# Career concerns and staged investment: Evidence from the venture capital industry[*]

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First Draft: July 2000

**Abstract**

I develop a model in which career concerns lead to inefficient reinvestment decisions. Managers have incentives to inflate interim returns by continuing bad projects and delaying write-offs. In the venture capital industry, the syndication of follow-on investments can help to solve this problem by providing an intermediate, arm's-length valuation. The evidence suggests that young venture firms do use syndication to certify investment quality. Moreover, the gap in quality between syndicated and non-syndicated investments - measured by ex post outcomes - is especially high for young venture firms, consistent with the hypothesis that career concerns reduce the efficiency of staged investment.

[*] I would like to thank Paul Gompers, Oliver Hart, Josh Lerner, Asis Martinez-Jerez, Scott Mayfield, Rick Ruback, Andrei Shleifer, Jeremy Stein, Geoff Verter, Noam Wasserman, Jeff Wurgler and seminar participants at Harvard University and Harvard Law School for helpful comments. This study has been supported by the Division of Research of the Harvard Graduate School of Business Administration.

Many corporate projects involve some form of staged investment. Unlike in large corporations, where data are rarely available on a project by project basis, the venture capital industry provides a rich source of information to analyze the staged investment decisions of managers.

This paper shows how career concerns can lead to inefficient reinvestment decisions and how the syndication of follow-on investments may help.[1] Relying on Holmstrom (1982), Stein (1989), and Bebchuk and Stole (1993), I develop empirical predictions from a model of career concerns and staged investment. Once an investment decision has been made, the manager's personal fortunes are tied to its success or failure. This creates a bias towards continuation, even when the manager's private information suggests abandonment or continuing the project involves forgoing profitable alternatives. Like other career concerns, this bias is stronger for less experienced managers. The impact of failure to a manager with no track record is larger than the impact to a seasoned manager. Nonetheless, this poses no problem if managers of projects that are worth refinancing can identify themselves. If a costly signal is available, it will be used predominantly among less experienced managers where the career concerns problem is recognized to be severe.

I focus on two empirical predictions. The first prediction is a link between career concerns and the syndication of follow-on rounds of finance. A manager, by bringing on a new investor, can certify an efficient continuation. If syndication is costly, not all projects and all managers will use this certification mechanism. Costs may arise from simple transaction costs, a limited number of potential syndication partners who can therefore extract rents from the first venture capitalist, inefficient monitoring of the firm under joint ownership, or residual information

[1] Here, syndication refers to the joint purchase of shares by more than one venture capital organization.

problems between the first and second venture capitalists. The second prediction is a gap in quality between syndicated and non-syndicated investments. If there is inefficient continuation, it will appear only in non-syndicated investments, lowering the average probability of a successful outcome in this subsample. Moreover, the gap in quality is a function of experience. The temptation to continue unprofitable projects and enhance short term reputation is larger for less experienced managers.

The first empirical part of this paper establishes a link between syndication choice in follow-on rounds of financing and career concerns. I focus on a sample of 4,747 portfolio companies from the Securities Data Company (SDC) *VentureExpert* database, where a single venture capital firm made the first round investment. This sample, where the career concerns of the original investor are simpler to characterize, represents 53 percent of the companies covered by SDC over the period from 1967 to 1996. My analysis shows that young venture firms are more likely to syndicate the second round of finance. The rate of syndication falls from over 60 percent for venture firms in their first year of operation to less than 40 percent for firms in their tenth year. This gap remains statistically significant, controlling for portfolio company characteristics, including the level of investment, and venture firm characteristics, including the level of committed capital.

The second empirical part of this paper focuses on the difference in quality between syndicated and non-syndicated investments, and the effect of experience on this difference. I measure the probability of a successful exit through an initial public offering or an acquisition. Controlling for industry, venture firm investment stage focus, portfolio company age, and the size of the investment, syndication increases the probability of an IPO by 11 percent. Moreover, this effect is decreasing in firm age. Each year reduces the effect of syndication by 0.6 percent.

Put another way, the difference in quality between syndicated and non-syndicated investments is twice as large for a new venture firm as for a firm in its tenth year. Allowing for exit by way of an acquisition or IPO strengthens the results.

These two sets of empirical results support the model of career concerns and staged investment. However, there are alternative explanations. First, venture firm age may proxy for capital constraints. Young venture firms may be unable, or unwilling because of diversification considerations, to refinance their portfolio companies. Second, younger venture firms may lack the expertise to provide advice, contacts, and services beyond the initial round of financing. Third, syndication may perform a certification function, consistent with the first empirical result, but this certification may be related to the IPO process rather than the efficiency of staged investment decisions.[2] Fortunately, some of these alternatives are testable. By including controls for the size of investment and venture fund commitments, limiting the sample to unconstrained venture firms who have recently raised a second fund, and controlling for the influence of the syndication partner's experience level, I conclude that there is an independent influence of career concerns on syndication. Because the two sets of empirical results do not survive in an analysis of the first round syndication decision, I argue that the influence of career concerns is related to reinvestment rather than the IPO process. Nonetheless, the main results are indirect evidence of an underlying distortion. As a result, it is difficult to rule out every alternative hypothesis.

The broader implications are for corporate investment. The model of career concerns and investment and the empirical results relate to a set of stylized facts in corporate finance, such as

[2] Lerner (1995) also tests three other theories of syndication. In Sah and Stiglitz (1986), joint investment produces better decisions. In Admati and Pfliederer (1994), it is optimal for the first venture capitalist to commit to syndication ex ante so as not to exploit its informational advantage ex post. In addition, window dressing, identified by Lakonishok, Shleifer, Thaler, and Vishny (1991) in the mutual fund industry, may be a motivation. While undoubtedly important determinants of syndication, these theories do not explain the relationships among venture firm age, syndication, and the outcome of the portfolio company.

the inefficient allocation of capital within conglomerate firms and the soft budget constraint. The concluding section also emphasizes the effect of career concerns on the efficient exercise of real options and the comparative advantage of venture capitalists in financing entrepreneurial ventures, which are typically valued for investment opportunities rather than current cash flow.

The paper proceeds as follows. Section 1 puts the paper in the context of the career concerns and venture capital literatures. Section 2 develops a model of career concerns and investment and evaluates costly syndication as a solution. In section 3, I describe the SDC data and sample selection. Section 4 considers the relationship between second round syndication and venture firm age. Section 5 looks at the outcome of syndicated and non-syndicated investment. In section 6, I conclude and discuss the broader implications in corporate finance.

## 1. Investment, career concerns, and the syndication of venture capital

The theoretical literature on career concerns dates back to Fama (1980), who argued that career concerns could induce effort, and thereby circumvent explicit incentive pay. Holmstrom (1982), in formalizing this intuition, recognized that career concerns improved some agency problems and made others worse. Since then, many papers have applied the career concerns approach to managerial behavior. Theory on career concerns and investment has focused on *ex ante* risk choice (Holmstrom and Ricart i Costa (1986)), myopia (Stein (1988, 1989)), and herding (Scharfstein and Stein (1990), Zwiebel (1995), Prendergast and Stole (1996), and Avery and Chevalier (1999)). Empirical studies have focused on effort in the managerial labor market (Gibbons and Murphy (1992)) and in venture capital (Gompers and Lerner (1999)), risk taking by mutual funds (Chevalier and Ellison (1997, 1999)), and earnings forecasts by security

analysts (Hong, Kubik, and Solomon (2000)). Unlike these theoretical and empirical papers, I focus on career concerns and the efficiency of staged investment.

Venture capitalists are especially prone to career concerns. The typical venture capital fund lasts ten to twelve years (Levin (1999)). However, venture capitalists repeatedly raise capital from their investors, often raising a new fund every two to three years. The pressure to produce returns prior to raising a second fund is particularly high. Gompers (1996) argues that younger venture capitalists grandstand, taking companies public too early in an attempt to demonstrate skill. Also in this spirit, the contractual provisions in venture capital limited partnerships are sensitive to past performance (Gompers and Lerner (1996)). This paper focuses on the syndication of follow-on investment as a certification mechanism.

Certification is only one function of syndication. There are other benefits and costs to bringing on a partner. While the ultimate investors do not necessarily value the diversification of idiosyncratic risk, venture capitalists themselves may. Or, capital constraints may force syndication. Lerner (1995) finds some empirical support for three additional rationales. Stiglitz and Sah (1986) argue that decision-making is improved when there are multiple agents. When there is asymmetric information between initial and new venture capitalists, Admati and Pfleiderer (1994) show that the optimal policy is for the initial venture firm to commit to maintaining a constant equity share from financing round to financing round, which then requires new investors. Finally, window dressing - a phenomenon described by Lakonishok, Shleifer, Thaler and Vishny (1991) where mutual fund managers buy winners *ex post* to fool their investors - may be behind later stage syndication. I consider these theories of syndication as alternative explanations for my empirical results.

## 2. A model of career concerns, reinvestment, and syndication

This section presents a model of staged investment when managers have career concerns. The first part of the model applies generally to the investment decisions of both corporate managers and venture capitalists. After making an initial investment, the manager learns something about the quality of the project, which outside investors or higher management do not observe. With a stake in the successful completion of the project, which reveals skill at identifying and managing projects, the manager overinvests in the second round in an attempt to fool the market. In equilibrium, no one is fooled. The amount of overinvestment is a function of experience. For an experienced manager, success or failure does not change the market's beliefs by much, and the amount of overinvestment is small. For an unseasoned manager, a single failure has a large impact, and the amount of overinvestment can be large.

The second part of the model is specific to venture capital. By syndicating follow-on rounds of financing, inexperienced managers can certify their reinvestment decisions, and reduce inefficient investment. With access to more information than outside investors, a venture partner, who did not invest in the first round and is unencumbered by reputation concerns, can provide an arms-length valuation. The original manager maximizes this valuation and his reputation by choosing the first best level of investment. While the use of syndication is specific to venture capital investment, inefficient reinvestment arising from career concerns is not. Corporate projects frequently involve staged investments, and division managers will have a stake in continuing projects started within their tenure. In the second section below, I discuss qualitatively other mechanisms that can be employed to minimize the inefficient reinvestment that can arise with career concerns.

The model gives two empirical predictions. The first is that less experienced venture capitalists are more likely to syndicate follow-on investments. The second, and somewhat more subtle, prediction is that there is a difference in the return on investment for syndicated and non-syndicated follow-on investments, and this difference is decreasing in experience.

A. Career concerns and reinvestment

I consider a manager making a series of investment decisions on behalf of outside investors or higher management. All have a common discount rate $r$. Each investment lasts for up to three periods. At time $t$, the manager locates and starts a new project for a fixed cost $c$. At time $t$+1, the manager learns information $k_{t+1}$ about the quality of the project. The manager then has the opportunity to invest $i_{t+1}$ and refinance the project.[3] In exchange, investors receive a cash flow of $f(i_{t+1})$ at $t$+2.

There are two key properties of the production function. The information $k$ is simply the manager's ideal investment choice. In addition, the net present value of the project is increasing in $k$. In other words, better reinvestment opportunities require more investment. Two production functions that satisfy these properties are shown in Figure 1.[4] These properties are summarized as follows.

$$k = \arg\max_{i} \tfrac{1}{1+r} f(i \mid k) - i \qquad (1)$$

[3] In the model, the only decision is the level of investment. In reality, the manager may also be able to influence the risk (and return) profile of the project at the reinvestment stage. Career concerns may influence the choice of risk as well. In Holmstrom (1982), managers avoid risk. In Chevalier and Ellison (1997), mutual fund managers may increase or decrease their portfolio risk depending on the level of interim returns.

[4] The production functions in Figure 1 also reflect two additional assumptions, which are required to solve the career concerns problem in closed form. The production function is linear in $k$ at the optimum and does not depend on $k$ in the range of excess investment, i.e. where $i$ is greater than $k$. Specifically, I assume that output equals $g(1+r)k$ at the optimum, where $g > 1$, and rises at a rate $g(i-k)$ thereafter, where $g'(0) < 1+r$ and $g'' < 0$.

$$f_k(i = k \mid k) > 1 + r$$

The investments overlap in time. At time *t*, the manager is starting a new project that will ultimately be resolved at time *t*+2. At the same time, the manager is reinvesting in a project started at time *t*-1 and distributing the proceeds from a project started at time *t*-2.

The manager's skill determines the quality of the reinvestment opportunity. Better managers identify projects that are more likely to be worth refinancing. However, on any particular project, the expected return is a function of both skill and luck. I assume that the ideal reinvestment level $k$ is equal to the manager's skill $h$ plus a normally distributed error $e$ with mean zero and precision $h_e$.

$$k_t = h + e_t \tag{2}$$

There is common information except with respect to the ideal reinvestment level $k$, which only the manager observes. Initially, no one knows the manager's skill $h$. The market starts out with a normally distributed prior with mean $m_0$ and precision $h_0$. By observing investment $i$ and cash flow $y$ each period, the market updates this prior, and gradually learns how skilled the manager is. The market's information set is as follows.

$$\mathbf{i}_t = \begin{Bmatrix} y_t \\ i_t \end{Bmatrix} = \begin{Bmatrix} f(i_{t-1} \mid k_{t-1}) - i_t - c \\ h + b_t + e_t \end{Bmatrix} \tag{3}$$

In equation (3), I redefine the investment decision as optimal reinvestment plus an excess investment of $b$. This setup allows me to use the methodology of Holmstrom (1982) and Stein (1989) to analyze the manager's decision. In Holmstrom, the manager exerts effort in an attempt to fool the market about his productivity. In Stein, the manager underinvests and engages in earnings management in an attempt to fool the market about the level of permanent earnings. Here, the manager has an incentive to overinvest in follow-on rounds in an attempt to fool the

market about his ability to select winning projects in the first place. As in Bebchuk and Stole (1993), managers overinvest because there is common information about the level of investment and asymmetric information about its productivity.

When investing, the manager has two concerns: the return on current projects and the market expectation of future returns.

$$V_t = E_t\left[-c + \frac{-i_{t+1} - c}{1+r} + \frac{f\left(i_{t+1} \mid k_{t+1}\right) - i_{t+2} - c}{\left(1+r\right)^2} + \cdots + \frac{f\left(i_{t+j-1} \mid k_{t+j-1}\right) - i_{t+j} - c}{\left(1+r\right)^j} + \cdots\right] \tag{4}$$

This is the net present value of cash flows from future projects. Moreover, (4) is the valuation at which the manager can finance new projects from the market. I assume that the manager weights the two concerns in the following way.

$$U_t\left(i_t\right) = pV_t + \left(1-p\right)\left(\tfrac{1}{1+r}\, f\left(i_t \mid k_t\right) - i_t\right) \tag{5}$$

The manager's utility function captures reputational concerns and incentive pay. The first term captures reputation concerns. The net present value of future cash flows *V* is the valuation at which the manager can raise new finance. Because the manager must repeatedly raise money from his superiors or the financial markets for a corporate manager and from private investors for a venture capitalist, there is a positive weight on *V*. The second term captures incentive pay in an informal way. Pay is often contingent on future accounting performance for corporate managers. Venture capitalists typically provide one percent of the committed capital for their funds. In addition, they receive a fee of two to three percent of funds under management and a twenty percent carried interest on capital gains (Gompers and Lerner (1999)). With complete contracting and the assumed risk neutrality of the manager in (5), incentive compensation could eliminate the career concerns problem. Instead of formally adding risk aversion, wealth constraints, and incomplete contracting to the model, I follow Miller and Rock (1985) and Stein

(1989) and assume that the net effect of these modifications is an exogenous weight between zero and one on the current investment opportunity.

Each period, the market uses data on cash flow and investment to update its prior on the manager's skill $h$. In equilibrium, the information on cash flow is not used. In practice and in a straightforward extension to this basic model, realized returns provide further information about skill. I look for a rational expectations equilibrium where the manager's excess investment choice is known to be $\bar{b}_t(\mathbf{I}_t)$ conditional on past decisions $\mathbf{I}_t = \{\mathbf{i}_1, \mathbf{i}_2, ..., \mathbf{i}_t\}$ and time $t$. The market forms a posterior mean $m_t$ in the following way.[5]

$$\bar{k}_t = i_t - \bar{b}_t(\mathbf{I}_t) = h + e_t \tag{6}$$

$$m_t = \tfrac{h_0}{h_t} m_0 + a_t \sum_{j=1}^{t} \bar{k}_j \text{ , where } h_t = h_0 + t h_e \text{ , } a_t = \tfrac{h_e}{h_t}$$

The market learns the manager's skill level $h$ with increasing accuracy. The posterior distribution is a weighted average of the market prior $m_0$ and the series of investment decisions made by the manager over the course of his career. As time passes, the weight that the market places on a new information $k_t$ grows smaller. In other words, as $t \to \infty$, $a_t$ falls to zero.[6] Importantly, holding the market belief about $b$ constant, the manager has scope to interfere with the market's signal by raising $i$. Having specified market beliefs, we can differentiate the manager's utility function holding these beliefs constant. Together, (6) and (7) determine equilibrium investment.

$$p \frac{dV_t}{db_t} + (1-p)\left( \frac{1}{1+r} \frac{df(i_t \mid k_t)}{db_t} - \frac{di_t}{db_t} \right) = 0 \tag{7}$$

[5] See Holmstrom (1982) for details.

[6] This weight also depends on the relative importance of luck and skill. If the interim outcome of a project is largely luck ($h_e$ is small), then $a$ is small and there is little scope to manipulate the market beliefs for managers of any age.

The second term is recognizable as the first order condition for the first best level of investment. So, if the first term is positive, the manager overinvests. Calculating the derivative of *V*, however, is challenging. In order to find a closed form solution, I make the problem tractable by assuming that the production function is linear in *k* at the optimum and does not depend on *k* in the range of excess investment. Specifically, I suppose that output equals $g(1+r)k$ at the optimum, where $g > 1$, and rises at a rate $g(b)$ thereafter, where $g'(0) < 1+r$ and $g'' < 0$. In other words, there are constant returns to scale up to a certain point *k*, after which there are decreasing returns. A bad investment opportunity is one where decreasing returns set in early. A good project can operate efficiently at a larger scale. Two production functions of this type are shown in Figure 1. It then follows from (4) and (6) that the first term is equal to the weight $p$ times $(g-1)a_t/r$. The derivative of the second term is the weight $(1-p)$ times $f'(i_t)/(1+r)$-1. Setting the equilibrium beliefs equal to the manager's choice of excess investment, we arrive at the following condition.

$$f'(\bar{i}_t) = (1+r)\left(1-\frac{p}{1-p}(g-1)\frac{a_t}{r}\right) \tag{8}$$

**Comparative statics.** The manager overinvests. The amount of overinvestment is increasing in the productivity of investment ($g$) and decreasing in incentive pay ($1-p$). As is typical of career concerns models, the distortion declines with experience *t*. Over time, the market learns the manager's skill. As described above, the benefit of manipulating the signal *k* through investment falls, or $a_t \to 0$ as $t \to \infty$. From (8), investment converges to the first best, or $\bar{i}_t \to k_t$. Interestingly, desired incentive pay may fall with the manager's experience level as a result, in a model where $p$ is endogenously chosen. In contrast, models of effort and career concerns, such

as Gibbons and Murphy (1992), predict the opposite. This is not surprising in light of Holmstrom's original analysis, where he notes that career motives can be beneficial or detrimental, as they are in this case. Finally, with the chosen production function, overinvestment is not a function of the manager's private information. Undoubtedly, a less restrictive production function might produce interesting comparative statics with respect to *k*.

The manager faces a tradeoff between efficient investment and reputation. At the optimal level of investment, there is a first order gain in reputation and a second order loss in investment efficiency. Figure 1 illustrates the tradeoff. The solid line represents the real investment opportunity for a manager who receives information *k* about the quality of his projects. First, consider the reputation gain. Suppose, counterfactually, that the market believes the manager will choose the optimal level of investment *k*. In this case, the manager can inflate his reputation. By choosing *k'* larger than *k*, the manager fools the market into believing that the present value of the project marked on the vertical axis is *B* instead of *A*. The market updates its beliefs about the manager's skill using *B*, and the manager realizes a reputation gain proportional to *B* minus *A*. The manager's experience level determines the factor of proportionality. Second, consider the cost of overinvestment. By choosing *k'* instead of *k*, the profit on the current investment opportunity falls. The cost to the manager is proportional to the difference between *D* and *C*. The factor of proportionality depends on incentive pay.

B. Syndication as a solution

The manager has an incentive to overinvest. In the model, this distortion arises because of asymmetric information on project quality combined with career concerns. In equilibrium, no

one is fooled. Inefficient reinvestment actually imposes deadweight costs that lower the manager's expected wages. As a result, the manager and his investors or superiors will take steps to minimize this distortion.

There are several possible solutions left out of the model. First, allowing for the endogenous determination of incentive pay might reduce overinvestment. However, it is unlikely to solve the problem entirely. Risk aversion and incomplete contracts limit the effectiveness of incentive pay. Incentive pay, when explicitly modeled, introduces another dimension of deadweight costs if the manager is more risk averse than his investors (Grossman and Hart (1983)). Similarly, with incomplete contracts, investors renegotiate with the manager each period as information about skill is revealed, limiting the effectiveness of an incentive contract for each period (Grossman and Hart (1986)). Second, the optimal incentive scheme might depend directly on the level of investment. In particular, the manager might be rewarded for investing less. MacKie-Mason (1991) derives an optimal contract for sequential development projects that includes termination fees. However, a fee of this kind is not typical in venture capital partnership agreements and corporate compensation contracts. Third, the manager may bring on new, informed investors who can reveal the private information and are unencumbered by reputation concerns. This could take the form of an initial public offering - bringing on a large number of public investors - or with syndication - bringing on one or two additional venture capitalists. Gompers (1996) finds that younger venture capitalists bring firms public sooner to enhance their reputation. I focus on the possibility of syndication in this section, although the analysis could apply to the IPO decision as well.

To capture the possibility of syndication, I add a player into the model: The partner is another manager who observes project quality but has no personal stake in the success of the original

manager's activities. This partner is willing to invest at a return *r*. As a result, an equity investment by the partner fully reveals project quality *k*. The easiest way to see this is by imagining that the partner buys the entire investment opportunity. Without side payments, the most he will pay when there is a single project is the maximum net present value of $\frac{1}{1+r} f(k \mid k) - k$. As a consequence, incentive pay *and* career concerns push the manager to maximize the proceeds of the sale, and the sale reveals *k*. Of course, the partner need not buy the entire project. An equity investment of any size reveals the market price.

Syndication may also impose costs. With some bargaining power, the partner can transfer surplus from the manager. In addition, joint control may impose deadweight costs as in Grossman and Hart (1986). Finally, a residual information asymmetry between the manager and the partner may create a lemons problem, which affects the price at which the partner will invest. In Myers and Majluf (1984), the residual information asymmetry would not be costly if the manager and the partner could write a riskless debt contract. However, a riskless debt contract will fail to reveal even the common information shared by the partner and manager on project quality. Another way to avoid this cost is to commit to syndicate *ex ante* as in Admati and Pfleiderer (1994). Instead of formally modeling these effects, I assume that syndication imposes a cost $c_s$ on the original manager. This cost may vary from project to project. In some cases, it may be negative. When the cost is negative, the partner brings expertise and contacts that add value to the project.

The manager will syndicate to the extent that the benefit exceeds the cost. The new objective is to solve the following maximization problem, where *U* is defined in (5).

$$\max_{i_t, s_t \in [0,1]} U_t(i_t)(1 - s_t) + (U_t(k_t) - c_s)s_t \tag{9}$$

The manager can either signal with investment as before or make the first best level of investment and pay the costs of syndication. The market beliefs do not change. So, the first order condition of (9) with respect to investment along with (6) yield the same equilibrium condition for *i* derived above in (8). Again, no one is fooled in equilibrium. The private information is revealed whether the manager chooses to syndicate or not. This simplifies the derivative of (9) with respect to syndication, and gives it a simple intuition. The benefit of syndication is eliminating overinvestment, and the cost is simply $c_s$. The manager will syndicate if the benefit exceeds the cost.

$$(1-p)\left[\tfrac{1}{1+r}\left(f(k_t \mid k_t) - f(\bar{i}_t \mid k_t)\right) - (k_t - \bar{i}_t)\right] > c_s \tag{10}$$

**Comparative statics.** Younger managers are more likely to syndicate. From (1), the left hand side is positive: *k* is by definition the first best level of investment and anything other than *k* is suboptimal. Furthermore, provided *f* is strictly concave in the range of excess investment, the first term is increasing in $\bar{i}_t$. It follows from (8) that $\bar{i}_t$ is decreasing in age and from (10) that the use of syndication is an increasing function of excess investment. These two together imply that older managers syndicate less. As I showed above, non-syndicated investment converges to the first best, $\bar{i}_t \to k_t$, and so the left hand side in (10) converges to zero. Of course, for a particular project, the cost of syndication could well be negative. In other words, for some subset of the projects, the syndication partner adds value. So, even older managers will syndicate some projects. The comparative static on incentive pay (1-*p*) is ambiguous. While raising incentive pay has the direct effect of increasing the first term in (10), it also has the indirect effect of lowering non-syndicated investment and hence the benefits of syndication.

The manager weighs the costs and benefits of syndication. Figure 2 illustrates this tradeoff. The solid line represents the first best level of investment, and the dashed line shows the non-syndicated, second best level of investment from equation (8). As the manager becomes more experienced and the effect of new information on reputation falls, investment converges to the first best. The cost of syndication, measured as an equivalent investment level, is indicated in Figure 2 by a light solid line. When the second best level of investment is above this cutoff, there is syndication. When it is below the cutoff, there is none. In other words, for a given cost of syndication, there is a critical age $t^*$ above which the manger no longer syndicates. This leads to the first empirical prediction.

**Prediction 1.** The probability of syndication falls with the manager's experience level.

Syndication leads to the first best level of investment. By definition, any other investment choice leads to a lower return on investment. The second best level of investment approaches the first best as the manager gains experience and his ability to fool the market about skill declines. Figure 2 illustrates the gains from syndication. For all levels of experience, there are benefits to syndication: investment falls from the second best dashed line to the first best solid line. The magnitude of this benefit falls with experience. This leads to the second empirical prediction.

**Prediction 2.** (a) Syndicated investments have a higher return on investment.

(b) The effect of syndication on returns falls with the manager's experience level.

Overinvestment can take two forms. Managers may invest *too much* in each project or refinance *too many* projects, or possibly both. Above, I apply the work of Holmstrom (1982) and Stein (1989) to find a rational expectations equilibrium where managers overinvest in each project. By contrast, a model where the manager makes a discrete investment choice to continue or abandon each project is more challenging to solve in closed form.[7] Nonetheless, such a model would likely produce similar comparative statics. Younger managers choose to continue more projects, and venture capitalists use syndication to certify an efficient continuation. In this case, a selection effect is at work. Syndication does not cause a project to perform better. Rather, venture capitalists syndicate better performing projects. Based on this intuition, the empirical test of second prediction has two parts. The first is to measure the difference in the probability of a successful exit between syndicated and non-syndicated follow-on investments. The second is to determine how this difference varies with the venture capitalist's experience level.

## 3. Data

The data in this paper come from the Securities Data Company (SDC) *VentureExpert* database. Since 1977, SDC Venture Economics has gathered information on the date of venture financings, the funds disbursed, and the identity of the portfolio company receiving the funds and the set of venture firms disbursing the funds. The database is filled back to the early 1960s.[8]

[7] The difficulty with a discrete investment choice model is that the asymmetric information is not revealed by the manager's actions in each period.

[8] Lerner (1994, 1995) checks this data for completeness and accuracy by examining the subset of venture-backed biotechnology firms. The coverage of firms is fairly complete, with the SDC portfolio companies representing 98 percent of the patents awarded to venture-backed biotechnology firms over the period studied. There also appears to be no bias in the reporting of disbursements. However, the number of financing rounds is overstated by 28 percent. In these cases, SDC often records the staged distribution of funds in a single round as multiple rounds of financing.

The full sample consists of 8,894 portfolio companies that received a first round of financing between 1967 and 1996. The construction of this initial sample is described in the appendix. From this total, 827 are from the back-filled period before 1977. The remainder is split roughly equally across the later two decades, with 3,869 between 1977 and 1986 and 4,198 between 1987 and 1996. The sample does not cover the recent wave of venture financings. I leave out companies that received first round financing after 1996, because I am primarily interested in the syndication of investment in the second round, and I track the initial investments through the end of 1998. Over three-quarters of second round financings occur within two years. For the regressions, I focus on the subsample of 4,747 firms that were initially financed by a *single* venture capitalist.[9] When there is a single venture capitalist making the first round decision, the notion of career concerns in second round investments is clearer.[10] The annual breakdown of first and second round investments for these 4,747 firms is shown in Table 1.

For each transaction, SDC records information on the portfolio company, the investors, and the size of the disbursement. Table 2 presents summary statistics. The first three columns show means and medians for the full sample. The second three columns present the same statistics for the subset of portfolio companies initially financed by one venture capitalist.

Panel A describes the portfolio companies. For the full sample, the typical investment in both the first and second round is around 1.5 million in 1996 dollars.[11] At the first round, the median

[9] Because SDC may overstate the number of rounds in some instances, I also run the regressions below excluding portfolio companies where the second round occurs within 90 days. The regression results are not sensitive to this exclusion.

[10] Venture firm age is the proxy for reputation concerns. While I focus on the sample where there is a single venture firm making the initial investment, I also run the regressions below using the full sample and average venture firm age in the first round. The results are statistically and economically very similar. This reduces the concern that the results might be driven by the initial selection of portfolio companies.

[11] All dollar values are converted to 1996 levels using the CPI from Ibbotson (1999).

funded firm is two years old. Both age and disbursements are skewed: the mean investment levels are 2.9 and 3.2 million, and the mean age is four years.[12]

The industry distribution is weighted toward information technology, at 48 percent, followed by non-high technology, at 33 percent, and medical, health, and life sciences, at 18 percent. SDC provides a finer industry breakdown, which appears in Table 2 below. Industry matched data from Compustat are consistent with a technology focus. Each portfolio company is mapped by SIC code into one of the 49 industry groupings in Fama and French (1997). For each industry-year pair, I calculate the median research and development to sales ratio, the median plant, property, and equipment to assets ratio, and the median market to book ratio. The composition of industries in the SDC database lead to an average R&D intensity of 1.7 percent, an average asset tangibility of 44.3 percent, and an average market to book ratio of 2.0. In the regressions, I use these measures as industry controls.[13]

The typical exit path is by public offering or acquisition. About 20 percent of the companies sell shares to the public markets in an IPO with an additional 22 percent sold privately. SDC records a bankruptcy or liquidation for three percent of the companies. This category includes Chapter 7 and Chapter 11 bankruptcies, other liquidations, and defunct firms. A large fraction of the remaining 54 percent, where no exit is recorded by SDC, are presumably also failed investments. Undoubtedly, some are also unreported acquisitions. An explicit liquidation or bankruptcy is only required when a company has debt finance or significant fixed assets.

[12] First round investment is missing nine percent of the time (809 out of 8,894). Second round investment is missing five percent of the time (272 out of 5,231). Company age is missing 29 percent of the time (2,551 out of 8,894). In the regressions below, I fill in the data with industry-year medians. The regression results are not sensitive to this data replacement.

[13] Because these cannot be included in addition to industry fixed effects, I run but do not report regressions with industry fixed effects. The regression results are not sensitive to the inclusion of fixed effects.

For each portfolio company, SDC records its status at the time of each disbursement. At the first round of financing, not surprisingly, the bulk of the investments are for seed or early stage finance. In the regressions below, I use company status to predict whether or not there is a second round of finance. A follow-on investment can only be syndicated if there is a second round. Company status serves as an instrument to control for the possible bias associated with this sort of self selection.

Panel B describes the venture firms. Forty-seven percent of the first round investments are syndicated. On average, two venture firms invest in each company. Sixty percent of the companies receive at least one more round of finance. On average, each company has three rounds of financing. In the second round, the rate of syndication rises to 55 percent, and the average number of venture capitalists increases to 2.5. The proxies for venture firm career concerns are firm age, past success at bringing portfolio companies public and raising a second fund, and fund size. The average venture firm is nine years old.[14,15] Sixty-seven percent have already completed an IPO, and 36 percent have raised a second fund. The median fund size is 29.5 million, and the average is 63 million.[16] SDC also specifies the fund's stage focus, which I do not report in Table 2. The vast majority of the funds are balanced stage funds at 41 percent of the sample. Gompers and Lerner (1999) find that the SDC classifications do not always match the descriptions in the partnership agreements. As a result, I use the company stage

[14] When the first round is syndicated, I record an average age, past IPO, second fund, and fund size. So, the summary statistics for these variables are medians and averages of portfolio company averages.

[15] A venture firm's age is the difference, measured in years, from the date of investment to the date of the first investment by that firm recorded by SDC. SDC also provides firm founding dates for some institutions. The regression results for age defined relative to first investment and age defined relative to founding are the same. Formal venture investing started in 1946 with the private equity firm American Research & Development. Because the founding dates precede 1946 in some cases, I report results using the age relative to first investment.

[16] Fund size is missing seven percent of the time (611 out of 8,894). In the regressions below, I fill in the data with venture firm age-year medians. The regression results are not sensitive to this data replacement.

classifications to predict whether or not there is a second round of finance in the regressions below.

The summary statistics for the subsample of portfolio companies initially financed by a single venture capitalist are similar, though the difference in means is often statistically significant. The first and second round investment levels are lower, while the subsample portfolio companies are about a year older on average. The industry distribution is tilted away from high technology. This is reflected in the SDC industry classifications, and the Compustat matched R&D and asset intensity numbers. Exit by IPO or acquisition is slightly lower. By construction, none of the first round investments are syndicated. The subsample portfolio companies have fewer rounds of financing, which is a result of the slightly different industry distribution.[17] On the measures of career concerns, firm age, past success at bringing portfolio companies public and raising a second fund, and fund size, the two samples are almost identical. Finally, almost half of the subsample portfolio company investments are syndicated in the second round.

## 4. Empirical results: career concerns and syndication

The empirical analysis focuses on the two predictions from the model in Section 2. The aim of this section is to test the first prediction - to identify a link between career concerns and the syndication of follow-on financing. Although there is a clear univariate relationship between measures of reputation and syndication, there are alternative explanations unrelated to career concerns. The leading alternative is that venture firm age is a proxy for capital constraints.[18] A

[17] Gompers (1995) analyzes a subset of these venture capital investments. The finding that high technology firms (represented by research and development expenditure) have more rounds holds in the larger sample.

[18] Section 5 evaluates a broader range of alternative explanations that link venture firm age to syndication.

young firm may not have the resources to provide second round financing. To test for this possibility, I include portfolio company controls, including the size of the second round investment, and venture firm controls, including the size of commitments available to the firm. I also analyze the effect of venture firm age on the first round syndication decision, where capital constraints but not career concerns play a role, and attempt to limit the sample to a set of unconstrained venture firms. Finally, I use a venture firm fixed effects approach, which considers how the decision to syndicate changes within a venture firm as it ages, controlling for changes in second round investment and changes in fund size.

A. Univariate analysis of the syndication decision

The syndication of follow-on finance is more common for younger venture firms and in high technology industries. First, Figure 3 shows the rate of second round syndication by venture firm age. The 4,747 portfolio companies initially financed by a single venture firm are divided by venture firm age into groups along the horizontal axis. The rate of syndication falls from over 60 percent for venture firms in their first year of operation to less than 40 percent for venture firms that are ten years old.

Second, the rate of second round syndication is higher in high technology industries. Table 3 shows the rates of syndication by SDC industry group. The first column shows the number of portfolio companies initially financed by a single venture firm in each industry. The second column shows the rate of second round syndication for these firms. The next three columns show matched Compustat data on research and development expenditures, fixed assets, and the market to book ratio. The final column shows the rate of first round syndication. There are higher rates of syndication in biotechnology, communications, computers, medical, and semiconductors, all

with at rates over 48 percent. This set of industries has higher research and development expenditures and fewer fixed assets. Meanwhile, lower technology industries, such as agriculture, business services, construction, consumer related, finance, industrial and energy, manufacturing, and utilities all have rates of syndication below 41 percent. One interpretation is that because lower technology firms have less proprietary information, more tangible assets, and more profits, outside investors can determine valuation without the venture firm resorting to syndication. However, with fixed assets as collateral for debt financing, lower technology industries also require less equity finance. Consistent with this second hypothesis, the industry rates of syndication are highly correlated across the first and second round.

Table 4 looks at a wider range of reputation measures. In addition to firm age, career concerns can be measured by past success at fundraising or taking firms public and by fund size. Once a venture firm has raised a second fund or successfully taken a firm public, its survival may be more assured. The results of Table 4 corroborate Figure 3. Younger venture firms, venture firms with past success, and large venture funds are less likely to syndicate the follow-on round. The rate of syndication is ten percentage points lower for venture firms that are over five years old, a difference that is significant at the one percent level. The rate of syndication is lower by seven percent for venture firms that have successfully raised a second fund and lower by eight percent for venture firms that have completed an IPO. Finally, larger venture funds have lower rates of syndication.

Career concerns and capital constraints are both plausible interpretations of the univariate results in Table 4. First, firm age, past success, and venture fund size measure career concerns. Older, more established, and more successful venture firms are able to raise larger funds. Second, firm age, past success, and especially venture fund size measure capital constraints. A

small fund may be unable to provide a second round of finance by itself, having exhausted its committed capital. The two are not mutually exclusive, and both may play a role in the decision to syndicate. The next two subsections perform additional tests in an attempt to establish an *independent* influence of career concerns on syndication choice.

B. Venture firm age and syndication: Capital constraints and career concerns

The univariate results have two drawbacks. First, there may be important omitted variables that give rise to the relationship between second round syndication and venture firm age. Second, there is selection bias. Only portfolio companies with a second round of finance are included in Table 4. I address these problems in two ways. In this subsection, I use a Heckman model of selection to analyze the determinants of second round syndication. In the next subsection, I use venture firm fixed effects.

The maximum likelihood Heckman model in the first four columns of Table 5 has two equations. The dependent variable in the first is whether the portfolio company *has* a second round of finance, while the dependent variable in the second equation is whether there is syndication *conditional on* a second round of finance. Ideally, the instruments in the first equation influence the probability of a second round but do not directly affect the syndication choice in the second round. For this first equation, I rely on the SDC classification of the company stage at the first round. As described in the appendix, I aggregate these classifications into eight stages: seed, early, first, second, third, expansion, bridge, and other.[19] When initially financed at an early stage, a portfolio company is much more likely to receive a second round of

[19] This aggregation makes the interpretation of the coefficients in Table 5 easier, but does not influence the results. Using the full set of SDC stage classifications does not affect the coefficients in the second equation of the Heckman model.

financing. The coefficients in Table 5, which are over 0.70 for seed, early, and first stage financings and less than 0.48 for second, third, expansion, and bridge, are consistent with this intuition. First round stage explains seven percent of the variation in second round finance.

The second equation includes two sets of controls: portfolio company characteristics and venture firm characteristics. The portfolio company controls are the level of second round investment, company age, and matched Compustat research and development and fixed assets intensity. I also run but do not report regressions with the more general approach of including industry fixed effects for each SDC industry group in Table 3. The coefficient on firm age is unchanged. The venture firm characteristics and market effects are the size of the fund, the state of the IPO market, and the yield on long-term government bonds from Ibbotson and Associates (1999). The market variables capture changes in the fundraising environment. The determination of "hot" and "cold" IPO markets is described in the appendix and in Bayless and Chaplinsky (1996). Again, I also run but do not report regressions with the more general approach of including year fixed effects.

The base model matches the univariate results. Introducing a two stage selection model leaves the coefficient largely unchanged. Venture firm age is statistically significant at the one percent level and economically important: The coefficient of -0.017 means that each year of venture firm age reduces the rate of syndication by 0.7 percent.[20] The second column introduces portfolio company controls. The basic result is strengthened as the coefficient increases in absolute value by over a third to -0.024. Consistent with a capital constraints model of syndication, the size of the second round investment is strongly positively correlated with syndication in the second round. Second round investments in older portfolio companies are also

[20] For economic significance, I report the coefficient from a linear estimation in the second stage of the Heckman model (rather than a probit estimation).

less likely to be syndicated. Finally, as in the univariate results in Table 3, fixed assets intensity is negatively, and significantly, related to second round syndication. Perhaps lower fixed assets are a proxy for an information asymmetry about the portfolio company valuation. However, the coefficient on research and development, which is negative, though not statistically significant, does not support the fixed assets intensity result.

The third column adds venture firm controls to the base model. This reduces the age coefficient in absolute value by a quarter, dropping it from -0.017 to -0.013. However, the negative coefficient on venture fund size captures two effects: reputation and capital constraints. As a consequence, although the coefficient on age is now economically smaller, reputation may still be just as important a determinant, now through both venture firm age and size, of the syndication choice. In the next section, I use a fixed effects approach to disentangle the two effects of venture fund size. None of the market effects are statistically significant. The point estimates suggest that syndication is higher in hot IPO markets and lower in cold IPO markets.[21] The fourth column adds both portfolio company and venture fund controls to the base model. The results are essentially the same as when these variables are added separately. The net effect of the two sets of controls is to leave the coefficient on venture firm age unchanged from the base model. Also, adding the portfolio company controls makes the IPO market effects significant at the ten percent level.

Capital constraints are an important determinant of syndication choice. Second round investment is the best single predictor of syndication, and venture fund size is negatively, and significantly, related to syndication choice. However, the multivariate results in Table 5 suggest

[21] The stronger effect of the IPO market is on the probability of a second round. As in Lerner (1994), I find that a second round of private financing is more likely when the IPO market is classified as cold a year (the median time between the first and second round) after the first round, and less likely when the IPO market is hot.

that venture firm age, a proxy for career concerns, plays an independent role. Before reaching a final conclusion, I perform two additional tests.

First, the last column of Table 5 shows the determinants of first round syndication. Unlike in the second round analysis, there is no self selection, and I include the company stage effects along with the portfolio company and venture firm controls in a single probit estimation. Consistent with the second round results and with capital constraints, investment and venture fund size are important determinants of first round syndication. While capital constraints should play a role in both the first and second round, career concerns need not. Indeed, venture firm age changes sign. This suggests that the second round age effect is not capital constraints, but rather something else. Interestingly, the coefficient on fixed assets intensity also changes sign. Second, I limit the sample to venture firms that would appear to be financially unconstrained, and repeat the regression in the fourth column of Table 5. I define a firm as constrained if it has not raised a new fund for at least three years at the time of a portfolio company's second round of financing. This eliminates 939 of the 4,747 companies. The coefficient on venture firm age for this subsample is -0.018 and is significant at the one percent level. These results provide additional evidence for a link between career concerns and the syndication of follow-on rounds.

C. Venture firm reputation at the founding date

Venture fund size plays two roles. First, size measures the extent to which the venture firm can finance investment without bringing in a syndication partner. Second, size may measure the experience level of the venture capitalist. With an exact measure of experience, we would estimate the following regression, separating the capital constraints and career concerns effect of

venture fund size, and estimating the probability that venture capitalist *i* chooses to syndicate an investment at time *t*.

$$Syndication_{it} = \Phi\left(b_1\, Experience_{it} + b_2\, Size_{it} + e_{it}\right) \tag{11}$$

In the multivariate analysis above, we have a crude proxy for experience - venture firm age. Venture firm age fails to capture variation in the experience level of the venture team when the firm is founded. In column 2 of Table 5, including firm size reduced the coefficient on firm age. Because we do not have the initial experience level of the venture capitalist, size could be picking up an experience effect as well capital constraints. The actual estimation is as follows.

$$Syndication_{it} = \Phi\left(\begin{array}{c} b_1\left(Experience_{it} - Initial\ Experience_i\right) + b_2\, Size_{it} \\ + b_1\, Initial\ Experience_i + e_{it} \end{array}\right) \tag{12}$$

The initial age of the venture capitalist is an omitted variable. Omitted variable bias appears in two ways in Table 5. The coefficient on age understates the influence of career concerns on syndication choice, which has a negative correlation with the omitted variable, and the coefficient on venture fund size, which has a positive correlation with the omitted variable, overstates the capital constraints effect. Venture firm fixed effects addresses this econometric problem by removing the influence of initial career concerns.[22] In essence, the fixed effects model identifies the change in syndication behavior *within* a particular venture firm as it ages.

The fixed effects model in Table 6 uses the same two sets of controls. The first column shows the univariate relationship between age and syndication with venture firm fixed effects.

[22] Fixed effects does not completely solve the problem. I assume a linear effect of age, whereas the effect of reputation in Figure 2 is clearly nonlinear.

The next two columns add portfolio company and venture firm controls, and the final column includes both.[23]

The within estimator is over a third larger than the simple univariate estimator in Table 4. Each additional year reduces a venture firm's rate of syndication by over 1.2 percent. As before, the second round investment level has a positive effect on syndication, and venture fund size has a negative impact on syndication. However, after removing the effect of initial reputation, the coefficient on venture fund size is no longer statistically significant. This provides some support that the effect of size on syndication in Table 5 is a career concerns effect and that the reduction in the age coefficient is not a rejection of career concerns in favor of capital constraints.

## 5. Empirical results: syndication and success

The first empirical section documents a link between career concerns and the syndication of follow-on finance. The aim of this section is to test a second prediction - to measure the difference in the quality of syndicated and non-syndicated investments and establish a link between career concerns and this difference in quality. This is a somewhat more precise test of the model of career concerns and staged investment in Section 2. As such, it casts some doubt on an alternative explanation that links career concerns and syndication to the IPO process. In addition, the experience level of the syndication partner is not an important determinant of the portfolio company outcome. This suggests that a certification mechanism, rather than the expertise of the syndication partner, is at work. Finally, this section ends with a review of the empirical facts and a discussion of a set of alternative explanations.

[23] A shortcoming of the fixed effects model is that it cannot accommodate year fixed effects. Venture firm fixed effects, year fixed effects, and venture firm age are perfectly collinear. As a result, a within estimator of the effect of age on syndication choice (or any other dependent variable) cannot be identified along with year fixed effects.

A. Syndication and firm outcomes

Syndication is associated with successful outcomes. When the second financing round is syndicated, the firm is more likely to have a public offering or a private sale in its future. Figure 4 shows a simple comparison of syndicated and non-syndicated financing rounds for the subset of firms initially financed by a single venture firm. For each financing round, the portfolio companies are divided into groups. The solid bars show average outcomes for a non-syndicated sample - companies where only the original investor provides follow-on funding. The dashed bars show average outcomes for a syndicated sample - companies where a new investor provides capital in at least one of the subsequent rounds. This second set of investments has been certified with an arms-length investment. The differences are economically large. The unconditional probability of success - an IPO or a private sale - is 36 percent. This rate rises to 52 percent when the second round is syndicated and continues to 57 percent for firms that receive five or more rounds of financing. By contrast, when a follow-on round is not syndicated the rate rises to 38 percent in the second round and falls to 30 percent for firms that receive five or more rounds of financing.[24]

Syndicated financing rounds are also larger. The difference of 14 percentage points (52 minus 38), in the probability of a successful outcome, between syndicated and non-syndicated second rounds falls to 9 percent controlling for this higher investment level. However, the coefficient remains significant at the one percent level.

B. The effect of venture firm age on the value of syndication

[24] The sample size falls for each set of bars. There are only 105 portfolio companies that receive five rounds without syndication, and only 577 portfolio companies that receive five rounds with at least one syndicated investment.

The simple comparison of outcomes for syndicated and non-syndicated investments suggests a certification mechanism. Venture firms bring on new investors when things are going well. A further implication of the model in section 2 is that the benefits of syndication are greatest for young venture firms. The effect of a single failure is smaller for a more experienced venture capitalist, the temptation to continue an unprofitable venture is lower, and, as a result, the certification benefit is falls with venture firm age.

Investment outcome is defined in two ways. In the first two columns of Table 7, the dependent variable is equal to one if the portfolio company has an initial public offering prior to year end 1998. In the second two columns of Table 7, the dependent variable is equal to one for a private sale prior to year-end 1998, two for an initial public offering, and zero for all other outcomes. The highest returns are realized when the portfolio company is taken public, the next most desirable outcome is a private sale, and any other outcome, whether bankruptcy or unreported, is least desirable.[25]

The independent variables in Table 7 are venture firm age, whether the portfolio company received a second round of financing, whether the second financing round was syndicated, and the interaction of syndication and venture firm age. These last two independent variables are designed to measure the effect of syndication on firm outcome and the influence of venture firm age on its magnitude. The first and third columns do not include portfolio company and venture firm controls, while the second and fourth columns include both.

[25] For example, the National Venture Capital Association (1999) reports that the average valuation in a merger or acquisition in 1998 was 67.8 million. Meanwhile the average proceeds (typically for a small fraction of the firm) from an IPO was 49.2 million. Also, an older Venture Economics (1988) study reports that a $1 investment in a firm that goes public provides an average cash return of $1.95 in excess of the initial investment with an average holding period of 4.2 years. Meanwhile, a $1 investment in an acquired firm yields a cash return of only 40 cents over a 3.7 year mean holding period.

There are two interesting effects in Table 7. First, syndication remains a strong predictor of success, controlling for the portfolio company and venture firm characteristics. In all four columns, the coefficient on second round syndication is significant at the one percent level. Second, the effect of syndication falls with venture firm age. The coefficient on the interaction between syndication and venture firm age is negative and significant at the one percent level. The economic effects are also large. The coefficient of 0.45 in column 2 means that syndication increases the probability of an IPO by over 11 percent, a major impact given a mean rate of public offerings in the subsample of less than 20 percent. This effect falls by 0.6 percent per year as the venture firm ages. So, syndication increases the probability of an IPO for a ten-year old venture firm by only five percent.

The other effects are more predictable. Both total investment and size increase the probability of a successful exit. The size of the venture fund seems to play an independent role with a positive effect, although it is not significant at the ten percent level.

The last two columns show ordered probit results. There is a strong positive effect of syndication. In other words, syndication increases the probability of moving from failure to a private sale and from a private sale to an initial public offering. Again, these effects are a decreasing function of venture firm age. The coefficient on syndication for a new firm is over two times as a large as for a venture firm in its tenth year.

As a second check, I re-estimate but do not report the regressions in the second and fourth columns with first round investments. Controlling for portfolio company and venture firm characteristics, syndication is not a strong a predictor of success in the first round. Syndication increases the probability of an IPO by two percent and has a p-value of 0.12. This effect actually increases with venture firm age, although the rate of increase is not statistically significant. The

results for the ordered probit are similar. This lends further support to the link between career concerns and reinvestment. If there is a mechanical effect of syndication and the interaction between syndication and age on the probability of a successful outcome, it should appear in the first round as well.

C. Alternative explanations

I focus on three patterns in second round financing: the rate of syndication falls with venture firm age, syndicated investments have a higher probability of a successful outcome than non-syndicated investments, and this gap in probability falls with venture firm age. These empirical facts are consistent with the model in Section 2. Undoubtedly, many other considerations play a role in the decision to syndicate, but I argue that no other story fully explains this set of empirical facts.

*Capital constraints.* One argument for syndication is that the original investor is capital constrained. Consequently, younger firms with smaller funds are more likely to syndicate. While capital constraints or diversification appear to be a motivation to syndicate – both fund size and investment are significant determinants of syndication – three empirical results suggest that this is not the whole story. First, capital constraints should influence both first and second round financing. While second round finance is a decreasing function of age, first round finance is not. Second, after controlling for investment and fund size, firm age should have no effect. The Heckman and fixed effects results suggest that this is not the case. Third, the effect of age remains in a sample of firms that have recently raised new funds.

*Expertise.* The syndication partner may bring expertise that a young venture firm cannot provide. This possibility gives rise to an additional prediction. The age of the syndication partner

should enter positively in the regressions in Table 7.[26] In Table 8, I include the age of the syndication partner in the first and the third column and the difference in age between the original venture firm and the syndication partner in the second and fourth columns. In all four columns, the effect of the syndication partner is not statistically significant. And, in all four cases, the basic effects of syndication and the interaction between syndication and venture firm age in Table 7 remain. This provides some support for a model of certification over a model of expertise.

*Certification and the IPO process.* Another possibility is a variation on the model in section 2. Young venture firms certify their successful investments with an arms-length valuation, but the desire for certification is not related to inefficient reinvestment. Instead, both the entrepreneur and venture capitalist want to add investors prior to a public offering. To some extent, this alternative explanation is also built on the premise that a reinvestment by the original venture capitalist alone is suspect.[27] But the second investor may serve to improve the precision of the valuation, rather than the efficiency of reinvestment. The first round results suggest that this is not the whole story. If the certification is unrelated to reinvestment, the first and second round should give similar results. But, none of the three empirical results hold in the first round.

In addition to these three alternative explanations, Lerner (1995) describes there other motivations for syndication. While these undoubtedly play a role in the decision to syndicate investments, none explains the empirical results presented here.

[26] A second alternative prediction that gives the same empirical prediction (in terms of the effect of the age of the syndication partner) is reciprocity (Piskorski (2000)). Young venture firms may refer promising deals to older venture firms with the expectation that some deal flow will return.

[27] Alternatively, a new venture capitalist may bring skills required to take the firm public. However, Table 8 shows that including the age and the investment stage focus of the syndication partner does not change the basic results in Table 7.

*Decision Making.* The benefits of group decision making may also lead to syndication [Sah and Stiglitz (1986)]. Perhaps this benefit is larger for younger venture capitalists. Consistent with this intuition, the age of the syndication partner has a positive though statistically insignificant effect in an unreported variation on the regressions in Table 6. Including this variable does not change the effect of syndication and the interaction between syndication and firm age. Furthermore, this argument is not limited follow-on financing. Both first and second round investments would be improved through syndication. Yet we only observe a significant relationship between age and syndication in the second round.

*Asymmetric information among providers of capital.* The initial venture firm will have an information advantage relative to other investors *ex post* (Admati and Pfleiderer (1994)). As a result, the optimal contract may involve a commitment to syndicate follow-on rounds. This alternative explanation does not make strong predictions about age and syndication. In fact, experienced venture capitalist may have more power over the entrepreneur in terms of providing additional finance.

*Window dressing.* Venture firms, in the same spirit as the window dressing of mutual fund managers in Lakonishok, Shleifer, Thaler and Vishny (1991), may wish to invest just prior to an initial public offering. The desire to inflate reputation in this way is likely to be greatest among younger venture firms, who are eager to be associated with success. The window dressing prediction is that younger firms join later round syndicates. The finding here is a different one: younger firms syndicate their follow-on investments.

While the results appear to favor the model of career concerns and staged investment, one empirical fact gives some pause. The probability of a second round of financing is not decreasing appreciably with venture firm age. Controlling for portfolio company and venture firm

characteristics, the coefficient on venture firm age is negative but not statistically significant.[28] This suggests that younger venture firms do not overinvest. However, the model in section 2 does not make an unconditional prediction about investment efficiency. Non-syndicated investments are less efficient for less experienced managers – the empirical result presented in this section – but less experienced managers syndicate more often – the empirical result presented in the preceding section. These two results can offset to eliminate an unconditional relationship between experience and reinvestment. Nonetheless, the empirical results presented here are evidence of a solution rather than the underlying distortion and are therefore less than definitive evidence.

## 6. Conclusions

This paper investigates how career concerns influence the efficiency of sequential investments. This has implications for corporate investment. Like a corporate project, an entrepreneurial firm from the perspective of the venture capitalist presents a series of sequential investment decisions. Like a corporate manager, the venture capitalist must choose among many new and existing investment opportunities. But, unlike in a corporation, a venture capitalist has the ability to syndicate follow-on investments, passing a credible signal to the venture fund's ultimate investors.

The argument is that career concerns can lead to inefficient reinvestment decisions and that syndication can mitigate this inefficiency. A theoretical model shows that a young manager may invest too much or too often in an attempt to fool the market about his project selection and management skills. For venture capitalists, syndication solves the problem of overinvestment by

[28] The dependent variable is whether or not there is a second round of financing and the independent variables are the portfolio and venture firm controls described above along with year fixed effects.

providing an arms-length valuation. If syndication is costly, it will be used predominantly by younger venture firms where the reputation problem is most severe. Consistent with this theory, I find that the rate of syndication in follow-on investments is considerably higher for younger venture firms. In addition, the benefits are greater for younger firms. Syndication substantially increases the probability that a firm will be sold either in a private sale or through an initial public offering. This effect decreases with venture firm age.

The broad implication of this paper is for investment. In particular, I argue that managers have a preference for continuing old projects in which they have reputational capital. This model makes non-obvious predictions that are consistent with casual empirical observation. For example, within a firm, rotating division managers may improve investment efficiency despite the loss of specialization and information. In addition, the model bears on several other issues in corporate finance.

*Inefficient allocation of capital.* Conglomerates engage in inefficient diversification [for example, Lang and Stulz (1994), Berger and Ofek (1995, 1996), and Comment and Jarrell (1995)] and cross-subsidization [for example, Lamont (1997), Shin and Stulz (1996), and Scharfstein (1997)]. If we introduce a second, new investment opportunity at the point of reinvestment and a fixed budget constraint into the model, the manager will overinvest in the old project and underinvest in the new one. A corporate manager with a variety of investment opportunities may cross-subsidize divisions, using the cash flow from one division to invest and signal value creation in another. The market is not fooled in equilibrium, but the manager has an incentive to misallocate capital nonetheless. There are other models of inefficient allocation within corporations that do not map into the venture capital industry, such as rent seeking by

division managers [Scharfstein and Stein (2000)] and investments designed to entrench management [Shleifer and Vishny (1989)].

*Soft budget constraint.* Kornai (1980) coined the soft budget constraint to describe the phenomenon where a project on the verge of failure has its budget constraint relaxed with the addition of extra capital. In Dewatripont and Maskin (1995), centralized credit causes the refinancing of projects that should not have been funded in the first place. There is asymmetric information at the time of the initial investment. Because this investment is sunk, refinancing the project is worthwhile *ex post*. In this model, there is no asymmetric information between the entrepreneur and the manager. The entrepreneur's budget constraint is relaxed for a different reason: the career concerns of the intermediary investment manager.

*Real options.* Managers maximize value by optimally exercising real options [for example, Mason and Merton (1985), Dixit (1992), and Pindyck (1991)]. The setup here is close to a real options framework. The manager makes a small initial investment $c$, uncertainty about the prospects of the project are resolved at the next stage, and the manager makes an irreversible investment based on this information. Unlike a real option, the project payoffs are linear in $k$. However, a more general production function would likely also produce overinvestment. In particular, managers with career concerns might exercise their real options too early and too often.

*Venture capital and the financing of entrepreneurial ventures.* When investment and cash flow are not observable, managers underinvest [for example, Miller and Rock (1985) and Stein (1989)]. As a result, managers have an incentive to inflate dividends or earnings by reducing investment *below* the optimal level. Here and in Bebchuk and Stole (1993), there is asymmetric information is over investment opportunities. In this case, signaling can result in too much rather

than too little investment. Investment and cash flow are observable here but project quality is not. Furthermore, at the point of investment, the project has no earnings. In this case, investment itself is the signaling device. As a result, managers increase investment *above* the optimal level. While dividend signaling and earnings management are likely distortions in established firms, investment signaling may be more important for emerging and entrepreneurial firms where growth options represent the bulk of market value. Syndication may give venture capitalists a comparative advantage in terms of investment efficiency over corporations in financing entrepreneurial ventures. For projects with real options, no cash flow, and valued based on investment opportunities, the syndication of follow-on rounds helps mitigate the career concerns problems associated with reinvestment decisions.

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## Appendix. Construction of the sample

**SDC Venture Expert.** The sample consists of all US-based portfolio companies from the SDC *VentureExpert* database that received a first round of financing in the thirty-year period between 1967 and 1996. The total sample consists of 8,894 venture firms. Of these, 4,747 received first round financing from a single venture firm. This final sample excludes portfolio companies initially financed by individuals (firm name = "Individuals") and unidentified

| Variable | Description |
|---|---|
| Round Investment | The total financing received ($000) deflated to 1998 by the consumer price index from Ibbotson (1999). |
| Company Age | The difference between the year of initial investment in the portfolio company and the year in which the portfolio company was founded. |
| Company SDC Industry | Industry of the portfolio company. The seventeen industry categories are communications, computer hardware, computer software, other computer, semiconductors/other electronics, biotechnology, medical/health related, consumer related, industrial/energy, transportation, finance, insurance, real estate, business services, manufacturing, agriculture, forestry, fishing, etc., construction & building products, utilities & related firms, and other products. |
| Company Compustat Industry | Industry (based on Fama and French (1997)) of the portfolio company. See Fama and French for the mapping from SIC code into 49 industry groups. |
| Company Exit | Exit status of the portfolio company as of August, 1999, is listed as IPO (Company IPO = yes), Merger (Company Situation = merger, acquisition, or LBO or Company Status = subsidiary), Bankruptcy (Company Situation = Bankruptcy Chapter 7 or Bankruptcy Chapter 11 or Company Status = Liquidated/Defunct), or none reported. |
| Company Number of Rounds | Total number of financing rounds from the initial financing in the portfolio company through year-end 1998. |
| Company Number of VCs - First Round | Total number of investors in the first financing round. |
| Company Number of VCs - Second Round | Total number of investors in the second financing round. |
| Company New VC - Second Round | Equal to 1 if the second financing round contains a new investor. |
| Company Stage - First Round | The first round stage (level 2 from SDC) are grouped into eight categories. The stages are seed (Seed or Startup), early (early, R&D early, or other early), first, second, third, expansion (expansion, R&D expansion, other expansion), bridge (bridge, bridge loan), and other. |
| Venture Firm Age | The difference between the year of initial investment in the portfolio company and the year in which the venture firm made its first investment recorded by SDC. |

**SDC Venture Expert.** Continued.

| Variable | Description |
|---|---|
| Venture Firm Completed an IPO | Equal to 1 if the date of the initial investment is after the first venture firm's first IPO recorded by SDC. |
| Venture Firm Raised a new Fund | Equal to 1 if the date of the initial investment is after the first venture firm's second fund closed as recorded by SDC. |
| Venture Fund Size | Total amount of capital committed ($M) by the limited and general partners of a venture fund deflated to 1998 by the consumer price index from Ibbotson (1999). |
| Venture Fund Focus | Focus of the venture fund. The seven stage categories are seed stage, early stage, balanced stage, later stage, expansion stage, buyout, not classified. |

**New Issues.** Summary statistics from the SDC *Global New Issues* database covering 1971 through 1998 and from the *Federal Reserve Bulletin* covering from 1967 through 1998.

| Variable | Description |
|---|---|
| Number of IPOs | Total IPOs in each month recorded by SDC. |
| Hot IPO market | New issues data is from the *Federal Reserve Bulletin* and is detrended with an S&P 500 total return index. Three-month moving average is in the top quartile (from 1967 through 1998) for at least a three month period. This definition is based on Bayless and Chaplinsky (1996). |
| Cold IPO market | Three-month moving average is in the bottom quartile (from 1967 through 1998) for at least a three month period. This definition is based on Bayless and Chaplinsky (1996). |

**S&P Compustat.** Summary statistics from S&P Compustat for all firm-years between 1967 and 1996.

| Variable | Description |
|---|---|
| Compustat Industry | Industry (based on Fama and French (1997)) of the portfolio company. See Fama and French for the mapping from SIC code into 49 industry groups. |
| Research & Development Expense | Industry-year median research and development expense (Item 46) divided by sales (Item 12). When there are less than four companies in an industry-year, the median for the entire period is used. |
| Asset Tangibility | Industry-year median net plant, property, and equipment (Item 7) divided by assets (Item 6). When there are less than four companies in an industry-year, the median for the entire period is used. |

**S&P Compustat.** Continued.

| Variable | Description |
|---|---|
| Market to Book Ratio | Industry-year median market value of equity (Item 24 times Item 25) plus book value of long term debt (Item 6 minus Item 60 minus Item 74) divided by assets (Item 6). When there are less than four companies in an industry-year, the median for the entire period is used. |

**Stocks, Bonds, Bills, and Inflation.** Year-end values from Ibbotson (1999) covering 1967 through 1997.

| Variable | Description |
|---|---|
| Interest Rate | Yield on long-term government bonds. |

**Figure 1. Overinvestment.** The tradeoff between reputation and incentive pay.

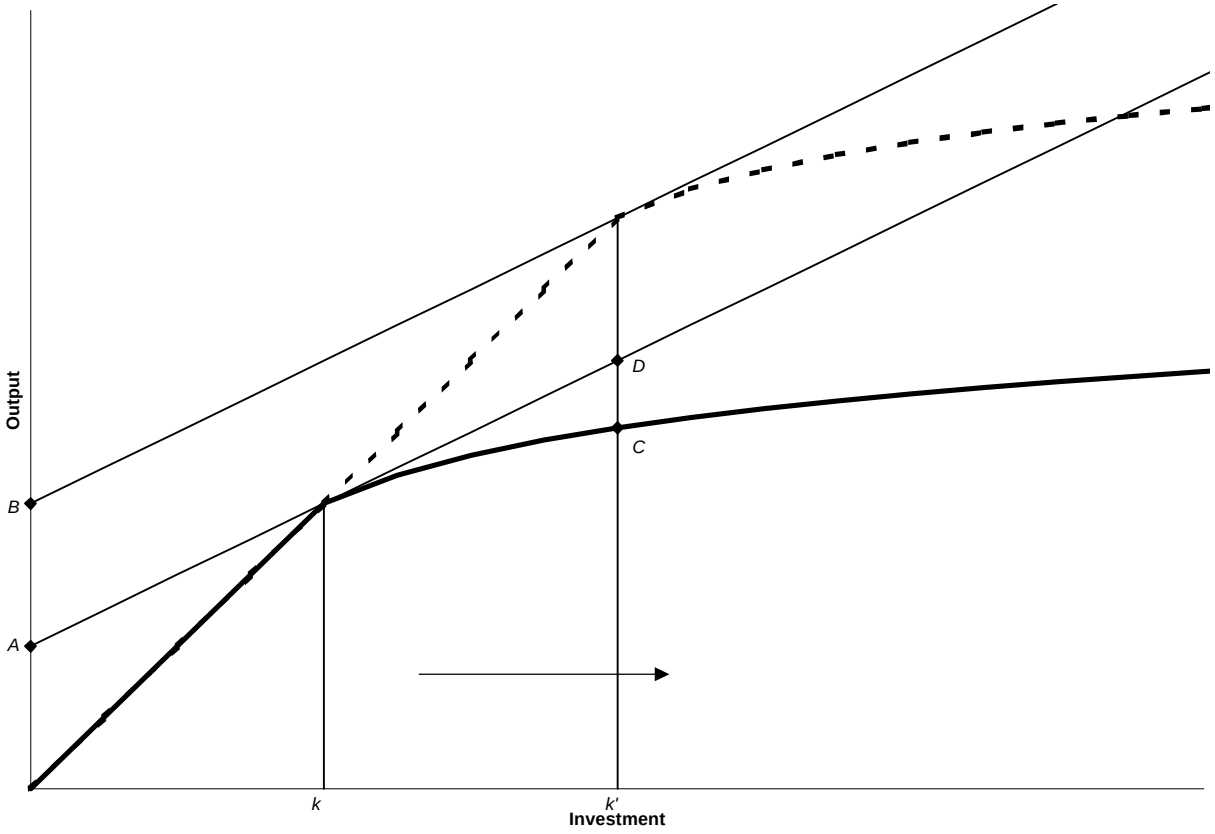

**Figure 2. Overinvestment and syndication.** The choice between overinvestment and costly syndication.

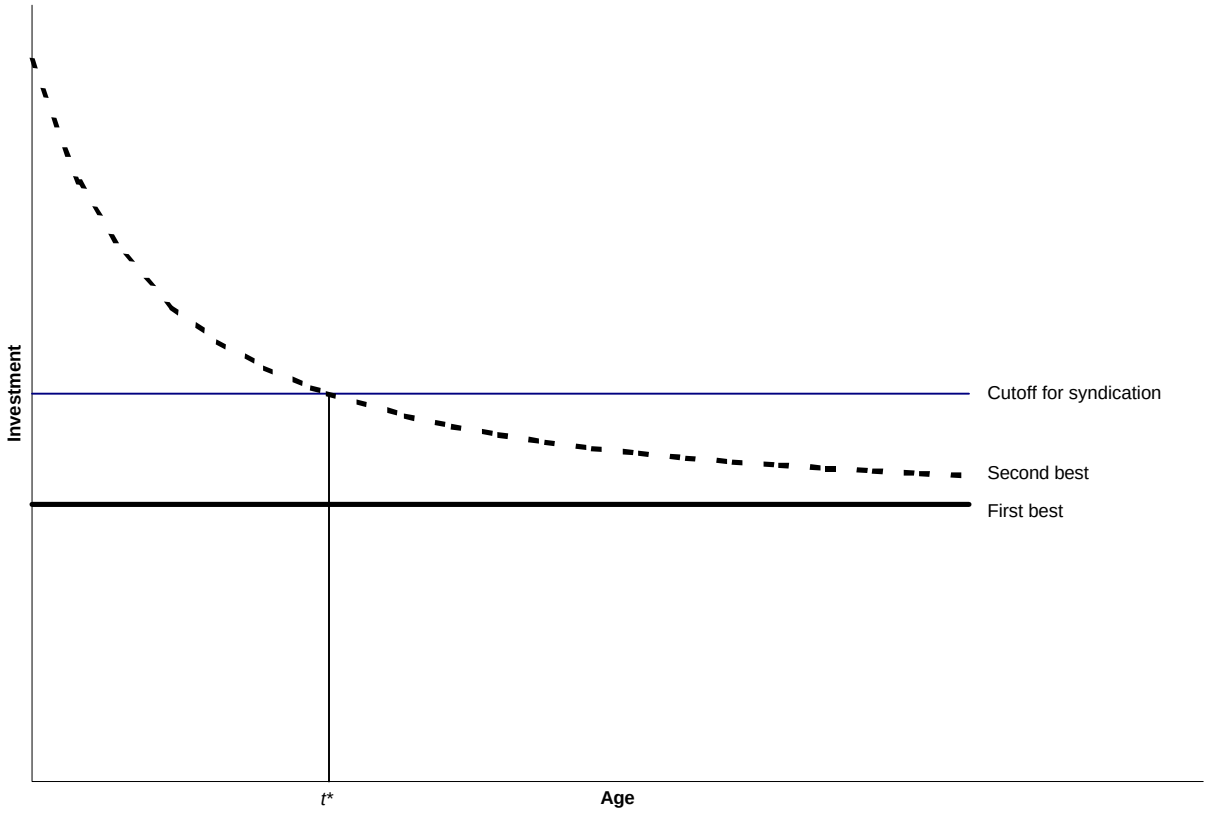

**Figure 3. Syndication.** Probability of syndication by venture firm age for second round investments that follow a non-syndicated first round.

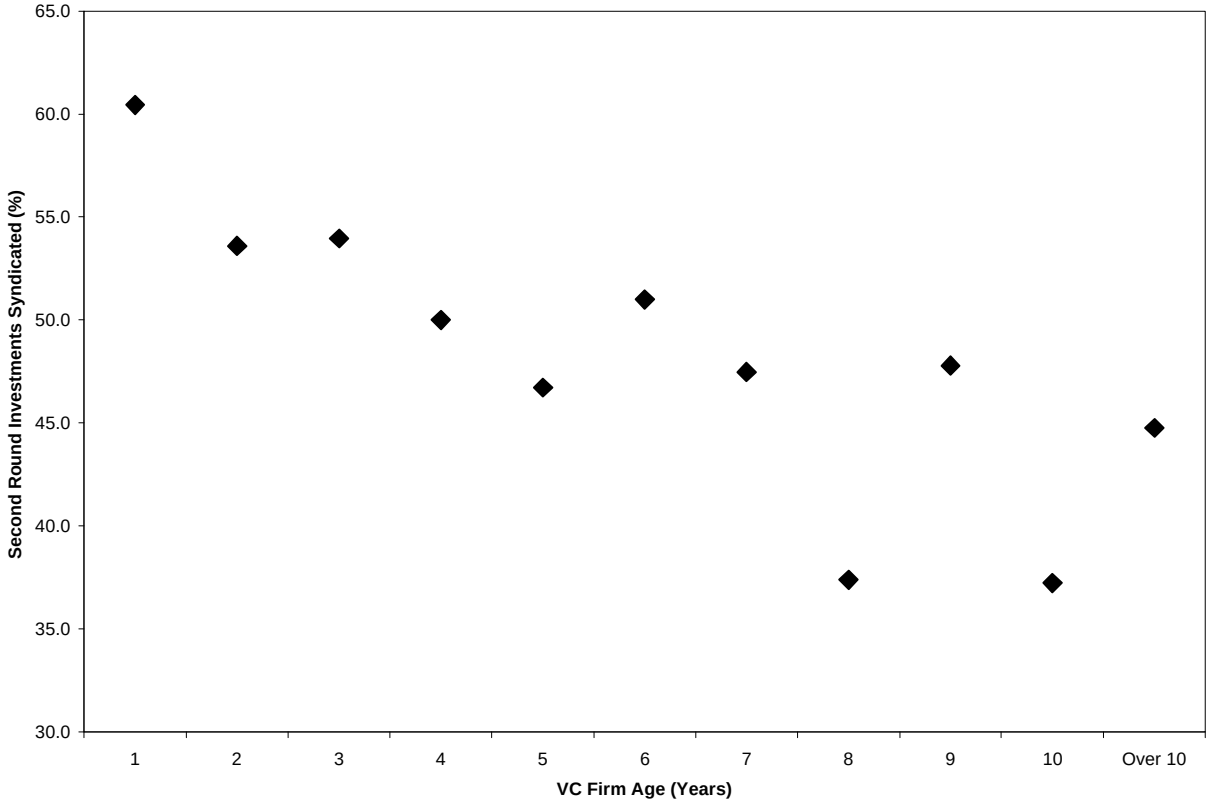

**Figure 4. Syndication and exit status.** Probability of an exit by acquisition or IPO (as recorded by SDC *VentureExpert*) for firms with a non-syndicated first round. The solid bars show success rates when the follow-on round is syndicated. The hatched bars show success rates when the follow-on round is not syndicated.

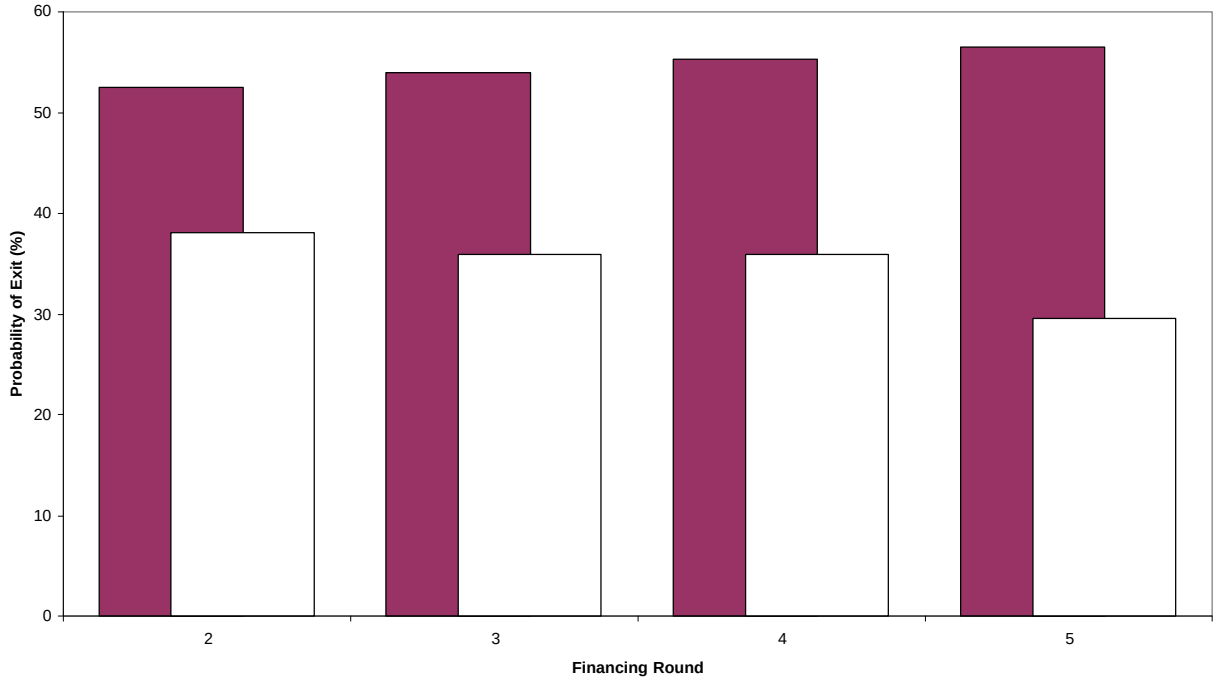

**Table 1. Portfolio companies where the first round investment is made by a single venture capitalist.** Portfolio companies for the full SDC sample of companies receiving a first round of finance between 1967 and 1996 and the subsample of firms initially financed by a single venture capitalist.

| | *Full Sample* | | *Single VC First Round* | |
|---|---|---|---|---|
| **Year** | **First Round** | **Second Round** | **First Round** | **Second Round** |
| 1967 | 18 | 0 | 17 | 0 |
| 1968 | 56 | 0 | 39 | 0 |
| 1969 | 141 | 12 | 111 | 8 |
| 1970 | 94 | 38 | 72 | 25 |
| 1971 | 90 | 34 | 68 | 20 |
| 1972 | 99 | 26 | 72 | 15 |
| 1973 | 121 | 26 | 94 | 16 |
| 1974 | 64 | 31 | 46 | 19 |
| 1975 | 70 | 21 | 46 | 14 |
| 1976 | 74 | 26 | 49 | 13 |
| 1977 | 109 | 33 | 77 | 19 |
| 1978 | 189 | 47 | 116 | 27 |
| 1979 | 210 | 64 | 128 | 32 |
| 1980 | 294 | 89 | 152 | 44 |
| 1981 | 498 | 167 | 247 | 67 |
| 1982 | 447 | 266 | 207 | 102 |
| 1983 | 616 | 334 | 272 | 117 |
| 1984 | 584 | 358 | 258 | 126 |
| 1985 | 436 | 344 | 195 | 114 |
| 1986 | 486 | 292 | 220 | 113 |
| 1987 | 571 | 324 | 278 | 114 |
| 1988 | 482 | 325 | 233 | 126 |
| 1989 | 435 | 303 | 215 | 116 |
| 1990 | 313 | 270 | 168 | 108 |
| 1991 | 233 | 185 | 136 | 91 |
| 1992 | 336 | 230 | 177 | 114 |
| 1993 | 290 | 184 | 156 | 95 |
| 1994 | 322 | 232 | 183 | 100 |
| 1995 | 460 | 221 | 253 | 104 |
| 1996 | 756 | 370 | 462 | 207 |
| 1997 | 0 | 314 | 0 | 160 |
| 1998 | 0 | 65 | 0 | 32 |
| Total | 8,894 | 5,231 | 4,747 | 2,258 |

**Table 2A. Summary statistics by portfolio company.** Description of company and venture firm characteristics for 8,974 firms recorded by Securities Data Company *VentureExpert* as receiving venture financing in the 30-year period between 1967 and 1996. In panel A, the company characteristics are first and second round investment (by all venture firms), converted into 1996 dollars using the CPI from Ibbotson (1999), firm age, Compustat industry matched characteristics (R&D to sales, asset tangibility, and market-to-book), industry classification (information technology, medical/health/life science, or non-high technology), exit status (IPO, acquisition, bankruptcy, or liquidation), and company status in the first round (seed, early, first, second, third, expansion, bridge, or other). I use a finer industry classification for industry fixed effects in the regressions.

| | *Full Sample* | | | *Single VC First Round* | | |
|---|---|---|---|---|---|---|
| | **N** | **Median** | **Mean** | **N** | **Median** | **Mean** |
| | Panel A: Company characteristics | | | | | |
| 1st Round Investment ($000) | 8,085 | 1,505 | 2,912 | 4,038 | 842 | 1,876 |
| 2nd Round Investment ($000) | 4,959 | 1,543 | 3,170 | 2,103 | 1,072 | 2,411 |
| Company Age (Years) | 6,343 | 2.00 | 4.07 | 2,938 | 2.00 | 5.05 |
| Industry | | | | | | |
| Information Technology | 8,894 | | 48.54% | 4,747 | | 43.50% |
| Medical/Health/Life Science | 8,894 | | 17.74% | 4,747 | | 16.47% |
| Non-High Technology | 8,894 | | 33.27% | 4,747 | | 39.22% |
| Not Classified | 8,894 | | 0.45% | 4,747 | | 0.80% |
| Industry-Matched Data | | | | | | |
| R&D to Sales | 8,854 | 0.00 | 1.72 | 4,709 | 0.00 | 1.47 |
| Asset Tangibility | 8,854 | 37.66 | 44.32 | 4,709 | 39.80 | 45.80 |
| Market-to-Book Ratio | 8,854 | 1.95 | 2.01 | 4,709 | 1.93 | 1.99 |
| Exit | | | | | | |
| IPO | 8,894 | | 20.44% | 4,747 | | 17.53% |
| Acquisition | 8,894 | | 22.19% | 4,747 | | 19.13% |
| Bankruptcy or Liquidation | 8,894 | | 3.37% | 4,747 | | 2.65% |
| None Reported | 8,894 | | 53.99% | 4,747 | | 60.69% |
| Company Status | | | | | | |
| Seed Stage | 8,894 | | 35.53% | 4,747 | | 28.40% |
| Early Stage | 8,894 | | 11.85% | 4,747 | | 12.77% |
| First Stage | 8,894 | | 10.07% | 4,747 | | 8.03% |
| Second Stage | 8,894 | | 7.59% | 4,747 | | 6.83% |
| Third Stage | 8,894 | | 3.73% | 4,747 | | 3.27% |
| Expansion | 8,894 | | 12.11% | 4,747 | | 13.12% |
| Bridge | 8,894 | | 2.34% | 4,747 | | 2.99% |
| Other Status | 8,894 | | 16.78% | 4,747 | | 24.61% |

**Table 2B. Summary statistics by portfolio company.** Description of company and venture firm characteristics for 8,974 firms recorded by Securities Data Company *VentureExpert* as receiving venture financing in the 30-year period between 1967 and 1996. In panel B, the venture firm characteristics are the number of investors in the first round, the number of rounds, the average age, past success in completing an IPO, past success in raising a second fund, fund size, and the number of investors in the second round (if there is one).

| | *Full Sample* | | | *Single VC First Round* | | |
|---|---|---|---|---|---|---|
| | **N** | **Median** | **Mean** | **N** | **Median** | **Mean** |
| | Panel B: Venture firm characteristics | | | | | |
| Number of VCs | 8,894 | 1.00 | 1.97 | 4,747 | 1.00 | 1.00 |
| Number of VCs > 1 | 8,894 | 0.00 | 0.47 | 4,747 | 0.00 | 0.00 |
| Number of Rounds | 8,894 | 2.00 | 3.16 | 4,747 | 1.00 | 2.55 |
| Number of Rounds > 1 | 8,894 | 1.00 | 0.60 | 4,747 | 0.00 | 0.49 |
| Average VC Age (Years) | 8,894 | 8.00 | 8.84 | 4,747 | 7.00 | 8.77 |
| Average VC Completed an IPO | 8,894 | 1.00 | 0.67 | 4,747 | 1.00 | 0.65 |
| Average VC Raised a New Fund | 8,894 | 0.00 | 0.36 | 4,747 | 0.00 | 0.35 |
| Average VC Size ($000) | 8,283 | 29,500 | 62,864 | 4,281 | 25,000 | 73,862 |
| Second Round | | | | | | |
| Number of VCs | 5,231 | 2.00 | 2.54 | 2,258 | 1.00 | 1.79 |
| Number of VCs > 1 | 5,231 | 1.00 | 0.55 | 2,258 | 0.00 | 0.48 |

**Table 3. Syndication by Industry.** Probit regressions of syndication on measures of venture capital reputation. The measures of reputation are age, whether the venture firm has completed the financing of a second fund or an initial public offering, and the size of the current fund. Standard errors are heteroskedasticity robust and clustered by venture capital fund.

| | *Non-syndicated first rounds* | | | | | *All First Round* |
|---|---|---|---|---|---|---|
| **Industry** | **N** | **Second Round Syndication Rate** | **R&D to Sales (%)** | **Fixed Assets (%)** | **Market to Book Ratio** | **Syndication Rate** |
| Computer Other | 14 | 0.82 | 0.74 | 37.64 | 2.05 | 0.60 |
| Computer Hardware | 425 | 0.61 | 4.96 | 31.97 | 2.16 | 0.58 |
| Semiconductors, Other Electronic | 378 | 0.57 | 3.38 | 42.36 | 1.88 | 0.49 |
| Biotechnology | 241 | 0.51 | 1.58 | 31.17 | 1.99 | 0.50 |
| Communications | 504 | 0.50 | 0.82 | 63.52 | 1.96 | 0.49 |
| Computer Software | 744 | 0.49 | 0.47 | 31.77 | 2.26 | 0.52 |
| Medical/Health | 541 | 0.48 | 2.42 | 36.01 | 2.23 | 0.50 |
| Industrial, Energy | 531 | 0.41 | 1.16 | 63.37 | 1.78 | 0.42 |
| Consumer Related | 519 | 0.41 | 0.70 | 56.98 | 1.83 | 0.42 |
| Agriculture, Forestry, Fish | 35 | 0.40 | 0.01 | 68.10 | 1.64 | 0.31 |
| Business Services | 236 | 0.33 | 0.05 | 72.43 | 1.95 | 0.32 |
| Manufacturing | 158 | 0.31 | 0.39 | 52.27 | 1.76 | 0.27 |
| Transportation | 83 | 0.28 | 0.41 | 67.80 | 1.70 | 0.37 |
| Finance, Insurance, Real Estate | 238 | 0.26 | 0.00 | 14.96 | 1.85 | 0.24 |
| Construction | 46 | 0.08 | 0.03 | 44.24 | 1.69 | 0.31 |
| Utilities | 6 | 0.00 | 0.00 | 104.38 | 1.62 | 0.25 |

**Table 4. Syndication and reputation.** Probit regressions of syndication on measures of venture capital reputation. The measures of reputation are age, whether the venture firm has completed the financing of a second fund or an initial public offering, and the size of the current fund. Standard errors are heteroskedasticity robust and clustered by venture capital fund.

| | *Dependent variable: Syndication* | | | | |
|---|---|---|---|---|---|
| | **Firm Age** | **Firm Age > 5** | **Raised a Second Fund** | **Completed an IPO** | **Log Fund Size** |
| | Follow-on investments for non-syndicated first rounds | | | | |
| Reputation Coefficient (%) | -0.72[a] | -9.68[a] | -7.45[a] | -8.04[a] | -1.90[a] |
| | (0.18) | (2.67) | (2.67) | (3.00) | (0.52) |
| N | 2,258 | 2,258 | 2,258 | 2,258 | 2,055 |
| $\chi^2$ | 15.62 | 12.98 | 7.73 | 7.13 | 13.25 |

[a]significant at the 1% level, [b]significant at the 5% level, [c]significant at the 10% level

**Table 5. Syndication in the second round: Heckman model of selection.** Heckman regressions of second round syndication on venture capital reputation. The measure of reputation is age. The venture firm focus (seed, early, balanced, late, expansion, or buyout) is used for the first stage regression. The additional independent variables are characteristics of the portfolio company and characteristics of the venture fund. Standard errors are heteroskedasticity robust.

| | *Second stage dependent variable: Syndication* | | | | |
|---|---|---|---|---|---|
| | **Base Model** | **Portfolio Company Controls** | **Venture Fund Controls** | **All Controls** | **First Round** |
| VC Firm Age | -0.017[a] | -0.024[a] | -0.013[a] | -0.017[a] | 0.006[a] |
| | (0.004) | (0.004) | (0.004) | (0.004) | (0.002) |
| *Portfolio Company Characteristics* | | | | | |
| Log (Investment) | | 0.485[a] | | 0.488[a] | 0.107[a] |
| | | (0.024) | | (0.025) | (0.009) |
| Company Age | | -0.009[c] | | -0.009[c] | -0.011[a] |
| | | (0.005) | | (0.005) | (0.002) |
| R&D to Sales | | -0.278 | | -0.569 | 0.001 |
| | | (0.950) | | (0.967) | (0.003) |
| Asset Tangibility | | -0.535[a] | | -0.610[a] | 2.622[a] |
| | | (0.144) | | (0.148) | (0.404) |
| First Round Stage Fixed Effects | No | No | No | No | Yes |
| *Venture Firm Characteristics* | | | | | |
| Log (Fund Size) | | | -0.030[a] | -0.046[a] | -0.274[a] |
| | | | (0.009) | (0.010) | (0.054) |
| *Market Effects* | | | | | |
| Hot IPO Market | | | 0.106 | 0.135[c] | 0.048[c] |
| | | | (0.072) | (0.080) | (0.028) |
| Cold IPO Market | | | -0.088 | -0.135[c] | 0.049 |
| | | | (0.065) | (0.073) | (0.031) |
| Treasury Yield | | | 0.787 | -0.092 | 7.591[a] |
| | | | (1.624) | (1.811) | (0.614) |
| | *First stage dependent variable: Second round* | | | | |
| Seed Stage | 0.856[a] | 0.843[a] | 0.860[a] | 0.847[a] | |
| Early Stage | 0.701[a] | 0.694[a] | 0.705[a] | 0.698[a] | |
| First Stage | 0.795[a] | 0.788[a] | 0.785[a] | 0.777[a] | |
| Second Stage | 0.405[a] | 0.398[a] | 0.409[a] | 0.401[a] | |
| Third Stage | 0.194[c] | 0.189[c] | 0.192[c] | 0.185[c] | |
| Expansion Stage | 0.457[a] | 0.451[a] | 0.448[a] | 0.443[a] | |
| Bridge | 0.482[a] | 0.464[a] | 0.484[a] | 0.464[a] | |
| N | 4,747 | 4,709 | 4,715 | 4,677 | 14,189 |
| Uncensored N | 2,258 | 2,255 | 2,226 | 2,223 | |
| $\chi^2$ | 24.58 | 439.95 | 52.37 | 416.14 | 1,506.41 |

[a]significant at the 1% level, [b]significant at the 5% level, [c]significant at the 10% level

**Table 6. Syndication in the second round: fixed effects.** Ordinary least squares regressions of second round syndication on venture capital reputation. The measure of reputation is age. The additional independent variables are characteristics of the portfolio company and characteristics of the venture fund. Standard errors are heteroskedasticity robust.

| | *Dependent variable: Second round syndication* | | | |
|---|---|---|---|---|
| | **Base Model** | **Portfolio Company Controls** | **Venture Fund Controls** | **All Controls** |
| VC Firm Age | -0.012[a] | -0.010[a] | -0.012[a] | -0.009[a] |
| | (0.002) | (0.002) | (0.003) | (0.002) |
| *Portfolio Company Characteristics* | | | | |
| Log (2nd Round Investment) | | 0.151[a] | | 0.150[a] |
| | | (0.006) | | (0.006) |
| Company Age | | -0.001 | | -0.001 |
| | | (0.001) | | (0.001) |
| R&D to Sales | | -0.148 | | -0.141 |
| | | (0.258) | | (0.260) |
| Asset Tangibility | | -0.141[a] | | -0.136[a] |
| | | (0.047) | | (0.048) |
| First Round Stage Fixed Effects | No | Yes | No | Yes |
| *Venture Firm Characteristics* | | | | |
| Log (Fund Size) | | | -0.009 | -0.011 |
| | | | (0.009) | (0.008) |
| *Market Effects* | | | | |
| Hot IPO Market | | | 0.041 | 0.030 |
| | | | (0.031) | (0.027) |
| Cold IPO Market | | | -0.019 | -0.029 |
| | | | (0.028) | (0.025) |
| Treasury Yield | | | -0.728 | -0.831 |
| | | | (0.768) | (0.697) |
| VC Firm Fixed Effects | Yes | Yes | Yes | Yes |
| N | 2,064 | 2,064 | 2,045 | 2,042 |

[a]significant at the 1% level, [b]significant at the 5% level, [c]significant at the 10% level

**Table 7. Probability of success: probit and ordered probit.** Probit and ordered probit regressions of investment success on reputation and syndication. The measure of reputation is venture firm age. The additional independent variables are characteristics of the portfolio company and characteristics of the venture fund. Standard errors are heteroskedasticity robust.

| | *Outcome* ∈ {None=0, IPO=1} | | *Outcome* ∈ {None=0, Acquired=1, IPO=2} | |
|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(4)** |
| VC Firm Age | 0.009[a] | 0.003 | 0.002 | 0.003 |
| | (0.003) | (0.004) | (0.003) | (0.003) |
| Second Round | 0.172[a] | 0.118[b] | 0.229[a] | 0.165[a] |
| | (0.054) | (0.058) | (0.044) | (0.047) |
| *Syndication Effects* | | | | |
| Syndicated Second Round | 0.537[a] | 0.454[a] | 0.548[a] | 0.437[a] |
| | (0.084) | (0.090) | (0.068) | (0.072) |
| VC Firm Age * Syndicated | -0.024[a] | -0.024[a] | -0.024[a] | -0.025[a] |
| | (0.007) | (0.007) | (0.006) | (0.006) |
| *Portfolio Company Characteristics* | | | | |
| Log (1st and 2nd Round Investment) | | 0.158[a] | | 0.160[a] |
| | | (0.020) | | (0.017) |
| Company Age | | 0.006[b] | | 0.005[b] |
| | | (0.003) | | (0.002) |
| R&D to Sales | | 1.924[a] | | 1.882[a] |
| | | (0.646) | | (0.579) |
| Asset Tangibility | | -0.140 | | -0.240[a] |
| | | (0.101) | | (0.085) |
| First Round Stage Fixed Effects | No | Yes | No | Yes |
| *Venture Firm Characteristics* | | | | |
| Log (Fund Size) | | 0.011 | | 0.012[b] |
| | | (0.007) | | (0.006) |
| Year Fixed Effects | No | Yes | No | Yes |
| N | 4,747 | 4,709 | 4,747 | 4,709 |
| $\chi^2$ | 111.17 | 342.13 | 206.04 | 465.86 |

[a]significant at the 1% level, [b]significant at the 5% level, [c]significant at the 10% level

**Table 8. Probability of success: syndication partner effects.** Probit and ordered probit regressions of investment success on reputation and syndication. The measure of reputation is venture firm age. The regressions also include the age of the syndication partner. The additional independent variables are characteristics of the portfolio company and characteristics of the venture fund. Standard errors are heteroskedasticity robust.

| | *Outcome* ∈ {None=0, IPO=1} | | *Outcome* ∈ {None=0, Acquired=1, IPO=2} | |
|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(4)** |
| VC Firm Age | 0.002 | 0.002 | 0.002 | 0.002 |
| | (0.004) | (0.004) | (0.003) | (0.003) |
| Second Round | 0.119[b] | 0.119[b] | 0.166[a] | 0.166[a] |
| | (0.058) | (0.058) | (0.047) | (0.047) |
| *Syndication Effects* | | | | |
| Syndicated Second Round | 0.541[a] | 0.541[a] | 0.482[a] | 0.482[a] |
| | (0.110) | (0.110) | (0.090) | (0.090) |
| VC Firm Age * Syndicated | -0.024[a] | -0.027[a] | -0.023[a] | -0.024[a] |
| | (0.008) | (0.009) | (0.006) | (0.008) |
| Partner Age * Syndicated | -0.002 | | -0.001 | |
| | (0.006) | | (0.005) | |
| Difference in Age * Syndicated | | -0.002 | | -0.001 |
| | | (0.006) | | (0.005) |
| *Portfolio Company Characteristics* | | | | |
| Log (1st and 2nd Round Investment) | 0.152[a] | 0.152[a] | 0.156[a] | 0.156[a] |
| | (0.021) | (0.021) | (0.017) | (0.017) |
| Company Age | 0.006[b] | 0.006[b] | 0.005[b] | 0.005[b] |
| | (0.003) | (0.003) | (0.002) | (0.002) |
| R&D to Sales | 2.111[a] | 2.111[a] | 2.021[a] | 2.021[a] |
| | (0.654) | (0.654) | (0.589) | (0.589) |
| Asset Tangibility | -0.116 | -0.116 | -0.212[b] | -0.212[b] |
| | (0.102) | (0.102) | (0.086) | (0.086) |
| First Round Stage Fixed Effects | Yes | Yes | Yes | Yes |
| *Venture Firm Characteristics* | | | | |
| Log (Fund Size) | 0.011 | 0.011 | 0.013[b] | 0.013[b] |
| | (0.007) | (0.007) | (0.006) | (0.006) |
| Year Fixed Effects | Yes | Yes | Yes | Yes |
| N | 4,564 | 4,564 | 4,564 | 4,564 |
| $\chi^2$ | 349.79 | 349.79 | 462.29 | 462.29 |

[a]significant at the 1% level, [b]significant at the 5% level, [c]significant at the 10% level