Strategic Alliances, Venture Capital, and the Going Public Decision *

Umit Ozmel
Columbia University

David T. Robinson
Duke University

Toby Stuart
Harvard Business School

April 26, 2007

Abstract

Strategic alliances and venture capital play a contrasting but complementary role in the going public decision of young biotechnology firms. Increased alliance activity lowers the hazard of future VC activity, but future VC activity raises the hazard of either. Both types of private capital raise the hazard of going public, and in many specifications alliances play a larger role than VC activity in raising the hazard of IPO. Finally, while VC activity raises the hazard of an acquisition, increased alliance activity lowers it dramatically. These results highlight both the importance of alliance partners in resolving asymmetric information problems in the capital acquisition process, as well as the potential conflict of interest between different sources of private equity.

Why do firms go public? Although there is relatively little empirical work examining the motives behind private firms' decisions to IPO, there is a broad consensus among finance scholars and practitioners that a key driver is the need to access large amounts of capital, amounts in excess of what private equity markets can provide. Indeed, in a

*PRELIMINARY DRAFT: Please do not cite without permission. We are grateful to Jim Brander, Thomas Hellmann, Mark Leary, Michael Roberts and seminar participants at Southern Methodist University and the University of British Columbia for helpful comments. Any errors are our own.

recent survey Brau and Fawcett (2006) find that 2/3 of all CFOs list the need to grow as the main reason behind the timing of their IPO.

Given that hunger for financial resources is a major factor in the going public decision for many firms, this paper focuses on a natural question: What role do private equity markets play in the going public decision?

To explore this question, we focus on a sample of private firms in the biotechnology sector. This sector provides an ideal setting for studying the interaction of public and private capital markets because biotechnology firms frequently access different types of private capital. While venture capital is very active in the biotechnology sector, biotechnology firms at the same time often rely on inter-firm commercialization agreements (strategic alliances) to provide funding. Both types of funding are important sources of private capital for biotechnology firms (Lerner and Merges, 1998).

A major hurdle to empirical work in this area is the dearth of data on private firms. In this paper we develop a novel panel containing over 1900 privately held biotechnology firms that both received venture funding and participated in alliance activity, but to varying degrees. The data begin at a firm's birth, and record the funding histories of the firms in question, as well as prevailing market conditions. This allows us to estimate the effect that strategic alliance activity and venture funding activity have on the hazard of going public: that is, the probability that a firm goes public at a particular point in time as a function of the time since its last funding event. By modeling the duration of the time spell as a private firm, or of the time spell since the last funding event, we can better account for time-series variation in market conditions and other factors that affect firms' funding decisions.

Our results demonstrate not only the interplay between the two types of private equity capital, but also their joint impact on the going-public decision and alternative exit strategies for private investors. First we explore the interaction of venture and alliance funding in the private equity market. Here we observe an asymmetry. Obtaining more funding through strategic alliances lowers the probability that a firm receives another round of venture financing, but raises the probability that it engages in subsequent alliance activity. In contrast, more venture activity increases both the hazard of future venture activity and the future of additional alliance activity.

Next we explore the role that alliances and venture capital play on the going public decision. It comes as no surprise that firms with more venture funding are at greater risk of going public. What is surprising, however, is the fact that strategic alliance activity has an equal, if not greater, impact on the hazard of going public. In contrast, while increased venture capital also raises the hazard of being acquired (VCs, after all, need to exit their investments to book their returns), increased alliance activity substantially lowers the hazard of an acquisition.

These findings reflect two competing forces at work. First, the typical alliance contract in this setting affords project-level decision rights and monitoring provisions to the alliance partner (Robinson and Stuart, 2007). This creates potential for conflicts of interest with venture capitalists, whose firm-level investments create exit motives that may be at odds with the intentions of the alliance partner, and whose firm-level control and cash flow rights may be at odds with the decision rights of the alliance partner. The opposing force is the role that VCs and alliance partners play in resolving the asymmetric problems that firms face when they go public. Our results indicate that strategic alliance partners play a critical role in resolving asymmetric information, in many cases a more important role than played by the venture capitalist.

Of course, any attempt to establish a causal link between private capital market behavior and the going public decision must deal with a variety of endogeneity concerns. Because our models relate the stock of past behavior to the hazard of future behavior, reverse causality in the narrow sense is less of an issue here than it often is in cross-sectional regressions. Nevertheless, any link between past behavior and the going public decision may reflect unobserved heterogeneity in firm characteristics that drives preferential selection into the private capital market. To control for this, we allow for unobserved firm-level heterogeneity in our hazard rate estimation. This guards against the possibility that time-invariant, unobserved quality differences across firms simultaneously make them attractive private equity recipients as well as IPO candidates.

Comparing alternative model specifications indicates that controlling for unobserved heterogeneity has an important affect on our findings. Our measurements of the importance of alliance activity are attenuated when we fail to correct for unobservables. This fact suggests that alliance activity has a treatment effect, rather than just a selection effect, on the going public decision. This extends work by Stuart, Huang and Hybels (1999), who argue that alliance partners play a certification role for young firms. Nevertheless, the possibility remains that time-varying firm characteristics that are uncaptured by our models somehow simultaneously drive private equity and public capital market outcomes. When we compare point estimates across model specifications that include alternative control variables, however, we find little variation in the loadings on alliance and VC activity, which suggests that omitted variables are not driving our results.

Our paper is related to a number of papers that explore determinants of the going public decision. Pagano, Panetta, and Zingales (1998) explore this question in a sample of private Italian firms. They find that larger, more profitable firms go public. In recent work, Chemmanur, He and Nandy (2006) find a similar relation between profitability, performance and going public in US Census of Manufactures data, and also show that IPOs are more likely among market leaders in more concentrated, and less opaque, industries. Our work compliments these findings by focusing on performance in private capital markets, rather than product market performance, as drivers of the going public decision. In that regard, our paper builds on Lerner (1994), which also examines the going public decision among biotech startups, but focuses on the role of the VC in timing access to the public capital market. The recent paper by Hsu (2006) is also closely related. He uses a small sample of technology firms funded under the SBIR program to explore the role that venture capital plays in the commercialization strategies of small, private companies. His analysis also explores the link between venture capital and the firm's going public decision.

Our analysis is distinct from his in a number of ways. On a methodological level, we study a much larger sample, albeit one that is focused on a narrower range of business activities, and we employ statistical models that explicitly account for the effect of the passage of time between funding events. On a conceptual level, however, our main question concerns the degree to which strategic alliances and venture capital are substitutes or complements for one another in the lead-up to the firm's IPO, and how this spills over into the firm's going public decision. Hsu (2006) is primarily concerned with the role that the venture capitalist plays in facilitating subsequent alliance activity. The VCs role as facilitator may stem from professionalizing the startup firm (Hellmann and Puri, 2002), from providing access to other portfolio companies with complementary assets (Lindsey, 2002), or from screening (variety of cites in finance and sociology). By focusing on the feedback between these alternative forms of funding, and on their dual role in the going public decision, our analysis is distinct from Hsu (2006) but complements his work.

Our analysis is also related to numerous studies exploring the role of strategic alliance partners as sources of capital for nascent firms. Most notably, Lerner, Shane and Tsai (2003) show how strategic alliances are relied upon more often during cold IPO markets. This paper's subject is closely related; however, instead of using the substitution of public markets and alliance capital as an identification strategy for measuring differences in control rights across financing regimes, we instead measure the change in the probability of a future IPO as a function of current and past alliance activity.

In that regard, our estimation strategy is related to recent work in the capital structure and investment literature. Leary and Roberts (2005) use duration analysis to study firms' capital structure rebalancing decisions. Whited (2006) uses a similar estimation strategy to measure the role of external financing constraints on the timing of investment decisions. Both these papers implement non-parametric hazard estimation techniques developed in Meyer (1990).

The remainder of the paper is organized as follows. First, we discuss the relevant theory and offer a series of empirical predictions to guide our analysis. This is contained in Section 1. In Sections 2 and 3 we describe our data and discuss key features of our estimation strategy. Section 4 contains our results exploring the interaction between venture capital, alliance activity and the going public decision. Section 5 concludes.

1 Predictions

In this section we draw on past work to develop a series of predictions about the role of venture capital and strategic alliance funding on the probability of going public. We start with predictions surrounding VC funding, since these are fairly unambiguous. Then we proceed to competing hypotheses surrounding the role of strategic alliance funding.

1.1 Venture Capital

The predictions for venture capital and going public are straightforward. We predict that increasing the venture capital funding that a private biotechnology firm receives should increase the probability that it goes public.

This prediction builds directly on the expressed motives of venture capital investors. A VC investor provides capital to a startup with a view to a later exit opportunity, either in the form of an IPO or a sale to another firm. Therefore, any given VC investor who has already invested in a biotechnology company is likely to press for a favorable exit. Moreover, the selection process that precedes the VC's investment decision is likely to favor biotechnology firm that have a higher probability of a favorable exit. Finally, the role that VCs play in the professionalization of startup firms implies that greater VC contact is likely to predict a higher likelihood of the biotechnology firm reaching the point at which it can successfully IPO.

The predictions for venture capital on subsequent alliance activity are less clear cut. A number of papers suggest that increased venture funding should lead to a greater chance of future alliance activity. Hellmann and Puri (2002) emphasize the role of venture capitalists in professionalizing start-up businesses. Since having a more professionally managed firm probably raises a firm's attractiveness as an alliance partner, this suggests that increased venture activity should increase the hazard of subsequent alliance activity. Likewise, Lindsey (2003) shows that venture capitalists facilitate alliance activities among portfolio companies. In addition, Hochberg, Ljunqvist and Lu (2005) find that better networked VCs are more successful, arguing that this owes to their more extensive business connections that can be brought to the aid of portfolio companies. These arguments also predict that increased VC activity should increase the hazard of alliance activity, since the VC may play an active role in helping the firm forge new alliances.

On the other hand, as we discuss in detail below, the incentives of VCs and alliance partners may differ, and contractual rights that are conferred to the VC in a standard term sheet (see Kaplan and Strómberg (2004) or Sahlman (1990)) may deter subsequent alliance activity. In light of the substantial evidence indicating that strategic alliances facilitate knowledge flows between firms, VCs may be reluctant to have a portfolio company enter into a relationship with another firm when that relationship could dilute the value of the portfolio company's intellectual property. These arguments predict that venture capital should lower the hazard of subsequent alliance activity.

1.2 Strategic Alliances as Substitutes to Venture Capital

The potential for strategic alliances to act as a substitute for venture capital stems from several factors. First, as Robinson and Stuart (2007) note, venture capitalists fund *firms*, not *projects*. In contrast, strategic alliance partners generally sponsor research activity on at most a small subset of projects that the biotechnology firm is operating.

The fact that venture capital and strategic alliance capital have different implications for project-level management inside the firm is borne out by the features of real-world financial contracts. Strategic alliance contracts typically stipulate project-level oversight that is conducted by a team composed of members from both the biotechnology firm and the alliance partner. These contracts also frequently require that certain resources (typically man-hours of research personnel, or else named researchers at the biotechnology firm) be devoted to the project in question. Contracts typically state that the failure to perform along these dimensions constitutes breach, and triggers termination rights. While the alliance partner has broad project-level oversight and monitoring rights, it seldom has firm-level oversight provisions, such as board seats.[1]

In contrast, Kaplan and Stromberg (2003) find that venture capital contracts typically allocate a majority of board seats to the VC firm. Even when the VC does not receive an outright majority, it receives at least some board representation almost without exception. VC investors typically lack the technical expertise to participate in the day-to-day management of biotechnology research projects.

The organizational differences contemplated and installed through these contracts create the potential for conflict of interest between these funding sources. When scarce resources must be allocated across projects, the alliance partner may press the biotechnology firm to divert resources away from other internal projects, towards projects that center around alliance activity. Any such resource diversions that are overall value-

[1] This description is taken from Robinson and Stuart (2007).

destroying, even if they strictly benefit one project, should in principle be frowned upon from the point of view of the VC, since they stand to undermine the value of the VCs exit opportunity. Thus, one reason why strategic alliances may substitute for venture capital is that the potential incentive conflicts between these sources of funding may drive away potential VC investors who fear partial holdup at the hands of the strategic alliance partner.

There are other reasons why alliance partners might substitute for venture capital. Alliance partners may simply crowd out venture capital by lowering a biotechnology firms' funding requirements and hence increasing its bargaining position. Or the provisions in alliance contracts that place limitations on a change in the biotechnology firms' control may make an investment in such a firm less desirable, since VCs may anticipate having future strategic exit options foreclosed through the presence of the alliance investor.

These arguments all suggest that increased strategic alliance activity may diminish the incentives for VC investors to participate, and may also lower the firm's probability of going public.

1.3 Strategic Alliances as Complements to Venture Capital

The preceding arguments overlook the screening role that strategic alliance partners play in biotechnology. By collaborating with a startup biotechnology firm, an alliance partner sends a powerful signal to outside observers that the biotechnology has valuable ideas and resources (Stuart, Hoang, and Hybels, 1999). This screening role can be substantial, especially given the high degree of uncertainty surrounding technical developments in biotechnology.

Thus, a screening or certification argument would predict that increased strategic alliance activity would increase the probability that a firm goes public. This can occur through two distinct channels. The direct channel is through the certification that the alliance partner provides to participants in the public capital markets: underwriters, investment bankers and future investors are likely to look more favorably upon a firm that has received stronger certification from industry insiders. But there is also an indirect channel. Increased alliance activity may attract greater amounts of venture investment into the company, since the alliance partner's certification also serves to inform participants in the private equity market. Even if alliance activity has no direct certification role for public capital markets, increased alliance activity can still increase the hazard of going public through this indirect channel.

2 Data Description

2.1 Data Sources

To test these predicitons, we analyze a large sample of venture capital-backed biotechnology firms. We have retrieved all available records for VC-backed companies in the biotechnology sector from Thomson Financials VentureXpert database. These data consist of 1903 firms that were founded between the years 1980 and 2004. We must underscore that this is not a random sample of firms; all companies in the data received one or more rounds of funding from venture investors. From VentureXpert, we assembled the financing histories of the firms in the sample. These record include the date of founding of the company, the dates of all private equity financing rounds, the identities of the investors in each round, and when one took place, the time at which firms went public.

The focus of our empirical analysis is on the relationships between venture capital, alliance partnerships, and the public equity markets as potential sources of financing for early stage life sciences companies. We use Recombinant Capitals (ReCap) rDNA database to track the alliance activity of the firms in the ventureXpert sample. ReCap scours the newswire, company websites, securities filings, industry news sources, etc. to identify information on strategic alliances in the biomedical arena. The alliance data, which now list more than 20,000 transactions, date back to the early years of the biotech industry. In addition to the month and year in which each transaction was established, the database contains basic information about the terms of the agreement.

We also incorporate the evolving stock of intellectual property rights held by each firm. For patents issued pre-1999, we utilize the NBER patent database. For post-1999 patents, we conducted automated searches of the USPTO's searchable patent database.

2.2 Independent Variables

We observe firms from founding forward and update covariates as they change. Broadly, our covariates fall into four categories: VC characteristics, alliance histories, innovation histories, and current market characteristics.

2.2.1 VC characteristics

For each firm i in month t, we include the number of distinct financing rounds the firm has experienced prior to month t. One drawback with the VentureXpert data is that it does not contain reliable information on either the size of the financing round or the implied valuation of the firm. Nevertheless, this provides us with valuable information about the reputation of the VC firms involved in the biotechnology company.

There are a number of possible measures of the quality of a venture investor. First, we can tally the previous investment experience of each VC. Presumably, venture investors with extensive track records have repeatedly proven able to raise new investment capital from limited partners, and thus they have probably posted above average returns. Another measure is the network centrality of the VC in question. We focus on the latter approach.

There is one complication with specifying the influence of VC firm quality on the outcomes experience by individual portfolio companies. In most cases, there is a non-unique mapping of VC firms to biotechnology startups. This occurs because venture-backed companies are commonly financed by syndicates of investors. As a result, the typical firm in the data is financed by multiple venture investors. We control for this in two ways. First, we simply measure the centrality of most central VC in the prior financing round. This variable is called Max VC Centrality, last round. We also compute a proportional measure: for each firm-round, compute the fraction of total investor-rounds in which the VC participated. This provides a set of weights that sum to 1. We then use these weights to augment VC quality. We call this variable "VC Centrality, weighted."

2.2.2 Alliance characteristics

We measure three attributes of biotech firms strategic alliance histories. First, we include a time-changing count of the number of alliances the firm has entered. Ceteris paribus, since firms in this industry often require compelling technology to attract alliance partners, firms with greater numbers of alliances are more likely to be operating along in-demand technological trajectories. Second, we include a cumulating sum of the total amount of equity capital that the biotech firms in the sample have raised from strategic partners. Controlling for the number of alliances, this variable offers a potential window into the fact that equity sold to an alliance partner may substitute for capital raised on the public equity market.

2.3 Summary Statistics

Table 1 reports summary statistics for the independent variables based on whether the firm in question remained private throughout the sample or else went public at some point in its life. We report summary statistics at three points in a firm's life: at one year, two years, and three years of age.

The table clearly illustrates the fact that firms that ultimately go public evolve along different financing trajectories than firms which ultimately remain private.

3 Data Structure and Estimation Strategy

The skeleton of the dataset we analyze is an unbalanced panel of 156,442 firm-month observations, representing data from 1903 distinct firms. Each firm enters the data at its founding date (as reported by VentureExpert) and exits the sample in one of three ways. First, a firm can exit our sample by experiencing one of the exit events we are interested in studying (an IPO or an acquisition). Such an outcome is typically called a *failure* in duration analysis (although the companies in question no doubt see it differently). A company can also drop out of the sample at some point before the end of our sample. This is called *censoring*. Finally, a company can still be private at the end of our sample period; this is called *right-censoring*. A right-censored observation is presumably still at risk of experiencing a failure, but that failure occurs outside our sample period, if at all.

Table 2 provides a more detailed analysis of censoring and failure. It reports a total of 353 IPOs and 150 acquisitions. All firm-month observations that do not conclude in one of the events we analyze are treated as being censored. This dataset structure allows us to update dependent variables on a monthly basis to reflect changes in the firms financing, alliance, or innovation history, as well as the current state of the equity markets in the biotechnology sector.

3.1 Outcome variables

3.1.1 Time-to-funding

First, we explore the waiting time until a firm experiences a subsequent capital raising event. Because we have a particular interest in the interplay between project-level (alliance) and firm-level (VC) financing, we analyze the likelihood of occurrence of these two types of financing events via separate estimation of distinct hazard rates. That is, first we estimate models of the time to next VC round, then we estimate models of time to next alliance. By estimating separate models, we allow both the baseline hazards to vary as well as the parameter estimates on firm- and market-level covariates to vary. In these regressions, we treat transitions to the terminal states in our data, acquisitions or going public, as censored spells.

3.1.2 Time-to-exit

The private, VC-supported firms in the sample experience three types of exit events (in addition to the continuation of the firm as a private entity at the close of our observation window, which is treated as a censored event): IPO, acquisition, or they cease to exist.[2] In the second set of regressions, we estimate the competing risks of going public, getting acquired, and failing.

3.2 Analysis Time

Since we are interested in modeling the probability of a funding event at a point in time as a function of the time since last funding event, we must specify analysis time

[2]Unfortunately, ventureXpert almost certainly underreports the incidence of firm failure. In many instances, the outcome experienced by the firm is indeterminate, as a public record of a terminal event may not exist and a member of the firm does not respond to a survey questionnaire. In these instances, we censor the final record of the firm.

in a manner that both satisfies the underlying econometric assumptions of proportional hazard models and yields coefficients that have sensible economic interpretations. The identifying assumption is that controlling for the right-hand side variables, two firms observed at the same point in analysis time have the same hazard of experiencing an event. Therefore, calendar time would not be an appropriate choice for analysis time, even if we accounted for the staggered entry of firms into our sample, because this parametric choice would require all private firms in the data in month t to be at identical risk of IPO or other funding event.

Instead, we use the firm's age as the main unit of analysis time throughout our analysis. Since our data are monthly, we track the firm's age in months, but for the purposes of reporting estimated coefficients, we track analysis time in quarters of a year (3 month blocks). The choice of time scale has no impact on our analysis except to affect the interpretation of the coefficients.

3.3 Survival and Attrition

A useful way to understand how attrition over time, either through an exit or a firm death, affects our sample is by analyzing an estimate of the survival function for the data. Figure 1 plots the Kaplan-Meier survival estimate. Formally, for all $t_i < t$, the survival function at time t is a step function defined in analysis time given by the following formula:

$$\hat{S}(t) = \prod_{t_i < t} \left[1 - \frac{d_i}{Y_i} \right] \tag{1}$$

where d_i is the number of observations experiencing IPO at t_i and Y_i is the number of firms at risk of IPO at time i; the fraction $\frac{d_i}{Y_i}$ is a measure of the conditional probability of failure at time i. Intuitively, $\hat{S}_t$ simply measures the fraction of the sample that is at risk at time t or greater. It illustrates that about 50% of the firms in our sample have yet to exit (either by IPO or by attrition) at 60 quarters of age.

Although we model a variety of funding decisions and exit events for investors, at the heart of our analysis is estimating a firm's hazard of an event occurring as a function of time. That is, we are interested in the probability of a funding event occurring during a small interval of time t to $t + \Delta t$ as a function of time and other firm and market characteristics. Formally, the hazard function for firm i at time t can be expressed as

$$h_i(t) = \frac{f_i(t)}{1 - F_i(t)} \tag{2}$$

where $f(t)$ is the density function associated with the event at time t and $F(t)$ is the cumulative distribution function associated with the event at time t. Writing the survivor function, 1-F(t), as S(t), this can be expressed as

$$h_i(t) = -dln(S_i(t)). \tag{3}$$

Following standard practice, we assume a proportional hazard specification which allows us to write the hazard of firm i at time t as

$$h_i(t) = \omega_i h(0) e^{x'\beta} \tag{4}$$

where $h(0)$ is the baseline hazard, x is a vector of covariates, β is a coefficient vector, and ω_i is a term that captures unobserved firm-level heterogeneity (known as frailty in the parlance of duration model estimation).

Figure 2 plots a kernel density estimate of the empirical hazard of IPO as a function of the firm's age. It displays two distinct humps, reflecting spikes in the probability of going public, at around 5 years after first VC round and again at around 15 years. In contrast, Figure 3 plots the empirical hazard of being acquired. The x-axis is scaled identically between the two graphs to facilitate a comparison in these two types of exit. Note first that our data do not contain acquisitions occurring after about 12 years of age for a firm. Also, note that while the hazard of acquisition rises with the hazard of

IPO in the early life of a firm, the former stays elevated after five years of age, while the hazard of IPO drops off dramatically after 5 years of age and does not surge upward again until around age 15.

The most likely reason for this pattern in the data is a combination of the investment horizon of a VC company and the spike in IPO activity that occurred in the mid to late 1990s. The spike in the hazard of IPO at five years of age probably owes to VC investors attempting to exit their positions in portfolio companies towards the end of a VC fund's lifespan. The second peak at age 15 years likely owes to the fact that there was a pronounced spike in IPO activity, especially for high-tech firms, in the late 1990s. Thus, while many young firms were entering the public capital markets at this time, the public markets were also receptive to issues from more mature companies that had existed for many years as a private company. The confidence intervals around the survival estimates in Figure 1 cast doubt on the notion that the second spike is attributable to the fact that only a few firms remained in the sample at that age.

4 Results

In this section we examine parameter estimates from proportional hazard models to study the interplay between VC funding and strategic alliance activity on the road to the going public decision. In the first subsection, we focus on time-to-next-funding models; that is, we estimate the hazard of time to next VC round or next strategic alliance as a function of prior funding activity. In the second subsection, we focus on time-to-exit models. First we consider time-to-IPO as a function of alliance and VC activity. Then we consider time-to-acquisition.

In the current draft, we postpone the discussion of results that are corrected for firm-level heterogeneity until section 4.3. The tables discussed in section 4.1 and 4.2 report more standard hazard rate estimations. A future draft will incorporate the heterogeneity-corrected findings into the main body of the discussion.

4.1 Models of the Time to Next Funding Event

We begin by estimating the hazard of a subsequent private equity funding event as a function of past funding history and other firm characteristics. In the current version, we present piecewise exponential estimates of the hazard function. That is, to estimate the hazard function, we create dummy variables corresponding to the deciles of firm age. Within each age decile, an exponential hazard function is estimated.

4.1.1 Time to Next VC Round

Table 3 presents estimates of the hazard of a funding round as a function of firm characteristics. In general, the table illustrates that holding constant a firm's age and its past alliance activity, a firm with more prior rounds of VC funding is at an increased hazard of receiving a future round of funding.

In contrast, the effect of an additional alliance on a firm's hazard of VC funding is negative. This can be seen in two ways. First, in models (3)-(7), the hazard rate associated with an additional alliance is below one, meaning that it lowers the hazard of a subsequent round of VC funding. The effect of additional funding through alliances is even stronger. In models (5)-(7), the hazard associated with the natural log of total alliance equity is about 0.90, which is highly significantly different than one.

Note that in column (2), which does not control for past VC activity, total alliance activity has a positive impact on the hazard of subsequent funding. This no doubt occurs through a signaling or certification effect, by which higher quality firms are at greater risk of both greater VC funding and more alliance activity. Indeed, when we include the patent count for the firm, we see that it impacts the hazard of VC funding positively.

Table 3 also sheds light on the role of VC characteristics and market conditions on VC funding. The intensity of IPO activity has a positive impact on the hazard of subsequent VC funding. Likewise, firms that have had prior investments from more reputable VCs have a higher hazard of subsequent VC funding.

4.1.2 Time to Next Alliance

Table 4 turns from VC funding to estimates of the hazard of entering into an alliance as a function. The picture that emerges from this analysis is quite different than that presented in Table 3. Instead of lowering the hazard of an alliance, increased prior VC funding raises the hazard of a subsequent alliance. The order of magnitude of this effect is comparable to the increase in the hazard associated with prior alliance activity. In general, all the VC variables (prior activity as well as both measures of VC quality) work to increase the hazard of alliance activity.

4.2 Time to Exit

While the previous subsection was concerned with the interplay between alternatives in the private capital market, this subsection analyzes the impact of prior actions in the private capital market on a firm's decision to exit the private capital market.

4.2.1 Time to IPO

Table 5 analyzes the hazard of going public as a function of a firm's past actions and its age. It illustrates that both types of past activity in the private capital market—strategic alliances and venture capital funding—raise the hazard of going public. Note, too, that the effect of additional alliance equity is also positive. Thus, while alliance equity crowds out venture capital, it still has a dramatic effect on the hazard of going public.

Table 5 also illustrates the importance of VC reputation for the going public decision. A one unit increase in weighted VC centrality of the prior participants has a four-fold increase in the hazard of going public. This finding corresponds to the finding of Hochberg, Ljunqvist, and Lu (2005) who show that better networked VCs have better success. Our analysis shows that an important component of the increased success experienced by better-networked VCs stems from the fact that they take firms public more frequently than other VCs.

We see further evidence of the role that the VCs reputation plays in the going public decision in Table 6 when we relate conditions at firm founding to the hazard of IPO. The results that stand out here are the large impact that the initial VC reputation has on the going public decision. This affect is large and the only one at present that is significant.

4.2.2 Time to Acquisition

Table 7 analyzes the hazard of being acquired as a function of a firm's past actions and its age. We employ the same set of independent variables as in Table 5 so that we can compare magnitudes in a straightforward manner.

Whereas alliance activity and VC funding work in tandem to raise the hazard of IPO, they work in an opposite manner on the hazard of acquisition. Additional rounds of VC funding raise the hazard of acquisition, just as they raise the hazard of IPO. But additional alliance activity in general lowers the probability of acquisition. This can be seen most clearly by examining the coefficients on the natural log of alliance equity. In Table 5 these coefficients are on the order of 1.5, here they are in the range of 0.5-0.6. Thus, an additional alliance cuts the hazard of acquisition by roughly one-half.

In contrast to Table 6, Table 8 indicates that initial conditions have no appreciable impact on the hazard of acquisition. The estimates from Table 7 on the role IPO intensity indicate that weak market conditions may play a role in the choice between IPO and acquisition; when IPO intensity is high, the hazard of acquisition is low. This effect is imprecisely estimated, however.

In sum, the findings from Table 7 contrast the exit motives of the venture capitalist with the role played by the alliance partner. That an increase in VC funding increases the probability of acquisition reflects the VCs desire to exit an investment so that the returns can be booked. In contrast, the lower hazard of acquisition with respect to additional alliance activity speaks to both the signaling role that alliances play, as well as to the fact that the presence of a pre-existing alliance partner on the capitalization table of the biotechnology firm may present an impediment to acquisition. Indeed, many alliance contracts explicitly contemplate change of control and list it as an event which triggers the right to terminate the agreement (Robinson and Stuart, 2007). Perhaps the role that alliance partners play in constraining exit options is a force in lowering the hazard of subsequent VC funding that we see in Table 3.

4.3 Accounting for Firm-level Heterogeneity

As discussed above, the previous findings do not have corrections in place for the firm-level heterogeneity captured through the ω_i term of Equation 4. These estimations are still pending, owing to the computationally burdensome nature of estimation random effects hazard models for 1900 firms. Instead, we briefly report some key findings to illustrate the importance of the corrections for understanding the magnitudes of the point estimates in question.

Table 9 reports four alternative specifications for the hazard of going public. The coefficients are reported in relative hazard form; i.e., coefficients that are greater than one raise the baseline hazard, while point estimates below one lower the hazard of going public. Equation (1) reports a Cox proportional hazard estimation. In the Cox procedure, the baseline hazard is not estimated directly; instead, the partial likelihood associated with the event distribution (rather than firm-month distribution) is maximized. The Cox approach is standard throughout biostatistics, medicine, and other areas of the social sciences (see Hellmann and Puri, 2000, or Shumway, 2001, for a discussion).

Equation (2) assumes that the baseline hazard follows an exponential distribution. In some sense, this is closest to estimating a panel Probit model in which firm age was omitted from the right-hand side (Allison, 1984). Comparing Eq. (1) and (2), the point estimates are mostly stable, but the loading on IPO intensity drops considerably in the exponential estimation, and the loading on VC rounds goes up by quite a bit.

Columns (3) and (4) both report piecewise exponential models of the baseline hazard. In these models, as discussed above, dummy variables are created for the deciles of analysis time and included in the hazard specification. The difference between them comes from the fact that Column (4) contains firm-level frailty estimates, whereas Column (3) does not. Comparing these two columns, the biggest changes in the coefficients are the ones that are associated with alliance activity. Both the total alliance activity variable and the log of alliance equity variable have noticeably stronger impact on the hazard of going public once we account for unobserved heterogeneity in firm characteristics. This suggests that the impact of alliances on the going public decision is stronger once we account for factors that may affect selection into the alliance in the first place.

5 Conclusion

The paper is one of the first to analyze how the interplay between alternative funding sources in the private capital market affect a firm's decision to IPO. Strategic alliances and venture capital funding both raise the hazard that a firm goes public. Past VC funding also raises the hazard of a firm being acquired, while past strategic alliance activity does exactly the opposite.

The results surrounding the effect of VC funding on firm exit are unsurprising. After all, VC funds invest in portfolio companies hoping to book a return through a favorable exit. The findings here bear out this simple intuition, and illustrate the importance of the VC network in bringing about this outcome. Biotechnology companies that have VC investments from better networked VCs are at substantially greater hazard of going public.

What is perhaps more surprising is the role of alliances in the going public decision. The results presented here indicate that alliance activity has roughly the same impact on the hazard of going public as venture funding. Tentative results from semi-parametric frailty models suggest that the results for alliances are actually *stronger* than that of prior VC funding. This illustrates the importance of strategic alliance activity in the going public decision of private high-tech firms.

Our findings raise a number of interesting questions for future research. Our analysis ends where most analyses begin: at the date a firm becomes a public corporation. Linking our findings to the short-term and long-term performance of IPOs is a fruitful avenue for exploring the role of alliances in greater detail. We leave this for future work.

References

[1] Allison, Paul, 1984. "Event History Analysis: Regression for Longitudinal Event Data."" Series: Quantitative Applications in the Social Sciences. Sage University Paper #46. Sage Publications, Beverly Hills, CA.

[2] Barry, Christopher, Chris Muscarella, John Peavy and M.R. Vetsuypens, 1990. "The Role of Venture Capital in the Creation of Public Companies," *Journal of Financial Economics*, vol. 15, no. 2, pp. 213-232.

[3] Boot, Arnoud W.A., Radhakrishnan Gopalan, and Anjan Thakor, 2006. "The Entrepreneur's Choice between Private and Public Ownership," *Journal of Finance*, vol. 61, no. 2, pp. 803-836.

[4] Black, Bernard and Stuart Gilson, 1998. "Venture Capital and the Structure of Capital Markets: Banks versus stock markets," *Journal of Financial Economics*, vol. 47, pp. 243-277.

[5] Brau, James C. and Stanley E. Fawcett, 2006. "Initial Public Offerings: An Analysis of Theory and Practice." *Journal of Finance*, vol. 61, no. 1, pp. 399-436.

[6] Gans, Joshua, David Hsu, and Scott Stern, 2002. "When Does Start-up Innovation Spur the Gale of Creative Destruction?" *Rand Journal of Economics*, vol. 33, pp. 571-586.

[7] Hellmann, Thomas and Manju Puri, 2000. "The Interaction between Product Market and Financing Strategy: The Role of Venture Capital," *Review of Financial Studies*, vol. 13, pp. 959-984.

[8] Hellmann, Thomas and Manju Puri, 2002. "Venture Capital and the Professionalization of Start-up Firms: Empirical Evidence," *Journal of Finance*, vol. 57, no. 1, pp. 169-197.

[9] Hochberg, Yael, Alexander Ljungqvist, and Yang Lu, 2005. "Venture Capital Networks and Investment Performance." Journal of Finance.

[10] Hsu, David H., 2004. "What do Entrepreneurs Pay for Venture Capital Affiliation?" *Journal of Finance*, vol. 59, pp. 1805-1844.

[11] Hsu, David H., 2006. "Venture Capitalists and Cooperative Start-up Commercialization Strategy." *Management Science*, vol 52, no. 2, pp 204-219.

[12] Leary, Mark and Michael Roberts, 2005. "Do Firms Rebalance Their Capital Structures?" Journal of Finance, vol. 60, no. 6, pp. 2575-2620.

[13] Lerner, Josh and Robert Merges, 1998. "The Control of Technology Alliances: An Empirical Analysis of the Biotechnology Industry." Journal of Industrial Economics, vol. 46, no. 2, pp. 125-156.

[14] Lerner, Josh, 1995. "Venture Capital and the Oversight of privately held firms." Journal of Finance, vol. 50, no. 1, pp. 301-318.

[15] Lerner, Josh, Hilary Shane and Alexander Tsai. "Do Equity Financing Cycles Matter? Evidence from Biotechnology Alliances," *Journal of Financial Economics*, 67: 411-446.

[16] Lindsey, Laura, 2002. "The Venture Capital Keiretsu Effect: An Empirical Analysis of Strategic Alliances among Portfolio Firms." Working Paper, Stanford University (Arizona State University).

[17] Lowery, Michelle, 2002. "Why Does IPO Volume Fluctuate So Much?" *Journal of Financial Economics*, vol. 67, no. 1, pp. 3-40.

[18] Michelacci, Claudio and Javier Suarez, 2004. "Business Creation and the Stock Market." *Review of Economic Studies*, vol. 71, pp. 459-481.

[19] Pagano, Marco, F. Panetta, and Luigi Zingales, 1998. "Why do Companies go Public? An Empirical Analysis," *Journal of Finance*, vol. 53, no. 1, pp. 27-64.

[20] Robinson, David T. and Toby Stuart, forthcoming. "Financial Contracting in Biotech Strategic Alliances," *The Journal of Law and Economics*

[21] Robinson, David T. and Toby Stuart, forthcoming. "Network Effects in the Governance of Strategic Alliances," *The Journal of Law, Economics, and Organization*, Spring, 2007.

[22] Sahlman, William A. "The Structure and Governance of Venture-Capital Organizations." Journal of Financial Economics 27, no. 2 (October 1990): 473-521.

[23] Stuart, Toby, Ha Hoang and Ralph Hybels. "Interorganizational Endorsements and the Performance of Entrepreneurial Ventures." Administrative Science Quarterly 44, no. 2 (June, 1999), pp 315-349.

[24] Whited, Toni, 2006. "External finance constraints and the intertemporal pattern of intermittent investment." Journal of Financial Economics.

[25] Zingales, Luigi, 1995. "Insider Ownership and the Decision to go Public," *Review of Economic Studies*, vol. 60, pp. 425-448.

Kaplan-Meier Survival Estimates

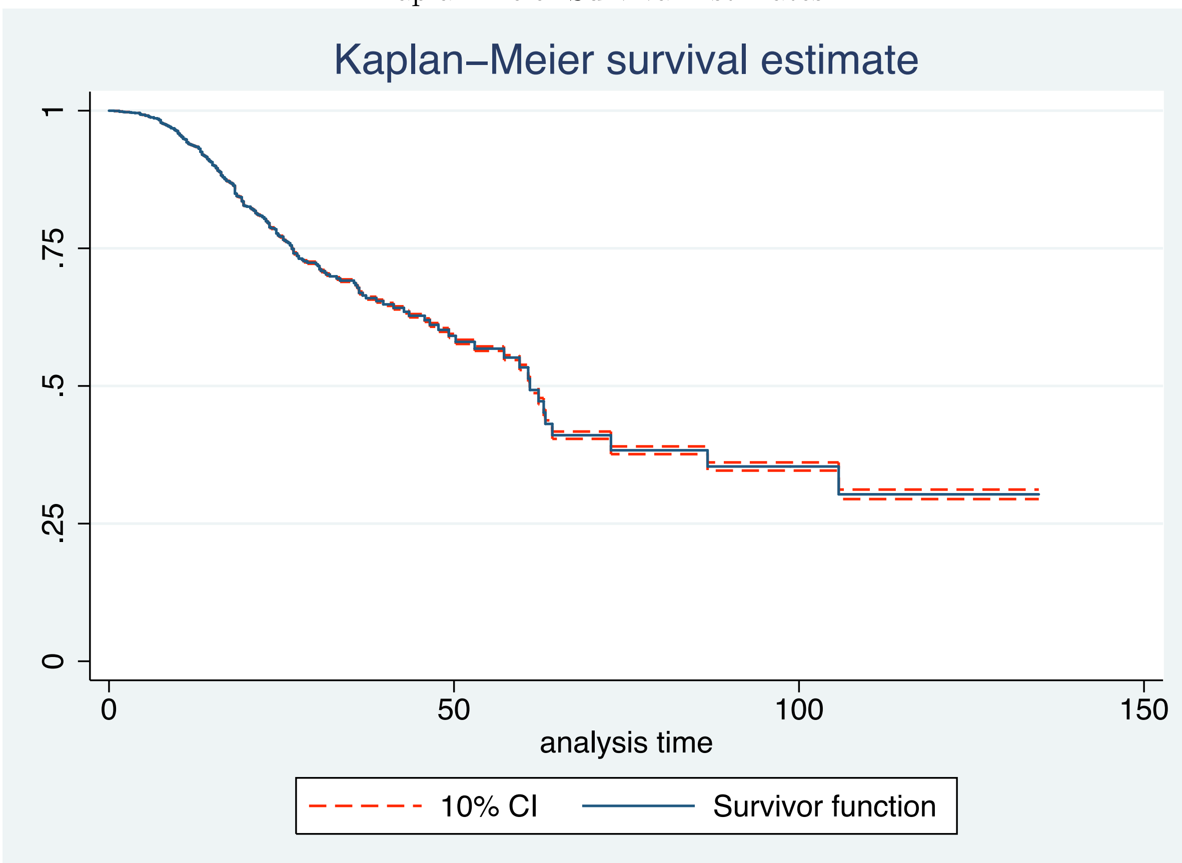

Figure 1: This graph plots the product-limit estimate of the survival function for our sample. The black line plots $\hat{S}(t) = \prod_{t_i<t}\left[1 - \frac{d_i}{Y_i}\right]$, where d_i is the number of events occurring at time t_i and Y_i is the number of firms at risk at time t_i. This is known as the Kaplan-Meier survival estimate. The red lines surrounding it are 10% confidence bands around the estimate.

The Hazard of Going Public

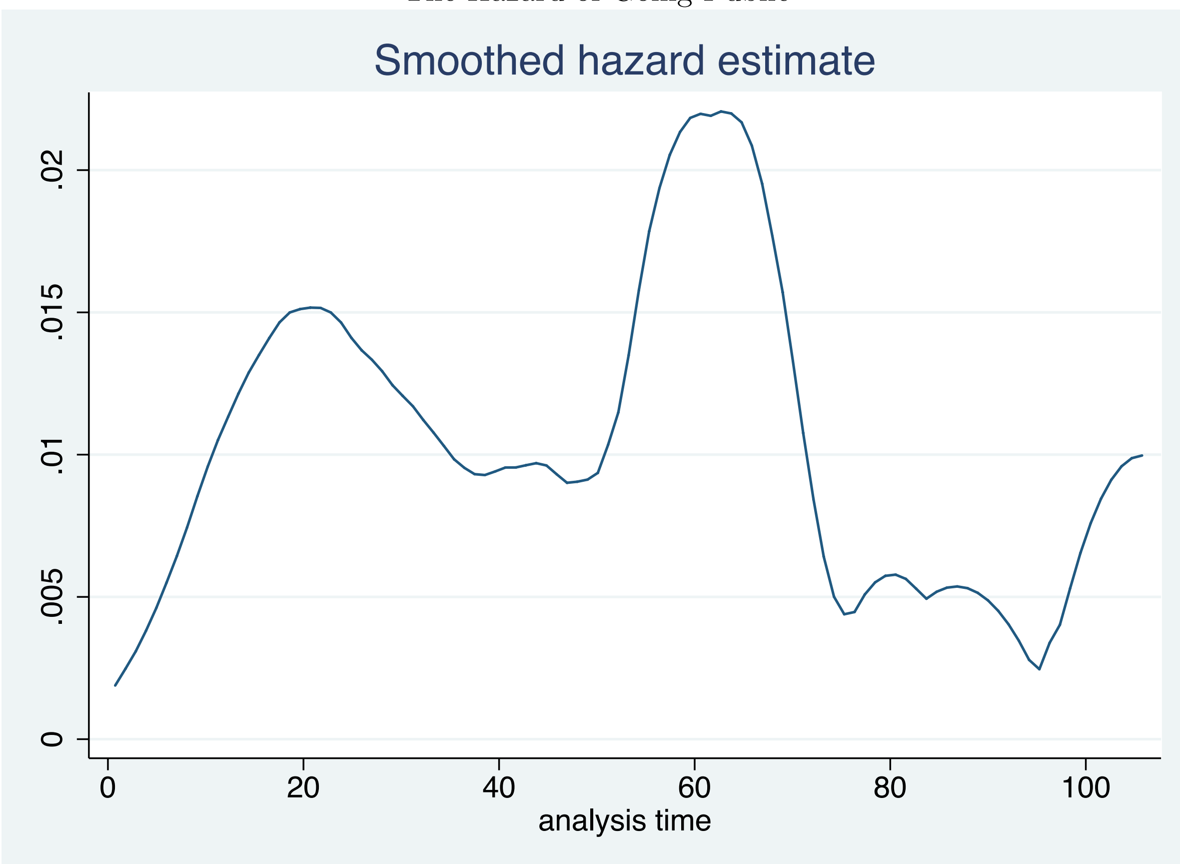

Figure 2: This graph plots the hazard of IPO as a function of the firm's age, measured in quarters.

The Hazard of Being Acquired

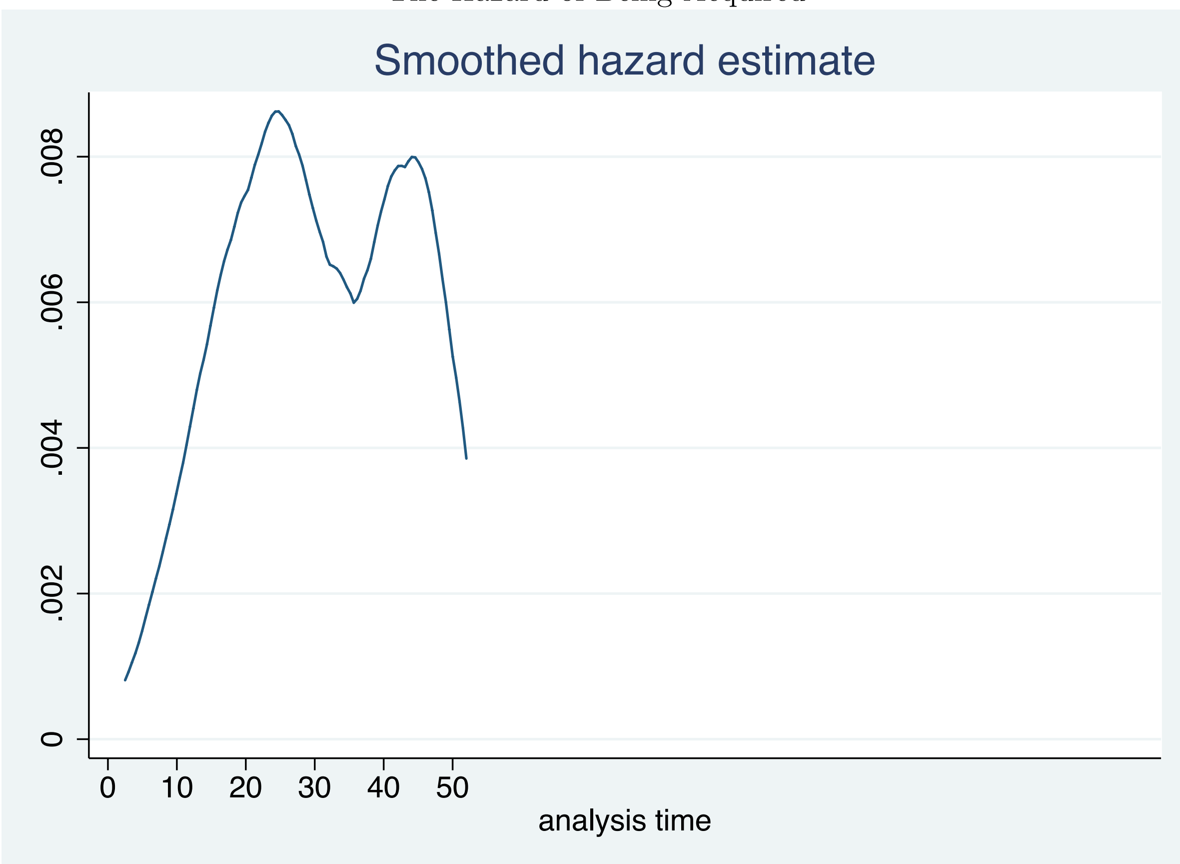

Figure 3: This graph plots the hazard of being acquired as a function of the firm's age, measured in quarters. The x-axis is scaled so that the graph is comparable to Figure 2.

The Distribution of Firm Age at IPO

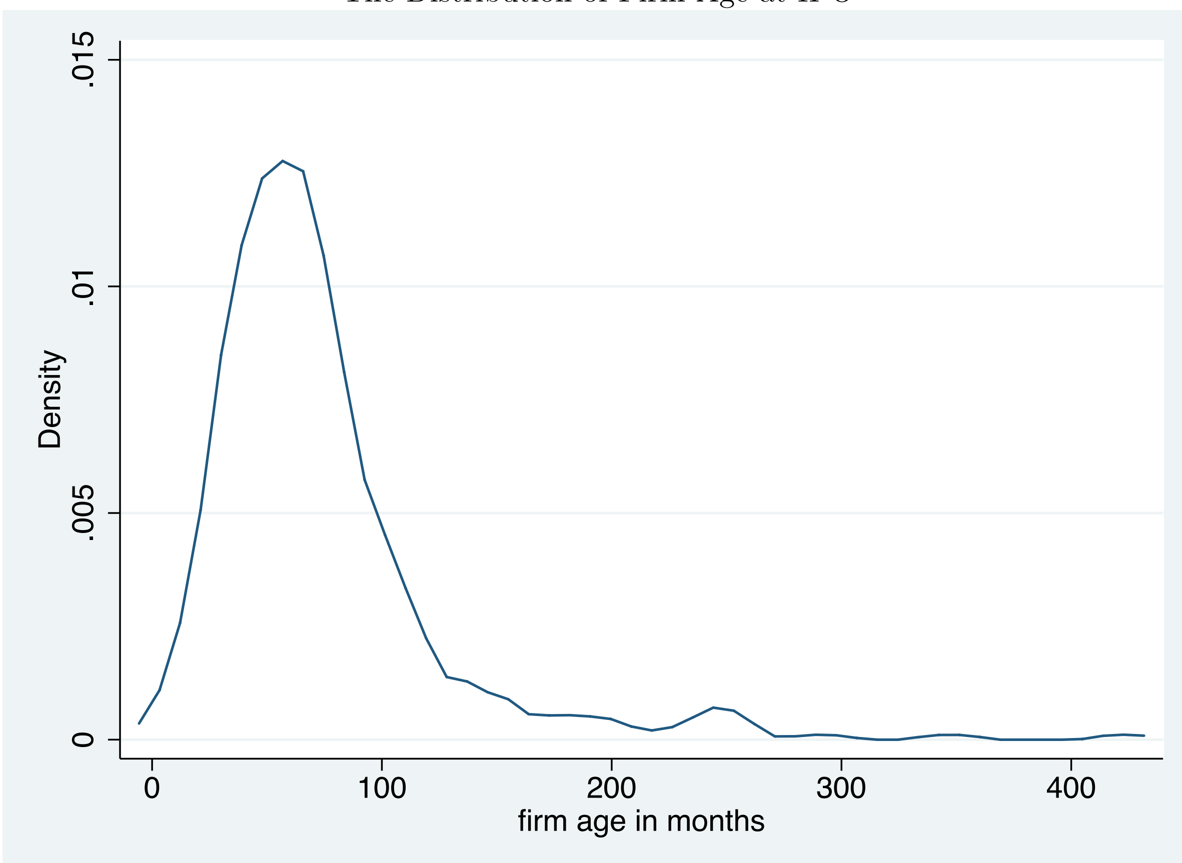

Table 1: Summary Statistics at 12, 24, and 36 months of age

This table reports summary statistics for the firms in our sample at three points in their life: age 12 months, age 24 months, and age 36 months. The column labeled 'Overall' reports the grand mean across all observations in the data. For each age category, Priv. denotes firms that never went public, while Pub. denotes firms that IPO at some later point. The column labeled 't(diff)' reports the t-statistic associated with the test that the means across the two groups at that point in time are equal.

		Age = 12 mos			Age = 24 mos			Age = 36 mos		
Variable	Overall	Priv.	Pub.	t(diff)	Priv.	Pub.	t(diff)	Priv.	Pub.	t(diff)
Total Rounds of VC Funding	1.53	0.39	0.72	-5.69	0.71	1.42	-8.56	1.29	2.00	-7.10
Total Patents, last 5 yrs.	1.01	0.14	0.14	0.16	0.32	0.50	-1.99	0.56	1.30	-2.63
Total Alliances, last 5 yrs.	0.48	0.04	0.31	-7.47	0.13	0.83	-8.18	0.26	1.47	-8.04
ln(Alliance Equity), last 5 yrs.	0.07	0.00	0.05	-2.85	0.01	0.14	-4.54	0.02	0.36	-7.01
Time Since last VC Round	27.81	9.85	8.50	4.99	17.49	12.21	9.38	14.09	14.99	-1.05
Time Since last Alliance	36.47	10.86	9.85	5.74	21.83	18.84	6.20	30.60	25.79	5.37
VC Centrality, weighted	0.03	0.02	0.07	-7.28	0.02	0.09	-9.37	0.03	0.09	-7.98
Max VC Centrality, last round	0.04	0.01	0.09	-6.62	0.02	0.13	-8.12	0.03	0.15	-8.43
Conditions at firm's founding										
IPO Intensity	0.31	0.25	0.38	-4.07	0.26	0.39	-3.95	0.27	0.39	-3.37
S&P500 level	681.22	871.26	399.54	24.15	871.48	396.61	24.10	859.99	385.78	23.72
S&P500 return	0.02	0.01	0.02	-3.20	0.01	0.02	-3.00	0.01	0.02	-2.74
Patents	0.34	0.41	0.30	0.66	0.41	0.17	2.57	0.40	0.15	2.61
VC Centrality	0.01	0.00	0.02	-2.27	0.00	0.02	-2.23	0.00	0.02	-1.96

Table 2: Summary Statistics for Funding Spells and Final Outcomes

This table provides summary statistics for various funding events and final outcomes.

Variable	total	mean	Firm-level values: min	median	max
Number of subjects	1903				
Number of records	156442	82.21	3	72	539
Exit time, in quarters		20.55	.75	18	134.75
Funding Events					
Private funding events	9269	4.87	1	4	31
VC Financing rounds	5252	2.76	0	2	17
Strategic Alliances (funded)	4085	2.15	0	2	24
Strategic Alliances (equity)	124	0.07	0	0	12
Strategic Alliances (combined)	4209	2.21	0	2	24
Final Outcomes					
IPOs	353	.19	0	0	1
Acquisitions	150	0.079	0	0	1

Table 3: Piecewise Exponential Hazard Estimates of VC Funding

Table reports relative hazard of obtaining a subsequent round of venture funding as a function of independent variables. Coefficients are interpreted as factors by which the hazard increases; coefficients greater than one reflect increases in the hazard of another VC round, while coefficients below one reflect decreases in the hazard of another round. See Table 2 for more information on firm event histories. Robust standard errors reported in parentheses below point estimates. One, two, and three asterisks indicate significance at the 10, 5, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Total Rounds of VC Funding	0.490***		1.662***	1.665***	1.669***	1.672***	1.644***
	(0)		(0.010)	(0.010)	(0.011)	(0.011)	(0.011)
Total Alliances, Last 5 yrs.		1.107***	0.990	0.980**	0.996	0.995	0.984
		(0.0051)	(0.0090)	(0.0092)	(0.011)	(0.012)	(0.012)
Total Patents, Last 5 yrs.				1.015***	1.016***	1.016***	1.011***
				(0.0022)	(0.0022)	(0.0023)	(0.0024)
ln(Alliance Equity), last 5 yrs.					0.912**	0.905**	0.905**
					(0.039)	(0.039)	(0.038)
IPO Intensity					1.244***	1.247***	1.118**
					(0.058)	(0.059)	(0.055)
Time Since Last Alliance						1.000	1.000
						(0.0012)	(0.0011)
VC Centrality, weighted							9.781***
							(1.15)
Max VC Centrality, last round							1.593***
							(0.13)

Table 4: Piecewise Exponential Hazard Estimates of Alliance Activity

Table reports relative hazard of obtaining a funded or equity-backed alliance as a function of independent variables. Coefficients are interpreted as factors by which the hazard increases; coefficients greater than one reflect increases in the hazard of another alliance, while coefficients below one reflect decreases in the hazard of another alliance. See Table 2 for additional information on event histories. Robust standard errors reported in parentheses below point estimates. One, two, and three asterisks indicate significance at the 10, 5, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Total Rounds of VC Funding	0.159***		1.274***	1.273***	1.169***	1.140***	1.123***
	(0)		(0.013)	(0.013)	(0.013)	(0.016)	(0.017)
Total Alliances, Last 5 yrs.		1.242***	1.236***	1.232***	1.162***	1.162***	1.153***
		(0.0078)	(0.0080)	(0.0079)	(0.0082)	(0.0083)	(0.0087)
Total Patents, Last 5 yrs.				1.038***	1.020***	1.021***	1.013***
				(0.0021)	(0.0037)	(0.0043)	(0.0046)
ln(Alliance Equity), last 5 yrs					3.129***	3.112***	3.064***
					(0.10)	(0.10)	(0.099)
IPO Intensity					1.958***	1.973***	1.706***
					(0.15)	(0.15)	(0.14)
Time Since Last VC Round						0.994**	0.997
						(0.0026)	(0.0026)
VC Centrality, weighted							12.83***
							(2.92)
Max VC Centrality, last round							2.624***
							(0.36)

Table 5: Cox Proportional Hazard Estimates of the Going Public Decision

Table reports relative hazard of going public as a function of independent variables. Coefficients are interpreted as factors by which the hazard increases; coefficients greater than one reflect increases in the hazard of IPO, while coefficients below one reflect decreases in the hazard of IPO. 156,000 observations from 1903 firms included, of which 353 went public during the 1980-2004 sample period. Robust standard errors reported in parentheses below point estimates. One, two, and three asterisks indicate significance at the 10, 5, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Total Rounds of VC Funding	1.309***		1.257***	1.252***	1.208***	1.128***	1.119***
	(0)		(0.029)	(0.028)	(0.029)	(0.035)	(0.035)
Total Alliances, Last 5 yrs.		1.177***	1.164***	1.157***	1.119***	1.103***	1.104***
		(0.029)	(0.027)	(0.027)	(0.025)	(0.024)	(0.024)
Total Patents, Last 5 yrs.				1.021***	1.018**	1.015	1.011
				(0.0081)	(0.0072)	(0.0096)	(0.0089)
ln(Alliance Equity), last 5 yrs.					1.591***	1.385***	1.379***
					(0.12)	(0.10)	(0.10)
IPO Intensity					4.487***	5.526***	5.107***
					(0.53)	(0.65)	(0.61)
Time Since Last VC Round						0.990**	0.992*
						(0.0047)	(0.0046)
Time Since Last Alliance						0.986***	0.987***
						(0.0030)	(0.0029)
VC Centrality, weighted							4.405***
							(2.37)
Max VC Centrality, last round							1.862***
							(0.44)

Table 6: Initial Conditions and the Hazard of IPO

Table reports relative hazard of going public as a function of independent variables. Coefficients are interpreted as factors by which the hazard increases; coefficients greater than one reflect increases in the hazard of IPO, while coefficients below one reflect decreases in the hazard of IPO. 156,000 observations from 1903 firms included, of which 353 went public during the 1980-2004 sample period. Robust standard errors reported in parentheses below point estimates. One, two, and three asterisks indicate significance at the 10, 5, and 1% level, respectively.

	(1)	(2)	(3)
IPO Intensity	1.144	1.139	1.001
	(0.20)	(0.12)	(0.11)
S&P 500 level	0.998***	0.998***	0.997***
	(0)	(0.00021)	(0.00022)
Total Patents, Initial		1.016	1.015
		(0.028)	(0.029)
Initial VC Centrality, weighted		4.692***	2.136
		(1.46)	(1.09)
Time Since Last VC Round			0.977***
			(0.0041)
Time Since Last Alliance			0.975***
			(0.0025)

Table 7: Cox Proportional Hazard of Being Acquired

Table reports relative hazard of being acquired as a function of independent variables. Coefficients are interpreted as factors by which the hazard increases; coefficients greater than one reflect increases in the hazard of acquisition, while coefficients below one reflect decreases in the hazard of acquisition. 156,000 observations from 1903 firms included, of which 150 were acquired during the 1980-2004 sample period. Robust standard errors reported in parentheses below point estimates. One, two, and three asterisks indicate significance at the 10, 5, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Total Rounds of VC Funding	1.253***		1.251***	1.255***	1.267***	1.140***	1.132***
	(0)		(0.033)	(0.033)	(0.034)	(0.048)	(0.049)
Total Alliances, Last 5 yrs.		1.113***	1.075***	1.090***	1.125***	1.006	1.003
		(0.024)	(0.026)	(0.027)	(0.029)	(0.054)	(0.055)
Total Patents, Last 5 yrs.				0.956*	0.966	0.928**	0.926**
				(0.023)	(0.022)	(0.030)	(0.030)
ln(Alliance Equity), last 5 yrs.					0.658**	0.556***	0.563***
					(0.12)	(0.11)	(0.11)
IPO Intensity					0.732	0.874	0.785
					(0.21)	(0.26)	(0.24)
Time Since Last VC Round						0.980***	0.981***
						(0.0053)	(0.0054)
Time Since Last Alliance						0.977***	0.977***
						(0.0054)	(0.0053)
VC Centrality, weighted							3.932
							(4.11)
Max VC Centrality, last round							1.096
							(0.66)

Table 8: Initial Conditions and the Hazard of Being Acquired

Table reports relative hazard of being acquired as a function of independent variables. Coefficients are interpreted as factors by which the hazard increases; coefficients greater than one reflect increases in the hazard of acquisition, while coefficients below one reflect decreases in the hazard of acquisition. 156,000 observations from 1903 firms included, of which 150 were acquired during the 1980-2004 sample period. Robust standard errors reported in parentheses below point estimates. One, two, and three asterisks indicate significance at the 10, 5, and 1% level, respectively.

	(1)	(2)	(3)
IPO Intensity	1.123	1.122	1.014
	(0.47)	(0.18)	(0.17)
S&P 500 level	1.000	1.000	0.999**
	(0.72)	(0.00025)	(0.00026)
Total Patents, Initial		1.009	1.006
		(0.029)	(0.031)
Initial VC Centrality, weighted		2.477	1.221
		(2.16)	(1.12)
Time Since Last VC Round			0.976***
			(0.0040)
Time Since Last Alliance			0.987***
			(0.0032)

Table 9: Alternative Hazard Specifications

The table reports estimates on the hazard of going public for a sample of 132,927 observations comprising 1886 firms. Column (1) estimates Cox proportional hazards. Columns (2) assumes the hazard function follows an exponential distribution. Columns (3) and (4) fit piecewise exponential distributions to the hazard. Column (4) includes firm-level random effects to account for unobserved heterogeneity. Constants are estimated in equations (2) through (4) but suppressed for brevity.

	(1)	(2)	(3)	(4)
Total VC Rounds	1.127***	1.204***	1.131***	1.233***
	(0.000021)	(0.023)	(0.030)	(0.049)
Total Patents	1.017**	1.026***	1.023***	1.033***
	(0.017)	(0.0080)	(0.0078)	(0.011)
Total Alliances	1.121***	1.131***	1.119***	1.261***
	(0.00000082)	(0.026)	(0.025)	(0.038)
ln(Alliance Equity)	1.607***	1.595***	1.580***	1.658***
	(1.07e-10)	(0.13)	(0.12)	(0.15)
IPO Intensity	4.736***	4.051***	4.150***	4.233***
	(0)	(0.40)	(0.40)	(0.51)
Time—last VC	0.983***	0.993*	0.983***	0.988**
	(0.00021)	(0.0040)	(0.0043)	(0.0049)
Time^2	1.000*	1.000	1.000**	1.000
	(0.099)	(0.000017)	(0.000012)	(0.000021)
Estimation	Cox	Exp.	PE	PE
Random Effects	No	No	No	Yes