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Human and financial capital as determinants of biopharmaceutical IPO de-listings[☆]

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ABSTRACT

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1. Introduction

The management and financing of nascent firms are two of the most fundamental issues in enterprise research. For biopharmaceutical firms, the financing issue increasingly has been addressed by way of an initial public offering (IPO). The IPO represents an “extraordinary, transitory event” in the lives of many firms (Mak & Roush, 2000: 157). Research on IPOs has focused primarily on their financial and operational performance both before and after the IPO (Kooli & Meknassi, 2007). Few studies have analyzed the de-listing of IPOs after the offering (Fischer & Pollock, 2004), with most examining financial and market conditions' effect on firm de-listing (e.g. Baker & Kennedy, 2002; Sanger & Peterson, 1990).

Combining a human capital perspective with the IPO literature, the present study examines pre-IPO human and financial capitals' effect on firm de-listing after the IPO. Specifically, the study's interest is in knowing if chief executive officer (CEO) attributes and sources of capital are associated with recent biopharmaceutical IPOs' de-listing from the public markets. The study examines biopharmaceutical firms as they rely heavily on the talents of their managers (Baum & Silverman, 2004), are hyper-competitive (Oliver & Lieeskind, 1997), have considerable capital requirements (DiMasi & Grabowski, 2007; Xu, 2009), few financial resources of their own (McCutchen & Swamidass, 1996), long gestation periods for their marketable products (Williams & Pouder, 2010), and are strategically committed to one single industry (Liebeskind, Oliver, Zucker, & Brewer, 1996).

The study chooses CEOs to examine as they are widely considered to occupy a position of unique and powerful influence on the firm (Daily & Johnson, 1997).

Human capital theory (HCT) suggests that firms with individuals with more or superior quality human capital achieve higher performance in accomplishing pertinent tasks (Wincent, Anokhin, & Örtqvist, 2010), which in turn should lead to a positive outcome for the firm. The study accepts this central tenet of HCT. The study examines the outcome of the IPOs' de-listing or non-de-listing status after three years of going public, as this is an understudied area, and is well beyond the typical lock-up period for pre-IPO investors to divest their investment in the firm.

De-listings are a frequent event on all stock exchanges (Fama & French, 2004). Firms de-list for two major reasons—financial distress and takeovers (Baker & Kennedy, 2002). Fama and French (2004) find de-listings between 1980 and 2001 to be primarily attributable to poor financial performance. Researchers (e.g. Bach & Smith, 2007; Welbourne & Andrews, 1996) typically associate de-listing with firm non-survival. This is because a negative financial performance de-listing typically signals the firm's inevitable financial collapse (Peristiani, 2003). The limited existing literature on IPO acquisitions suggests that targets of acquisitions are typically weak underperformers (Jain & Kini, 1999), with few acquired IPOs spun-off and re-listed in their original form. This study takes an overall view of a firm's de-listing as a negative outcome (but does not go as far to call it non-survival or failure) as it represents the end of a firm's stock being publicly traded by itself.

The study examines general, industry-specific, and firm-specific human capital factors associated with the IPO's CEO and relate them to firm de-listing. It also integrates the IPO literature related to sources of capital and their effect on IPO de-listing. In addition, the study tests to see if there are differences related to the variables in

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firms that do not de-list, and firms that de-list due to financial reasons or takeovers.

2. Theoretical framework and research hypotheses

2.1. Human capital theory

Inherent in the history of management scholarship is the view that top executives matter. Human capital theory (e.g. Becker, 1964; Hambrick & Mason, 1984; Schultz, 1961), specifically, suggests that a firm's outcomes can be partially predicted by managerial characteristics. Human capital theory primarily has been linked with three schools of thought: the behavioral school of decision making, social capital theory, and the resource based view of the firm. Hambrick and Mason (1984) joined HCT with the behavioral school of decision making (e.g. Cyert & March, 1963). Hambrick and Mason (1984) noted that managerial characteristics could act as indicators of the broad tendencies or behaviors that a manager brought to an administrative position. These behaviors are the product of the individual's experiences, training, and background also known as their cognitive base. HCT posits that increases in knowledge or skills enhance an individual's cognitive base or ability, typically leading to better outcomes for the firm (Davidsson & Honig, 2003).

One particular aspect of an individual's knowledge or cognitive base that HCT scholars note relates to the supporting relationships between professionals and other economic actors, otherwise known as social or relational capital (e.g. Fischer & Pollock, 2004; Pennings, Lee, & Witteloostuijn, 1996). Social capital can occur at both the individual or firm-specific level, but is mainly attributable to individual actors who provide critical resources (Davidsson & Honig, 2003). Typically, social capital is associated positively with firm performance.

Scholars also tie HCT to the resource based view (RBV) of the firm (e.g. Arthurs, Besenitz, Hoskisson, & Johnson, 2009; Dimov & Shepherd, 2005). This linkage maintains that the knowledge and capabilities of the CEO and other top team members act as resources that lead to competitive advantage as long as they are rare, valuable, inimitable, and non-substitutable (Barney, 1991). Furthermore, a CEO's experiences, characteristics, and knowledge may act as dynamic resources, leading to competitive advantage for the firm. This competitive advantage also may lead to the positive outcome of remaining publicly traded. Firms usually hire employees, including CEOs, based on their perceived human capital for this very reason, i.e. the CEO's human capital has transferable economic value for the firm (Becker, 1962; Lepak & Snell, 2002). Thus, the behavioral school of decision making, social capital theory, and RBV are used to reinforce and expand the central tenets of human capital theory—that is, people matter, and to a certain extent different people affect the firm and its performance differently based upon the level or characteristics of their cognitive bases.

Individuals can possess general, industry-specific, and firm-specific knowledge and skills (Becker, 1962). General human capital relates to an individual's education or life experiences that may enhance their overall decision-making ability (Cooper, Gimeno-Gascon, & Woo, 1994). Industry-specific human capital relates to the knowledge and capabilities that cannot be completely transferred to other industries. Whereas, firm-specific human capital represents a unique set of processes, procedures, and insights that have limited value outside of the originating firm (Gimeno, Folta, Cooper, & Woo, 1997).

2.1.1. General human capital

Becker (1964) notes that younger persons typically change jobs more frequently than older persons do. Hambrick and Mason (1984) propose that the age of managers was inversely related to their willingness to take risks, with younger managers being more inclined to take risk. Hambrick and Mason (1984) base their proposal

on previous research that argues that older executives were less risk-tolerant due to their: (1) ability to grasp new ideas or integrate these ideas into the firm, (2) greater commitment to the firm and the status quo, and (3) desire to seek financial security rather than pursue new disruptive strategies that might lead to firm failure. Hambrick and Mason (1984) also associate younger managers with greater growth and variability in profits. Wiersema and Bantel (1992) found that firms in the process of strategic change are often managed by teams whose managers are younger.

The IPO process itself is a transformational change for the organization with new reporting and operational requirements (Peristiani & Hong, 2004). The pursuit of too much growth or change on the part of the firm, however, can lead to financial distress (Miller, 1977). Robbins-Roth (2000) notes that many of the private firms in the initial wave of biotechnology pursued too aggressive a growth strategy and suffered financial distress, with venture capital partners having to discipline them. In addition, younger managers may be more inclined to merger or acquisition than older CEOs believing that there may be additional opportunities in the established or acquiring firm. Younger CEOs also may believe that they have time once again to become a CEO elsewhere. Thus, the hypothesis:

Hypothesis 1a. In the biopharmaceutical industry, older IPO CEOs will be negatively associated with de-listing.

Education represents explicit knowledge that can be articulated, codified, and transferred between individuals and firms (Dimov & Shepherd, 2005). Higher levels of education of an individual can reflect greater cognitive knowledge and capability (Wiersema & Bantel, 1992). Thus, higher levels of education typically are associated with higher task performance by HCT scholars. Education also can reflect commitment, motivation, and discipline (Cooper et al., 1994), which are essential HCT qualities necessary to running a new venture.

The Master of Business Administration (MBA) degree is considered the main general professional degree for those wishing to manage firms. Erikson (2002: 283) notes that most graduating MBAs have “inherent business potential,” and that venture capitalists tend to invest in start-ups that have MBAs as part of their managerial talent. Hambrick and Mason (1984) suggest that those with a MBA are not as risk-prone as self-made executives are, with an MBA's didactic training more geared toward moderating tendencies for big losses or mistakes.

Thus, the hypothesis:

Hypothesis 1b. In the biopharmaceutical industry, IPO CEOs with a MBA will be negatively associated with de-listing.

Prior business experience also can play a significant role in performance. Experience aids in the assimilation of new knowledge and new situations (Davidsson & Honig, 2003). Senior management experience, specifically, may act to cultivate skills for interacting with diverse stakeholders and supervising disparate functions (Cooper et al., 1994). Few (if any) management jobs require greater breadth of experience than that of a CEO. Additionally, CEOs are the primary employees responsible for firm performance and the human capital that they bring from their prior CEO experience may lead to the firm's continued listing on a stock exchange. Thus, the hypothesis:

Hypothesis 1c. In the biopharmaceutical industry, IPO CEOs with previous CEO experience will be negatively associated with de-listing.

2.1.2. Industry-specific human capital

Cooper et al. (1994) note that industry-specific human capital can affect the performance of a firm by providing the tacit knowledge of the key success factors of an industry. Tacit knowledge relates to “know-how,” which is often non-codified knowledge (Davidsson &

Honig, 2003) and includes knowledge of people, technologies, and other firms. One would expect that industry-specific tacit knowledge would be vital to the success of firms in this industry and at this stage of the firms' and industry's life cycles.

The biopharmaceutical industry is under-going rapid change as the traditional chemical based pharmaceutical technologies are being replaced by biotechnology (Zucker & Darby, 1997). Biotechnology is relatively new and has very specialized technology and personnel. For example, Zucker, Darby, and Brewer (1998) discover that the founding of new biopharmaceutical firms depends notably on the number of "star scientists." Several other studies find industry experience to be important for firm survival. Bach and Smith (2007) find CEOs of computer related industries with greater industry experience to be associated with IPO survival. Cooper et al. (1994) discover that new firms with management teams with little industry experience have higher failure rates. Pennings et al. (1996) find Dutch accounting firms with founders with more industry-specific experience having lower mortality rates.

In addition to founders, most of the personnel working in this industry are highly trained professionals and require a different set of skills to manage them than, say, a manufacturing firm. Scholars (e.g. Drucker, 1952; Quinn, Anderson, & Finkelstein, 1996) studying the management of professionals suggest that professionals prefer being managed by individuals with backgrounds similar to their own, and that the success of the firm can be in some part attributable to being managed by such personnel. Thus, the hypotheses:

Hypothesis 2a. In the biopharmaceutical industry, IPO CEOs with greater biopharmaceutical experience will be negatively associated with de-listing.

Hypothesis 2b. In the biopharmaceutical industry, IPO CEOs with a doctoral degree in the sciences or medicine will be negatively associated with de-listing.

2.1.3. Firm-specific human capital

As an individual's time with a firm grows, they typically develop more firm-specific human capital (Pennings et al., 1996). An implication of this is that employees whose human capital is firm-specific may become less mobile as they have a limited scope of applicability (Becker, 1964; Gimeno et al., 1997). Hambrick and Mason (1984) propose that there is an inverse relationship between years of service by top managers and their making significant strategic choices about new environments. Wiersema and Bantel (1992) find a relationship between length of tenure and commitment to the status quo.

Mobility may be an issue for some managers, this study also takes the position that length of tenure relates to commitment to the firm and can mean a belief in the firm's success. From this perspective, CEO length of tenure can also represent a CEO's belief in his own human capital and as Becker (1964: 9) states "[m]any workers increase their productivity by learning new skills and perfecting old ones while on the job." Also, longer-tenured CEOs may display greater commitment to the status quo because they had a greater role in developing it than did shorter-tenured CEOs. The human capital trait of tenure also suggests certain knowledge about what works within the firm, and can signal the perseverance necessary to remain publicly traded. Thus, the hypothesis:

Hypothesis 3a. In the biopharmaceutical industry, IPO CEOs with longer tenures will be negatively associated with de-listing.

Many studies (e.g. Arthurs et al., 2009; Cooper et al., 1994) note that new ventures often come from the insight of individuals working within an industry who identifies a new opportunity. The biotechnology industry is replete with such scientist-founder entrepreneurs. Founders not only have the greatest knowledge of the firm's operating history, but also know the pre-history of the firm. Initially, much

of the human capital of the firm derives from the founder. As Cooper et al. (1994: 375) observes about founder-entrepreneurs, "[h]e or she is most often solely responsible for the process that gives meaning to data, identifies the range of alternatives, determines actions, and carries these out." Because of this, founders of firms should have greater firm-specific human capital and both emotional and financial commitment in excess of a CEO who is hired after the firm's founding. Fischer and Pollock (2004) note that founder-CEOs may have more ability than non-founder-CEOs have in reducing internal conflicts and battles during and after the IPO. Thus, the hypothesis:

Hypothesis 3b. In the biopharmaceutical industry, IPO CEOs who had been founders of the firm will be negatively associated with de-listing.

2.2. Financial capital sources

Cooper et al. (1994: 375) note, "the availability of financial capital can affect the performance of the venture by creating a buffer against random shocks and by allowing the pursuit of more capital-intensive strategies, which are better protected from imitation." Biopharmaceutical firms are highly capital-intensive firms and spend a greater percentage of their revenue on research and development (R&D) than any other industry (Danzon, Nicholson, & Pereira, 2005). New biopharmaceutical firms, however, typically lack internally generated revenue and rely on outside sources of capital to fund their R&D efforts (McCutchen & Swamidass, 1996). This study suggests that financial capital can be similar to human capital from the perspective that firms with access to greater or higher quality financial capital should achieve higher performance in accomplishing relevant tasks and lead to firm non-de-listing.

Biopharmaceutical firms typically receive funding from several sources (Williams & Pouders, 2010). These funding sources include founders, banks, angel investors, venture capitalists, other biopharmaceutical firms, and the public markets. Prominent among these sources of funding are venture capitalists and other biopharmaceutical firms.

Venture capitalists have well developed selection methods for choosing promising new firms for investment (Kollmann & Kuckertz, 2010). Venture capitalists also offer management expertise (Jain, 2001) and help establish social ties with other stakeholders including other financiers. In this sense, venture capitalists may represent a form of human capital for the new firm and a higher quality of investor compared with inactive investors. Venture capitalists typically generate a high internal rate of return. This return typically is generated by way of an IPO or pre-IPO acquisition. Venture capitalists, however, also typically retain interest in the firm post IPO (Barry, Muscarella, Peavy, & Vetsuypens, 1990). For these reasons, the presence of venture capital typically is portrayed as adding value to the firm (e.g. Baum & Silverman, 2004; Chen, 2009). Thus, the hypothesis:

Hypothesis 4a. IPOs with venture capital investors will be negatively associated with de-listing.

Other biopharmaceutical firms invest in new biopharmaceutical firms as well. Lerner and Merges (1998) find that pharmaceutical firms are the single largest provider of funds for new biopharmaceutical firms. These established firms invest in new firms either by acquiring their stock or by way of strategic alliances. Established pharmaceutical firms do this in order to gain access to the capabilities, knowledge, and patents of biotechnology firms (Danzon, Epstein, & Nicholson, 2007). Nicholson, Danzon, and McCullough (2005) find that in 1998 biotechnology firms received from strategic alliances with pharmaceutical firms more than three times the amount they collected in the private and public equity markets combined.

The presence of other biopharmaceutical firms in the form of owners or strategic alliance partners could represent either a threat

or opportunity for the new firm. On the one hand, biopharmaceutical firm investors are the entities most likely to acquire another biopharmaceutical firm. For example, biotechnology firms are increasingly opting to be acquired rather than pursue an IPO (Hamilton, 2006). Alternatively, biopharmaceutical firms provide needed capital in excess of venture capitalists or others' funds. Biopharmaceutical firms also provide additional industry-specific human capital in the form of knowledge about managing in this complex environment and progressing through the arduous regulatory process. Like venture capital, funds from other biopharmaceutical firms may represent the dimension of quality funds (i.e., active investment). It also seems unlikely, and expensive, for an owner to dilute their ownership interest in a firm in one year (i.e., by way of an IPO) and then turn around and buy back that interest and others' interest a few short years later. Thus, the hypotheses:

Hypothesis 4b. IPOs with biopharmaceutical firm strategic alliance partners will be negatively associated with de-listing.

Hypothesis 4c. IPOs with other biopharmaceutical firm investors will be negatively associated with de-listing.

3. Research design and measures

3.1. Sample

The sample includes biopharmaceutical drug firms with standard industrial classification (SIC) codes 2834 (Pharmaceutical Preparations) and 2836 (Biological Products). The sample represents biopharmaceutical firms that went public for the first time between January 1, 1996 and December 31, 2007. One hundred fifty seven (157) biopharmaceutical firms went public during this period of which the study uses 153 firms. The author checked each firm's Security & Exchange Commission's (SEC) filings, yahoo.finance.com, and the appropriate stock exchanges' (e.g. NASDAQ) websites to verify the date the firm's stock traded for the first time and its status of trading or de-listing. The study follows the firm's status through December 31, 2010, with 1996 being the first year that these data are available via the SEC's website.

3.2. Measures

Data come from the firm's filing with the SEC. The dependent variable indicates if the firm de-lists or ends trading in a major stock market exchange within three years of its initial public offering or not. The study controls for the firm's total assets and number of U.S. patents under the control of the firm. The independent variables acting as proxies for human capital include: CEO who is a founder, CEO's age, CEO's tenure, number of years the CEO has

Table 2
Human capital related to de-listing or non-de-listing.

	Coefficient estimate	S.E.	Wald	Sig.	Exp(B)
Assets	.14	.20	.48	.49	1.15
Patents	-.34	.29	1.44	.23	.71
CEO age	.11	.05	6.02	.01	1.12
MBA	-.64	.65	.97	.33	.53
Previous CEO	1.50	.73	4.28	.04	4.50
Bio experience	-1.06	.49	4.65	.03	.35
Ph.D./M.D.	.04	.56	.01	.94	1.04
CEO tenure	.17	.09	3.28	.07	1.18
Founder	1.45	.54	7.24	.01	4.28
Venture capital	-.69	.60	1.34	.25	.50
Alliance partner	1.06	.52	4.24	.04	2.90
Biopharmaceutical	-.76	.45	2.89	.09	.47

N = 153; Nagelkerke R² = .23.

worked in the biopharmaceutical sector (non-academic), CEO's previous experience as a CEO at another firm, and two variables for CEO's education—MBA and doctoral degree in a scientific field (Ph.D. or M.D.). The independent variables for financial capital include venture capital ownership interest, biopharmaceutical ownership interest, and strategic alliance participation. The study determines venture capital investment by cross-matching principal stockholding firms and individuals with Pratt's Guide to Venture Capital Sources (1996–2004 eds.). The study uses a logistic regression analysis.

4. Results

Table 1 presents the descriptive statistics and correlations between variables in the models. Thirty eight of the 153 firms (or 24.8%) de-list within three years of their IPO.

Table 2 presents the logistic regression analysis results. The results indicate a good fit of the model to the data (Model $\chi^2 = 25.95$ (p = .01); -2 Log likelihood = 145.57; Cox & Snell R² = .16; R²_L = .15; and Nagelkerke R² = .23). The prediction table also appears to indicate good accuracy of prediction (77.1% correctly predicted).

Table 2 shows that the human capital variables of CEO age, CEO with previous CEO experience, number of years of biopharmaceutical experience by the CEO, and CEO as founder have a statistically significant correlation with firm de-listing. The direction of the relationship between de-listing and number of years of previous biopharmaceutical experience is as predicted. This supports the hypothesis (e.g. Hypothesis 2a) related to firms with CEOs with greater biopharmaceutical experience being less likely to de-list. The odds ratio shows that every one year increase in biopharmaceutical experience decreases the likelihood of de-listing by 65%. Although several other of the human capital variables are

Table 1
Descriptive statistics and correlations.

	Mean	S.D.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) 3-Year delisting	.25	.43	-												
(2) Assets (ln)	16.85	1.19	.05												
(3) Patents (ln)	2.48	.76	-.04	.15											
(4) CEO age	49.14	5.94	.09	-.09	.04										
(5) MBA	.26	.44	.07	-.08	.02	-.14									
(6) Previous CEO	.17	.38	-.14	-.15	-.05	.09	.17*								
(7) Ph.D./M.D.	.58	.50	-.06	-.08	.12	.03	-.60**	-.14							
(8) Bio experience (ln)	2.52	.55	-.06	.06	.07	.56**	-.05	.03	-.11						
(9) Founder	.42	.50	-.19*	.00	-.06	-.07	-.27**	-.07	.18*	-.14					
(10) CEO tenure	3.95	2.68	.01	.13	.11	.08	-.24*	-.12	.11	.13	.36**				
(11) Venture capital	.79	.41	.11	.14	.08	-.04	.12	-.11	-.08	.03	-.18*	-.10			
(12) Biopharmaceutical	.41	.49	.10	.10	.18*	.02	-.08	-.03	.07	-.04	-.07	-.08	-.13		
(13) Alliance partner	.73	.45	-.05	.08	.18*	.10	.03	-.15	.03	.11	-.18	.07	.12	.19*	-

N = 153. *significant at the .05 level; **significant at the .01 level.

Table 3
Human capital over time.

	Coefficient estimate	S.E.	Wald	Sig.	Exp(B)
Assets	.15	.13	1.24	.27	1.16
Patents	.27	.29	.87	.35	1.31
CEO age	.09	.04	6.57	.01	1.09
MBA	-.67	.49	1.84	.18	.51
Previous CEO	.62	.46	1.80	.18	1.85
Bio experience	-.90	.45	4.08	.04	.41
Ph.D./M.D.	-.48	.41	1.39	.24	.62
CEO tenure	.07	.06	1.22	.27	1.07
Founder	1.06	.43	6.09	.01	2.89
Venture capital	.18	.40	.19	.66	1.19
Alliance partner	1.59	.49	10.49	.00	4.92
Biopharmaceutical	.09	.35	.06	.80	1.09

N = 153.

statistically significant, the direction of three of these variables (e.g. CEO age, previous CEO, and CEO as founder) is not as hypothesized; and thus, is contrary to the hypotheses (e.g. [Hypothesis 1a](#); [Hypothesis 1c](#); [Hypothesis 3b](#)). Interestingly, a one unit increase in either being a previous CEO or founder increases the odds of de-listing by a factor of 4.50 and 4.28, respectively. The other human capital variables are not statistically significant, and thus do not support the hypotheses (e.g. [Hypothesis 1b](#); [Hypothesis 2b](#); [Hypothesis 3a](#)).

Of the financial capital sources variables, only the variable of having an alliance partner is statistically significant. The direction of the variable, however, is contrary to the hypothesis (e.g. [Hypothesis 4b](#)) and increases the odds of being de-listed by a factor of 2.90.

Given the results from the logistic regression model related to de-listing, it is useful to study the influence of the variables over time and know the reason for the de-listing. A survivor analysis using the Cox regression model helps in this manner. In this phase of the study, the study relaxes the previous requirement of surviving three years or less and examines all 153 IPOs over time, noting if they remain listed or when they terminated their trading. Fifty of the 153 firms (32.7%) de-list at some time over the study period.

[Table 3](#) presents the results from the Cox regression model. Four indicators are statistically significant—CEO's age, CEO biopharmaceutical experience, founder, and having an alliance partner. Similar to the logistic regression results, only CEOs with more biopharmaceutical experience supports one of the hypotheses ([Hypothesis 2a](#)). Thus, the results from the Cox regression model, in general, point to the same conclusions as the logistic regression model.

Additionally, of the 38 firms that de-list within 3 years, 63.2% (24 firms) de-list due to takeovers, with the remaining 36.8% (14 firms) de-listing due to financial reasons. The cause of de-listing is determined by visiting the SEC website and tracking down the

Table 4
Human capital related to non-delisting, takeovers, and financial distress.

Independent variables	Dependent variables											
	Log (P _{NDL/TO})				Log (P _{NDL/FD})				Log (P _{TO/FD})			
	B	Wald	p-value	Exp(B)	B	Wald	p-value	Exp(B)	B	Wald	p-value	Exp(B)
Assets	.10	.16	.69	1.11	-.14	.22	.64	.87	-.24	.46	.50	.79
Patents	-.38	1.26	.26	.68	-.18	.19	.67	.83	.20	.16	.69	1.22
CEO age	.04	.66	.42	1.04	.13	3.49	.06	1.14	.09	1.24	.27	1.10
MBA	.06	.01	.94	1.06	-1.54	2.57	.11	.22	-1.60	2.10	.15	.20
Previous CEO	1.30	2.42	.12	3.67	1.71	2.01	.16	5.52	.41	.08	.77	1.50
Bio experience	-.21	.13	.72	.81	-1.97	6.75	.01	.14	-1.75	4.19	.04	.17
Ph.D./M.D.	.05	.01	.94	1.05	.09	.01	.92	1.10	.04	.00	.97	1.05
CEO tenure	.11	.94	.33	1.12	.27	3.90	.05	1.31	.16	.86	.35	1.17
Founder	1.9	8.45	.00	7.28	.93	1.25	.26	2.54	-1.05	1.10	.30	.35
Venture capital	-.75	.10	.32	.47	-.66	.48	.49	.52	.09	.01	.94	1.09
Alliance partner	1.03	3.02	.08	2.80	.55	.45	.50	1.74	-.48	.27	.60	.62
Biopharmaceutical	-.58	1.22	.27	.56	-1.40	3.10	.05	.25	-.82	1.05	.31	.44

N = 153; Nagelkerke R² = .28; NDL = Non-De-listing; TO = Takeover De-listing; FD = Financial Distress De-listing.

appropriate form or information for both the acquired firm and the acquiring firm. The finding related to cause of de-listing is opposite the findings of much of the research on de-listings. Due to this, it is useful to see if there are differences between firms surviving and those that de-list due to takeovers or financial distress. The study uses a multinomial logistic regression to assist in this analysis. [Table 4](#) presents the results.

The results indicate a good fit of the model to the data (Model $\chi^2 = 36.97$ (p = .04); -2 Log likelihood = 184.57; Cox & Snell R² = .22; R²_L = .17; and Nagelkerke R² = .28). The first panel (e.g. Log (P_{NDL/TO})) shows that the only variable with a statistically significant relationship between non-de-listing and takeovers is CEOs who are also founders. In other words, IPOs with CEOs as founders are more likely than IPOs without CEO founders to be taken over or acquired compared with firms that did not de-list. The odds ratio shows that a firm with a founder is more likely to be acquired by a factor of over 7.

The second panel (e.g. Log (P_{NDL/FD})) shows three variables with statistically significant results: CEOs with biopharmaceutical experience, CEO tenure, and biopharmaceutical investors. There is a negative relationship for both CEO biopharmaceutical experience and biopharmaceutical investors. This means that IPOs with CEOs with greater biopharmaceutical experience are less likely than IPOs with CEOs with less biopharmaceutical experience to de-list due to financial distress compared with firms that did not de-list. Similarly, IPOs with biopharmaceutical investors are less likely than IPOs without biopharmaceutical experience to de-list due to financial distress compared with firms that did not de-list. The reverse is true for IPOs with CEOs with greater tenure, as IPOs with CEOs with greater tenure are more likely than IPOs with CEOs with less tenure to de-list for financial reasons than IPOs that do not de-list.

The third panel (e.g. Log (P_{TO/FD})) shows that the variable of CEOs with greater biopharmaceutical experience to be statistically significant and this relationship is negative. This means that IPOs with CEOs with greater biopharmaceutical experience are less likely than IPOs with CEOs with less biopharmaceutical experience to de-list due to financial distress compared with firms that de-listed due to takeover.

5. Discussion

5.1. Discussion of findings

Human capital theory generally posits that more or better quality human capital leads to greater performance, which the study argues should lead to firm non-de-listing. The study's results did not affirm

Table 5
Comparative results of the three analyses.

	3 year delisting (Table 2)	Any year delisting (Table 3)	Non-de-list/takeover (Table 4)	Non-de-list/financial distress (Table 4)	Takeover/financial distress (Table 4)
CEO age (Hypothesis 1a)	—	—	n.s.	n.s.	n.s.
MBA (Hypothesis 1b)	n.s.	n.s.	n.s.	n.s.	n.s.
Previous CEO (Hypothesis 1c)	—	n.s.	n.s.	n.s.	n.s.
Bio experience (Hypothesis 2a)	+	+	n.s.	+	+
Ph.D./M.D. (Hypothesis 2b)	n.s.	n.s.	n.s.	n.s.	n.s.
CEO tenure (Hypothesis 3a)	n.s.	n.s.	n.s.	—	n.s.
Founder (Hypothesis 3b)	—	—	—	n.s.	n.s.
Venture capital (Hypothesis 4a)	n.s.	n.s.	n.s.	n.s.	n.s.
Alliance partner (Hypothesis 4b)	—	—	n.s.	n.s.	n.s.
Biopharmaceutical (Hypothesis 4c)	n.s.	n.s.	n.s.	+	n.s.

+ means statistically significant as hypothesized; — means statistically significant but not as hypothesized; n.s. means not statistically significant.

this and differs from much of the IPO literature. Table 5 summarizes our findings for all analyses.

Following much of the IPO literature, the study takes the view that financial distress or takeover represents the same outcome—de-listing. The study finds somewhat different results when it examines these causes individually. To help with the interpretation of these results, the study combines the literature on motivations for firms (and hence CEOs) for undertaking an IPO with the human capital literature and examines the results from all three statistical methods simultaneously.

Much of the finance literature on IPOs takes the view that the IPO is part of the natural progression in the firm's life cycle (Zingales, 1995). However, as Pagano, Panetta, and Zingales (1998: 28) note “going public is not a stage that all companies reach, but is a choice.” Some of the non-mutually exclusive reasons (Jain & Kini, 1999) for going public include raising capital for diversification, increasing shareholder liquidity, exploitation of the mis-pricing issue, establishment of fair market value for the firm, and facilitation of future mergers and acquisitions (Kim & Weisbach, 2008; Pagano et al., 1998).

One speculation with respect to takeovers compared to non-de-listed firms is that founder-CEOs may realize that the IPO represents a way to establish fair market value that is greater than they could negotiate on their own. The merger and acquisition literature suggests that firms often struggle with establishing a price for the target firm (Vanhaverbeke, Duysters, & Noorderhaven, 2002). The IPO may represent a means for the pre-IPO owners to establish fair market value in order for others to acquire their interests, with the takeover facilitating not only an acquisition but also an exit vehicle for the founder-CEO. In this case, the IPO may represent an exit mechanism for the founder-CEO similar to that for the venture capital firms. This exit of the founder-CEO may be due to CEO burn-out, exhaustion, boredom, or other opportunities, with founders, perhaps, finding that the transition from entrepreneur to professional manager of a publicly traded firm a difficult one.

Another speculation is that the founder-CEO may represent a serial entrepreneur who is more likely to take a firm public and then seek to hand over the management of the firm to another. The IPO itself does not facilitate someone else managing the firm; however, an acquisition may. Halebian, Devers, McNamara, Carpenter, and Davison (2009) note that top team turnover is common in firms that are acquired. The significant finding of CEO tenure with respect to financial distress de-listing may suggest that the CEO was “hanging on” or too committed to the status quo as opposed to seeking to exit the firm, which would be the opposite motivation of a serial entrepreneur or (perhaps) founder-CEO who is trying to establish fair market value with the IPO.

Furthermore, regardless of method, the results show that CEOs with greater biopharmaceutical experience are negatively related to de-listings (especially due to financial distress). This suggests that to a certain extent industry experience matters for biopharmaceutical CEOs.

This is the case no matter if we compare financial distress de-listings to non-de-listings or takeovers. Likewise, having biopharmaceutical investors lessens the likelihood of a financial distress de-listing compared to non-de-listing. Taken together, this suggests that industry experience and (perhaps social human capital) connections matter with respect to not having a financial distress de-listing.

5.2. Limitations

The present study has several limitations. The study examines only biopharmaceutical firms, and it is not known if the findings are generalizable to other firms in other industries. The sample size is modest and represents a relatively short period of time. The study also focuses on the influence of a single individual as opposed to those of the top management team or governing body. It also looks at the CEO's attributes prior to the IPO, not considering changes in attributes or persons post IPO.

6. Conclusions

The study finds several indicators that suggest that CEOs with more or better quality human capital are associated with IPOs' de-listings. It also finds that the majority of firms in the study de-list due to acquisitions, not financial distress. The study speculates that the motivations of CEOs may somewhat account for the findings. The findings should be of interest to scholars, practitioners, and investors as they suggest that biopharmaceutical firms with founder-CEOs are associated with a greater likelihood of the firm being acquired after the IPO, as well as firms with CEOs with greater biopharmaceutical experience or biopharmaceutical investors being less likely to suffer a financial distress de-listing.

References

- Arthurs, J. D., Besenitz, L. W., Hoskisson, R. E., & Johnson, R. A. (2009). Firm-specific human capital and governance in IPO firms: Addressing agency and resource dependence concerns. *Entrepreneurship Theory and Practice*, 33(4), 845–865.
- Bach, S. B., & Smith, A. D. (2007). Are powerful CEOs beneficial to post-IPO survival in high technology industries? An empirical examination. *The Journal of High Technology Management Research*, 18, 31–42.
- Baker, G. P., & Kennedy, R. E. (2002). Survivorship and the economic grim reaper. *Journal of Law, Economics, and Organization*, 18(2), 324–361.
- Barney, J. A. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99–120.
- Barry, C. B., Muscarella, C. J., Peavy, J. W., & Vetsuypens, M. R. (1990). The role of venture capital in the creation of public companies. *Journal of Financial Economics*, 27(2), 447–471.
- Baum, J., & Silverman, B. S. (2004). Picking winners or building them? Alliance, intellectual and human capital as selection criteria in venture financing and performance of biotechnology startups. *Journal of Business Venturing*, 19(3), 411–436.
- Becker, G. S. (1962). Investment in human capital: A theoretical analysis. *Journal of Political Economy*, 70(5), 9–49.
- Becker, G. S. (1964). *Human capital*. Chicago, IL: University of Chicago Press.
- Chen, C. J. (2009). Technology commercialization, incubator and venture capital, and new venture performance. *Journal of Business Research*, 62, 93-1-3.

- Cooper, A. C., Gimeno-Gascon, F. J., & Woo, C. Y. (1994). Initial human and financial capital as predictors of new venture performance. *Journal of Business Venturing*, 9, 371–395.
- Cyert, R. M., & March, J. G. (1963). *A behavioral theory of the firm*. Englewood Cliffs, N.J.: Prentice Hall.
- Daily, C. M., & Johnson, J. L. (1997). Sources of CEO power and firm financial performance: A longitudinal assessment. *Journal of Management*, 23(2), 97–117.
- Danzon, P. M., Epstein, A., & Nicholson, S. (2007). Mergers and acquisitions in the pharmaceutical and biotech industries. *Managerial and Decision Economics*, 28, 307–328.
- Danzon, P. M., Nicholson, S., & Pereira, N. S. (2005). Productivity in pharmaceutical-biotechnology R&D: The role of experience in alliances. *Journal of Health Economics*, 24, 317–339.
- Davidsson, P., & Honig, B. (2003). The role of social and human capital among nascent entrepreneurs. *Journal of Business Venturing*, 18(3), 301–331.
- DiMasi, J. A., & Grabowski, H. G. (2007). The cost of biopharmaceutical R&D: Is biotech different? *Managerial and Decision Economics*, 28, 469–479.
- Dimov, D. P., & Shepherd, D. A. (2005). Human capital theory and venture capital firms: Exploring “home runs” and “strike outs”. *Journal of Business Venturing*, 20(1), 1–21.
- Drucker, P. (1952). Management and the professional employee. *Harvard Business Review*, 30(3), 84–90.
- Erikson, T. (2002). Entrepreneurial capital: The emerging venture’s most important asset and competitive advantage. *Journal of Business Venturing*, 17, 275–290.
- Fama, E. F., & French, K. R. (2004). New lists: Fundamentals and survival rates. *Journal of Financial Economics*, 73, 229–269.
- Fischer, H. M., & Pollock, T. G. (2004). Effects of social capital and power on surviving transformational change: The case of initial public offerings. *Academy of Management Journal*, 47(4), 463–481.
- Gimeno, J., Folta, T. B., Cooper, A. C., & Woo, C. Y. (1997). Survival of the fittest? Entrepreneurial human capital and the persistence of underperforming firms. *Administrative Science Quarterly*, 42, 750–783.
- Haleblian, J., Devers, C. E., McNamara, G., Carpenter, M. A., & Davison, R. B. (2009). Tacking stock of what we know about mergers and acquisitions: A review and research agenda. *Journal of Management*, 35(3), 469–502.
- Hambrick, D. C., & Mason, P. A. (1984). Upper echelons: The organization as a reflection of its top managers. *Academy of Management Review*, 9(2), 193–206.
- Hamilton, D. P. (2006). Biotech companies opt to sale to drug firms over IPOs. <http://www.post-gazette.com/pg/06194/705609-28.stm> Accessed 3/12/10
- Jain, B. A. (2001). Predictors of performance of venture capitalist-backed organizations. *Journal of Business Research*, 52, 223–233.
- Jain, B. A., & Kini, O. (1999). The life cycle of initial public offering firms. *Journal of Business Finance and Accounting*, 26(9), 1281–1307.
- Kim, W., & Weisbach, M. S. (2008). Motivations for public equity offers: An international perspective. *Journal of Financial Economics*, 87, 281–307.
- Kollmann, T., & Kuckertz, A. (2010). Evaluation uncertainty of venture capitalists’ investment—criteria. *Journal of Business Research*, 63(7), 641–747.
- Kooli, M., & Mekkass, S. (2007). The survival profile of U.S. IPO issuers: 1985–2005. *Journal of Wealth Management*, 10(2), 105–119.
- Lepak, D. P., & Snell, S. A. (2002). Examining the human resource architecture: The relationships among human capital, employment, and human resource configurations. *Journal of Management*, 28(4), 517–543.
- Lerner, J., & Merges, R. (1998). The control of technology alliances: An empirical analysis of the biotechnology industry. *Journal of Industrial Economics*, 46(2), 125–156.
- Liebeskind, J. P., Oliver, A. L., Zucker, L., & Brewer, M. (1996). Social networks, learning, and flexibility: Sourcing scientific knowledge in new biotechnology firms. *Organization Science*, 7(4), 429–443.
- Mak, Y. T., & Roush, M. L. (2000). Factors affecting the characteristics of boards of directors: An empirical study of New Zealand initial public offering firms. *Journal of Business Research*, 47, 147–159.
- McCutchen, W. W., & Swamidass, P. M. (1996). Effect of R&D expenditures and funding strategies on the market value of biotech firms. *Journal of Engineering and Technology Management*, 12, 287–299.
- Miller, D. (1977). Common syndromes of business failure. *Business Horizons*, 20(6), 43–53.
- Nicholson, S., Danzon, P. M., & McCullough, J. (2005). Biotech-pharmaceutical alliances as a signal of asset and firm quality. *Journal of Business*, 78(4), 1433–1464.
- Oliver, A. L., & Lieskind, J. P. (1997). Three levels of networking for sourcing intellectual capital in biotechnology. *International Studies of Management & Organization*, 27(4), 76–103.
- Pagano, M., Panetta, F., & Zingales, L. (1998). Why do companies go public? An empirical analysis. *The Journal of Finance*, 53(1), 27–64.
- Pennings, J. M., Lee, K., & Witteloostuijn, A. (1996). Human capital, social capital, and firm dissolution. *Academy of Management Journal*, 41(4), 425–440.
- Peristiani, S. (2003). Evaluating the riskiness of initial public offerings: 1980–2000. *Federal Reserve Bank of New York Staff Reports*. http://www.newyorkfed.org/research/staff_reports/sr167.pdf. Accessed 7/20/09
- Peristiani, S., & Hong, G. (2004). Pre-IPO financial performance and aftermarket survival. *Current Issues in Economics and Finance*. http://www.newyorkfed.org/research/current_issues. Accessed 2/05/10
- Pratt’s Guide to Venture Capital Sources* (1996–2004 eds.). Wesley Hills, MA: Capital.
- Quinn, J. B., Anderson, P., & Finkelstein, S. (March–April). Managing professional intellect: Making the most of the best. *Harvard Business Review*, 71–80.
- Robbins-Roth, C. (2000). *From alchemy to IPO*. New York: Perseus.
- Sanger, G. C., & Peterson, J. D. (1990). An empirical analysis of common stock delistings. *Journal of Financial and Quantitative Analysis*, 25(2), 261–272.
- Schultz, T. W. (1961). Investment in human capital. *The American Economic Review*, 51(1), 1–17.
- Vanhaverbeke, W., Duysters, G., & Noorderhaven, N. (2002). External technology sourcing through alliances or acquisitions: An analysis of the application-specific integrated circuits industry. *Organization Science*, 13(6), 714–733.
- Welbourne, T. M., & Andrews, A. O. (1996). Predicting the performance of initial public offerings: Should human resource management be in the equation? *Academy of Management Journal*, 39(4), 891–919.
- Wiersema, M. F., & Bantel, K. A. (1992). Top management team demography and corporate strategic change. *Academy of Management Journal*, 35(1), 91–121.
- Williams, D. R., & Poudler, R. W. (2010). R&D spending and sources of funding of private U.S. biopharmaceutical firms seeking to go public. *Journal of Commercial Biotechnology*, 16(4), 284–292.
- Vincent, J., Anokhin, S., & Örtqvist, D. (2010). Does network board capital matter? A study of innovative performance in strategic SME networks. *Journal of Business Research*, 63, 265–275.
- Xu, B. (2009). R&D innovation and the value of cash in the biotech industry. *Journal of Business Research*, 62(8), 750–755.
- Zingales, L. (1995). Insider ownership and the decision to go public. *The Review of Economic Studies*, 62, 425–448.
- Zucker, L. G., & Darby, M. P. (1997). Present at the biotechnological revolution: Transformation of technological identity for a large incumbent pharmaceutical firm. *Research Policy*, 26, 429–446.
- Zucker, L. G., Darby, M. P., & Brewer, M. B. (1998). Intellectual human capital and the birth of the U.S. biotechnology enterprises. *The American Economic Review*, 88, 290–306.