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CHARACTERISTICS, CONTRACTS, AND ACTIONS:
EVIDENCE FROM VENTURE CAPITALIST ANALYSES

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ABSTRACT

We study the investment analyses of 67 portfolio investments by 11 venture capital (VC) firms. VCs consider the attractiveness and risks of the business, management, and deal terms as well as expected post-investment monitoring. We then consider the relation of the analyses to the contractual terms. Greater internal and external risks are associated with more VC cash flow rights, VC control rights; greater internal risk, also with more contingencies for the entrepreneur; and greater complexity, with less contingent compensation. Finally, expected VC monitoring and support are related to the contracts. We interpret these results in relation to financial contracting theories.

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There is a large academic literature on the principal agent problem in financial contracting. This literature focuses on the conflicts of interest between an agent, who is an entrepreneur with a venture that needs financing, and a principal, who is the investor providing the funds for the venture. Theory has identified a number of ways that the investor / principal can mitigate these conflicts. First, the investor can engage in information collection before deciding whether to invest, in order to screen out ex ante unprofitable projects and bad entrepreneurs. Second, the investor can engage in information collection and monitoring once the project is under way. Third, the financial contracts, i.e. the allocation of cash flow and control rights, between the entrepreneur and investor can be designed to provide incentives for the entrepreneur to behave optimally.

In this paper, we focus empirically on the information collection process and on the relation between that process and the ensuing financial contracts. We do so by studying a sample of venture capital (VC) investments in portfolio companies. To help the VC partnership evaluate an investment in a company, it is common for the individual venture capitalist who sponsors the investment to prepare a detailed investment analysis or memorandum for the other partners. In this paper, we analyze the investment memoranda from 11 VC partnerships for investments in 67 companies. We complement our analysis with information from the company business plans, data on the financial contracts from Kaplan and Strömberg (2001), and data on the subsequent performance of the companies.

While VCs are interesting in their own right, we think they also are interesting theoretically in that they approximate investors assumed by theorists. VCs invest in entrepreneurs who need financing to fund a promising venture. Although they are

intermediaries, VCs are sophisticated and have strong incentives to maximize value. At the same time, they receive few or no private benefits of control.¹

Previous works has studied what venture capital partnerships (VCs) do and how they add value. For example, Gorman and Sahlman (1989), Hellman and Puri (1998 and 2000), and Lerner (1995) focus primarily on what VCs do after they have invested in a company. Kaplan and Strömberg (2001) and Gompers (1995) focus on the nature of the financial contracts. MacMillan, et al. (1985), MacMillan, et al. (1987), and Fried & Hisrich (1994) use evidence from surveys of VCs to describe the characteristics of VC investments.

We believe this paper makes two contributions. First, it adds to existing work by describing the characteristics and risks that VCs consider in actual deals. Second, this paper is novel in considering how those characteristics and risks relate to the financial contracts (cash flow rights and control rights) and, in turn, how the contracts are related to subsequent monitoring. We are able to utilize the VCs' direct assessments rather than the indirect proxies (for risk and monitoring) used in most previous research.

First, we describe the VC analyses. These analyses include a set of investment theses or rationales for making the investment and a discussion of the concomitant risks. Consistent with academic and practitioner accounts, VCs explicitly consider the attractiveness of the opportunity – the market size, the strategy, the technology, customer adoption, and competition – the management team, and the deal terms.² VCs also explicitly delineate the risks involved in the investments. The risks typically relate to the same characteristics that the VCs evaluate for attractiveness.

¹ See Hart (2001) for a concurring view.

² See the work previously cited as well as Bygrave and Timmons (1992) or Quindlen (2000).

Next, we present direct evidence on VC actions or monitoring. We rely on the investment analyses at the time of the initial investment that describe actions that the VCs took before investing and that the VCs expect to undertake conditional on investing. We confirm that VCs play a significant role in shaping and recruiting the senior management team. In at least half of the investments, the VC expects to play an important role in recruiting management. We also find that in more than one-third of the investments, the VC expects to provide value-added services such as strategic advice or customer introductions. Because the investment memoranda vary in the detail they provide, these results likely understate the VCs' activities in this area. These results support and complement the results in Hellman and Puri (2000 and 2002).

We then consider how the assessments in the VCs' analyses interact with the design of the financial contracts. We focus on the risks or uncertainties identified by the VCs in each transaction, dividing them into risks that are: (1) associated with external uncertainty – the relevant information is external to the firm and, we argue it is more likely that the VC and the entrepreneur are equally informed; (2) associated with internal uncertainty – the relevant information is internal to the firm and, we argue it is more likely that the VC is less informed than the entrepreneur; and (3) associated with complexity. Greater external and internal risks are associated with more VC ownership, more VC control, and more contingent compensation. Greater internal risk is also associated with more contingent financing. Greater complexity is associated with less contingent compensation. We interpret these results in relation to financial contracting theories. For example, the relations between internal and external risk and control are strongly consistent with the model in Dessein (2001). Similarly, the result for complexity risk is consistent with theories like Holmstrom and Milgrom (1991) that focus on the use of incentives in the presence of multiple objectives.

Finally, we relate the financial contracts to expected VC actions. VCs are more likely to strengthen the management teams as VC control increases. This result is consistent with theories such as Dewatripont and Tirole (1994) in which VC board control is necessary for management intervention. VCs value-added services are increasingly likely as VC cash flow rights increase, but are not related to VC board control. This is consistent with the double-sided moral hazard theories, such as Casamatta (2000), Inderst and Muller (2001), and Repullo and Suarez (2000).

The paper proceeds as follows. Section I describes our sample. Section II describes the VC analyses. Section III examines the relation between the contracts and the VC analyses. Section IV examines the relation between ex post monitoring and the contracts. Section V summarizes our results and discusses their implications.

I. Sample

In this version of the paper, we analyze VC investments in 67 portfolio companies by eleven venture capital partnerships. This represents a subsample of the investments described and analyzed in Kaplan and Strömberg (2001).

A. Description

We obtained the initial sample by asking VCs in fourteen VC partnerships to give us detailed information on as many of their portfolio company investments as they were willing to provide. For each of these companies, we asked the VC to provide the term sheet as well as the stock purchase and security purchase agreements for each financing round in which they participated. We also asked the VC to provide (if available) the portfolio company's business

plan at the time of the financing, the VC's internal analysis of the investment, and the subsequent portfolio company financial performance.

Most VC partnerships have an investment process in which the partner (or partners) responsible for the investment writes up an investment analysis or memorandum describing a potential investment. The entire partnership group uses the memorandum as a guide in deciding whether or not to make the investment. If the VC does in fact make the investment in a company, the memorandum then serves as a guide for post-investment monitoring.

VCs at eleven of the fourteen VC partnerships provided an investment memorandum / VC analysis for at least one of their portfolio company investments. The investment memoranda have varying degrees of detail. Some are brief two page write-ups while others are in-depth descriptions and discussions exceeding twenty pages. A consequence of this is that our results are certain to understate the extent of analyses that the VCs perform.

Table 1 presents summary information for our sample. As mentioned above, panel A indicates that we have data on investments in 67 portfolio companies by eleven VC firms. 25 of these investments are pre-revenue (which we refer to as early stage) rounds. I.e., the firms receiving financing either did not have revenues or were not yet operating. The remaining investments are rounds in which the firms had revenues and were already operating. Also, in 44 cases, the sample includes the first investment any VC ever made in the portfolio company; in the remaining 23 cases another VC fund had previously invested when our VC acquired a stake.

Panel B shows that the sample companies / investments are relatively recent. All but 11 of the 67 companies were initially funded by the VCs between 1996 and 1999.

Panel C shows that the sample represents a wide variety of industries. The largest group, not surprisingly, is in information technology and software (24 observations, or 36%), but the sample also includes biotech, telecom, healthcare, and retail ventures.

Panel D shows that the portfolio companies were funded by 11 VC firms with no more than 15 companies from any one VC.

Panel E indicates the amounts of the sample financings. The VCs committed a median of \$6.0 million in equity in each financing round. A median of \$4.8 million was disbursed on closing with the rest contingent on milestones. Pre-revenue rounds in our sample tended to make greater use of contingent funding.

Finally, Panel F indicates that 17 of the 67 companies have subsequently gone public, ten have been sold, and three have been liquidated. The remaining 37 companies are still private.

B. Sample selection issues

In this section, we discuss potential selection issues concerning our sample. Our sample of portfolio companies and financings is not a random sample in that we obtained the data from venture capital firms with whom we have a relationship.

One possible bias is that the VCs provided us with deals they thought were their better investments. This is unlikely for two reasons. First, many of the investments the VCs provided us were their most recent (as evidenced by the years in which the financings were completed). Second, 6 of the 11 individual VCs who provided investment analyses provided all of their individual investments in the relevant sample period. Even if the bias exists, it is unlikely to affect the results. The results for the 6 VCs who provided all their analyses are similar to the results for the entire sample.

Another possible bias in our sample is that the VCs we study have above average ability. This is true because we contacted only successful venture capitalists. We do not think this bias (if it exists) is of much concern for many of our analyses because we are interested in understanding how VCs choose and structure their investments rather than how well they perform. If anything, a bias towards more successful VCs would be helpful because we are more likely to have identified the methods used by sophisticated, value maximizing principals.

A third possible bias is that the three VCs from our previous paper that did not provide investment memoranda are somehow different from the others. However, the contractual characteristics for the investments made by those three VCs are qualitatively similar to the contractual characteristics for the investments made by the eleven other VCs.

Finally, it is worth adding that the industry and geographic composition of the sample portfolio companies is in line with the overall composition of all VC investments over the same period.

II. Description of VC investment analyses

A. Investment Theses

As mentioned earlier, the VC analyses invariably include a set of investment theses or rationales for making the investment. Such theses or arguments were present for all 67 portfolio company investments in our sample.

Table 2 summarizes the information in the investment theses. Following previous work on VC company characteristics,³ we distinguish among factors that relate to the opportunity (the company's market, product / service / technology, strategy, and competition), to the management team separate from the opportunity, to the deal terms, and to the financing environment.

Panel A shows that factors relating to the opportunity are important considerations in a VC investment. All but one of the investments included investment rationales based on such factors. Consistent with academic and practitioner accounts, VCs are attracted to large and growing markets. This was mentioned explicitly in 46 of the 67 portfolio company investments. In at least one-third of the investments, VCs were attracted by the product / technology; by the strategy / business model; by high likelihood of customer adoption; and by a favorable competitive position.

Panel B considers factors related to management. In over 60% of the investments, the VCs explicitly cited the quality of management as a reason for investing. In 27% of the investments, the VCs cited favorable performance to date.

Panel C shows that the terms of the investment are also important. In particular, a low valuation or low amount of capital at risk are each attractive in roughly 20% of the investments.

B. Investment Risks

While the VC investments always include a number of positive elements, they also typically involve risks and uncertainties. The VCs identified risks in 65 of the 67 portfolio companies in our sample.

Table 3 summarizes these risks. Panel A indicates that the VCs viewed the opportunity as having significant uncertainties in 60 of 67 investments. In order of frequency, these uncertainties included business model / strategy risks, competitive risks, market size risks, product / technology risks, and adoption risks. Thus, while the VCs believed these opportunities were attractive investments, the VCs did not believe the investments were without risk.

³ See e.g. MacMillan, Siegel, and SubbaNarasimha (1985).

Panel B indicates that the VCs viewed some aspect of management as risky in 61% of the analyses. For example, one CEO was “difficult” while several management teams were incomplete. Interestingly, this is roughly the same percentage as the 60% for which the quality of management was one of the reasons for making the investment. It is easy to reconcile this by observing that a VC might think very highly of the opportunity, but be uncertain as to whether the founder can hire or build the rest of the management team.

Panel C shows that VCs view deal terms as important risks in more than 37% of the investments. These risks include high valuation (i.e., paying too much) in 19% of the investments, an investment that exposes the VC to substantial downside risk in 13%, and high monitoring costs in 15%. It is worth pointing out that the valuation is endogenous to the contracts. We recognize this and do not include valuation as a risk in the regressions that follow.

The risks of high monitoring costs or involvement costs are particularly interesting. In several investments, the VC worried that the investment might require too much time. In two cases, this involved the VC becoming chairman of the company. This indicates that while VCs regularly play a monitoring and advisory role, they do not intend to become too involved in the company. A plausible interpretation is that VCs do not want to be involved in the day-to-day details of too many of their portfolio companies.

In general, the strengths and risk factors we identify are similar to the ones emphasized in the VC strategy and management literature, as well as from anecdotal accounts.⁴ In particular the strong focus on management, both as a strength and as a risk, is consistent with the survey results of MacMillan, Siegel, and SubbaNarasimha (1985). Also, similar to their findings, market size and growth rank high among the factors VCs are concerned about. The biggest

⁴ For example, see MacMillan, Siegel, and SubbaNarasimha (1985), MacMillan, Zemann, and Subbanarasimha (1987), and Quindlen (2000).

difference compared to their findings is the low ranking for exit conditions, both in the investment thesis and as a risk factor. One potential explanation for this is that exit conditions were not much of a concern due to the exceptionally strong IPO and M&A markets in the late 1990's, where the bulk of our sample is concentrated.

C. Financial forecasts

The investment analyses often included financial forecasts provided by management, by the VCs, or by both. Table 4 summarizes these forecasts. The table indicates that the companies were expected to grow quickly. The median company had sales of \$1.6 million in the year before the investment, but was expected to have sales of over \$80 million four years after the investment. Not surprisingly, the management forecasts tend to be more optimistic than the VC forecasts. By year 4, the median management forecast is for earning before interest and taxes (EBIT) of \$11.9 million versus a median VC forecast of \$6.5 million.

D. Relation of strengths and risks to firm characteristics

Table 5 relates the presence of different investment theses and risk factors to exogenous firm characteristics. Most of the significant differences are found across different industries and across different VC funds. The industry and the VC effects are hard to disentangle in our sample, since VCs tend to concentrate in particular industries.⁵ The results are consistent, however, with the finding of MacMillan, Siegel, and SubbaNarasimha (1985) that VCs tend to follow different investment styles with respect to the criteria imposed in their screening process.

Somewhat surprisingly, we identify very few significant differences in risks and strengths across the stages of the investment. There seems to be more of a focus on the business

model and strategy for revenue-generating ventures, and more of a focus on a contractual structure that mitigates VC downside risk for pre-revenue ventures. Competitive risk is more of a concern for first VC rounds, while valuation is more often a risk for subsequent VC financings. On the whole, however, our risk factors seem to be measuring risks that cannot simply be captured by looking at the stage of the investment.

E. VC Actions

A number of papers have studied the role of venture capitalists in assisting and monitoring their portfolio companies. Gorman and Sahlman (1989), MacMillan, Kulow, and Khoylian (1988), Ruhnka, Feldman, and Dean (1992), Sapienza (1992), and Sapienza, Manigart, and Vermeir (1996) report results from surveys of venture capitalists, showing that VCs spend substantial time and effort monitoring and supporting their investments. Using data provided by start-up companies, Hellman and Puri (2000 and 2002) find that firms financed by venture capitalists bring products to market more quickly and are more likely to professionalize their human resource functions. Lerner (1995) finds evidence that VCs are involved in CEO replacement decisions. These papers suggest that venture capitalists both assist / advise and monitor their portfolio companies. The results, however, are either survey-based or indirect.

In this section, we use the VC investment analyses to complement and corroborate that previous work by reporting the actions that the VC took before investing and those actions the VC expected to undertake conditional on investing.

Table 6 confirms that VCs play a large role in shaping and recruiting the senior management team. In 16% of the investments, the VC plays a role in shaping the management

⁵ For example, all our retail deals come from one VC that specializes in retail deals, and the same is true for our healthcare ventures.

team before investing. In 43% of the investments, the VC explicitly expects to play a role after investing.

The investment memoranda also provide evidence of other potential roles played by the VCs. In 9% of the investments, the VCs are active in shaping strategy and the business model before investing, and in 30% they are active in these areas after investing. These actions include the design of employee compensation, development of business plans and budgets, implementation of information and accounting systems, and assistance with mergers and acquisitions.

Table 7 relates the extent of VC actions to exogenous firm characteristics. Similar to our results for investment theses and risks, the extent of VC actions varies much more across VCs and industries than it does across the stage of the investment. This is consistent with survey evidence from MacMillan, Kulow, and Khoylan (1988) and Ruhnka, Feldman, and Dean (1992). Unlike Sapienza (1992) and Sapienza, Manigart, and Vermeir (1996), we do not find that VCs are more involved in value-added activities for early stage ventures. On the contrary, these actions are more frequent for post-revenue ventures and later VC investment rounds, although differences are not statistically significant.

Our results almost certainly understate the actions the VCs take because these are only actions that the VC (a) decided to include in the report as important; and (b) had done or planned at the time of the investment. Even so, they provide strong support for and complement the results in Hellman and Puri (2000). In addition to actions traditionally associated with investor monitoring, such as replacing management after poor performance, there is substantial evidence of VCs assisting the founders in running and professionalizing the business, what Hellman & Puri (2000b) term the supporting role of venture capital.

III. The relationship between VC risk factors and contractual terms

In this section, we investigate the relationship between the VCs risk assessments and the design of the financial contracts for the ventures. Theoretically, financial contracts are designed in order to mitigate conflicts of interest between the VC and the entrepreneur by allocating cash flow and control rights between the two parties. In our earlier paper (Kaplan and Strömberg, 2001), we found the design of VC contracts corresponds fairly well to the types of contracts predicted by theory. In particular, using measures to capture the extent of asymmetric information and potential agency problems – such as whether the venture was generating revenue – we found support for the classical principal-agent theories (e.g., Holmström (1979)) and for control theories (e.g., Aghion and Bolton (1991) and Dewatripont and Tirole (1994)).

One shortcoming with this approach is that the proxies used did not distinguish among types of uncertainty. Most empirical work on agency and information problems in corporate finance shares this problem. Such work typically uses the ratio of R&D to sales, the market to book ratio, or the ratio of fixed to total assets as proxies for agency and information problems.⁶

In this paper, we try to overcome these problems by using the VC investment memos to construct more precise risk measures and relate these to financial contracts. This has at least two advantages. First, it allows us to distinguish among sources of uncertainty that have different theoretical predictions. Second, using actual risk assessments reduces measurement error and noise because we are sure to identify uncertainties that truly concern the VCs.

We focus on risks rather than on the investment theses for three reasons. First, previous empirical work focuses on the risks. Second, the predictions from the theories tend to focus on

⁶ See e.g. Titman and Wessels (1988), Smith and Watts (1992), or Gompers (1995).

the risks. Finally, given our small sample size, the collinearity between some of the risks and investment theses reduces the power of our tests. Our results are qualitatively similar when we net the investment theses against the risks.

A. *Description of Risk Measures*

To motivate studying the relation of risk to contractual terms, consider the predictions from classical principal agent theories on the relationship between uncertainty and pay-performance incentives. To the extent uncertainty comes from asymmetric information about management quality and actions, pay-performance incentives should increase with uncertainty.

On the other hand, the uncertainty might also be coming from external sources beyond management's control, such as uncertainty about market demand, or competition. Such uncertainty tends to make pay-performance compensation more costly for a risk-averse manager, and should lead to a negative relationship. However, Prendergast (2002) argues that there are reasons why this relationship may be positive.

Finally, the uncertainty could come from the fact that the firm's operations are highly complex, such as in a high-tech venture, in which case the optimal action space of the manager might be very hard to specify. In such environments, performance-based pay also should be less likely because compensation based on a signal correlated with a particular action will lead the manager to put too much emphasis on that action. (E.g., see Holmström and Milgrom (1991)).

We assign the risks identified in table 3 to three different categories. In the first category, external risk, we include those risks that we view as external to the firm. We classify market size, customer adoption, competition, and exit condition risks as external risks. Because these risks are external to the firm and largely beyond the control of the management team, we believe

that the VC and the founder should be more or less equally informed about these risks. We discuss this and other possible interpretations in connection with the results.

In the second category, internal risk, we include risks that are internal to the firm. We classify risks attributable to management quality, previous performance, capital at risk, negative influence of other investors, and costly monitoring as internal risks. These risks are related to management actions and/or the quality of the management team. We believe these risks are more likely to be one-sided or subject to asymmetric information and moral hazard with respect to the management team. Again, we discuss other interpretations in connection with the results.

In the third category, complexity risk, we attempt to capture complexity and, therefore, potential multi-tasking problems. We classify risks associated with product / technology, business model / strategy as complexity risks.⁷

We form a risk measure for each category by simply adding up the risk dummy variables from table 3 for the risks in each category, and normalizing the measure to lie between zero and one. While this measure may “throw away” information, it has the strong advantage that it minimizes the amount of our own interpretation that we have to apply to the investment analyses. As we noted earlier, we do not include valuation risk which may be endogenous to the contracts.

B. The effect of risk on the provision of founder cash flow incentives

Table 8 investigates the relation of the risk measures to different measures for the venture’s valuation. We use three different variables to capture the valuation. First, we calculate the pre-money value of the company. This captures the value that the VCs placed on the pre-

⁷ One potential criticism is that the risks we classify as complexity risks may also be subject to asymmetric information. We believe that this is less likely to be the case, especially at the ex ante stage when the outcome of the business strategy or the research and development is not known to all parties. To the extent that this is not correct, however, this introduces noise in the measure.

financing equity of the company. We calculate this as the amount of VC financing committed in the round divided by the fraction of equity acquired by the VC in the round. For the calculations, we assume that the company meets any performance milestones in the contracts, and that all the founder and employee stock vests fully. This measure will tend to overstate the true valuation, since performance milestones and vesting provide the VC with additional option values that might be substantial.⁸ Another problem with this measure is that it is not normalized or scaled. To control for scale, we include the expected sales for the year following the financing in the pre-money valuation regressions.⁹

The second and third measures are the fully diluted equity stakes of the VC and founder, respectively, again assuming full vesting and that all performance benchmarks are met. This is simply capturing how the value of the venture will be split between investors and founders if the venture turns out to be successful.

The regressions also include a number of control variables: industry dummies, VC dummies¹⁰, and dummies for whether the round is the first VC financing, whether the venture is not yet revenue generating, and whether any of the founders have previously founded a venture that was take public or sold to another public company.

The multivariate results in table 8 indicate that both external and internal risk make the investment less attractive to the VC. As a result, pre-money valuations increase while the fraction of the company that the founder is allowed to keep decreases. The results for complexity risk are more ambiguous and generally insignificant. One possible reason is that

⁸ I.e., in a worst case scenario, the VC will potentially only provide part of the funds committed and get an additional fraction of the equity of the company, effectively lowering the valuation.

⁹ Since sales are zero for a substantial fraction of ventures, we cannot simply divide the valuation by sales.

¹⁰ Since we only have a few observations for some of the VCs, we only include a VC dummy if the fund has more than 4 investments represented in the sample, which amounts to 5 of the 11 VCs. Moreover, two of these five VC dummies are perfectly collinear with the industry dummies and have to be dropped. In particular, all our healthcare deals come from one VC, who only provided healthcare deals, and the same was true for our retail deals.

while complexity risk might be unattractive to the VC, it also indicates that the founder's human capital is more crucial, thus allowing the founder to capture more of the value of the venture.

In Kaplan and Strömberg (2001), we document that the provision of founder cash flow incentives in VC financings is largely consistent with the principal-agent theories of Holmström (1979), Lazear (1986), and others. VCs change the entrepreneur's equity compensation function in response to uncertainty, making it more sensitive to performance in ventures that are not yet generating revenues and in early VC rounds, and less sensitive in ventures run by repeat entrepreneurs. With the exception of repeat entrepreneurs, however, these variables may proxy for external uncertainty, rather than asymmetric information or uncertainty about the manager's incentives. As argued above, only the latter type of "internal" uncertainty should be positively related to founder pay-performance incentives. Moreover, the repeat entrepreneur variable is also potentially problematic in that it might be correlated with founder wealth, as well as with higher bargaining power of the entrepreneur.

To shed more light on this issue, we regress founder pay-performance incentives on our three risk measures. Table 9 reports the results. We distinguish the pay performance sensitivity that is due to explicit performance benchmarks from the sensitivity induced by time vesting of the founders' shares. With time vesting, the founder's compensation is contingent on the board's decision to retain the founder, rather than on explicit benchmarks. Hence, one possible interpretation of time vesting is as a form of subjective performance evaluation. This is arguably beneficial when explicit benchmarks are too noisy and / or could lead to multi-tasking problems.

The first three regressions in table 9 investigate the use of explicit benchmarks in equity compensation. The dependent variable is calculated as: the fraction of founder equity if benchmarks are met less the fraction of founder equity if no benchmarks are met but full time

vesting occurs all divided by the fraction of founder equity if no benchmarks are met but full time vesting occurs.

We find that that the use of explicit benchmarks is higher in first VC rounds, higher for pre-revenue ventures, and lower for repeat entrepreneurs. When we add the three risk measures in the second regression, however, only the pre-revenue variable remains significant. Consistent with principal-agent and screening theories, we find that the use of benchmark compensation is significantly positively related to the degree of internal risk in the venture. Moreover, the degree of complexity risk is negatively related to benchmark compensation, consistent with multi-tasking theories of Holmström and Milgrom (1991) and Baker (1992).

In the third regression, we add industry and VC-fund fixed effects, and the results remain qualitatively similar, although the negative relationship with complexity risk is weaker and no longer statistically significant.

The results for internal risk and complexity risk are in accordance with existing principal-agent theory. In contrast, we also find a significantly positive relation between external risk and benchmark compensation which is contrary to the standard theoretical prediction. I.e., given that external risk is beyond management's control, and that the uncertainty about external factors is more or less symmetric between the VC and entrepreneur, we would expect a negative (or at least a zero) relationship with the use of performance benchmarks in compensation if managers are risk-averse. Recent work by Prendergast (2002), however, presents a model that generates a positive relation. In his model, a positive relation will exist when uncertainty makes it difficult to observe a manager's actions.¹¹

¹¹ The anomalous positive relationship between incentives and idiosyncratic risk has also been found by Allen and Lueck (1992), Core and Guay (1999), and Lafontaine (1992). Aggarwal and Samwick (1998) is one of the few studies that find the predicted negative relationship. Bhattacharyya and Lafontaine (1995) also discuss possible explanations for these conflicting results.

The last three regressions examine the determinants of founder time vesting. This equals (1) the fraction of founder equity if no performance benchmarks are met (but with full time vesting) less (2) the fraction of founder equity if no performance benchmarks and minimum time vesting, all divided by the fraction of founder equity if no benchmarks are met but with full time vesting. Time vesting is significantly higher for pre-revenue ventures.

When we add the three risk measures to the regression, we find that the degree of complexity risk is strongly positively related to the degree of time vesting, while both internal and external risks are insignificant. The positive relation between complexity and vesting is consistent with two theoretical explanations. First, vesting might be used as an alternative to explicit benchmarks when multi-tasking problems make benchmark compensation inefficient, similar to subjective performance evaluation. Second, by making it more costly for a founder to leave the firm before the shares have fully vested, vesting mitigates potential hold-up problems along the lines of Hart and Moore (1994). These potential hold-up problems will be more costly for complex ventures, for which the entrepreneur's specific (an inalienable) human capital is more valuable. The fact that there seems to be no reliable relationship between internal risk and vesting speaks more in favor of this latter explanation.

C. The effect of risk on the allocation of control

We now turn to the allocation of board control between the VC and the founder. According to the control theory of Aghion and Bolton (1992), the amount of control allocated to the VC should be increasing in the severity of the agency problem between the investor and the entrepreneur. When agency problems are small, they predict that the entrepreneur should always be in control. As agency problems get more severe, the VC should be allocated some control; at

first only in the bad state of the world, but then, as agency problems increase even more, in all states of the world. Kaplan and Strömberg (2001) document that state-contingent control is indeed a prevalent feature of VC contracts, with control shifting gradually from the VC to the entrepreneur as venture performance improves. Moreover, their regression results show that for pre-revenue ventures, where uncertainty about the viability of the venture should be higher, the VC receives board and voting control in more states of the world, broadly consistent with Aghion and Bolton (1992). When uncertainty is high, conflicts are more likely to arise between the VC and the founder regarding issues whether the manager should be replaced or the business should be continued. Hence, the VCs need to be allocated control in more states in order for their investment to be ex ante profitable.

Still, pre-revenue is at best a very rough measure of potential conflicts of interest. To get sharper measures, which are more likely to capture the risk factors about which the VC is truly concerned, we use our three risk variables and relate these to the degree of VC control. When external or complexity risk is high, the economic viability of the venture is more uncertain – hence, it is more likely that the VC is going to want to intervene and liquidate (or sell) the venture against management’s will. Similarly, when internal risk is high, the quality of the management team is more uncertain, and it is more likely that the VC is going to have to intervene in order to replace management.

Dessein (2001) explicitly introduces asymmetric information into an Aghion-Bolton type model. He shows that when entrepreneurs have private information about their types, good entrepreneurs have an incentive to relinquish some control rights to the VC to separate themselves from bad entrepreneurs. When the VC is allocated control, and subsequently acquires post-contracting information about entrepreneurial quality, the VC will exercise this

control and replace management only if information indicates that the entrepreneur is a bad type. Because entrepreneurs value their private benefits from running the firm, bad types will refrain from seeking VC financing. Hence, for ventures where asymmetric information is severe, implying that internal risk is high, we would expect to see more VC control.

Moreover, Dessein's model also predicts that VC control should be decreasing in the quality of post-contracting information. Empirically, it seems reasonable to expect post-contracting information to be noisier when the external environment is more uncertain, and, therefore, to expect VC control to be increasing in the amount of external risk.

Table 10 displays the results using two different measures of board control. The first dependent variable is a dummy for whether the VCs control more than half of the board seats in the venture. The second board variable equals zero if the founder always controls a majority of the seats, equals one if neither the VC nor the founder has a majority of the seats in the bad state, equals two if the VC controls a majority in the bad state only, and equals three if the VC controls a majority of the seats in the good and bad states.¹²

Using only general measures of uncertainty we find that the degree of VC control is higher for pre-revenue ventures, but increases with additional rounds of financing as the VC puts in additional funds in the venture. Adding the specific risk measures substantially increases the explanatory power of the regressions, and, in particular, both the external and internal risk measures are associated with more VC board control. These results give additional support for the Aghion-Bolton approach in general, and the Dessein (2001) model in particular.

In contrast, complexity risk comes in with a negative sign and is not statistically

¹² The classification of the situation in which neither party is in control in the bad state is arguably ambiguous. We have run alternative regressions (not in the table) in which we classify these situations as entrepreneur control (0) or with the VC control in the bad state (2). Our results are qualitatively identical.

significant. One plausible reason for this is that for complex ventures, the VC exercise of control by replacing management or liquidating the venture would not be very efficient because so much of the firm value is tied up in the founder's human capital rather than in tangible assets.

We obtain qualitatively similar results (that we do not report) when we use voting control rather than board control although only the internal risk is statistically significant. We believe that for most corporate decisions, including the replacement of management, board control is the more important measure. This view is supported by Lerner (1995).

D. The effect of risk on staging of funds and the allocation of liquidation rights.

The models of Townsend (1979), Hart and Moore (1998), and others focus on debt and the allocation of liquidation rights as the optimal financial contract, when entrepreneurs can steal or expropriate firm output. In their setting, where firm cash flow is not contractible, the optimal financial contract is a debt-like claim in which (1) the entrepreneur promises a fixed payment to the investor; and (2) the investor takes control of the project and liquidates the assets if the payment is not made. Bolton and Scharfstein (1990) and Neher (1999) build on the "stealing" approach to show that the ability to withhold future financing, through staging of funds, can serve as a similar liquidation threat in order to force repayment.

Previous empirical work has shown that these features are indeed standard in VC financings. Kaplan and Strömberg (2001) show that VC contracts exhibit several debt-like features: (1) the VC is always senior in liquidation to common stock; and (2) in four out of five cases the VC claim is redeemable, giving the VC the ability to force the firm to repay the liquidation amount if the firm has not yet been sold or gone public by some future date. These features do not vary much with the uncertainty of the venture, however, and the only significant

cross-sectional variable in their regressions is the long-term debt ratio of the industry.

For staging of funds, on the other hand, Gompers (1996) show that there is more staging in industries with fewer tangible assets, while Kaplan and Strömberg (2001) show that there is less staging for repeat entrepreneurs. Although this suggests that VCs use staging to mitigate agency problems, the risk proxies are all indirect and the results far from conclusive.

In table 11, we investigate the relationship of staging and liquidation rights to the VC risk factors. The first six regressions address staging of funds. We distinguish between two different types of staging: ex ante (or within-round) and ex post (or between-round). Ex post staging, measured by the number of months until the next financing round, measures the extent to which the VC increases the ability to liquidate the venture if performance is unsatisfactory by committing less funding in a given round. In an ex-ante staged deal, on the other hand, part of the VC's committed funding in the round is contingent on explicit financial or non-financial performance milestones. This essentially gives the VC the right to liquidate the venture when the milestones are not met. We measure ex ante staging by the fraction of the funds in a given round that is released contingent on milestones.

We find that the extent of both ex ante and ex post staging is positively related to the use of debt in the industry.¹³

With respect to our VC risk measures, however, the uses of the two types of staging seem to differ. Ex ante staging using explicit milestones primarily seems to be a way of dealing with internal risk. This is consistent with ex ante staging being a way for good firms to signal their type (or for VCs to screen out bad firms), similar to the way short-term debt is used in the model by Diamond (1991).

¹³ Recall that a negative coefficient on the ex post staging measure, the number of months until the next financing round, indicates a higher degree of staging.

Ex post staging, on the other hand, does not seem to be related to internal risk, but instead to the amount of risk external to the firm. This suggests that the driving force for ex post staging is not asymmetric information, but rather the option to abandon the project, which will be more valuable in volatile environments.¹⁴

The last four regressions investigate whether the different sources of risk are related to debt-like features in VC contracts, i.e. redemption rights and the size of the VCs claim in redemption or liquidation. None of these features seem to be related to internal risk (although redemption rights are somewhat less likely for repeat entrepreneurs). The only risk factor affecting the presence of redemption rights is the amount of external uncertainty. The interpretation here is far from clear, and the abandonment option argument does not apply well to redemption rights that apply more than five years into the future.

The size of the liquidation claim (measured by a dummy for whether the VC liquidation claim is larger than the VC investment) is significantly negatively related to complexity risk, and here the interpretation is more straightforward. For highly complex ventures, collateral value is likely to be very low, since most of the firm value is tied up in the founder's intangible human capital. Hence, the size of the liquidation claim will be more or less irrelevant for these ventures.

E. Summary

In this section, we have studied the relation of venture capitalist risk assessments to the financial contracts they utilize in their investments. We find that: (1) Greater internal and external risks are associated with more VC cash flow rights. (2) When internal risk is high, VCs appear to screen entrepreneurs by making funds and equity stakes contingent on explicit

¹⁴ See Berger, Ofek, and Swary (1996) and Cornelli and Yosha (2000).

milestones. (3) Greater internal risk is associated with more VC control, while a less noisy external environment with more accurate post-investment information is associated with less VC control. These are both consistent with the model of Dessein (2001). (4) Complexity risk is associated with a decrease in the usefulness of screening, consistent with the multi-tasking problem of Holmström and Milgrom (1991). (5) In complex ventures, where it is likely that more value is tied up in the founder's human capital, VC liquidation claims are less effective, while tying the entrepreneur to the firm through vesting founder stock becomes more important. (6) Ex post, between-round staging (in contrast to ex ante staging contingent on explicit milestones) does not seem to be used to mitigate internal risk, but rather as a response to a noisier external environment, consistent with the abandonment option being more valuable.

In interpreting our results, we believe that internal risks are more likely to be associated with asymmetric information and moral hazard problems while external risks are more likely to be associated with general or two-sided uncertainty. All of the results, and particularly the fact that internal risks are more important for contingent compensation and contingent funding, are consistent with this interpretation.

Nevertheless, it is possible to argue that the risks we classify as internal are not related to asymmetric information and moral hazard problems. For example, in some circumstances management risk may measure managerial overconfidence as ascertained by the VC. Similarly, management may have better information on customer adoption, competition, or the market than the VC.

We have two reactions to these concerns. First, while the arguments are possible, we think they are relatively unpersuasive. VCs typically undertake due diligence with respect to those risks that are external to the firm and should be able to obtain the same information as the

founders. It is for risks internal to the firm, that the VCs are more likely to be at a disadvantage on average. Second, for those readers who are not persuaded by our preferred interpretation, the fact remains that external risk, internal risk, and complexity risk are significantly and differently related to the contracts. Alternative interpretations must be able to explain this.

IV. The relationship between contracting and monitoring

In the previous section, we find a relation between the risk factors identified in the VC's initial screening and the financial contracts. In this section, we consider the relation between the contracts and the subsequent VC post-investment actions.

As we showed in table 6, above, the VC screening process also identifies areas where the VCs expect to add value through monitoring and support activities. The design of the financial contracts may affect the VC's ability and incentives to actually carry out such activities. First, the founder might not agree with the actions that the VC would like to implement. In such cases, VCs will need some formal control to carry out those actions against the will of the entrepreneur. Second, monitoring and support activities could potentially take a lot of VC time and effort (see e.g. Gorman and Sahlman, 1989). The VC will undertake them only if sufficiently compensated through an increase in the value of its claims. Recent theoretical work has formalized this so called "double moral hazard" problem and shown that the VC financial claim must have a substantial equity component to provide incentives for support activities that affect the "upside" value of the venture.¹⁵

Similar to Hellman and Puri (2002), we distinguish between VC actions that are more likely to be adversarial to management and VC actions that both investors and founders are

¹⁵ See Casamatta (2000), Dessi (2001), Inderst and Müller (2001), Renucci (2000), Repullo and Suarez (1998), and Schmidt (1999),

likely to agree to. In particular, we argue that actions related to strengthening and replacing the management team are more likely to lead to conflict, while actions related to developing the strategy and business model (such as arranging non-VC financing, assisting with mergers, or leverage strategic relationships) are less likely to do so. The first group of actions are more likely to be related to the degree of VC control; the second group of actions, to VC equity incentives. Finally, we also consider the possibility of free-riding behavior among VCs decreasing the incentives to provide monitoring and support. One prevalent feature of VC financings is that they are often syndicated, with several different VC funds investing together in a given portfolio company.¹⁶

Table 12 reports the results of regressions of expected VC monitoring and support activities on contract characteristics. The first three regressions analyze expected management team interventions as a function of VC board control. Consistent with our hypothesis, the first regression shows that the VC is more likely to expect to engage in strengthening or recruiting management when the degree of VC board control is higher. (We measure board control using the four-category board control variable analyzed in section 4.3 normalized to lie between zero and one). The interaction between board control and syndicate size has a negative sign, consistent with a free-riding problem, although the sign is not significant.

The second regression shows that this result is robust to including a number of control and contracting variables, as well as including industry and VC dummies. Notably, the equity stake of the VC is not significant in predicting management interventions. Since the contracting variables may suffer from endogeneity bias, the third regression instruments the board variables using our three risk measures. The board control variable is still positive and significant, and the negative coefficient on the interaction with syndicate size is now significant at the 10% level.

¹⁶ See Lerner (1994), and Sorensen and Stuart (2001).

The last three regressions in the table analyze expected value-added support activities as a function of the VC's equity stake. The first of these specifications shows that the VC equity stake is indeed significantly related to the extent to which the VCs expect to engage in value-added support, while the interaction with syndicate size is significantly negative, consistent with free-riding. The two subsequent specifications show that this result is robust to the inclusion of other control variables, as well as to an instrumental variables specification.

Although VC board control and the size of the VC equity stake are highly correlated ($\rho = 0.52$), the last two specifications – regressions (7) and (8) – show that the previous conclusions are robust. Board control does not explain the extent of value-added support and the VC equity stake does not explain management interventions.

To conclude, the analysis in table 12 yields three results. First, board control is associated with a greater ability and tendency for the VC to intervene in management, consistent with control theories such as Aghion and Bolton (1992) and Dewatripont and Tirole (1994) in general, and with Hellman's (1998) application to VC management intervention in particular. Second, consistent with the double-sided moral hazard theories, equity incentives increase the likelihood that VCs perform value-added support activities. Third, free-riding within a syndicate can reduce the extent to which VCs are willing to engage in such activities, particularly value-added support.

V. *Summary and Discussion*

In this paper, we consider how venture capitalists (VCs) assess their investments by studying the contemporaneous investment analyses produced by 11 VC firms for investments in 67 portfolio companies. Consistent with most academic and anecdotal accounts, we find that VCs consider the attractiveness of the opportunity, the management team, and the deal terms.

We also provide evidence on how the venture capitalists expect to monitor those investments. In at least half of the investments, the VC expects to play an important role in recruiting management; in at least a third, they expect to provide other value-added services, such as developing strategy or facilitating partnerships. These results provide confirmation of the results in Hellman and Puri (2000 and 2002).

We then consider the relation of the contractual terms to the VC analyses. The novel aspect of this analysis is our ability to distinguish among external risk, internal risk, and complexity risk. Consistent with asymmetric information and moral hazard theories, greater internal risk is associated with more contingent compensation for the entrepreneur and greater VC control. Greater external risk is also associated with more VC control. Consistent with multitasking and hold-up theories, greater complexity is associated with less contingent compensation and more time vesting.

Finally, we relate the financial contracts to expected VC actions. VCs are more likely to strengthen the management teams as VC control increases. In contrast, VCs value-added services are increasingly likely as VC cash flow rights increase, but are not related to VC board control.

More generally, the results confirm that VCs exert effort in evaluating investments and are well-informed. This suggests that theories should model this explicitly as in Garmaise

(1999). VCs also exert time and effort in monitoring and aiding companies in which they invest to improve outcomes. Effort is not just monitoring and replacing poorly performing management, but also includes assisting and providing inputs to the company. Again, this suggests that theories should model this explicitly as in Casamatta (2000).

Our cross-sectional results relating the contractual terms to the VC identified risks also are supportive of several contracting theories. The findings that founder pay-for-performance incentives increase in internal risk and decrease in complexity are consistent with Holmstrom (1979) and Holmstrom and Milgrom (1991). The findings that VC control rights increase with internal and external risks is strongly supportive of Dessein (2001) and Aghion and Bolton (1992).

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**Table 1
Summary Information**

Summary information for 90 investments in 67 portfolio companies by 11 venture capital partnerships. Investments were made between 1987 and 1999. Pre-revenue stage rounds are financing rounds for companies that had no revenues before the financing. First VC investments refer to observations where we have the investment memorandum for the first time any venture capital fund invested in the company. Repeat entrepreneur refers to observations where, before founding this particular portfolio company, the founder had successfully gone public with a previous venture or sold such a venture to a public company. Total financing committed is the total amount of equity financing committed to by the venture capitalists at the time of the financing round.

<u>A.:</u>	<u>Portfolio Companies</u>	<u>Financing Rounds</u>
Number of observations	67	90
Pre-revenue	25	26
First VC investments	44	44
Repeat entrepreneur	14	14

B.: By year initial round financed:

	<u>Pre-1995</u>	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>Total</u>
# companies	11	14	12	29	1	67

C.: By industry

	<u>Biotech</u>	<u>IT/Soft- ware</u>	<u>Telecom</u>	<u>Health- care</u>	<u>Retail</u>	<u>Other Industries</u>
# companies	7	24	10	10	10	6

D.: By VC Partnership

	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>Total</u>
# portfolio companies in current draft	7	3	3	15	4	4	2	10	2	10	7	67

E.: Financing Amounts

	<u>Mean</u>	<u>Median</u>	<u>N</u>
Total financing committed (\$ millions)	9.7	6.0	67
Total financing committed pre-revenue rounds (\$ millions)	14.5	9.5	21
Total financing provided (\$ millions)	5.5	4.8	67
Total financing provided pre-revenue rounds (\$ millions)	4.8	4.0	21

F.: Outcomes as of 5/15/01

	<u>Private</u>	<u>Public</u>	<u>Sold</u>	<u>Liquidated</u>
# of companies	37	17	10	3

Table 2
Investment Theses in Venture Capitalist Analyses

Explicitly mentioned reasons for investing according to venture capitalist analyses for investments in 67 portfolio companies by 11 venture capital partnerships. Investments were made between 1987 and 1999.

A. Opportunity: Market conditions, product, strategy, and competition.

Explicit reason	N	%	Examples
Large market size and growth	46	68.7%	<ul style="list-style-type: none"> • Two very important and visible market opportunities, which should both be over \$1B within a few years. • Large market amenable to rapid growth • Very large market in which incumbents earn high profit margins • Virtually unlimited market potential in the long term • Large and growing market with favorable demographic and privatization trends. • Company could dramatically impact the evolution of the computer industry • Dramatic shifts in business favor company's market
Attractive product and/or technology	27	40.3%	<ul style="list-style-type: none"> • Late stages of product development (first product launch planned in 15-18 months) • Superior technology with large market potential • Revolutionary new technology • Has developed excellent product • Has built a robust, scalable system that can meet the current market demands. • Best product on the market. • Well tested technology/product. • Early stage company with post-beta product with competent/experienced technology team
Attractive business strategy/ model	36	53.7%	<ul style="list-style-type: none"> • Company significantly reduces costs while maintaining quality • Compelling business strategy. Presence or likelihood of validating corporate alliances • Outsourcing means less for company to manage • Attractive and demonstrated profitability of business model • Excellent new concept • Favorable acquisition opportunities, which will be driver of growth. • Distinctive strategy • High value-added, high margin strategy for very little capital upfront. • "Lean and mean" operation with few employees and good customer focus • Pure play / focused
High likelihood of customer adoption	20	29.9%	<ul style="list-style-type: none"> • Conceptual acceptance by professional community • Beta arrangements with large customers • Solid base of customers who regularly renew • Increasing popularity of approach among customers • Company has very interesting beta sites, who have been enthusiastic about product. • Major corporations are customers and are positive regarding the capabilities of the product and the management team • Attractive customer value proposition.
Favorable competitive position	22	32.8%	<ul style="list-style-type: none"> • Company has intellectual property rights to all significant research findings using this technology, not very threatening competitors. • Company is targeting a significant market segment that is underserved by incumbents • Early mover advantages from being pioneer of this concept and largest player • Highly fragmented industry, which makes the industry ripe for consolidation • No competitors. • Early entrant • Very few effective alternatives available, and noone currently targeting all three target segments • First-mover advantage, similar to Amazon and AOL • Given the large market, there is more than enough room for several competitors. • Strong proprietary and patent position • Potential for large market share with early penetration - meeting clearly unaddressed needs
Any of the above	66	98.5%	

B. Management: Quality and previous performance.

Explicit reason	N	%	Examples
Quality of management	40	59.7%	<ul style="list-style-type: none"> • Comfortable with the management team. • Management team is of the highest quality in the industry • Experienced management team which is critical driver of success • VC is investing because of quality of management team, who is believed to be good in science, and at raising and conserving money. • Experienced, proven and high-profile CEO competing in a market where execution is key • Very good CFO just hired • Known CEO for a long time. • CEO/founder is one of the few managers in the industry capable of attracting necessary employees. Has developed excellent product while consuming only modest amounts of capital • Experienced managers out of successful venture backed company • Strong CEO/founder with very high marks from existing investors • Current management team has executed well so far. • Management team has extensive internet and website management experience. . • Key members of management team has industry experience. Team is well-balanced, young and aggressive. • Highly sought-after entrepreneur/founder, who co-founded successful company that subsequently went public. Strong board. • Excellent CEO joining company. • CEO is very frugal and will not spend capital unwisely • Executive team has acquired a significant level of penetration and relationships in a fairly short time
Favorable performance to date	18	26.9%	<ul style="list-style-type: none"> • Attractive and demonstrated profitability of business model • Rapid growth: over 40% last four years • Company has a manageable cash burn rate and is expected to be cash-flow break-even within 12 months • Company has good reputation in industry • Company has been successful to date and has made substantial improvements during last two years • Significant sales growth and momentum. • Has developed product, well positioned to achieve revenue target. • Company is operationally break-even. • Year one sales of \$3.2M, profitable so far • Cash flow positive.
Any of the above	45	67.2%	

C. Deal terms: Valuation, contractual structure, syndicate and portfolio considerations.

Explicit reason	N	%	Examples
Low valuation	14	20.9%	<ul style="list-style-type: none"> • Low valuation 5-year IRR of 46% in conservative case. • Very profitable unit model (60% IRR over 10 years) • Valuation is attractive and should give high returns if successful • Exit multiples are shooting up • VC only has to invest \$1 million at a \$2 million pre-money valuation
Contractual structure that limits risk	13	19.4%	<ul style="list-style-type: none"> • The participating preferred should protect VC in case of mediocre performances. • Unique investment structure: only have to put in money if milestones are met; combination of cumulative non-convertible preferred stock and regular convertible preferred has benefit that VC will be paid back most of investment out of IPO proceeds. • Equipment can be funded with debt • Gives investors ability of investors to control growth • Successfully structured investment to minimize downside, by only providing limited funds until milestones met • VC commitment will be invested over time. If initial (Chicago) launch not successful, VC has option to cut back. • Cash-efficient early stage thanks to future company acquisitions with stock • New investor has the benefit of reduction in VC pro rata investment if more funds needed • Limited risk for VC: will only own 4.4% of company. • Can take company to leading industry position with a minimum of capital.
Positive influence of other investors	4	6.0%	<ul style="list-style-type: none"> • Investing partners include investors who previously invested early in some extremely successful companies • Former COO of US industry leader involved as active chairman and interim CEO, as well as investor. • Main reason that VC is investing is that it is required to get a new individual investor which has the benefit of (1) reduction in VC pro rata investment if more funds needed, and (2) the skills of the investor and the interim "turnaround" COO that he is getting company"
Good fit in VC investment portfolio	12	17.9%	<ul style="list-style-type: none"> • Adds additional breath to VC portfolio within this market segment • VC is strong in this geographic region • Participation in the rapidly growing market • Good strategic fit with VC. • VC has board seat on company in complementary business, with which VC could facilitate marketing partnership. • Represents new market segment for the funds, which should stimulate some additional opportunities (assuming a positive outcome) • Potential for (Non-California) VC to lead a Silicon Valley deal.
Any of the above	31	46.3%	

D. Financial and exit conditions.

Explicit reason	N	%	Examples
Financial market conditions and exit opportunities	11	16.4%	<ul style="list-style-type: none"> • If successful, possibility for early exit or acquisition • Expect to have access to both debt and equity in public markets on attractive terms • Quick flip potential for the investment • Many strategic buyers available • Recent public market enthusiasm for e-commerce companies might enable public equity financing to mitigate future financing risks • Given the size of the market opportunity and company's strategy, capital markets will be receptive given that company achieves business plan. Also, a consolidation trend should emerge in industry as more companies enter market.

Table 3
Risks and Uncertainties in Venture Capitalist Analyses

Explicitly mentioned risks in investing according to venture capitalist analyses for 67 portfolio companies by 11 venture capital partnerships. Investments were made between 1987 and 1999.

A. Opportunity: Market conditions, product, strategy, and competition

Explicit reason	N	%	Examples
Uncertain market size and growth	21	31.3%	<ul style="list-style-type: none"> • Regulatory uncertainty • Sensitive to a substantial increase in interest rates • Country risk. Regulations changing • Currency risk • New, largely unproven, marketplace • General downturn in industry • Uncertain demand / market size
Uncertainty about product and/or technology	21	31.3%	<ul style="list-style-type: none"> • Outcome of clinical tests and development: Must prove that technology is superior to other marketed alternatives, in terms of efficiency and side effects. • Early stage research project: Project is elegant, ambitious and, consequently, difficult. • Ability to make technology work at target cost point • No guarantee product will work in a full production environment • Identification and development of a more compelling product.. • Product scalability is to be fully tested.
Risks in business strategy/ model	34	50.7%	<ul style="list-style-type: none"> • Real sales effort needs to be mounted, which is very reliant on management team's experience to manage profitably. Transferability of business model to other markets? • Are there enough candidates available for acquisition? • Will company be able to ensure quality while pursuing a growth-through-acquisition strategy?" • How scalable is the business? Is there any operating leverage in the business model? • Lack of focus? • Vulnerable strategy • Execution of business model has yet to be proven. • Will company be able to attract employees? • VC due diligence showed that margins and expense percentages of existing stores have to be brought into line with prototype model • Key partnerships not nailed down. • Geographical risk – US corporate and foreign R&D
Uncertain customer adoption	15	22.4%	<ul style="list-style-type: none"> • Ability to convince customers to bet on an unproven technology • Customers may not want to pay enough of a premium for product • Customer reaction is unknown • Speed of adoption. Target customers have not historically been speedy adopters. • Financial viability of customers and existing contracts • Significant risk that product will not work in new geographical areas • Challenge is to broaden the product beyond the initial customer segment, which requires an identity creation. Customer sensitivity on pricing at a broader is yet to be tested
Risky competitive position	27	40.3%	<ul style="list-style-type: none"> • Customers might become competitors once they learn company's business model • Strong competition may exist. Patent protection alone might not provide enough barriers to entry. • Many new entrants - price competition could drive down margins • Early, but not first competitor. • Competition and pricing pressures • Competitive and tight labor market, competing with larger established competitors for employees. • New alternative technology might be a long-term threat. • Uncertainty about market share and pricing. • Low barriers to entry. Low switching costs. • Product can be copied. Competitors are large entrenched companies with superior distribution channels.
Any of the above	60	89.6%	

B. Management: Quality and previous performance

Explicit reason	N	%	Examples
Quality of management	41	61.2%	<ul style="list-style-type: none"> • CEO is a "rather difficult person". Active involvement of Chairman will be crucial. • Unproven management team • Management team is still incomplete • CEO/founder has a strong desire for acquisitions. VCs have to devote substantial time evaluate • Company is highly reliant on one individual (the founder/CEO) • Management has not shown in the past that it can effectively forecast financial progress • Management group has no real company building experience • Company still needs management (CEO, CFO, COO) and control (operating, reporting and billing) systems. • Is the fact that company is in so many seemingly disparate businesses a reflection of management's lack of focus? • Good but not great management team • Management team is incomplete. Need seasoned industry executive. • Incomplete management team. One of the milestones for further funding is the ability to attract an appropriate VP of sales and marketing to complete the management team • Involvement of one of the investors as chairman and interim CEO, (replacing founder) is critical to success. Need to find new permanent CEO. • Will the management team be able to integrate acquisitions?" • Incomplete junior management team. • Founder/Chief Development Officer has only limited operating experience. Newly recruited CEO is unproven. Key executives in operations and marketing are yet to be recruited. • Management is young and relatively inexperienced • Will need to strengthen management team. Have to ensure involvement of VC investor as chairman. Will have to hire CEO eventually. • Youth and lack of executive experience of management team • The CEO's choice of past companies has been questioned. • Management team still needs to be completed with COO, VP marketing, and CFO. • Need of new COO to turn company around • Management seems to lack sufficient resources in the area of business development. Need senior business development executive. • Weak management. Will get great management with new hires, investment conditional on this.
Questionable performance to date	5	7.5%	<ul style="list-style-type: none"> • Company is making losses and performing below plan • Bad debt problem, which significantly changed the profitability of the company, because of past business procedures.
Any of the above	40	59.7%	

C. Deal Terms: Valuation, contractual structure, syndicate and portfolio considerations

Explicit reason	N	%	Examples
High valuation	13	19.4%	<ul style="list-style-type: none"> • Even if price lower than some of competitors price still rather high, "reflecting the size and visibility of the markets company is addressing". • Are the financial model assumptions valid? • Is the valuation realistic? Price seems high. Are the financial projections realistic? • Relatively high valuation compared to past VC deals. • Valuation is on the high side for a start-up. VCs still believe it is reasonable due to the high calibre of the four founders. • High valuation because of competition between VCs to invest in deal.
Contractual structure and downside risk	9	13.4%	<ul style="list-style-type: none"> • Uncertainty about what the proper milestones should be. • Large amount of capital for a start-up enterprise. Will require strong management oversight. • Aggressive bank loan assumptions. Might require either slower expansion or more equity capital • What will the leverage be and what happens to leverage if the IPO is delayed? • Company has little in the way of underlying asset value and thus offers limited downside protection. VC will have to commit to deal without assurance that corporate partnership will materialize. • Company expects to need an additional \$3m in financing next year. No assets of value except for employees. • Need sufficient checks and balances regarding drawdown of funds
Negative influence of other investors	4	6.0%	<ul style="list-style-type: none"> • Lead VC will not have unilateral control, but have to reach agreement with 3 other VCs. • Previous investor (who is selling all shares to VCs) is anxious to get out at a deep discount • Company had discussions with other VC previously that decided not to finance deal (stated reason: the deal was too small for them – wanted to put in at least \$20m)
Costly to monitor investment	10	14.9%	<ul style="list-style-type: none"> • Long distance relationship risk in high-tech/engineering development project (R&D is done in Israel) • Complicated legal and financial due diligence • Need sufficient checks and balances regarding drawdown of funds • May require too much time from VC. • Geographical risk – California corporate and overseas R&D • CEO/founder has a strong desire for acquisitions. VCs have to devote substantial time to evaluate these. • Involvement of one of the investors as chairman and interrim CEO, (replacing founder) is critical to success. • Have to ensure active involvement of one of VC investors as chairman.
Any of the above	25	37.3%	

D. Financial and exit conditions.

Explicit reason	N	%	Examples
Financial market conditions and exit opportunities	5	7.5%	<ul style="list-style-type: none"> • What will the leverage be and what happens to leverage if the IPO is delayed? • Would maybe be better to sell company • Financial market and political fluctuations. • How will public markets treat the company?

Table 4
Company financial forecasts

Description of VC and management financial forecasts at the time of investment for investments in 67 portfolio companies by 11 venture capital partnerships. Investments were made between 1987 and 1999.

	1 year before inv.			1 st year after inv.			2 nd year after inv.			3 rd year after inv.			4 th year after inv.		
	mean	median	(N)	mean	median	(N)	mean	median	(N)	mean	median	(N)	mean	median	(N)
<u>All VC projections</u>															
Sales (\$MM)	9.7	1.6	(38)	18.5	17.6	(30)	37.0	30.4	(29)	62.1	51.0	(28)	83.6	83.3	(21)
Sales growth %				4211%	136%	(14)	228%	103%	(29)	93%	68%	(28)	59%	54%	(21)
EBIT (\$MM)	-1.0	-0.6	(35)	-0.8	-0.3	(21)	1.8	1.1	(21)	7.1	2.7	(21)	9.5	6.5	(18)
EBIT/Sales %	-184%	-8%	(34)	-146%	-1%	(21)	-16%	5%	(21)	9%	5%	(21)	11%	10%	(18)
<u>All Management projections</u>															
Sales (\$MM)	9.7	1.6	(38)	17.4	6.9	(46)	32.3	21.5	(40)	57.2	38.6	(36)	99.5	86.7	(31)
Sales growth %				772%	174%	(30)	665%	173%	(40)	107%	91%	(36)	75%	63%	(30)
EBIT (\$MM)	-1.0	-0.6	(35)	-1.1	-0.8	(41)	1.6	1.2	(36)	6.9	4.5	(33)	15.1	11.9	(28)
EBIT/Sales %	-184%	-8%	(34)	-307%	-6%	(40)	1%	6%	(36)	15%	14%	(33)	21%	15%	(28)
<u>Observations with both Management and VC projections</u>															
(A) VC projections															
Sales (\$MM)	9.2	3.7	(12)	16.7	16.5	(19)	33.3	26.8	(16)	63.4	49.2	(15)	76.5	73.3	(12)
Sales growth %				520%	129%	(12)	261%	164%	(16)	111%	72%	(15)	69%	54%	(11)
EBIT (\$MM)	-0.5	-0.3	(8)	-1.3	-0.1	(14)	1.4	0.6	(13)	9.4	3.8	(12)	10.6	8.6	(11)
EBIT/Sales %				-208%	-1%	(14)	-30%	-5%	(13)	8%	8%	(12)	12%	12%	(10)
(B) Management projections															
Sales (\$MM)	9.2	3.7	(12)	16.2	10.3	(19)	35.6	40.8	(16)	62.7	58.4	(15)	112.8	123.8	(12)
Sales growth %				515%	468%	(12)	468%	216%	(16)	99%	87%	(15)	74%	57%	(11)
EBIT (\$MM)	-0.5	-0.3	(8)	-1.5	-0.7	(14)	2.2	1.2	(13)	8.0	8.4	(12)	16.7	21.7	(11)
EBIT/Sales %				-177%	-10%	(14)	-13%	2%	(13)	13%	15%	(12)	28%	20%	(10)

Table 5
Relations between VC risk analysis and firm characteristics

Explicitly mentioned strengths and risks in investing according to venture capitalist analyses and their relation to exogenous firm characteristics for 67 portfolio companies by 11 venture capital partnerships. Investments were made between 1987 and 1999. Asterisks indicate significant differences using either a Mann-Whitney (for pre- vs. post-revenue and first vs. subsequent round) or a Kruskal-Wallis (for Industry and VC funds) test at: 1% ***; 5% **, and 10% * levels.

Strength (S) / Risk (R)		Full Sample (N=66)	Pre-revenue (N=21)	Post-revenue (N=46)	First round (N=44)	Subseq. round (N=23)	Biotech (N=7)	IT / software (N=24)	Telecom (N=10)	Health-care (N=10)	Retail (N=10)	Other (N=6)	KW Industry (5 d.f.)	KW VC-funds (10 d.f.)	
<i><u>Opportunity:</u></i>															
Mkt size /growth, %	IT	68.7	66.7	69.6	70.5	65.2	57.1	66.7	60.0	80.0	60.0	100.0	4.44	13.25	
	R	31.3	28.6	32.6	31.8	30.4	0.0	29.2	20.0	80.0	10.0	50.0	17.67***	31.3***	
Cust. adoption, %	IT	29.9	33.3	28.3	36.4	17.4	14.3	33.3	20.0	50.0	10.0	50.0	6.30	11.3	
	R	20.9	9.5	26.1	20.5	21.7	14.3	16.7	20.0	0.0	40.0	50.0	8.25	11.6	
Competition, %	IT	32.8	38.1	30.4	38.6	21.7	42.9	33.3	20.0	60.0	20.0	16.7	5.78	11.7	
	R	40.3	42.9	39.1	50.0**	21.7**	14.3	37.5	60.0	20.0	70.0	33.3	9.02	21.9**	
Prod. / technol., %	IT	40.3	38.1	41.3	34.1	52.2	85.7	54.2	40.0	0.0	10.0	50.0	18.44***	31.0***	
	R	31.3	38.1	28.3	31.8	30.4	71.4	37.5	30.0	0.0	20.0	33.3	10.67*	18.9**	
Bus. model/strat., %	IT	53.7	28.6***	65.2***	54.5	52.2	14.3	50.0	40.0	80.0	70.0	66.7	9.38*	15.7	
	R	50.7	23.8***	63.0***	50.0	52.2	0.0	58.3	20.0	80.0	60.0	66.7	15.68***	24.6***	
<i><u>Management and previous performance:</u></i>															
Mgmt quality, %	IT	59.7	71.4	54.3	54.5	69.6	71.4	62.5	100.0	40.0	40.0	33.3	12.00**	13.9	
	R	61.2	57.1	63.0	68.2	47.8	28.6	45.8	50.0	100.0	90.0	66.7	15.72***	31.8***	
Perform. to date, %	IT	26.9	4.8***	37.0***	25.0	30.4	0.0	33.3	40.0	10.0	30.0	33.3	5.50	16.3*	
	R	7.5	0.0	10.9	6.8	8.7	0.0	4.2	0.0	20.0	10.0	16.7	4.78	4.8	
<i><u>Deal terms, exit:</u></i>															
Valuation	IT	20.9	14.3	23.9	15.9	30.4	0.0	29.2	20.0	20.0	10.0	33.3	4.07	9.07	
	R	19.4	9.5	23.9	13.6*	30.4*	14.3	12.5	10.0	50.0	30.0	0.0	9.42*	14.95	
Contractual struct. / downside risk, %	IT	19.4	38.1***	10.9***	20.5	17.4	28.6	12.5	20.0	40.0	10.0	16.7	4.35	15.2	
	R	13.4	28.6**	6.5**	15.9	8.7	0.0	12.5	20.0	30.0	10.0	0.0	4.79	19.1**	
Influence of other investors, %	IT	6.0	9.5	4.3	2.3	13.0	0.0	8.3	0.0	20.0	0.0	0.0	5.75	7.8	
	R	6.0	4.8	6.5	6.8	4.3	0.0	0.0	10.0	20.0	0.0	16.7	7.51	16.0*	
Portf.fit /monitoring cost%	IT	17.9	9.5	21.7	20.5	13.0	0.0	37.5	0.0	10.0	0.0	33.3	13.35**	13.4	
	R	16.4	23.8	13.0	18.2	13.0	0.0	12.5	40.0	20.0	0.0	33.3	8.87	18.2*	
Exit conditions, %	IT	16.4	14.3	17.4	11.4	26.1	14.3	16.7	40.0	0.0	0.0	33.3	9.12	32.5***	
	R	7.5	4.8	8.7	9.1	4.3	0.0	4.2	10.0	30.0	0.0	0.0	9.54*	14.3	

Table 6
Venture Capitalist Actions

Venture capitalist (VC) actions before investment and anticipated at the time of investment for for investments in 67 portfolio companies by 11 venture capital partnerships. Investments were made between 1987 and 1999.

	<u>Number (%) of companies</u>	
<u>Management</u>		
VC active in recruiting or changing management team before investing	11	(16%)
VC expects to be active in recruiting or changing management team after investing	29	(43%)
Any of the above	34	(51%)
 <u>Strategy / Business Model</u>		
VC explicitly active in shaping strategy / business model before investing	6	(9%)
VC explicitly expects to be active in shaping strategy / business model after investing	20	(30%)
Any of the above	23	(34%)
 <i>Examples:</i>		
Design employee compensation		
Arrange vendor financing agreements		
Install information and internal accounting systems		
Have company exit non-core businesses		
Implement currency hedging program.		
Hire market research firm to help with new store locations		
Assist with development of marketing plan		
Assist with mergers and acquisitions		
Develop business plan, budget, financial forecasts		
Monitor R&D and product management efforts		
Refine pricing model and work on major account strategy		
Assist technical service team		
Leverage VC strategic relationships		

Table 7
Relation between VC financial projections, exit strategy, expected actions, and firm characteristics

This table relates the extent of VC financial projections, valuations, exit analysis, and expected monitoring and support actions to firm characteristics for investments in 67 portfolio companies by 11 venture capital partnerships. Investments were made between 1987 and 1999. Asterisks indicate significant differences using either a Mann-Whitney (for pre- vs. post-revenue and first vs. subsequent round) or a Kruskal-Wallis (for Industry and VC funds) test at: 1% ***; 5% **, and 10% * levels.

Activity	Full Sample (N=66)	Pre-revenue (N=21)	Post-revenue (N=46)	First round (N=44)	Subseq. round (N=23)	Biotech (N=7)	IT / software (N=24)	Telecom (N=10)	Health-care (N=10)	Retail (N=10)	Other (N=6)	KW Industry (5 d.f.)	KW VC-funds (10 d.f.)
<i><u>VC Financial projections:</u></i>													
Financial projections done, %	44.8	42.9	45.6	40.9	52.2	14.3	33.3	50.0	90.0	50.0	33.3	12.52**	30.09***
Cum. Growth % yr. 1 to 3 (N=28) Mean (Median)	1336.9 (714.2)	1766.4 (1108.1)	1133.5 (660.2)	1272.5 (706.4)	1436.6 (785.1)	0.0 (1 obs.)	1359.1 (884.7)	1251.4 (721.9)	1333.7 (706.4)	2005.8 (869.1)	493.0 (493.0)	4.14	10.32
EBIT-marg. % yr. 3 (N=21) Mean (Median)	8.5 (5.2)	2.1 (6.9)	12.5 (4.5)	11.7 (5.2)	3.5 (5.8)	0.0 (1 obs.)	-23.7 (-18.4)	7.1 (14.6)	28.1 (12.6)	2.8 (3.2)	NA	9.12*	12.20*
<i><u>Explicit valuations:</u></i>													
Valuations done	43.3	52.4	39.1	45.5	39.1	28.6	33.3	60.0	90.0	20.0	33.3	13.85**	49.85***
Expected IRR % (N=25) Mean (Median)	53.8 (50.0)	51.1 (50.0)	56.0 (53.0)	51.3 (47.7)	60.3 (56.0)	50.0 (50.0)	57.4 (48.9)	45.6 (39.9)	53.2 (54.0)	56.0 (56.0)	72.5 (72.5)	3.40	8.39
<i><u>Exit strategy:</u></i>													
Exit analysis done, %	59.7	57.1	60.9	61.4	56.5	57.1	50.0	50.0	100.0	50.0	66.7	8.48	24.91***
IPO main alternative (N=40)	75.0	75.0	75.0	74.1	76.9	75.0	75.0	40.0	90.0	100.0	50.0	7.28	12.5
Sale main alternative (N=40)	25.0	25.0	25.0	25.9	23.1	25.0	25.0	60.0	10.0	0.0	50.0	7.28	12.5
<i><u>Expected VC actions:</u></i>													
VC to strengthen mgmt team	50.8	52.4	50.0	54.6	43.5	42.9	45.8	20.0	100.0	50.0	50.0	13.69**	14.5
Before investment	16.4	19.1	15.2	13.6	21.7	0.0	4.2	0.0	80.0	10.0	16.7	35.19***	35.61***
Anticipated	43.3	38.1	45.7	47.7	34.8	42.9	41.7	20.0	70.0	50.0	33.3	5.49	7.78
VC to perf. value-added act.	34.3	23.8	39.1	34.1	34.8	28.6	29.2	30.0	60.0	30.0	33.3	3.42	8.96
Before investment	9.0	9.5	8.7	6.8	13.0	0.0	0.0	20.0	40.0	0.0	0.0	17.67***	18.6**
Anticipated	29.9	23.8	32.6	31.8	26.1	28.6	29.2	10.0	50.0	30.0	33.3	3.81	7.25

Table 8

Relation Between Venture Capitalist Valuations, Divisions of Equity, and VC Risk Analyses: Multivariate Analysis

Relationship between venture capitalist (VC) risk analyses and contractual terms for investments in 67 portfolio companies by 11 venture capital partnerships. Investments were made between 1987 and 1999. Degree of external risk is the average of the dummy variables for the presence of market risk, competition risk, customer adoption risk, and financial market / exit risk. Degree of internal risk is the average of the dummy variables for the presence of management quality risk, questionable performance risk, contractual structure / downside risk, negative influence of other investors risk, and costly monitoring risk. Degree of complexity is the average of the dummy variables for product / technology risk and business model / strategy risk. First VC financing round takes the value of one if no VCs had invested in the company previous to this round, and zero otherwise. Pre-revenue venture takes the value of one if the venture is not generating any revenues at the time of financing, and zero otherwise. Repeat entrepreneur takes the value of one if the founder's previous venture was taken public or sold to public company. Expected sales in T+1 are the expected sales in the year subsequent to the investment, according to the VC analysis, where available, and otherwise according to the business plan. White (1980) robust standard errors are in parentheses. Asterisks indicate significant differences at: 1% ***; 5% **, and 10% * levels.

	Pre-money, \$M	Pre-money, \$M	VC Res.. CF %, best case	VC Res.. CF %, best case	Fnd Res.. CF %, best case	Fnd Res.. CF %, best case
Constant	16.46*** (5.71)		52.48*** (3.31)		31.01*** (3.72)	
First VC fin. round	-12.23** (5.28)	-7.45 (5.02)	-25.65*** (4.37)	-19.92*** (4.92)	21.29*** (4.54)	14.03** (5.32)
Pre-revenue venture	7.02 (4.92)	8.63 (6.21)	8.91** (4.45)	1.98 (4.69)	-3.32 (4.91)	3.03 (5.13)
Repeat entrepreneur		2.86 (6.44)		-1.06 (4.98)		-5.90 (6.35)
Expected sales in T+1	0.45*** (0.10)	0.42*** (0.11)				
Degree of external risk	-5.76* (3.06)	-7.97** (3.55)	2.90 (1.77)	2.68 (2.40)	-4.65** (1.99)	-4.12 (2.59)
Degree of internal risk	-0.96 (2.97)	-1.63 (3.89)	5.77*** (1.99)	5.50** (2.10)	-4.87** (1.98)	-4.18* (2.46)
Degree of complexity	7.95 (5.10)	6.92 (5.85)	-1.08 (3.23)	3.45 (3.34)	1.20 (3.21)	-2.40 (3.40)
Biotech		10.5 (11.4)		48.9 (5.7)		41.3 (9.0)
IT / Software		21.7 (9.3)		46.1 (5.9)		35.8 (6.7)
Telecom		19.9 (8.9)		58.8 (6.6)		30.4 (6.2)
Healthcare		10.4 (11.7)		54.2 (7.2)		28.4 (8.2)
Retail		22.2 (11.4)		50.7 (6.7)		33.2 (7.7)
Other		17.7 (11.1)		47.2 (7.7)		31.3 (7.9)
VC dummies	No	Yes	No	Yes	No	Yes
F-test Industry and VC dummies [p-val.]		F(8,39) = 3.1 [0.01]		F(8,52) = 3.9 [0.00]		F(8,52) = 2.4 [0.03]
Adjusted R-squared	0.32	0.38	0.38	0.49	0.28	0.36
Sample size	55	55	67	67	67	67

Table 9

Relation Between Founder Pay Performance Incentives, and VC Risk Analyses: Multivariate Analysis

Relationship between venture capitalist (VC) risk analyses and contractual terms for investments in 67 portfolio companies by 11 venture capital partnerships. Investments were made between 1987 and 1999. Fnd RCF% sensitivity, benchmarks (time vesting) is the difference in founders' residual cash flow rights (i.e. equity) if they meet performance (time vesting) benchmarks, as a percentage of the founders' equity stake if performance benchmarks are met and all founder and employee equity vest. Degree of external risk is the average of the dummy variables for the presence of market risk, competition risk, customer adoption risk, and financial market / exit risk. Degree of internal risk is the average of the dummy variables for the presence of management quality risk, questionable performance risk, contractual structure / downside risk, negative influence of other investors risk, and costly monitoring risk. Degree of complexity is the average of the dummy variables for product / technology risk and business model / strategy risk. First VC financing round takes the value of one if no VCs had invested in the company previous to this round, and zero otherwise. Pre-revenue venture takes the value of one if the venture is not generating any revenues at the time of financing, and zero otherwise. Repeat entrepreneur takes the value of one if the founder's previous venture was taken public or sold to public company. White (1980) robust standard errors are in parentheses. Asterisks indicate significant differences at: 1% ***; 5% **, and 10% * levels.

	Fnd RCF % sensitivity, benchmarks	Fnd RCF % sensitivity, benchmarks	Fnd RCF % sensitivity benchmarks	Fnd RCF % sensitivity, vesting	Fnd RCF % sensitivity, vesting	Fnd RCF % sensitivity, vesting
Constant	1.61 (1.13)	-2.38 (3.06)		19.57** (8.95)	-7.70 (11.67)	
First VC fin. round	3.15* (1.71)	1.85 (1.94)	2.76 (2.86)	-5.67 (10.24)	-9.90 (9.27)	-1.25 (9.42)
Pre-revenue venture	12.31** (5.69)	9.86** (4.07)	8.85* (4.50)	24.02** (9.84)	28.78*** (9.88)	17.36 (12.27)
Repeat entrepreneur	-10.01** (4.23)	-5.10 (3.08)	-4.62 (2.94)	-11.18 (10.26)	-1.31 (10.44)	-1.18 (11.62)
Degree of external risk		2.41* (1.42)	3.40* (1.88)		9.45 (5.94)	6.36 (5.78)
Degree of internal risk		5.57** (2.60)	7.45** (3.26)		4.02 (4.74)	1.15 (5.85)
Degree of complexity		-4.44* (2.32)	-1.83 (2.18)		15.66** (7.85)	14.78** (6.43)
Biotech			-11.5 (6.0)			7.3 (18.5)
IT / Software			-10.3 (5.4)			-9.1 (17.8)
Telecom			-0.4 (5.7)			22.9 (15.6)
Healthcare			-14.0 (8.0)			-0.8 (21.4)
Retail			-6.9 (5.9)			-13.2 (13.2)
Other			-13.6 (7.6)			-22.3 (16.3)
VC dummies	No	No	Yes	No	No	Yes
F-test Industry and VC dummies [p-val.]			F(8,52) = 0.95 [0.49]			F(8,52) = 1.78 [0.10]
Adjusted R-squared	0.19	0.37	0.39	0.03	0.13	0.20
Sample size	67	67	67	67	67	67

Table 10

Relation Between Allocations of Board Control Rights and VC Risk Analyses: Multivariate Analysis

Relationship between venture capitalist (VC) risk analyses and contractual terms for investments in 67 portfolio companies by 11 venture capital partnerships. Investments were made between 1987 and 1999. In specification (1) through (3) the dependent variable takes the value of one if the VC always controls more than half the board seats, and zero otherwise. In specification (4) through (6) the dependent variable takes the value of zero if the founder always control a majority of the board seats, one if outside board members are always pivotal, two if the VC controls the board only if the firms fails to meet some milestone or covenant, and three if the VC always controls more than half the board. Degree of external risk is the average of the dummy variables for the presence of market risk, competition risk, customer adoption risk, and financial market / exit risk. Degree of internal risk is the average of the dummy variables for the presence of management quality risk, questionable performance risk, contractual structure / downside risk, negative influence of other investors risk, and costly monitoring risk. Degree of complexity is the average of the dummy variables for product / technology risk and business model / strategy risk. Standard errors are in parentheses (for the simple logit regressions White robust standard errors are shown). Asterisks indicate significant differences at: 1% ***, 5% **, and 10% * levels. In specification 3, all retail observations had to be dropped because of collinearity: the VC did not have a majority of board seats for any of the retail companies in our sample.

	(1) VC has majority of board seats (logit) (0.53)	(2) VC has majority of board seats (logit) (1.29)	(3) VC has majority of board seats (logit) (2.65)	(4) Degree of VC board control (ordered probit) (0.35)	(5) Degree of VC board control (ordered probit) (0.37)	(6) Degree of VC board control (ordered probit) (0.44)
Constant	-0.98 (0.53)	-3.01** (1.29)	-5.42** (2.65)	-	-	-
Pre-revenue venture	1.87* (0.96)	1.99** (0.90)	2.52 (1.59)	1.00*** (0.35)	1.02*** (0.37)	0.87** (0.44)
Repeat entrepreneur	-0.28 (0.94)	1.60 (1.20)	2.38** (1.13)	-0.32 (0.38)	0.25 (0.43)	0.37 (0.48)
First VC fin. round	-1.50* (0.86)	-2.52*** (0.82)	-4.90*** (1.39)	-1.02*** (0.33)	-1.38*** (0.36)	-1.64*** (0.43)
Degree of external risk		1.18** (0.50)	2.60*** (0.90)		0.56*** (0.20)	0.64*** (0.23)
Degree of internal risk		1.05** (0.44)	2.17*** (0.83)		0.31* (0.17)	0.32 (0.21)
Degree of complexity risk		-0.45 (0.65)	-1.09 (0.98)		-0.20 (0.25)	-0.25 (0.28)
Biotech			-0.39 (2.68)			-0.19 (0.93)
IT / Software			2.94 (1.96)			0.71 (0.59)
Telecom			1.50 (2.33)			0.18 (0.73)
Healthcare			0.67 (2.21)			0.39 (0.72)
Retail			[dropped]			-0.94 (0.71)
VC dummies	No	No	Yes	No	No	Yes
χ^2 /F-test Industry and VC dummies [p-val.]			$\chi^2(6) = 7.88$ [0.25]			$\chi^2(7) = 9.58$ [0.21]
Ord. probit cutoff 1				-1.68 (0.33)	-1.28 (0.44)	-1.72 (0.85)
Ord. probit cutoff 2				0.06 (0.26)	0.70 (0.41)	0.53 (0.80)
Ord. probit cutoff 3				0.41 (0.27)	1.11 (0.42)	1.01 (0.82)
Adj. / Pseudo R-squared	0.12	0.30	0.46	0.09	0.17	0.24
Sample size	66	66	56	66	66	66

Table 11

Relation Between Allocations of Voting Control Rights and VC Risk Analyses: Multivariate Analysis

Relationship between venture capitalist (VC) risk analyses and contractual terms for investments in 67 portfolio companies by 11 venture capital partnerships. Investments were made between 1987 and 1999. Degree of external risk is the average of the dummy variables for the presence of market risk, competition risk, customer adoption risk, and financial market / exit risk. Degree of internal risk is the average of the dummy variables for the presence of management quality risk, questionable performance risk, contractual structure / downside risk, negative influence of other investors risk, and costly monitoring risk. Degree of complexity is the average of the dummy variables for product / technology risk and business model / strategy risk. First VC financing round takes the value of one if no VCs had invested in the company previous to this round, and zero otherwise. Pre-revenue venture takes the value of one if the venture is not generating any revenues at the time of financing, and zero otherwise. Repeat entrepreneur takes the value of one if the founder's previous venture was taken public or sold to public company. Standard errors are in parentheses (for the OLS regressions White robust standard errors are shown). Asterisks indicate significant differences at: 1% ***, 5% **, and 10% * levels.

	% VC votes in best case (logit)	% VC votes in best case (logit)	% VC votes in best case (logit)	Degree of VC voting control (ord. probit)	Degree of VC voting control (ord. probit)	Degree of VC voting control (ord. probit)
Constant	68.97*** (3.74)	60.74*** (5.02)	60.42*** (9.25)	-	-	-
Pre-revenue venture	13.40** (6.33)	11.15* (5.79)	3.75 (5.74)	0.98*** (0.38)	1.09*** (0.41)	1.22** (0.52)
Repeat entrepreneur	-8.06 (6.12)	-1.81 (6.67)	-3.90 (5.81)	-0.34 (0.41)	-0.03 (0.43)	-0.03 (0.48)
First VC fin. round	-26.12*** (5.35)	-27.79*** (5.13)	-21.67*** (5.41)	-1.81*** (0.41)	-2.00*** (0.43)	-1.76*** (0.50)
Degree of external risk		2.76 (2.13)	2.48 (2.71)		0.30 (0.20)	0.11 (0.24)
Degree of internal risk		6.82** (2.64)	6.66** (2.63)		0.36** (0.18)	0.28 (0.24)
Degree of complexity		-2.63 (3.69)	2.70 (3.82)		-0.00 (0.27)	0.32 (0.31)
Biotech			-5.27 (9.86)			-1.69 (1.06)
IT / Software			-1.35 (7.18)			-0.55 (0.61)
Telecom			7.71 (8.27)			-0.21 (0.91)
Healthcare			1.13 (9.71)			-0.75 (0.89)
Retail			-4.06 (8.91)			-0.44 (0.84)
VC dummies	No	No	Yes	No	No	Yes
χ^2/F -test Industry and VC dummies [p-val.]			F(7,52) = 4.68*** [0.00]			$\chi^2(7) = 12.73*$ [0.08]
Ord. probit cutoff 1				-2.16 (0.39)	-1.60 (0.50)	-2.63 (1.03)
Ord. probit cutoff 2				-1.65 (0.37)	-1.03 (0.49)	-1.99 (1.01)
Ord. probit cutoff 3				-1.14 (0.35)	-0.49 (0.47)	-1.35 (1.00)
Adj. / Pseudo R-squared	0.26	0.35	0.47	0.15	0.20	0.29
Sample size	67	67	67	67	67	67

Table 12

Relation Between Allocations of Liquidation Rights, Staging and VC Risk Analyses: Multivariate Analysis

Relationship between venture capitalist (VC) risk analyses and contractual terms for investments in 67 portfolio companies by 11 venture capital partnerships. Investments were made between 1987 and 1999. Degree of external risk is the average of the dummy variables for the presence of market risk, competition risk, customer adoption risk, and financial market / exit risk. Degree of internal risk is the average of the dummy variables for the presence of management quality risk, questionable performance risk, contractual structure / downside risk, negative influence of other investors risk, and costly monitoring risk. Industry median long-term debt ratio is the median ratio of long-term debt to assets for public firms in the venture's 3-digit SIC industry according to COMPUSTAT. Degree of complexity is the average of the dummy variables for product / technology risk and business model / strategy risk. White (1980) robust standard errors are in parentheses. Asterisks indicate significant differences at: 1% ***; 5% **, and 10% * levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	% of VC funding in round contingent	% of VC funding in round contingent	% of VC funding in round contingent	Number of months until next VC round	Number of months until next VC round	Number of months until next VC round	VC has redemption rights (logit)	VC has redemption rights (logit)	VC liq. claim > cumulative investment (logit)	VC liq. claim > cumulative investment (logit)
Constant	6.66 (5.18)	2.03 (6.41)	-	10.95*** (1.59)	11.27*** (1.94)	-	1.86** (0.89)	-1.05 (1.49)	2.59*** (0.98)	0.68 (1.67)
Pre-revenue venture	-0.98 (8.33)	-3.92 (6.74)	-11.92 (7.03)	-0.33 (1.95)	-1.02 (1.94)	1.39 (2.06)	-0.46 (0.89)	-0.65 (1.49)	-0.83 (0.91)	-2.02 (1.24)
Repeat entrepreneur	-4.67 (9.92)	1.17 (7.76)	-1.74 (7.25)	2.36 (1.94)	1.80 (1.80)	2.99 (1.79)	-1.19 (0.80)	-1.99** (0.94)	-1.09 (0.82)	-1.49 (1.34)
First VC fin. round	7.44 (6.94)	5.21 (6.58)	3.98 (6.39)	1.22 (1.94)	2.47 (1.87)	3.62* (2.14)	0.42 (0.88)	0.02 (0.95)	-0.63 (0.80)	-1.34 (1.02)
Industry median long-term debt ratio, %	1.39*** (0.29)	1.09*** (0.32)	0.65* (0.36)	-0.13** (0.06)	-0.07 (0.07)	-0.06 (0.08)	-0.02 (0.03)	1.97 (4.05)	1.45 (3.54)	-2.79 (5.23)
Degree of external risk		-0.00 (3.23)	1.93 (3.39)		-2.29*** (0.86)	-3.42*** (0.95)	0.96* (0.59)	1.70** (0.85)	0.68 (0.52)	1.23 (0.74)*
Degree of internal risk		12.07*** (3.40)	11.44*** (3.49)		-0.11 (0.64)	-1.00 (0.71)	-0.33 (0.47)	0.22 (0.61)	0.14 (0.39)	0.37 (0.60)
Degree of complexity		-5.20 (4.27)	-1.66 (5.14)		1.50 (1.18)	0.72 (1.37)	-0.38 (0.59)	0.04 (0.74)	-1.18** (0.57)	-1.63** (0.81)
Biotech			7.5 (10.7)			8.2 (3.4)		2.6 (2.0)		4.5 (2.5)
IT / Software			12.9 (11.1)			11.9 (2.6)		5.9 (1.8)		2.1 (2.1)
Telecom			21.0 (12.9)			10.9 (2.6)		2.2 (1.6)		4.4 (2.9)
Healthcare			23.4 (14.5)			11.9 (2.9)		0.2 (1.8)		3.9 (2.5)
Retail			-14.9 (12.1)			16.0 (2.8)		1.1 (1.4)		1.7 (1.5)
Other			10.3 (19.4)			17.6 (3.0)		-		-
VC dummies			Yes	No	No	Yes	No	Yes	No	Yes
χ^2 /F-test Industry and VC dummies [p-val.]			F(8,49)= 2.63** [0.02]			F(8,44)= 1.97* [0.07]		χ^2 (7)= 20.2*** [0.01]		χ^2 (7)= 4.89 [0.67]
Adj./Pseudo R-sq.	0.30	0.41	0.53	0.05	0.10	0.15	0.13	0.32	0.19	0.27
Sample size	65	65	65	60	60	60	65	65	64	64

Table 13

Relation Between Contracts and VC Monitoring and Support

Relationship between venture capitalist (VC) monitoring and support actions, undertaken and anticipated, and contractual terms for investments in 67 portfolio companies by 11 venture capital partnerships. Investments were made between 1987 and 1999. Degree of board control takes the value of 0.00 if the founder always control a majority of the board seats, 0.33 if outside board members are always pivotal, 0.67 if the VC controls the board only if the firms fails to meet a milestone, and 1.00 if the VC always has board majority. VC equity stake is measured assuming all performance benchmarks are met and all founder and employee equity vest. Syndicate size is the number of different venture capital funds that are investing in this or any previous round. White (1980) robust standard errors are in parentheses. Asterisks indicate significant differences at: 1% ***; 5% **, and 10% * levels. In regression 3, the 9 observations had to be dropped, since the healthcare dummy predicted success perfectly. In the two-stage least square specifications the contracting variables are instrumented by Pre-revenue, Repeat entrepreneur, First VC round, Degree of external risk, Degree of internal risk, and Degree of complexity risk.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	VC intervening in mgt team (Logit)	VC intervening in mgt team (Logit)	VC intervening in mgt team (2SLS)	VC value- added support (Logit)	VC value- added support (Logit)	VC value-added support (2SLS)	VC intervening in mgt team (Logit)	VC value-added support (Logit)
Constant	-0.87* (0.48)	-1.31 (2.79)	-0.07 (0.44)	-1.69** (0.80)	-4.97* (2.76)	-1.57 (0.85)	-0.30 (0.71)	-1.09 (0.49)
Pre-revenue venture		-1.12 (1.41)			-2.59 (1.78)			
Repeat entrepreneur		-0.13 (1.18)			1.19 (0.84)			
First VC fin. round		0.89 (1.28)			1.41 (1.59)			
Degree of board control	2.95** (1.27)	4.97** (2.33)	1.84** (0.85)		-1.52 (1.65)			1.01 (1.01)
Board ctl * syndicate size	-0.25 (0.16)	-0.20 (0.31)	-0.18* (0.11)		0.85** (0.40)			-0.05 (0.14)
VC best case equity stake		-2.26 (3.94)		3.38* (1.95)	7.92** (3.82)	4.06** (1.71)	1.56 (1.84)	
VC equity stake * syndicate size		-0.44 (0.60)		-0.27* (0.16)	-1.94** (0.90)	-0.25* (0.13)	-0.20 (0.15)	
Syndicate size		0.34 (0.44)			0.61 (0.49)			
Biotech		0.6 (1.7)	0.1 (0.4)		2.1 (1.6)	0.7 (0.5)		
IT / Software		-0.6 (1.3)	-0.1 (0.3)		-0.4 (1.1)	0.5 (0.4)		
Telecom		-1.9 (1.5)	-0.5 (0.3)		0.3 (1.2)	-0.0 (0.5)		
Healthcare		[dropped]	0.3 (0.3)		2.0 (1.7)	0.3 (0.3)		
Retail		0.5 (1.4)	0.4 (0.4)		0.4 (1.6)	0.6 (0.6)		
VC dummies	No	Yes	Yes	No	Yes	Yes	No	No
χ^2/F -test Industry and VC dummies [p-val.]		$\chi^2(6)= 3.9$ [0.69]	$F(7,55) = 1.65$ [0.14]		$\chi^2(7)= 7.0$ [0.43]	$F(7,56) = 1.01$ [0.44]		
Pseudo R-squared	0.08	0.20	-	0.04	0.23	-	0.02	0.01
Sample size	66	57	66	67	66	67	67	66