability (Stuart et al., 1999; Janey and Folta, 2006). During the Internet boom, investors readily accepted the mantra of "growth at all costs" and enthusiastically bid up the post-IPO offering prices to irrational levels (Lange et al., 2001). In fact, investor focus on the promise of growth rather than profitability resulted in Internet start-ups being viewed differently from typical

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[3] For example, Ritter and Welch (2002) report that the percentage of unprofitable firms going public rose form 19% in the 1980s to 37% during 1995–1998.

[4] Schultz and Zaman (2001) report that only 8.72% of the Internet firms that went public during January 1999 to March 2000 were profitable in the quarter prior to the IPO.

new ventures in that they were able to marshal substantial resources virtually independent of performance benchmarks (Mudambi and Treichel, 2005).

Since the Internet bubble burst in April 2000, venture capital funds dried up and many firms that had successful IPOs went bankrupt or faced severe liquidity problems (Chang, 2004). Consequently, investors' attention shifted from their previously singular focus on growth prospects to the question of profitability with their new mantra being "path-to-profitability." As such, market participants focused on not just whether the IPO firm would be able to achieve profitability but also "when" or "how soon." IPO firms unable to credibly demonstrate a clear path-to-profitability were swiftly punished with steeply lower valuations and consequently faced significantly higher financing constraints. Since cash flow negative firms are not yet self sufficient and, therefore, dependent on external financing to continue to operate, the inability to raise additional capital results in a vicious cycle of events that can quickly lead to delisting and even bankruptcy.[5] Therefore, the actual attainment of post-IPO profitability represents an important milestone in the evolution of an IPO firm providing it with legitimacy and signaling its ability to remain economically viable through the ups and downs associated with changing capital market conditions.

The theoretical framework supporting our analysis draws from signaling and agency theories as they relate to IPO firms. In our study, signaling theory provides the theoretical basis to evaluate the signaling impact of factors such as management quality, third party certification, institutional investor demand, and pre-IPO valuation uncertainty on the path-to-profitability. Similarly, agency theory provides the theoretical foundations to allow us to examine the impact of governance structure and change in top management ownership at the time of going public on the probability of achieving the post-IPO profitability milestone. Our empirical analysis is based on the hazard analysis methodology to identify the determinants of the probability of becoming profitable as a function of time for a sample of 160 Internet IPOs issued during the period 1996–2000.

Our study makes several contributions. First, we construct a theoretical framework based on agency and signaling theories to identify factors that may influence the path-to-profitability of IPO firms. Second, we provide empirical evidence on the economic viability of newly public firms (path-to-profitability and firm survival) in the Internet industry. Third, we add to the theoretical and empirical entrepreneurship literature that has focused on factors influencing the ability of entrepreneurial firms to achieve critical milestones during the transition from private to public ownership. While previous studies have focused on milestones during the private phase of firm development such as receipt of VC funding and successful completion of a public offering (Chang, 2004; Dimov and Shepherd, 2005; Beckman et al., 2007), our study extends this literature by focusing on post-IPO milestones. Finally, extant empirical evidence indicates that the phenomenon of young, early stage

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[5] The case of E-Toys an Internet based toy retailer best illustrates this cyclical process. E-Toys was successful in developing an extensive customer base and a strong brand. However, the huge investment in technology, advertising, and promotion to sustain their activities as well as increased competition from both new entrants and old economy firms adopting the Internet to sell toys resulted in depressed profit margins and a longer than expected post-IPO time-to-profitability. Investors discouraged by the firm not reaching profitability within the expected time frame reacted negatively, leading to a steep drop in stock prices and consequently drying up of additional sources of external financing. As a result, the firm was forced to file for bankruptcy within a short period of time after its highly successful IPO.

firms belonging to relatively new industries being taken public amid a wave of investor optimism fueled by the promise of growth rather than profitability tends to repeat itself over time.[6] However, profitability tends to remain elusive and takes much longer than anticipated which results in investor disillusionment and consequently high failure rate among firms in such sectors.[7] Therefore, our study is likely to provide useful lessons to investors when applying valuations to IPO firms when this phenomenon starts to repeat itself.

This articles proceeds as follows. First, using agency and signaling theories, we develop our hypotheses. Second, we describe our sample selection procedures and present descriptive statistics. Third, we describe our research methods and present our results. Finally, we discuss our results and end the article with our concluding remarks.

3. Theory and hypotheses

Signaling models and agency theory have been extensively applied in the financial economics, management, and strategy literatures to analyze a wide range of economic phenomena that revolve around problems associated with information asymmetry, moral hazard, and adverse selection. Signaling theory in particular has been widely applied in the IPO market as a framework to analyze mechanisms that are potentially effective in resolving the adverse selection problem that arises as a result of information asymmetry between various market participants (Baron, 1982; Rock, 1986; Welch, 1989). In this study, signaling theory provides the framework to evaluate the impact of pre-IPO factors such as management quality, third party certification, and institutional investor demand on the path-to-profitability of Internet IPO firms.

The IPO market provides a particularly fertile setting to explore the consequences of separation of ownership and control and potential remedies for the resulting agency problems since the interests of pre-IPO and post-IPO shareholders can diverge. In the context of the IPO market, agency and signaling effects are also related to the extent that insider actions such as increasing the percentage of the firm sold at the IPO, percentage of management stock holdings liquidated at the IPO, or percentage of VC holdings liquidated at the IPO can accentuate agency problems with outside investors and, as a consequence, signal poor performance (Mudambi and Treichel, 2005). We, therefore, apply agency theory to evaluate the impact of board structure and the change in pre-to-post IPO ownership of top management on the path-to-profitability of Internet IPO firms.

3.1. Governance structure

In the context of IPO firms, there are at least two different agency problems (Mudambi and Treichel, 2005). The first problem arises as a result of opportunistic behavior of agents to

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[6] Interestingly, just a few years after the dot.com bust, technology companies have again started going public while they are still unprofitable (Lashinsky, 2006).

[7] For instance, in the biotechnology industry where the first company went public a quarter century ago, public companies have taken in close to $100 billion dollars from stock market investors but have delivered cumulative losses of more than $40 billion (Hamilton, 2004). Similarly, the disk drive industry in the early 1980s passed through phases similar to the Internet industry in terms of high firm founding rates, explosive growth, overoptimistic investors, IPO clusters, and high post-IPO failure rate (Lerner, 1995).

increase their share of the wealth at the expense of principals. The introduction of effective monitoring and control systems can help mitigate or eliminate this type of behavior and its negative impact on post-issue performance. The extant corporate governance literature has argued that the effectiveness of monitoring and control functions depends to a large extent on the composition of the board of directors. We, therefore, examine the relationship between board composition and the likelihood and timing of post-IPO profitability.

The second type of agency problem that arises in the IPO market is due to uncertainty regarding whether insiders seek to use the IPO as an exit mechanism to cash out or whether they use the IPO to raise capital to invest in positive NPV projects. The extent of insider selling their shares at the time of the IPO can provide an effective signal regarding which of the above two motivations is the likely reason for the IPO. We, therefore, examine the impact of the change in ownership of officers and directors around the IPO on the likelihood and timing of attaining post-issue profitability.

3.1.1. Board composition

The corporate governance literature has generally argued that a greater proportion of outside directors on the board increases board independence and results in better monitoring of management and thereby lowers agency costs (Fama, 1980; Fama and Jensen, 1983; Williamson, 1984). Therefore, a greater proportion of outside directors on the board of Internet IPO firms is likely to lead to a more effective monitoring and control environment, thus ensuring that managers pursue shareholder value maximizing strategies. In addition, due to their short operating history, management of Internet IPO firms are unlikely to have developed the necessary links with customers, suppliers, bankers, and other important stakeholders of the firm. Outside directors can be instrumental in facilitating the establishment of such links, thereby allowing these firms to better compete in the product market as well as capital market. On the basis of the above discussion, we would expect Internet IPO firms with more independent boards to be on a faster path-to-profitability.

Hypothesis 1: The proportion of outsiders on the board of Internet IPO firms is positively related to the probability of profitability and negatively related to time-to-profitability during the post-IPO period.

The extant empirical evidence on the positive relation between board composition and performance, however, has been mixed, both for IPO firms as well as more seasoned corporations (Dalton et al., 1998; Baker and Gompers, 2003). The ambiguous results can be partly attributed to the tradeoff between the benefits from the presence of outside directors such as more effective monitoring and control, greater objectivity, and assistance in resource acquisitions versus the benefits provided by inside directors such as detailed knowledge of the firm's operations, customer requirements, and technology that in turn can help the strategic planning process. Viewed through the innovation and technology prism, high technology Internet IPO firms may actually benefit more from in-depth technological knowledge, expertise, commitment, and innovative thinking that insiders bring to the board, rather than from the monitoring and control benefits provided by outside directors. In support of this argument, Zahra (1996) points out that boards comprised of a higher proportion of insiders may be more innovative and better positioned to serve management

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as knowledgeable sounding boards in the formulation of strategy. Further, since high technology Internet firms are unlikely to generate substantial free cash flows in the period immediately after the IPO, the potential for wasteful expenditure is lower, and therefore, the benefits of monitoring and control provided by outsiders is less likely to be substantive. If there is a greater need for creative thinking and decision-making in high technology knowledge-based industries that only insiders are uniquely qualified to provide, we expect a negative relation between the proportion of outsiders on the board and the probability of profitability and a positive relation with time-to-profitability.

Hypothesis 1A: The proportion of outsiders on the board of Internet firms is negatively related to the probability of profitability and positively related to time-to-profitability during the post-IPO period.

3.1.2. Ownership of officers and directors

Corporate governance studies have also focused extensively on corporate ownership and its impact on performance, both in isolation and in conjunction with board composition. Both agency and signaling theories provide similar predictions regarding the relationship between the extent of insider ownership and post-issue performance. Agency theory suggests that high insider ownership reduces agency conflicts and enhances organizational performance, while signaling theory argues that higher insider ownership is a credible signal of insider's confidence regarding the future prospects of the firm. The change in the ownership of the top managers and directors around the offering can be viewed as an important signal of the issuing firm's future prospects (Leland and Pyle, 1977).

In the context of the IPO market, a large post-IPO decline in top management ownership can be interpreted as a signal of their lack of confidence in the ability of the firm to generate sufficient cash flows to reach the profitability milestone. Additionally, any decline in the ownership stakes of owners/managers is likely to adversely affect post-IPO performance due to higher agency costs (Jensen and Meckling, 1976). While the extent of the change in ownership of insiders around the IPO is an informative signal for all types of IPO firms, it is particularly relevant in the context of Internet firms that go public while predominantly unprofitable and where the informational and incentive problems are particularly acute. For instance, Mudambi and Treichel (2005) find that a substantial reduction in equity holdings of the top management of Internet firms signals an impending cash crisis. We, therefore, argue that the greater the decline in the pre-to-post IPO ownership of top managers and directors, the lower the probability of attaining profitability, and consequently the longer the time-to-profitability.

Hypothesis 2: The decline in ownership of officers and directors from pre-to-post-IPO is negatively related to the probability of attaining profitability and positively related to time-to-profitability after the IPO.

3.2. Management quality

An extensive body of research has examined the impact of top management team (TMT) characteristics on firm outcomes for established firms as well as for new ventures by drawing from human capital and demography theories (Eisenhardt and Schoonhoven,

1990; Finkelstein and Hambrick, 1990; Wiersema and Bantel, 1992; Hambrick et al., 1996; Beckman et al., 2007). For instance, researchers drawing from human capital theories study the impact of characteristics such as type and amount of experience of TMTs on performance (Cooper et al., 1994; Gimeno et al., 1997; Burton et al., 2002; Baum and Silverman, 2004). Additionally, Beckman et al. (2007) argue that demographic arguments are distinct from human capital arguments in that they examine team composition and diversity in addition to experience. The authors consequently examine the impact of characteristics such as background affiliation, composition, and turnover of TMT members on the likelihood of firms completing an IPO. Overall, researchers have generally found evidence to support arguments that human capital and demographic characteristics of TMT members influence firm outcomes.

Drawing from signaling theory, we argue that the quality of the TMT of IPO firms can serve as a signal of the ability of a firm to attain post-IPO profitability. Since management quality is costly to acquire, signaling theory implies that by hiring higher quality management, high value firms can signal their superior prospects and separate themselves from low value firms with less capable managers. The beneficial impact of management quality in the IPO market includes the ability to attract more prestigious investment bankers, generate stronger institutional investor demand, raise capital more effectively, lower underwriting expenses, attract stronger analyst following, make better investment and financing decisions, and consequently influence the short and long-run post-IPO operating and stock performance (Chemmanur and Paeglis, 2005). Thus, agency theory, in turn, would argue that higher quality management is more likely to earn their marginal productivity of labor and thus have a lower incentive to shirk, thereby also leading to more favorable post-IPO outcomes.[8]

We focus our analyses on the signaling impact of CEO and CFO quality on post-IPO performance. We focus on these two members of the TMT of IPO firms since they are particularly influential in establishing beneficial networks, providing legitimacy to the organization, and are instrumental in designing, communicating, and implementing the various strategic choices and standard operating procedures that are likely to influence post-IPO performance.

3.2.1. CEO characteristics

CEOs play a major role in designing and implementing strategic choices and policies for their firms. Their actions can have long-term significance since they typically define long-term policies of the firm (Parrino, 1997). While the role and influence of CEOs on strategic choices, incentive mechanisms, accountability issues, and consequently performance is vital for all types of organizations, their impact is especially relevant for newly public firms that face significant competitive, product market, and financing challenges during the post-IPO phase. The role and impact of CEOs can be even more critical for the subset of technology related IPO firms since they may require fundamentally different skill sets and competencies from CEOs compared to those required to run companies in more traditional industries.

We assess CEO quality by focusing on variables that capture the extent of general and specific human capital developed by them through their prior work experience and their risk propensity and decision-making behavior. In distinguishing between general and specific

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[8] We thank the Associate Editor, Phil Phan for suggesting this explanation.

human capital, we use an approach similar in spirit to Gimeno et al. (1997). Specifically, in the context of our study, general human capital is associated with skills and reputation built through experience in reputable organizations across industries, while specific human capital is developed though experience specifically within the technology sector.

Researchers in entrepreneurship have argued that career history is an important vehicle through which TMT members accrue bonding and bridging social capital that is likely to enhance venture performance (Burton et al., 2002). TMT members bring to the table a set of experience and contacts from prior jobs that can benefit their new employers (Burton et al., 2002; Chandler and Hanks, 1998). Recently, in addition to functional and tenure diversity, the entrepreneurship research has focused on background affiliation as another important TMT demographic characteristic that can influence firm outcomes particularly in young, high technology industries. For instance, Beckman et al. (2007) decompose background affiliation into affiliation diversity and affiliation overlap and provide evidence to indicate that they are significantly related to the ability of high technology entrepreneurial firms to attain important milestones such as receiving venture capital financing and successfully completing an IPO.

Focusing on past affiliation characteristics, we argue that the perceived value of the general human capital developed by CEOs is likely to depend on the nature of the organizations within which they gained experience prior to assuming their current roles. Research indicates that prior experience gained by working in a prominent company can be beneficial (Burton et al., 2002). Individuals who gain their corporate experience in major reputable corporations where they were provided with the opportunity to rotate through several functional areas as well as gain external experience through dealings with bankers, financial analysts, professional organizations, institutional investors, industry associations, and board memberships are likely to have built up significant social and reputation capital as well as credibility with various market participants. Therefore, prior affiliation of the CEO with a reputable organization has the potential to serve as a signal of management quality and legitimacy and, therefore, should be positively related to the probability of attaining profitability and negatively related to the time-to-profitability.

Hypothesis 3: CEO prior experience in reputable organizations is positively related to likelihood of attaining post-IPO profitability and negatively related to time-to-profitability.

Another dimension of CEO quality that we explore is the extent of specific human capital developed as a result of relevant experience in the technology sector. Due to the specific characteristics of technology businesses such as the need for risk taking behavior, faster time to market, shorter product life cycles, and a strong focus on R&D investments, relevant experience in the high velocity technology sector is likely to help improve the quality of CEO decision-making. In addition, relevant industry experience by the CEO should improve their credibility with capital market participants such as investment bankers, venture capitalists, and institutional investors. As such, the CEO's relevant industry experience in the technology sector can serve as a credible signal of management quality and should lead to a higher probability of profitability and a shorter time-to-profitability.

Hypothesis 3A: CEO prior experience in the technology sector is positively related to the probability of profitability and negatively related to the time-to-profitability.

In addition to human capital, we argue that the quality of top management entre-preneurial teams is determined by the decision-making behavior, appetite for growth, and risk taking propensity of the CEO. Extant research has suggested that older top managers compared to their younger counterparts tend to follow lower growth strategies, are more risk averse, and less likely to invest in R&D (Child, 1974; Hambrick and Mason, 1984; Barker and Mueller, 2002). Furthermore, drawing from learning theory, Hambrick and Mason (1984) argue that older executives may have greater difficulty in grasping new ideas and learning new behaviors. In addition, Mudambi and Treichel (2005) argue that the experience, knowledge, and insights associated with age are considered less valuable and even a liability for firms operating in the "new economy." They argue that in the context of Internet firms, younger founders and top managers were thought to have better insights and understanding of critical aspects of the new economy such as technology, markets, and metrics. On the basis of the above discussion, we hypothesize that CEO age is negatively related to the probability of attaining post-IPO profitability.

Hypothesis 3B: CEO age is negatively related to the probability of post-IPO profitability and positively related to time-to-profitability.

3.2.2. CFO characteristics

Unlike CEOs, the role, contributions, and impact of chief financial officers (CFOs) have received scant attention in the academic literature. A notable exception is a study by Mian (2001) who examines factors driving the choice and replacement of CFOs. He argues that the primary responsibility for the management of the financial system lies with the CFO. He points out that the functions of CFOs include preparing financial reports, raising capital, budgeting, tax management, cost management, and participating in the development and execution of financial strategy. Similar to their role in more seasoned firms, CFOs of IPO firms play a major role in communicating with analysts and presenting the firm's financial strategy and projections. Analysts depend on CFOs to provide earnings guidance and a concrete timeline for the firm to generate positive cash flows in order for it to become less reliant on the unpredictable nature of the external financing market for survival. CFOs need to demonstrate the abilities and skills to maintain a rapport with analysts, and instill in them confidence in the reliability and predictability of financial projections. Further, IPOs with high cash burn rates as is the usual case with Internet firms are obviously in need of highly sophisticated financial planning and forecasting systems to ensure that capital is available when needed on the best possible terms. Therefore, having a reputable CFO can be viewed as a strong signal of the firm's ability and intent to use sophisticated financial planning techniques as well as the firm's ability to communicate effectively with financial analysts and institutional investors.

Similar to our analysis of CEOs, we distinguish between general human capital and specific human capital for CFOs. As such, we argue that prior experience in a reputable organization represents a credible signal of CFO quality and, therefore, should be associated with a higher likelihood of attaining post-IPO profitability and shorter time-to-profitability. In addition, we argue that the specific human capital developed by CFOs as a result of experience in the technology sector is valuable in helping develop, communicate, and implement an effective financial strategy for Internet IPO firms and maintain a close

watch on the cash burn rate and time-to-profitability. The above discussion forms the basis for the following hypotheses:

Hypothesis 3C: CFO prior experience in reputable organizations is positively related to the probability of post-IPO profitability and negatively related to time-to-profitability.

Hypothesis 3D: CFO prior experience in the technology sector is positively related to the probability of post-IPO profitability and negatively related to time-to-profitability.

3.3. Third party certification

The extant literature has widely recognized the potential for third party certification as a solution to the information asymmetry problem in the IPO market (Beatty, 1989; Carter and Manaster, 1990; Megginson and Weiss, 1991; Jain and Kini, 1995, 1999b; Zimmerman and Zeitz, 2002). The theoretical basis for third party certification is drawn from the signaling models which argue that intermediaries such as investment bankers, venture capitalists, and auditors have the ability to mitigate the problem of information asymmetry by virtue of their reputation capital (Booth and Smith, 1986; Megginson and Weiss, 1991; Jain and Kini, 1995, Carter et al., 1998). In addition to certification at the IPO, intermediaries, through their continued involvement, monitoring, and advising role have the ability to enhance performance after the IPO. In the discussion below, we focus on the signaling impact of venture capitalists involvement and investment bank prestige on post-IPO outcomes.

3.3.1. Venture capitalist participation

The certification and value added roles of venture capitalists (VC) in legitimizing, financing, nurturing, developing, monitoring, and ultimately positioning entrepreneurial firms for an IPO has been widely documented (Barry et al., 1990; Barry, 1994; Gorman and Sahlman, 1989; Gompers and Lerner, 1997; Wright and Robbie, 1998; Arthurs and Busenitz, 2006). The certification role of VCs is derived from their reputation capital as well as from the rigorous process by which they select ventures that receive financing. As a result of their access to inside information on the prospects of the firm and with the value of their reputation capital at stake, VCs are in a credible position to provide certification to outside investors and bestow legitimacy on the venture firm (Megginson and Weiss, 1991; Jain and Kini, 1995). The value added potential of VCs, on the other hand, is derived from the fact that in addition to providing financing, they are active investors participating in activities such as raising funds, monitoring managers, serving on the board, participating in strategic planning, providing financial and operational expertise, and formulating human resource policies (Gorman and Sahlman, 1989; Barry et al., 1990; Sahlman, 1990; Lerner, 1997; Gompers and Lerner, 1997; Kaplan and Stromberg, 2001; Hellman and Puri, 2002).

As can be seen from the above discussion, while a substantial body of literature has focused on the certification and value added role of VCs prior to the IPO, relatively little is known regarding whether they are able to endow their companies with the capacity to achieve superior performance after the IPO (Arthurs and Busenitz, 2006). Since their compensation is contingent on the success of their investments and the fact that lock up agreements restrict VC exit immediately after the IPO, with the average time of exit being in the range of a year and a half, VCs have a strong incentive to remain engaged in nurturing their portfolio companies

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even after the IPO (Sahlman, 1990; Gompers and Lerner, 1998; Bradley et al., 2001). Applying a resource based perspective to entrepreneurship, Arthurs and Busenitz (2006) argue that VCs have the capacity to provide their ventures with greater dynamic capabilities during the post-IPO phase, thereby allowing venture managers to more effectively assess how well the firm's resource base is aligned to meet performance objectives as well as to identify adjustments needed to reconfigure the resource base to address the various weaknesses and threats that endanger the survival and success of the firm. Additionally, as a consequence of their industry specialization, reputation, and networks, VCs can provide their venture firm with access to resources from various sources as well as assuage the concerns of these resource providers regarding attempts at opportunism or poor quality decision-making by venture managers (Grant, 1996; Stuart et al., 1999; Arthurs and Busenitz, 2006). Further, the board of directors of VC-backed firms tend to be more experienced and better positioned to accelerate management's strategic and operational learning, and consequently have greater ability to bring about needed changes and strategic adjustments to the resource base as required by the nature of competition during the post-IPO phase (Rosenstein, 1988; Gorman and Sahlman, 1989; Sapienza, 1992; Barney et al., 1996; Fried et al., 1998).

As such, on the basis of the above discussion, we argue that VC involvement can serve not only as a certification mechanism to ensure a successful IPO but also as an indicator that the firm is well positioned to meet competitive product and capital market challenges during the post-IPO phase. Therefore, we expect:

Hypothesis 4: There is a positive relation between VC involvement with the probability of profitability and a negative relation with time-to-profitability.

3.3.2. Investment bank prestige

The vital role performed by lead investment bankers in the IPO process as well as their ability to perform a certification function has been the focus of several studies in the extant literature (Booth and Smith, 1986; Beatty and Ritter, 1986; Carter et al., 1998; Jain and Kini, 1999b). Further, reputable investment banks have the potential to add value during the post-issue phase through their superior monitoring abilities and advisory services in areas such as valuation, mergers and acquisitions, and raising capital. Consistent with these arguments, several studies have found a positive relationship between investment bank prestige and long-run post-IPO investment performance, operating performance, and survival (Carter et al., 1998; Jain and Kini, 1999a,b). In line with the above discussion, we would expect that Internet IPO firms marketed by prestigious investment bankers are more likely as well as more quickly able to attain profitability after the IPO compared to Internet IPO firms marketed by less prestigious investment bankers.

Hypothesis 4A: Investment bank prestige is positively related to the probability of attaining profitability and negatively related to time-to-profitability.

3.4. Institutional investor demand

Prior to marketing the issue to investors, the issuing firm and their investment bankers are required to file an estimated price range in the registration statement. The final pricing of the IPO firm is typically done on the day before the IPO based upon the perceived demand

from potential investors. Further, the final offer price is determined after investment bankers have conducted road shows and obtained indications of interest from institutional investors. Therefore, the initial price range relative to the final IPO offer price is a measure of institutional investor uncertainty regarding the value of the firm. Since institutional investors typically conduct sophisticated valuation analyses prior to providing their indications of demand, divergence of opinion on valuation amongst them is a reflection of the risk and uncertainty associated with the prospects of the IPO firm during the post-IPO phase. Consistent with this view, Houge et al. (2001) find empirical evidence to indicate that greater divergence of opinion and investor uncertainty about an IPO can generate short-run overvaluation and long-run underperformance. Therefore, higher divergence of opinion among institutional investors is likely to be negatively related to the probability of post-IPO profitability and positively related to time-to-profitability.

A related issue is the extent of pre-market demand by institutional investors for allocation of shares in the IPO firm. Higher pre-issue demand represents a favorable consensus of sophisticated institutional investors regarding the prospects of the issuing firm. Institutional investor consensus as well as their higher holdings in the post-IPO firm is likely to be an informative signal regarding the post-IPO prospects of the firm. Therefore, on the basis of the above discussion, we expect:

Hypothesis 5: Pre-market valuation uncertainty on the part of institutional investors is negatively related to the probability of profitability and positively related to time-to-profitability.

Hypothesis 5A: Pre-market institutional demand is positively related to the probability of profitability and negatively related to time-to-profitability.

4. Sample description and variable measurement

Our initial sample of 325 Internet IPOs over the period January 1996 to February 2000 was obtained from the *Morgan Stanley Dean Witter Internet Research Report* dated February 17, 2000. The unavailability of IPO offering prospectuses and exclusion of foreign firms reduces the sample size to 205 firms. Further, to be included in our sample, we require that financial and accounting information for sample firms is available on the Center for Research in Security Prices (CRSP) and Compustat files and IPO offering related information is accessible from the Securities Data Corporation's (SDC) Global New Issues database. As a result of these additional data requirements, our final sample consists of 160 Internet IPO firms. Information on corporate governance variables (ownership, board composition, past experience of the CEO and CFO), and number of risk factors is collected from the offering prospectuses.

Our final sample of Internet IPO firms has the following attributes. The mean offer price for our sample of IPO firms is $16.12. The average firm in our sample raised $99.48 million. The gross underwriting fee spread is around seven percent. About 79% of the firms in our sample had venture capital backing. Both the mean and median returns on assets for firms in our sample at the time of going public are significantly negative. For example, the average operating return on assets for our sample of firms is −56.3%. The average number of employees for the firms in our sample is 287. The average board size is 6.57 for our sample. In about 7.5% of our sample, the CEO and CFO came from the same firm. In addition, we find

that 59 firms representing 37% of the sample attained profitability during the post-IPO period with the median time-to-profitability being three quarters from the IPO date.

4.1. Description of variables

Table 1 provides a summary of the name, variable description, and measurement of each independent variable used in our analyses. The table also identifies the hypothesis that provides the theoretical justification for inclusion of the independent variable and the predicted sign of its relationship with the probability of profitability and time-to-profitability.

Table 1
Variable description and predicted relations between probability of profitability and time-to-profitability for each explanatory variable

Variable (Hypothesis #)	Expected sign for probability of profitability (time-to-profitability)	Description	Measure
POUT (H1)	+ (−)	Proportion of outside directors	Expressed as a percentage of board size (IPO prospectus)
POUT (H1A)	− (+)	Proportion of outside directors	Expressed as a percentage of board size (IPO prospectus)
CHTOP3 (H2)	+ (−)	Change in ownership of the top 3 officers and directors	Change in percentage ownership by the top 3 officers and directors (IPO prospectus)
CEOAGE (H3)	− (+)	Age of the CEO	Age of the CEO (IPO prospectus)
CEOREP (H3A)	+ (−)	CEO worked for reputable firm	Whether CEO's past experience is with a reputable firm (IPO prospectus)
CEOIND (H3B)	+ (−)	CEO has related industry experience	Whether CEO has relevant industry experience (IPO prospectus)
CFOREP (H3C)	+ (−)	CFO worked for reputable firm	Whether CFO's past experience is with a reputable firm (IPO prospectus)
CFOIND (H3D)	+ (−)	CFO has related industry experience	Whether CFO has relevant industry experience (IPO prospectus)
DVC (H4)	+ (−)	Venture capitalist backed or not	Dummy variable which takes the value 1 if IPO is VC backed
VUNC (H5)	− (+)	Valuation uncertainty	Filing price range / Average filing price (SDC)
DEMAND (H5A)	+ (−)	Pre-IPO demand	Offer price − Average filing price / Average filing price (SDC)
UNDREP (H4A)	+ (−)	Underwriter prestige	Carter, Dark, and Singh (1998) nine-point prestige scale
LSIZE (control)	+ (−)	Log of size of IPO issue	Log of gross proceeds raised at the IPO (SDC)
NUMEMP (control)	+ (−)	Pre-IPO number of employees	Pre-IPO number of employees (IPO prospectus)
FIRMAGE (control)	+ (−)	Age of the firm	IPO Year − Founding Year + 1 (IPO prospectus)
NUMRISK (control)	− (+)	Number of risk factors	Number of risk factors listed on the IPO prospectus

We briefly describe the measurement of the dependent and independent variables used in our analysis below.

We employ hazard analysis to evaluate the probability that a firm will attain profitability in the future given that it is currently unprofitable at the present time. We select the widely used semi-parametric Cox Proportional Hazards (*CPH*) model to identify variables that significantly influence the probability of Internet firms attaining post-IPO profitability as a function of time. A detailed discussion of *CPH* models is available in Cox (1972). We use quarterly operating income before depreciation as our measure of operating profitability. We define the event in our analysis as the attainment of a quarter of operating profitability after the IPO. In the post-IPO period, firms will either attain profitability, fail, or remain unprofitable until the end of our tracking period. Censored observations represent IPO firms that are unable to attain profitability by the end of our tracking period. If a firm has a quarter of operating profitability after the IPO then we assign it the profitable status and compute the time-to-profitability as the number of quarters elapsed between the IPO quarter and the quarter for which the firm first reported operating profitability. The construction of the dependent variable is on the basis of combining the time to occurrence of event (profitability) with the dichotomous status variable (attained profitability status versus remains unprofitable at end of tracking period). The dependent variable in the hazard model, therefore, denotes the likelihood that an Internet IPO firm will attain profitability in each period.

We include eleven independent variables in the study. Specifically, board independence, *POUT* is computed as the number of outside directors divided by the total board size. The variable CHTOP3 represents the change in the equity ownership of the top three officers and directors from pre-to-post IPO.[9] The variable *CEOAGE* measures the age of the CEO at the time of the IPO. We collect information on the nature of the CEO's (CFO's) prior organizational experience, which allows us to determine whether the CEO's (CFO's) previous employer was a major corporation or dominant firm in its industry. We classify reputation as high if the previous employer is a Fortune 500 firm, bulge bracket investment bank (CS First Boston, Lehman, Merrill Lynch, Morgan Stanley, Salomon Brothers), Big 5 accounting firm, top-tier consulting firm, or top-tier VC. We use a dummy variable, *CEOREP* (*CFOREP*) that equals one if the CEO's (CFO's) previous employment is with a reputable firm, otherwise it equals zero. To capture whether the CEO (CFO) has relevant industry experience, we construct a dummy variable *CEOIND* (*CFOIND*) that equals one if the CEO's (CFO's) previous employment is with a technology firm, otherwise it equals zero. We measure VCs participation with the dummy variable, *DVC* that takes on the value one if the IPO firm is VC-backed, and is zero otherwise. We use the Carter, Dark, and Singh (1998) nine-point prestige scale as a measure of investment banker reputation (*UNDREP*). We measure valuation uncertainty (*VUNC*) as the filing price range divided by the average filing price. Consistent with Hanley (1993), we compute a proxy for pre-market demand (*DEMAND*) as the difference in IPO offer price and the expected price divided by the expected price, where the expected price is simply the mid-point of the filing price range.

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[9] We designate the three officers and directors owning the highest number of shares prior to the issue as listed in the *Principal and Selling Stockholders* section of the IPO prospectus as the top three officers and directors.

In addition to the above-described independent variables, we include several control variables that proxy for level of information asymmetry, risk, size, stage of development, organizational stability, and legitimacy. We include the number of employees at the IPO (*NUMEMP*) as a control variable. It proxies for the extent of human capital deployed in the IPO firm. Firms operating in the Internet industry have balance sheets that look considerably different from firms operating in more traditional industries because to a large extent they are less dependent on tangible assets and more reliant on intangible assets such as ideas, knowledge, and creativity. Therefore, one of the main assets for technological firms is their human capital base consisting of developers, programmers, designers, and similar knowledge based workers. As such, we expect the likelihood of attaining post-IPO profitability to be positively related to the number of employees. In addition, consistent with several studies in the IPO literature we include firm size as measured by the natural logarithm of gross proceeds at the IPO (*LSIZE*) and risk as measured by the number of risk factors listed in the IPO prospectus (*NUMRISK*) as control variables (Beatty and Zajac, 1994; Jain and Kini, 1999a,b; Carter et al., 1998; Certo et al., 2001).

Finally, we include the variable *FIRMAGE* measured as one plus the age of the firm at IPO as a control variable. Firms that go public prematurely are unlikely to be adequately prepared and financed to withstand the various challenges in the product and financial markets facing newly public firms. Therefore, these firms are less likely to be on the path to achieving profitability compared to firms that had developed sufficiently prior to going public. As such, we expect that the probability of attaining post-IPO profitability is likely to be positively related to the age of the firm at the time of going public.

5. Results

Table 2 provides the means and correlations among all the variables included in this study. On average, outside directors represented 73% of board membership for sample firms. The average decline in pre-to-post ownership of the top three officers/directors was 10.81%. While 29.38% of CEOs had prior experience in reputable organizations, only 15.63% of CFOs prior experience was in major corporations. Further, 40% of CEOs had prior experience in technology firms compared to 31.25% of CFOs. The average age of CEO in the sample was 42.15. The correlation matrix for the most part indicates low correlations among the independent variables.

In Table 3, we provide a comparison of the characteristics of firms that attain post-IPO profitability versus firms that remain unprofitable during the post-IPO phase. While the mean gross proceeds raised at the IPO for the two groups is not significantly different the median gross proceeds is significantly higher for the unprofitable group. The mean (median) number of risk factors is significantly higher for the unprofitable group of IPO firms. The unprofitable group of firms has significantly higher venture capitalist participation. The average decline in pre-to-post IPO ownership of the top three officers/directors is 13.81% for unprofitable firms versus 5.6% for the profitable group and this difference is statistically significant. The mean percentage of outside directors on the board of unprofitable firms is significantly higher (74.74% versus 69.98%). There appears to be no difference between the two groups in terms of CEO's and CFO's prior experience in a reputable organization or relevant industry experience.

Table 2
Correlation matrix

Variable	Mean	LSIZE	FIRMAGE	NUMRISK	NUMEMP	VUNC	DEMAND	UNDREP	DVC	POUT	CHTOP3	CEOIND	CEOREP	CEOAGE	CFOIND	CFOREP
LSIZE ($ m.)	4.35	1.00														
FIRMAGE (years)	5.90	0.31	1.00													
NUMRISK	31.39	0.17	−0.19	1.00												
NUMEMP	287.46	0.41	0.25	−0.12	1.00											
VUNC (%)	17.42	−0.23	−0.05	0.18	−0.08	1.00										
DEMAND (%)	34.68	0.33	−0.09	0.13	−0.03	0.17	1.00									
UNDREP	8.65	0.21	0.02	0.05	0.09	−0.10	0.07	1.00								
DVC (%)	78.75	−0.14	−0.20	0.07	−0.25	0.07	0.10	0.16	1.00							
POUT (%)	72.99	0.14	0.05	0.03	0.02	0.15	0.07	0.03	0.06	1.00						
CHTOP3 (%)	−10.81	0.04	0.10	−0.17	0.13	−0.07	−0.03	0.00	−0.11	−0.03	1.00					
CEOIND (%)	40.00	−0.12	−0.07	0.01	−0.12	0.04	−0.08	0.06	0.08	−0.04	−0.05	1.00				
CEOREP (%)	29.38	0.05	−0.11	−0.02	0.01	0.01	0.03	0.03	0.07	−0.04	−0.16	0.20	1.00			
CEOAGE (%)	42.15	0.13	0.22	−0.15	0.11	−0.17	−0.05	0.08	−0.12	0.11	0.10	0.03	−0.02	1.00		
CFOIND (%)	31.25	−0.05	−0.04	0.02	−0.09	−0.12	−0.07	0.03	0.09	−0.02	0.19	0.17	0.07	0.01	1.00	
CFOREP (%)	15.63	0.17	−0.04	0.17	0.00	0.02	0.19	0.08	−0.03	−0.03	0.01	−0.04	0.14	−0.07	−0.07	1.00

Note: The table reports mean values and the correlation matrix for a sample of 160 IPO issuers over the period January 1996 through February 2000. The time-to-profitability is measured as the number of quarters elapsed between the IPO quarter and the quarter in which the firm's operating profit is first positive *after the IPO*. *LSIZE* is the natural logarithm of the gross proceeds raised at the IPO. *FIRMAGE* is the difference between the IPO year and the founding year plus one. *NUMRISK* is the number of risk factors listed in the IPO prospectus. *NUMEMP* is the pre-IPO number of employees. *VUNC* is the IPO filing price range over the average filing price. *DEMAND* is the difference between the IPO offer price and the average filing price divided by average filing price. *UNDREP* is a measure of the investment banker prestige using the Carter, Dark and Singh nine-point measure. *DVC* is a dummy variable that takes the value 1 if there is venture capitalist participation, else 0 otherwise. *CHTOP3* is the change in the ownership percentage around the IPO for the top three officers and directors. *POUT* is computed as the ratio of number of outside directors to board size. *CEOIND* (*CFOIND*) is an indicator variable that takes the value 1 if the CEO (CFO) has relevant industry experience, else 0 otherwise. *CEOREP* (*CFOREP*) is an indicator variable that takes the value 1 if the CEO (CFO) past experience is with a reputable firm, else 0 otherwise. *CEOAGE* is the age of the CEO. The differences in means (median) are computed using a *t*-test (Wilcoxon two-sample *z*-test).

Table 3
Differences in characteristics based on whether the firm achieves post-IPO operating profitability

Variables	Unprofitable mean (median)	Profitable mean (median)	Difference t-stat (z-stat)
SIZE ($ m.)	100.36 (75.00)	97.96 (59.50)	−0.11 (−2.64[a])
FIRMAGE (years)	4.92 (4.00)	7.60 (5.00)	1.58 (1.52)
NUMRISK	32.99 (33.00)	28.64 (28.00)	−4.07[a] (−3.82[a])
NUMEMP	225.62 (159.00)	393.32 (210.00)	1.73[c] (1.78[c])
VUNC (%)	17.53 (18.18)	17.22 (18.18)	−0.56 (−0.51)
DEMAND (%)	35.11 (33.33)	33.95 (28.57)	−0.19 (−0.57)
UNDREP	8.77 (8.88)	8.46 (8.88)	−1.24 (1.25)
DVC (%)	84.16 (100.00)	69.49 (100.00)	−2.21[b] (−2.18[b])
ALPHA (%)	59.59 (62.86)	71.93 (75.51)	2.65[a] (1.89[c])
CHTOP3 (%)	−13.81 (−5.29)	−5.60 (−1.77)	3.75[a] (1.68[c])
POUT (%)	74.76 (77.78)	69.98 (71.43)	−2.10[b] (−2.31[b])
CEOIND (%)	42.57 (0.00)	35.59 (0.00)	−0.87 (−0.86)
CEOREP (%)	27.72 (0.00)	32.20 (0.00)	0.60 (0.60)
CEOAGE (years)	42.50 (42.00)	41.56 (40.00)	−0.78 (−1.49)
CFOIND (%)	31.68 (0.00)	30.51 (0.00)	−0.15 (−0.15)
CFOREP (%)	18.81 (0.00)	10.17 (0.00)	−1.55 (−1.45)

Note: The table reports differences in means (medians) of various characteristics based on whether the IPO firm achieves post-IPO operating profitability using a sample of 160 IPO issuers over the period January 1996 through February 2000. The time-to-profitability is measured as the number of quarters elapsed between the IPO quarter and the quarter in which the firm's operating profit is first positive *after the IPO*. *SIZE* is the gross proceeds raised at the IPO. *FIRMAGE* is the difference between the IPO year and the founding year plus one. *NUMRISK* is the number of risk factors listed in the IPO prospectus. *NUMEMP* is the pre-IPO number of employees. *VUNC* is the IPO filing price range over the average filing price. *DEMAND* is the difference between the IPO offer price and the average filing price divided by average filing price. *UNDREP* is a measure of the investment banker prestige using the Carter, Dark and Singh nine-point measure. *DVC* is a dummy variable that takes the value 1 if there is venture capitalist participation, else 0 otherwise. *ALPHA* is the proportion of equity retained by the original entrepreneurs (including venture capitalists). *CHTOP3* is the change in the ownership percentage around the IPO for the top three officers and directors. *POUT* is computed as the ratio of number of outside directors to board size. *CEOIND* (*CFOIND*) is an indicator variable that takes the value 1 if the CEO (CFO) has relevant industry experience, else 0 otherwise. *CEOREP* (*CFOREP*) is an indicator variable that takes the value 1 if the CEO (CFO) past experience is with a reputable firm, else 0 otherwise. *CEOAGE* is the age of the CEO. The differences in means (median) are computed using a *t*-test (Wilcoxon two-sample *z*-test).
[a]Significant at the 0.01 level; [b]significant at the 0.05 level; and [c]significant at the 0.10 level.

The results of the estimated Cox Proportional Hazards (*CPH*) models are reported in Table 4. The overall model Chi-square statistic, individual variable coefficients, and their associated *p*-values are reported for all models. Since the dependent variable is the logarithm of the hazard rate, a positive coefficient on an explanatory variable in the *CPH* model indicates that an increase in the variable is associated with an increase in the hazard rate and consequently lower duration. In the context of our application, a positive (negative) coefficient indicates that an increase in the variable leads to an increase (decrease) in the probability of attaining profitability and a decrease (increase) in the time-to-profitability. Therefore, in the discussion of the results that follows, we will describe the effect of each independent variable only on the probability of attaining profitability with the implicit understanding that its effect on the time-to-profitability is opposite to that on the probability of profitability. Further, for each of the estimated models in Table 4, the first column

Table 4
Estimation of Cox proportional hazards models

Variables	Model 1		Model 2		Model 3		Model 4		Model 5	
	Coeff.	Hazard ratio	Coeff.	Hazard ratio	Coeff.	Hazard ratio	Coeff.	Hazard ratio	Coeff.	Hazard ratio
LSIZE	−0.994[a] (0.00)	0.370	−1.735[a] (0.00)	0.176	−0.944[a] (0.00)	0.389	−0.650[b] (0.03)	0.522	−1.731[a] (0.00)	0.177
FIRMAGE	0.061[a] (0.00)	1.063	0.083[a] (0.00)	1.087	0.056[a] (0.00)	1.058	0.063[a] (0.00)	1.065	0.089[a] (0.00)	1.093
NUMRISK	−0.050[b] (0.03)	0.951	−0.043[c] (0.08)	0.958	−0.051[b] (0.02)	0.950			−0.037 (0.19)	0.964
NUMEMP	0.001[a] (0.00)	1.001	0.001[a] (0.00)	1.001	0.001[a] (0.00)	1.001			0.001[a] (0.00)	1.001
VUNC			−0.088[c] (0.06)	0.916					−0.094[c] (0.08)	0.910
DEMAND			0.013[a] (0.00)	1.013					0.015[a] (0.00)	1.015
UNDREP					−0.103 (0.24)	0.902			−0.039 (0.72)	0.961
DVC					−0.586[c] (0.07)	0.557			−0.624[c] (0.10)	0.536
CHTOP3							0.040[a] (0.01)	1.041	0.033[b] (0.04)	1.033
POUT							−0.022[b] (0.02)	0.979	−0.017[b] (0.08)	0.983
CEOIND							−0.590[c] (0.06)	0.554	−0.535 (0.11)	0.585
CEOREP							0.506 (0.12)	1.659	0.529 (0.14)	1.698
CEOAGE							−0.012 (0.58)	0.988	−0.036 (0.14)	0.964
CFOIND							−0.331 (0.28)	0.718	−0.068 (0.84)	0.934
CFOREP							−0.927[c] (0.09)	0.396	−0.749 (0.20)	0.473
Overall Chi-square	37.056[a] (0.00)		45.279[a] (0.00)		37.056[a] (0.00)		40.150[a] (0.00)		64.028[a] (0.00)	

Note: Cox Proportional Hazards models are estimated using a sample of 160 IPO issuers over the period January 1996 through February 2000. The time-to-profitability is measured as the number of quarters elapsed between the IPO quarter and the quarter in which the firm's operating profit is first positive *after the IPO*. *LSIZE* is the logarithm of the gross proceeds raised at the IPO. *FIRMAGE* is the difference between the IPO year and the founding year plus one. *NUMRISK* is the number of risk factors listed in the IPO prospectus. *NUMEMP* is the pre-IPO number of employees. *VUNC* is the IPO filing price range over the average filing price. *DEMAND* is the difference between the IPO offer price and the average filing price divided by average filing price. *UNDREP* is a measure of the investment banker prestige using the Carter, Dark and Singh nine-point measure. *DVC* is a dummy variable that takes the value 1 if there is venture capitalist participation, else 0 otherwise. *CHTOP3* is the change in the ownership percentage around the IPO for the top three officers and directors. *POUT* is computed as the ratio of number of outside directors to board size. *CEOIND* (*CFOIND*) is an indicator variable that takes the value 1 if the CEO (CFO) has relevant industry experience, else 0 otherwise. *CEOREP* (*CFOREP*) is an indicator variable that takes the value 1 if the CEO (CFO) past experience is with a reputable firm, else 0 otherwise. *CEOAGE* is the age of the CEO. The results reported include the coefficient of each independent variable and the associated *p*-values in parenthesis for each model.

[a]Significant at the 0.01 level; [b]significant at the 0.05 level; and [c]significant at the 0.10 level.

contains the estimated coefficients and the second column reports the hazard ratios associated with the explanatory variables.

The first model in Table 4 includes the four control variables FIRMAGE, LSIZE, NUM-RISK, and NUMEMP. The coefficients of FIRMAGE and NUMEMP are positive and significant at the one percent level while the coefficients of LSIZE and NUMRISK are significantly negative at the 1% and 5% levels, respectively. Overall, the results in model 1 indicate that an increase in the size of the IPO offering (LSIZE) or the number of risk factors listed on the IPO prospectus (NUMRISK) are associated with a decrease in the probability of attaining profitability, while an increase in the age of the firm (FIRMAGE) or the number of employees (NUMEMP) at the IPO is associated with an increase in the probability of attaining the profitable state.

In Model 2, in addition to LSIZE, FIRMAGE, NUMRISK, and NUMEMP, we include measures of valuation uncertainty (VUNC) and institutional demand for the IPO issue (DEMAND) as independent variables. The results indicate that the coefficient of VUNC is significantly negative at the 10% level indicating that an increase in institutional investor uncertainty regarding the value of the Internet IPO firm reduces the probability of post-IPO profitability and this result is supportive of Hypothesis 5. Similarly, the results from Model 2 indicate that the coefficient of DEMAND is positive and significant at the one percent level. Therefore, stronger institutional demand for the offering in the pre-market is associated with a higher probability of attaining profitability and is supportive of Hypothesis 5A.

In Model 3, we include underwriter reputation (UNDREP) and VC participation (DVC) as additional explanatory variables to those used in Model 1 to evaluate the effect of third party certification on the probability of post-IPO profitability. We find that the coefficient on UNDREP is insignificant indicating that Hypothesis 4A is not supported. Further, the coefficient on DVC is significantly negative at the 10% level, which is opposite to the prediction from Hypothesis 4. The negative coefficient on DVC indicates that VC participation decreases the probability of attaining the post-IPO profitability state.

In Model 4, in addition to LSIZE and FIRMAGE, we include the independent variables CHTOP3, POUT, CEOIND, CEOREP, CEOAGE, CFOIND, and CFOREP. The results indicate that the coefficient of POUT is negative and significant indicating that an increase in the proportion of outsiders on the board of an Internet company results in lowering the probability of attaining post-IPO profitability. The results do not support Hypothesis 1 but instead support Hypothesis 1A. The coefficient on CHTOP3 is significantly positive at the one percent level indicating that the higher the change in percentage ownership by the top managers at the time of the IPO, which implies a smaller reduction in their percentage ownership, the higher is the probability of reaching the profitability state after the IPO as predicted by Hypothesis 2.

The results with CEO age indicate that the coefficient of CEOAGE is negative but not significant. The coefficient of CEOREP while positive is not significant at traditional levels of significance. On the other hand, the coefficient of CEOIND is negative and significant. Further, while the coefficients on both CFOREP and CFOIND are negative, only the coefficient on CFOREP is significantly different from zero. In Model 5, we include all the explanatory variables used in our analyses. The results in Model 5 are similar to those in Models 1–4 with a few noteworthy exceptions. While the coefficient on NUMRISK, CEOIND, and CFOREP are still negative, they are no longer statistically significant. The

coefficient on *CEOIND*, however, is marginally insignificant at the ten percent level (*p*-value = 0.11). Since the coefficients of variables associated with CEO and CFO characteristics are either insignificant or not consistently significant, there is no strong evidence to indicate that management quality as measured by these variables influences the probability of attaining post-IPO profitability. Therefore, Hypotheses 3, 3A, 3B, 3C, and 3D are not supported.

In addition to identifying variables that significantly influence the probability of attaining profitability, it is also useful to assess the economic impact of these variables by evaluating their impact on the risk or hazard that a currently unprofitable Internet firm will be profitable in the future. For continuous independent variables the hazard ratio represents the estimated percent change in the hazard of the event (attainment of profitability) for a one unit increase in the covariate of interest (controlling for other covariates) and is obtained by subtracting one from the hazard ratio and multiplying by 100. For indicator variables, the hazard ratio is interpreted as the estimated hazard of the event of interest occurring for those with a value of 1 relative to the estimated hazard for those with a value of 0 after controlling for other covariates.[10]

As mentioned earlier, the hazard ratios for each estimated model are reported in the second column. In interpreting the hazard ratios, we focus on Model 5 because all the covariates evaluated in this study are included in it. In the discussion that follows, we concentrate our attention on the risk ratios of the variables with significant coefficients in this estimated model. We find that a one percent increase in the change in top management ownership results in a 3.3% increase in the probability of attaining profitability. On the other hand, if the proportion of outside directors on the board increases by 15%, the probability of the firm attaining profitability in the future declines by 25.5%. Given that the mean board size in our sample is 6.57; this is roughly that impact on the probability of attaining profitability by substituting one outside director for an inside director prior to the IPO. Furthermore, our results indicate that delaying the IPO by a year has a significant impact on the probability of future profitability. For instance, every year that an Internet IPO firm delays its IPO raises the probability of attaining post-IPO profitability by 9.3%.

In addition, our results indicate that each additional employee in the firm at the time of the IPO increases the probability of attaining profitability in the future by 0.10%. We find that a one percent increase in pre-IPO valuation uncertainty results in a 9.0% decline in the probability of attaining profitability. Similarly, a one percent increases in the pre-IPO demand results in a 1.5% increase in the probability of attaining future profitability. Venture capital participation also has a major impact on the likelihood of profitability with VC backed Internet firms slightly more than half as likely to attain post-IPO profitability compared to non-VC backed Internet firms.

In Figs. 1–5, we graph the cumulative hazard functions for Model 5 by varying just the value of the covariate of interest while evaluating all the other covariates at their mean values. In our context, the cumulative hazard function tells us the cumulative risk of the profitability state being achieved over some period of time. Thus, the cumulative hazard

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[10] See Allison (2000) for further details on the interpretation of hazard ratios for quantitative and indicator variables. Hellman and Puri (2002) interpret the hazard ratio in a similar manner to that described above for indicator variables.
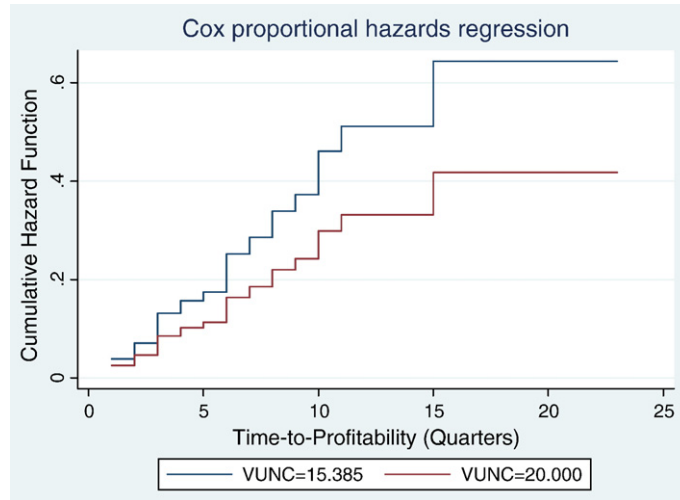
Fig. 1. Cumulative hazard function and *VUNC*.

function will always increase with time. For continuous variables, we plot the cumulative hazard function evaluating it first at the covariate's 25th percentile value and then at its 75th percentile value. For dummy variables, we evaluate the cumulative hazard function first at a value of zero for the covariate and then at a value of one for the covariate. Thus, this exercise allows us to visually see the impact of each variable on the cumulative hazard function holding the values of the remaining covariates at their mean values. We only plot these graphs for the variables that are significant in Model 5 (excluding significant control variables). These graphs indicate that the cumulative hazard of attaining profitability
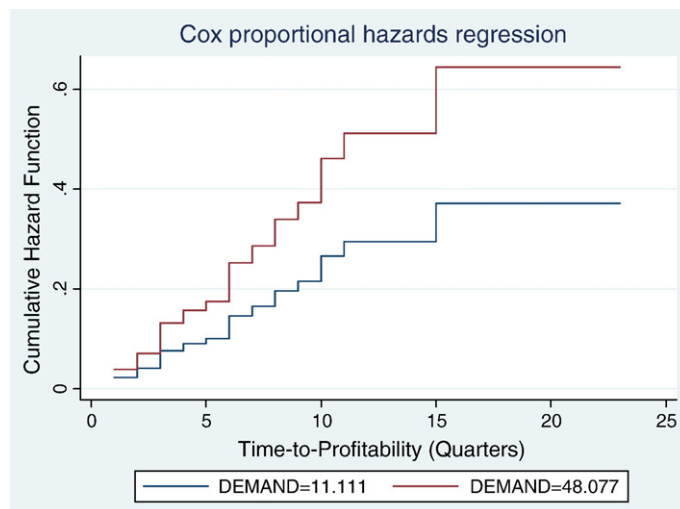

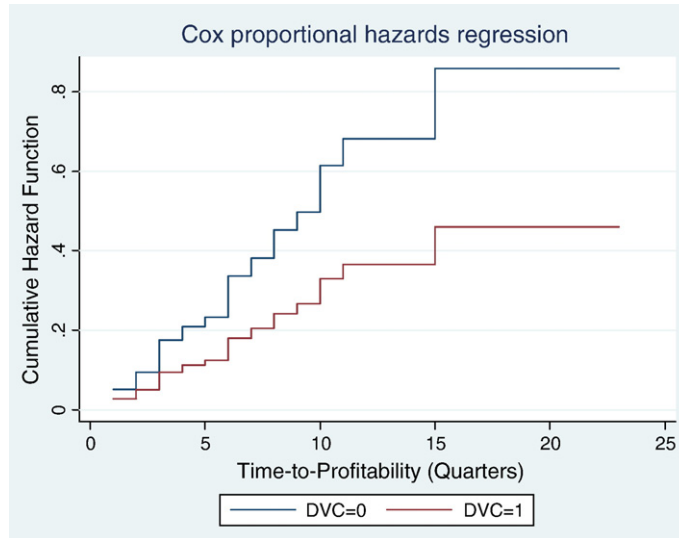Fig. 2. Cumulative hazard function and *DEMAND*.

Fig. 3. Cumulative hazard function and *DVC*.

increases with *DEMAND* and *CHTOP3*, while it decreases with *VUNC*, *POUT*, and *DVC*. Thus, Figs. 1–5 visually confirm our earlier reported findings.

Since Internet IPO firms are growth oriented, an argument can be made that even though they may not turn profitable within a reasonable time frame, their post-IPO growth prospects afford them the opportunity to continue to obtain external financing. As a result, these firms can continue to fund their positive NPV projects, eventually attaining
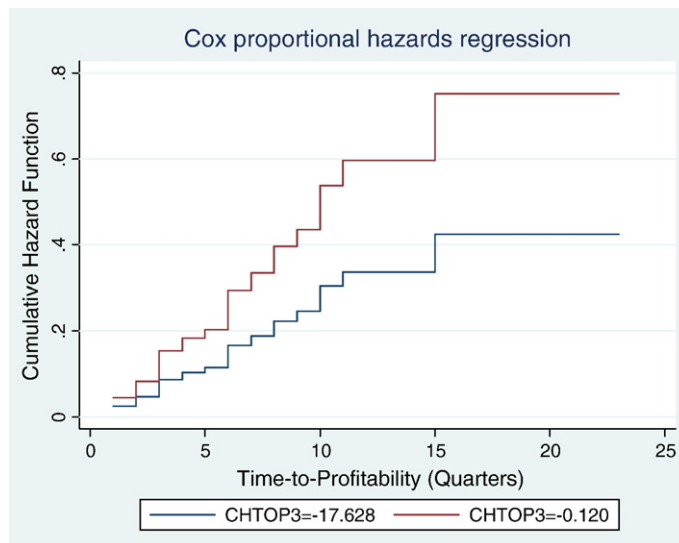
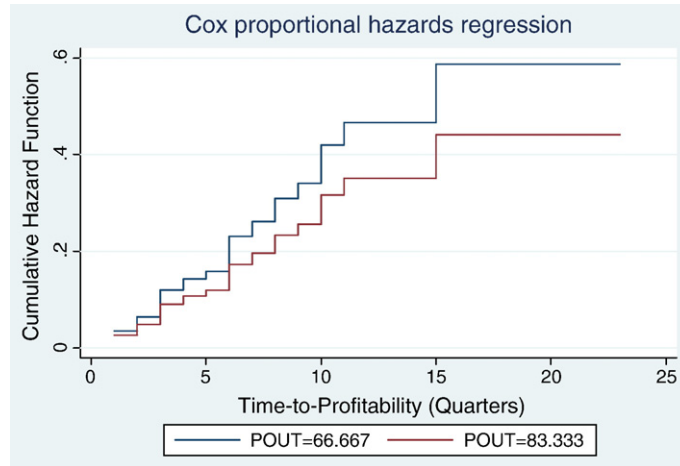Fig. 4. Cumulative hazard function and *CHTOP3*.

Fig. 5. Cumulative hazard function and *POUT.*

profitability several years after the IPO. Therefore, even though these firms may not be on an immediate path-to-profitability, they represent viable companies that can eventually turn profitable in the long run. We, therefore, also investigate whether the variables that are related to the probability of profitability and time-to-profitability also impact the timing and probability of failure. Based on CRSP delistment codes, we find that as of December 31, 2001, 112 (70.60%) firms survived, 31 (19.38%) are targets of successful takeovers, and only 17 (10.63%) are delisted due to financial distress. The small percentage of non-survivors precludes us from conducting a hazard model analysis using a more traditional definition of failure. Instead, we decided to examine an alternative definition of failure using NASDAQ's delisting price of one dollar per share as the cut-off price. Using this definition of failure, we find that 87 (54.38%) firms have prices that never drop below one dollar, while the remaining 73 (45.63%) firms have prices that fall below the one dollar cut-off price. We estimate the hazard models with the time from the IPO to the delisting trigger or end of the tracking period as the dependent variable.[11] We find that the results from this analysis are consistent with those obtained in the profitability analysis. In other words, our results are indicative of the fact that factors that influence whether an IPO firm is on the path-to-profitability or not also influence its prospects for survival.

6. Discussion of results and concluding remarks

The development path of various emerging industries tend to be similar in that they are characterized by high firm founding rates, rapid growth rates, substantial investments in R&D and capital expenditures, potential for product/process breakthroughs, investor exuberance, huge demand for capital, large number of firms going public while relatively young, and a struggle for survival during the post-IPO phase as profitability and growth

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[11] We do not report these results in the paper for purposes of brevity. These results are, however, available from the authors upon request.

targets remain elusive and shifts in investor sentiment substantially raise financing constraints. Recently, the Internet has rapidly emerged as a vitally important industry that has fundamentally impacted the global economy with start-up firms in the industry attracting $108 billion of investment capital during the period 1995–2000 (Chang, 2004). Consistent with the patterns witnessed in other emerging industries such as disk drives and biotechnology, the rapid formation of a large number of start-up Internet firms was followed by firms attempting to go public at a relatively early stage in their development when there was still considerable uncertainty and information asymmetry regarding their future prospects. Drawing on signaling and agency theory, our paper focuses on identifying factors known at the time of going public that influence the probability of Internet firms attaining post-IPO profitability.

Overall, our analysis indicates that the probability of post-IPO profitability for Internet firms decreases with an increase in the size of the offering, valuation uncertainty, venture capitalist participation, and proportion of outside board members. In contrast, an increase in firm age, number of employees, pre-IPO investor demand, greater presence of insiders on the board, and lower decline in ownership of the top three managers is associated with a higher probability of post-IPO profitability. We also document some weak evidence to indicate that CEO experience in the technology sector and CFO prior experience in a reputable organization are negatively related to probability of post-IPO profitability. Notably, we find that the factors that impact probability of post-IPO profitability also tend to impact the survival probability of Internet IPO firms.

There is a widespread perception amongst academicians, corporate governance advocates, and policy makers that internal control mechanisms are weak when insiders dominate the board, and this governance environment has a deleterious effect on the performance of the firm. However, in the case of high technology, early stage firms, the literature has also pointed to the fact that insiders by virtue of their detailed knowledge of firm strategy, products, and markets represent a valuable resource to the CEO as a sounding board to help in designing and implementing the strategic vision of the company. The success of young, high technology firms is critically dependent on the ideas, entrepreneurial spirit, expertise, and particularly risk-taking propensity of their founders, top management, and other insiders. These firms often make huge risky bets on ideas or technology regarding which there is little or no evidence on viability or market acceptance. Further, since these firms are in new and emerging industries with no established path-to-development, outside directors may have relatively little to contribute in terms of providing guidance, expertise, or monitoring of managerial actions. Consistent with this alternative governance argument for high technology early stage firms, we find that an increase in the proportion of outside directors on the board of Internet IPO firms is associated with a lower probability of post-IPO profitability. Thus, our results highlight the relative importance of insiders on the boards of early stage entrepreneurial firms.

A central issue influencing the effective functioning of the IPO market is the extent market signals are able to resolve adverse selection and moral hazard problems that arise as a result of information asymmetry between various market participants. A central assumption in the financial economics and entrepreneurship literature is that managers and insiders are better informed regarding a firm's prospects compared to outside investors. Further, among investor groups, institutional investors are assumed to be at an informational advantage

compared to retail investors. Consequently, managers and other insiders as well as institutional investors through their behavior and actions are in a position to credibly signal favorable information to outside investors regarding the likely future performance of IPO firms. In this study, we evaluate the signaling efficiency of the extent of ownership stakes sought in the post-IPO firm by more informed participants such as insiders and institutional investors. We find that the level of pre-market institutional investor demand and change in ownership of the top three officers and directors are significant and positively related to the probability of post-IPO profitability. These results indicate that sophisticated institutional investors and top managers of the company recognize the profitability prospects of the IPO firms and signal their confidence through their actions in terms of indicating interest in the offering and by retaining higher post-IPO ownership, respectively.

Entrepreneurial firms attempting to go public can gain legitimacy through their ability to attract top-tier managerial talent and through association with reputable third party intermediaries such as investment bankers and venture capitalists. We, therefore, investigate whether sources of legitimacy such as CEO/CFO quality, investment bank prestige, and venture capital involvement are effective signals of the ability of the IPO firm to attain post-IPO profitability. Our results suggest that in new emerging industries such as the Internet, skills and competencies required of top management are fundamentally different and prior organizational experience either in reputable organizations or in the technology sector does not convey any significant advantages in terms of ability to guide the company to post-IPO profitability. Similarly, while prior research has suggested that investment bank prestige is associated with lowering the level of information asymmetry at the time of going public, our evidence points to the lack of longer term post-IPO signaling effects such as association of investment bank prestige with the timing and likelihood of attaining post-IPO profitability. This result is consistent with recent arguments in the literature that suggest that the signaling effects of reputation tend to dissipate over time (Janey and Folta, 2006).

There is an extensive theoretical and empirical literature arguing for the benefits of VC participation in the IPO market both during the pre-IPO and post-IPO phases. However, several studies have also found that VC participation does not appear to enhance post-IPO performance and in fact VCs engage in grandstanding by taking their companies public before they are ready in order to generate additional business (Brav and Gompers, 1997). As such, VCs play a significant role in shifting the risk of financing developmental firms from the private equity to public equity markets. Since public equity markets may be less well equipped to handle the financing of early stage firms, VC involvement can have a detrimental effect on the ability of firms to attain post-IPO profitability. Further, arguments supporting the benefits of VC involvement during the post-issue phase are predicated on the assumption that VCs do not exit immediately after the IPO. The combination of the propensity of VCs to partly/wholly cash out at the expiration of the lock-up period along with the phenomenon of shorter lock-up periods during the Internet boom have resulted in significantly reducing the duration of post-IPO VC involvement in their venture firms (Bradley et al., 2001). The ability of VCs to exit early reduces their motivation as well as incentives to devote resources to monitoring management and providing other value added functions during the post-IPO phase. Further, in the context of Internet firms, Zacharakis et al. (2003) argue that VCs played an influential role in creating conditions for a boom and bust phenomena in the industry by infusing too many companies with questionable viability

with too much capital in a short period of time. In line with the above reasoning, we find that that venture capital participation leads to a decrease in the probability of profitability and an increase in the time-to-profitability. Our results, therefore, do not support recent arguments in the literature that VC involvement provides their venture firms with dynamic capabilities during the post-issue phase that lead to superior post-IPO performance.

We also find that firm and offering characteristics have an economically significant impact on the ability of the IPO firm to attain post-IPO profitability. We find that the amount raised at the IPO is negatively related to the probability of profitability and positively related to the time-to-profitability. A plausible explanation for this result is that easy access to capital allowed technology firms during the Internet bubble period to raise more than the requisite amount of capital both prior to and at their initial public offerings. Consistent with this conjecture, Ljunqvist and Wilhelm (2003) report that the mean gross proceeds raised by IPO firms nearly tripled during the 1996–2000 period. The extra cash provided these firms with ample incentives to pursue negative net present value projects resulting in a lower probability of attaining profitability and a longer time-to-profitability. In addition, we find that both the age of the firm and the number of employees employed by the firm at the time of going public are positively related to the probability of attaining post-IPO profitability.

One of the limitations of our study is that there may be a problem of generalizability of our results to other time periods and other emerging industries. Our sample period of 1996–2000 represents a period in the IPO market where disproportionate numbers of firms particularly in the technology sector were able to go public relatively easily soon after founding and while still unprofitable. Further, IPO investors during this period appeared to willingly accept the argument stressing growth over profitability and tended to optimistically value firms under the assumption that the high pre-IPO growth rates could be sustained for an unrealistically long period of time. However, as pointed out earlier in the paper, although the Internet phenomenon represented an unusual situation, similar periods have occurred in the IPO market in a variety of emerging industries such as biotechnology and disk drives and are likely to occur again in the future. Further, such waves of hot and cold IPO markets tend to repeat over time even for the same industries and sectors of the economy. We, therefore, believe that our study of the post-IPO path-to-profitability for Internet firms allows us to develop insights that are likely to be useful to investors when similar periods of IPO waves and over-investment in emerging industries occur.

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