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## Characteristics, Contracts and Actions: Evidence From Venture Capitalist Analyses

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# Characteristics, Contracts and Actions: Evidence From Venture Capitalist Analyses

by

Steven N. Kaplan and Per Strömberg\*

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## Abstract

We study the investment analyses of 67 portfolio investments by 11 venture capital (VC) firms. VCs describe the strengths and risks of the investments as well as expected post-investment monitoring. We classify the risks into three categories and relate them to VC cash flow rights, control rights, liquidation rights, contingencies, and monitoring. The internal risk results suggest that agency problems are important to contract design and monitoring. The external risk results are inconsistent with risk sharing, but, instead, consistent with certain types of monitoring and screening. Expected VC monitoring and support are related to the contracts.

G24: Investment banking; Venture Capital; Brokerage

G32: Financing policy; Capital and ownership structure

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Most financial contracting theories address how conflicts between a principal / investor and an agent / entrepreneur affect aspects of ex ante investor information collection, contract design, and ex post monitoring. For example, when agency problems – moral hazard and asymmetric information – are more severe, the theories predict that entrepreneur compensation will be more performance sensitive, investors will have stronger control rights, and investor monitoring will be more intense.<sup>1</sup>

Most previous research, including our own, tries to capture agency problems using indirect measures – e.g., firm age, firm size, industry R&D intensity, and industry market-to-book ratio.<sup>2</sup> A major limitation of these proxies, however, is that they may not measure moral hazard and asymmetric information, but rather general uncertainty about external factors outside of the manager's control. As a result, a positive relationship of the proxy variables to incentive and control mechanisms may not represent important agency conflicts per se, and may even be inconsistent with some of the theories.

In this paper, we empirically test the financial contracting theory predictions using investments by venture capitalists (VCs) in early stage entrepreneurs – real world entities that arguably closely approximate the principals and agents of theory.<sup>3</sup> We focus on the information collection process and on the relation between that process, the ensuing financial contracts, and subsequent monitoring. Rather than using indirect measures, we use direct measures of risk obtained from the contemporaneous VC investment memoranda prepared to evaluate and subsequently monitor the investments. We believe these measures are more likely to distinguish agency conflicts from other types of uncertainty. In addition, as a practical matter, these measures also capture the risks that investors are most concerned with.

We examine the investment memoranda from 11 VC partnerships for investments in 67 companies. We complement this data with information from the company business plans, data on the

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<sup>1</sup> E.g., see Holmstrom (1979), Aghion and Bolton (1992), Dessein (2002), and Hart (2001).

<sup>2</sup> See, for example, Smith and Watts (1992), Gompers (1995), or Kaplan and Strömberg (2003).

<sup>3</sup> See Hart (2001) for a concurring view.

financial contracts from Kaplan and Strömberg (2003), and data on the subsequent performance of the companies.

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. VCs explicitly consider the attractiveness of the external environment - the market size, customer adoption, and competition - the feasibility of the strategy and technology, the quality of the management team, and the deal terms. VCs also explicitly delineate the risks involved in the investments. The risks typically relate to the same characteristics that the VCs evaluate for attractiveness. These results are consistent with those in MacMillan, et al. (1985), MacMillan, et al. (1987), and Fried & Hisrich (1994) who rely largely on survey evidence.<sup>4</sup>

Second, we use these assessments to form three different “risk measures”: (1) internal uncertainty – the relevant information is internal to the firm and it is more likely that the VC is less informed than the entrepreneur; (2) external uncertainty – the relevant information is external to the firm and it is more likely that the VC and the entrepreneur are equally informed; and (3) difficulty of execution, different from both previous notions of risk, which captures the complexity of the task and the reliance on the entrepreneur’s human capital. We compare the risk measures to the financial contracts.

If agency conflicts arising from moral hazard and asymmetric information are important, then the financial contracts should be related to internal uncertainty. For example, traditional moral hazard theories – e.g., Holmstrom (1979) – predict that compensation should be more tied to performance signals as agency problems increase. Control theories – e.g., Aghion and Bolton (1992) and Dessein (2002) – predict that investor control will increase in agency conflicts. Theories of debt – e.g., Ross (1977) and Diamond (1991) – predict that liquidation rights increase with asymmetric information.

The agency theories make mixed predictions regarding external uncertainty. Traditional moral

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<sup>4</sup> Also, see Bygrave and Timmons (1992) or Quindlen (2000).

hazard theories based on risk-sharing predict performance-based pay decreases with external uncertainty. Alternatively, more recent theories – e.g., Prendergast (2002) – suggest that performance-based pay and direct monitoring are substitutes. As external uncertainty increases, direct monitoring becomes less effective and principals make greater use of pay-performance incentives. The control-based theories like Aghion and Bolton (1992) do not make explicit predictions regarding external uncertainty. But, Dessein (2001) introduces asymmetric information into such a model and finds that VC control increases with the noise in post-contracting information. When external uncertainty makes it more difficult to discover the entrepreneur's type ex post, the VC requires more control.

Two types of theories make predictions regarding execution or complexity risk. Theories of multitasking – e.g., Holmstrom and Milgrom (1991) – predict that pay based on specific milestones should decrease as execution risk increases because compensation based on a signal correlated with a particular action will lead the manager to put too much emphasis on that action. Hold-up theories – e.g., Hart and Moore (1994) – suggest that in highly complex environments where the entrepreneur's human capital is particularly important, we should observe contracts – such as vesting provisions – that make it costlier for the entrepreneur to leave.

Consistent with the agency explanation, internal uncertainty is significantly related to many of the incentive and control mechanisms in the financial contracts. Higher internal risk is associated with more VC control, more contingent compensation to the entrepreneur, and more contingent financing in a given round. The primary exceptions are that the overall fraction of founder cash flow rights and some VC liquidation rights are not related to internal risk.

External uncertainty is related to many contractual features. Similar to internal risks, higher external risk is associated with more VC control, and more contingent compensation. Higher external risk is also associated with increases in the strength of VC liquidation rights, and tighter staging, in the sense of a shorter period between financing rounds. These findings are highly inconsistent with

optimal risk-sharing between risk-averse entrepreneurs and risk-neutral investors, a common assumption in standard agency models.

Risk related to difficulty of execution shows a (weakly) negative relation with many contractual mechanisms such as contingent compensation and VC liquidation rights. These results suggest that for highly complex environments, where the manager's human capital is particularly important, standard incentive mechanisms are less effective. Furthermore, execution risk is significantly positively related to founder vesting provisions. This result is consistent with the multitasking and hold-up theories.

Third, we relate the financial contracts to VC actions or monitoring. We use the investment analyses to measure the actions that the VCs took before investing and that the VCs expect to undertake conditional on investing. In at least half of the investments, the VC expects to play an important role in recruiting management. 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 confirm and complement previous results on VC support activities, e.g. Hellman and Puri (2000 and 2002).

Consistent with the control theories, VCs are more likely to strengthen management as VC control increases. These theories show that investor control is necessary to implement actions that reduce the entrepreneur's private benefits, such as management interventions.

In contrast to management interventions, VC value-added services are less likely to be met by entrepreneur resistance. Instead, theories such as Casamatta (2002), Cestone (2002), Inderst and Muller (2001), and Repullo and Suarez (2000), argue that the problem is to provide incentives for the VC to undertake such activities. As predicted, VC's value-added services increase as the VC's equity stake increases, but are not related to VC control.

Fourth, and finally, we relate the analyses and risk factors to subsequent investment outcomes. This section should be considered descriptive because the theories do not make clear predictions concerning outcomes. We find that internal risk is negatively related and external risk is positively related to subsequent outcomes.

Overall, we believe this paper makes three contributions. First, it adds to existing work by describing the characteristics and risks that VCs consider in actual deals. Second, the paper is novel in using investors' direct assessments of risks rather than the indirect proxies used in most previous research. The internal risk results strongly suggest that agency problems are very important to contract design. The external risk results suggest that risk-sharing concerns are unimportant relative to other concerns such as monitoring. Third, we show that VCs expect to take actions with their investments and the actions are related to the contracts. Expected VC management intervention is related to VC board control while VC support or advice is related to VC equity ownership.

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

## *I. Sample*

### *A. Description*

We analyze VC investments in 67 portfolio companies by 11 VC firms. This is a subsample of the 119 companies from 14 VC firms analyzed in Kaplan and Strömberg (2003). Kaplan and Strömberg (2003) obtained their sample by asking the VCs to provide detailed information on as many of their portfolio company investments as they were willing to provide. For each portfolio company and for each financing round for the company, the VC was asked to provide (1) the term sheet; (2) the

stock purchase and security purchase agreements; (3) the portfolio company's business plan; and (4) the VC's internal analysis of the investment.

Most VC firms 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 firms provided an investment 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 likely 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. We study the first investment made by the VC in these companies. 25 of these investments are pre-revenue rounds – the firms receiving financing either did not have revenues or were not yet operating. We refer to these as early stage rounds. The remaining investments are rounds in which the firms had revenues and were already operating.

For 44 companies, the investment is the first investment any VC ever made in the company; in the remaining 23, another VC had invested before our VC acquired a stake.

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

Panel C indicates that the companies represent a wide range of industries. The largest group, not surprisingly, is in information technology and software (24 companies or 36%), which we have



broken down into internet related (14 companies) and non-internet related (10 companies). The sample also includes biotech, telecom, healthcare, and retail ventures.

Panel D shows that the portfolio companies were funded by 11 United States-based VC firms with no more than 15 companies from any one VC. Three VCs are based in California, four in the Midwest, one in the Northeast, and three have multiple offices. Five of the VCs are among the top 50 VC firms in the US in terms of capital under management, and all but two are among the top 150.

Panel E shows that for the median investment in our sample, the VC firm providing the financing was 12 years old and had raised 5 funds amounting to \$290M.

Panel F 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.

Finally, Panel G indicates that by October 31, 2002, 15 of the 67 companies are public, 16 have been sold, and 13 have been liquidated. The remaining 23 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 3 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 VCs are qualitatively similar to the contractual characteristics for the investments made by the other 11 VCs. Furthermore, the 3 VCs that did not provide investment memos appear to be of the same average quality as the 11 that did.

Another possible bias is that the VCs provide us with memos on their better investments. This is unlikely for several 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 VCs who provided us memos provided all of their individual investments in the relevant sample period. The contractual terms for the 6 VCs who provided all their investments are similar to the results for the entire sample. Finally, investments with memos are marginally, but insignificantly less likely to have gone public than investments without memos.

Another possible bias is that the investments with memoranda are somehow more controversial. The results in the previous paragraph suggest this is not the case. Furthermore, of the six VCs who gave us all their investments, four gave us memoranda for all of the investments. The other two gave us full access to the files in their home offices. They told us that if memos were not in the files, they were probably with a partner in a different office.

There do not appear to be industry or geographic biases as the industries and locations of the sample companies are in line with those of all VC investments over the same period.

It is possible that the VCs we study have above average ability. This is true because we contacted only successful VCs. 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.

Finally, we do focus somewhat on earlier stage investments in that we use the investment memos from the first investment made by the VC in the portfolio company. We do not see how this would bias our results.

## *II. Description of VC investment analyses*

In this section, we describe the VC investment analyses. We categorize the investment theses and risks, and then we describe them. Next, we describe the actions the VCs expect to take. Finally, we report the financial forecasts in the analyses.

### *A. Classification scheme*

Previous work on VC company characteristics<sup>5</sup> distinguishes 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. We include these factors, but classify them into three categories that are motivated by the theoretical predictions described in the introduction.

The first category includes internal factors – management quality, performance to date, downside risk, influence of other investors, VC investment fit (a measure of monitoring costs), and valuation. These factors are related to management actions and / or the quality of the management team. We believe these factors are more likely to be one-sided or subject to asymmetric information and moral hazard with respect to the management team.

The second category includes those factors we view as external to the firm. We classify market size, customer adoption, competition, and exit condition risks as such factors. Because these 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 factors.

The third category measures factors related to difficulty of execution or implementation – product / technology and business strategy / model. These factors are designed to capture the complexity of the task and the reliance on the entrepreneur's human capital.

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<sup>5</sup> See e.g. MacMillan, Siegel, and SubbaNarasimha (1985).

We recognize that there may be alternative interpretations of our categories. We postpone a discussion of these alternatives until later when we present our results.

Table 2 summarizes the classifications, investment theses, and risks.

### *B. Investment Strengths / Theses*

Panel A shows that internal factors are important considerations in VC investments. In almost 60% of the investments, the VCs explicitly cite the quality of management as a reason for investing. In almost 27%, the VCs cite favorable performance to date. A favorable valuation or a low amount of capital at risk are each attractive in roughly 20% of the investments.

Panel B considers factors external to the firm. These, too, are important in the VC investment decision. Consistent with academic and practitioner accounts, VCs are attracted to large and growing markets. This was mentioned explicitly in almost 69% of the portfolio company investments. VCs also are attracted to favorable a competitive position and a high likelihood of customer adoption in roughly 30% of the investments. Finally, favorable exit conditions play a role in 16% of the investments.

Panel C considers factors related to execution. In at least 40% of the investments, VCs were attracted by the product / technology or by the strategy / business model;

### *C. Investment Risks*

While the VCs found the investments attractive on a number of dimensions, table 2 also indicates that the VCs viewed the investments as having substantial risks.

Panel A reports internal risks. The panel indicates that the primary internal risk identified by the VCs was management, viewed as risky in some respect 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. This can be reconciled by observing that a VC might think very highly of the founder, but be uncertain as to whether the founder can hire or build the rest of the management team.

Panel A also indicates that the other internal factors – valuation, VC investment fit, downside risk, performance to date, and other investor influence – are concerns in, respectively, 19%, 15%, 13%, 7.5%, and 6% of the investments.

Two observations are worth making about these risks. First, the risks of VC fit or involvement costs are 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. Second, we recognize that valuation is endogenous to the contracts and do not include valuation as a risk in the regressions that follow.

Panel B reports that external factors that the VCs viewed as sources of risk. In 40%, 31%, and 22%, respectively, of the investments, the VCs viewed the opportunity as having significant competitive, market size, and customer adoption risks. Interestingly, exit conditions were viewed as a risk in less than 8% of the investments.

Panel C reports that execution difficulties are also important risks. In just over 50% of the investments, the VC views the strategy or business model as risky. In 31%, the VC views that product and, or technology as risky.

In general, the strengths and risks we identify are similar to those emphasized in the VC strategy and management literature, as well as in anecdotal accounts. The biggest difference compared to their findings is the low ranking for exit conditions, both as investment strengths and as risks. 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.

*D. Relation of strengths, risks and firm characteristics*

Table 3 explores the relation of strengths and risks to each other and, then, to exogenous investment characteristics – pre- or post-revenue, first or subsequent round, industry research and development, pre- or post-1998, California or non-California investment, lead or non-lead investor, and VC firm experience. We measure strengths and risks as the average of the dummy variables for internal, external, and execution strengths and risks. This normalizes the measures to lie between zero and one. While this may “throw away” information, it has the advantage that it minimizes the amount of our own interpretation that we have to apply to the investment analyses. We do not include valuation risk which may be endogenous to the contracts.

Panel A shows that internal strengths are not correlated with the other strengths and risks. Internal risks are correlated with external strengths and risks. External strengths and risks are correlated with each other as are execution strengths and risks. The length of the investment memos is particularly correlated with internal risks and external strengths. Page length, therefore, only captures some of the information in our measures of strengths and risks.

Panel B shows that internal strengths are unrelated to any investment characteristics. External strengths are greater in non-California investments. Internal and external risks are greater for low R&D industries and non-California investments. Execution strengths and risks are greater in post-revenue companies. Finally execution strengths are greater in high R&D industries. Most of the significant differences, therefore, are found across different industries and geographically. These effects are hard to disentangle in our sample because they are correlated with VCs who tend to concentrate in particular industries and in particular geographies.<sup>6</sup> In the regressions, we can control for these effects using VC dummies.

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<sup>6</sup> For example, all our retail deals come from one VC that specializes in retail deals, and the same is true for our healthcare ventures.

Panel B also shows that memos are longer for non-California investments and for investment in which the VC is the lead investor. It is worth mentioning that the VCs are the lead investors in most of our sample companies (57 out of 67).

#### *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-ups, 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) and Baker and Gompers (2001) find that VCs play an important role on the board of directors. These papers suggest that venture capitalists both 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 4 confirms that VCs play a large role in shaping and recruiting the management team. In 16% of the investments, the VC plays a role in shaping the management 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 help shape the strategy and the business model before investing; in 30%, they expect to be active in these areas afterward. 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.<sup>7</sup>

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.

#### *F. Financial forecasts*

Finally, the investment analyses often included financial forecasts provided by management, by the VCs, or by both. Table 5 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.

### *III. The relationship between VC risk factors and contractual terms*

In this section, we compare the direct VC risk assessments to the financial contracts. The regressions utilize our three summary measures of internal, external and execution risk as independent variables.

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<sup>7</sup> Although we do not report this in a table, we find that the extent of VC actions is highly correlated with the VCs and with industry. This is consistent with survey evidence from MacMillan, Kulow, and Khoylian (1988) and Ruhnka, Feldman, and Dean (1992).



We believe this improves upon the indirect measures used in Kaplan and Strömberg (2003). As mentioned in the introduction, if agency conflicts arising from moral hazard and asymmetric information are important, then internal uncertainty should be significantly related to financial contracts. Agency theories also make predictions regarding external and execution risks. We discuss the theoretical predictions in relation to the empirical results below.

In the regression analysis, we focus on risks rather than on the investment strengths for three reasons. First, previous empirical work focuses on the risks. Second, the predictions from the theories tend to focus on the risks. Finally, given our small sample size, the collinearity between some of the risks and investment theses reduces the power of our tests.

One concern with such risk measures is that they might measure negatives rather than uncertainty. Accordingly, the regressions attempt to control for the overall attractiveness of an investment by including the average of the strengths less the risks in all the regressions.

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

Table 6 investigates the relation of the risk measures to different measures of founder cash flow incentives. We measure cash flow incentives in three ways – the fraction of cash flow rights obtained by the founder, the sensitivity of those rights to explicit benchmarks, and the sensitivity of those rights to time vesting.

We measure the fraction of cash flow rights as the fully diluted percentage of equity that the founder would own in a best case scenario – i.e., all performance benchmarks are met and full time vesting occurs.

While the fraction of cash flow rights provides one measure of pay-for-performance, it is imperfect in that it may also provide a measure of the division of value. Because the entrepreneur is typically cash constrained, the VC will require greater cash flow rights than would be optimal from an

incentive perspective.<sup>8</sup> VCs increase the pay-for-performance sensitivity over and above founder equity percentage in two ways – using vesting based on explicit performance benchmarks and time vesting.

The sensitivity of cash flow rights to explicit benchmarks measures the percentage of a founder's fully diluted equity stake that vests subject to explicit performance benchmarks. For example, if a founder owns 30% of a company's equity and can earn an additional 10% if the founder meets the performance benchmark, then this measure will equal 25% (10% divided by a total of 40%). We view this measure as a clearer indicator of pay-for-performance sensitivity.

The sensitivity of cash flow rights to time vesting measures the percentage of a founder's fully diluted equity stake that vests subject to the founder remaining employed at the company for a stated period of time. This sensitivity is calculated in the same way as the sensitivity to explicit benchmarks. The multitasking theories can be interpreted as implying that VCs will use time vesting rather than explicit performance benchmarks when such benchmarks are too noisy or could lead to multi-tasking problems.

An alternative (and not mutually exclusive) interpretation of time vesting is that it is a way to make it more costly for the entrepreneur to leave and, therefore, will be used when the entrepreneur's human capital is particularly important.

It is worth pointing out that we do not have systematic data on cash payments or salaries. We do not view this as a problem. Just as top executive cash compensation is relatively less important than equity incentives in large companies, this should be even more the case for top executives in start-ups.

The regressions also include a number of control variables: industry R&D to sales, a dummy variable for whether the venture is generating revenue, and dummy variables for whether the round is the first VC financing, whether any of the founders have previously founded a venture that was taken public or sold to another public company, whether the company is in California, whether the financing

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<sup>8</sup> See Inderst and Muller (2001).

takes place after 1997, for industry, and for VC.<sup>9</sup> These control variables are included so that we increase the likelihood that we isolate the effects of the risk variables. In unreported regressions, we also control for the annual level of commitments to venture capital partnerships, whether the VC was the lead investor, the number of pages in the memo, and industry market-to-book. None of those variables is consistently significant and our primary results are qualitatively and statistically identical.

The first two regressions in table 6 show that the net attractiveness of the investment – strengths minus risks – is positively, but not significantly related to the founder equity percentage. When the risk measures are excluded (in unreported regressions), net attractiveness (strengths minus risks) is positive and highly significant (at the 1% level), suggesting that there is some collinearity. Furthermore, in unreported regressions, net attractiveness is significantly positively related to pre-money value – the implied value of the company’s pre-financing equity.

Internal risk and external risk are negatively related to founder equity percentage, but not significantly so. The internal risk result is not consistent with the agency predictions. We suspect, however, that this occurs because founder equity percentage is more a measure of value than a measure of pay-performance incentives.

The second two regressions in table 6 investigate the use of explicit performance benchmarks in equity compensation. The use of such benchmarks is strongly increasing in internal risk. This is very supportive of the agency predictions.

In contrast, we also find a significantly positive relation between external risk and benchmark compensation. This is contrary to the standard risk-sharing theoretical prediction, but consistent with the monitoring-related theory of Prendergast (2002).<sup>10</sup>

The use of performance benchmarks also increases with the net attractiveness of the investment. Net attractiveness is included in this regression as a control so the implication of this

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<sup>9</sup> Because we only have a few observations for some of the VCs, we include a VC dummy only for the 5 VCs who have more than 4 investments in the sample.

result is theoretically less clear. The risk results are unaffected by removing the net attractiveness variable.

The last two regressions of table 6 examine the determinants of founder time vesting. The degree of execution risk is significantly positively related to the degree of time vesting, while both internal and external risks are insignificant. The positive relation between execution risk and vesting is consistent with the two theoretical explanations mentioned in the introduction. 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 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.

#### *B. The effect of risk on the allocation of control*

We now turn to the allocation of board control between the VC and the founder. We use our three risk variables and relate these to the degree of VC control. We use two 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: (a) equals zero if the founder always controls a majority of the seats; (b) equals one if (i) outside board members are always pivotal or (ii) the VC controls the board only if the firm fails to meet some milestone or covenant; and (c) equals three if the VC always controls a majority of the seats.

Table 7 displays the results using the two different measures of board control. Both the internal and external risk measures are associated with more VC board control and highly significant. The

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<sup>10</sup> The 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.

internal risk result is strongly supportive of the agency models focusing on control such as Aghion-Bolton (1992). The external risk result, again, is supportive of the monitoring-related theories such as Dessein (2001) rather than the risk-sharing theories.

Execution risk comes in with a negative sign and is statistically significant in one specification. One plausible explanation is that it would not be efficient for the VC to exercise control – e.g., by replacing management – because so much of the firm value is tied up in the founder’s human capital.

We obtain qualitatively similar results (that we do not report) when we use voting control rather than board control. 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).

### *C. The effect of risk on staging of funds and the allocation of liquidation rights.*

In this section, we investigate the relationship of staging and liquidation rights to the VC risk factors. As mentioned in the introduction, agency theories such as Ross (1977) and Diamond (1991) predict that these debt-like features should be related to internal risk. In these models, strong liquidation claims are relatively less attractive to low quality entrepreneurs.

First, we 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.

The regressions in table 8 present our staging results. The uses of the two types of staging seem differ with respect to our VC risk measures. 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).

Ex post staging is increasing in, but not significantly related to internal risk. Ex post staging increases significantly in the amount of risk external to the firm – the months until the next VC round decreases with external risk. This suggests that agency problems are not the key driver of ex post staging.

Table 9 investigates whether the different sources of risk are related to debt-like features in VC contracts: (1) redemption rights; (2) the size of the VCs claim in redemption or liquidation; and (3) anti-dilution provisions.

The dependent variable in the first two regressions is whether the VC has redemption rights. Redemption rights give the VC the right to demand that the firm redeem the VC's claim typically at liquidation value at some stated time after the investment. Redemption rights are increasing in external risk and in the net attractiveness of the investment, but are not related to internal risk. The interpretation of this result is not clear.

The dependent variable in the second two regressions in table 9 measures whether the VCs liquidation claim exceeds the VCs cumulative investment. This is, therefore, a measure of the strength of the liquidation claim. Again, this variable is increasing in external risk. Consistent with screening, it also is increasing in internal risk in the more general regression. In addition, the size of the liquidation claim also is significantly negatively related to execution risk. This is again consistent with the hold-up theories where collateral value is likely to be lower for companies with execution risk where more of the firm value is tied up in the founder's intangible human capital. Hence, the size of the liquidation claim will be lower for these ventures.

The dependent variable in the last two regressions in table 9 is the presence of full-ratchet anti-dilution protection. Anti-dilution provisions increase the number of shares the VC receives from its

investment if the company subsequently raises money at a lower valuation. Similar to liquidation claims, anti-dilution provisions protect the VC in bad states and are relatively less attractive to low quality entrepreneurs. The dependent variable equals one if the investment has the strongest anti-dilution protection – full ratchet. With this provision, if the firm subsequently raises money at a lower value, the entire VC investment is re-priced at that lower value.

The last two regressions show that anti-dilution protection is strongly increasing in internal risk consistent with the agency predictions.

Overall, the results for staging and liquidation rights are mixed. Agency problems, as measured by internal risk, clearly play a role, but not uniformly. Certain liquidation rights also are increasing in external risk. The theoretical explanation for this result is less clear. One possible explanation, particularly for ex post staging, is that external risk increases the value of the option to abandon the project.<sup>11</sup>

#### *D. Summary*

In this section, we have studied the relation of VC risk assessments to the relevant financial contracts.

Internal uncertainty is significantly related to many of the incentive and control mechanisms in the financial contracts. Higher internal risk is associated with more VC control, more contingent compensation to the entrepreneur, and more contingent financing in a given round. The primary exceptions are that the overall fraction of founder cash flow rights and some VC liquidation rights are not related to internal risk. Overall, we interpret these results as very positive for the agency theories. The results for performance benchmarks, VC control rights, and ex ante staging are very strong as are the theoretical predictions for them. In contrast, as we have argued, the overall fraction of founder cash flow rights is a noisier measure of pay-performance sensitivity.

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<sup>11</sup> See Berger, Ofek, and Swary (1996) and Cornelli and Yosha (2000).

External uncertainty is related to many contractual features. Similar to internal risks, higher external risk is associated with more VC control, and more contingent compensation. Higher external risk is also associated with increases in the strength of VC liquidation rights, and tighter staging, in the sense of a shorter period between financing rounds. These findings are highly inconsistent with optimal risk-sharing between risk-averse entrepreneurs and risk-neutral investors, a common assumption in standard agency models. Instead, these results are more consistent with the theories in Prendergast (2002) and Dessein (2001) in which external uncertainty makes monitoring more difficult.

Risk related to difficulty of execution shows a (weakly) negative relation with many contractual mechanisms such as contingent compensation and VC liquidation rights. These results suggest that for highly complex environments, where the manager's human capital is particularly important, standard incentive mechanisms are less effective. Furthermore, execution risk is significantly positively related to founder vesting provisions. This result is consistent with the multitasking and hold-up theories.

#### *E. Alternative interpretations*

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. As we argue in the previous section, we believe the results are consistent with this interpretation. Nevertheless, one can argue that our classification of risks is inappropriate. In this section, we address several of those arguments.

First, one might argue that the risks we classify as external are, instead, internal. For example, management may have better information on customer adoption, competition, or the market than the VC. We think this argument is unpersuasive. VCs typically undertake due diligence with respect to those risks that are external to the firm – like customer adoption, competition and the market – and



should be able to obtain the same information as the founders. In fact, for some of these risks, the VCs may even be better informed.<sup>12</sup> It is for risks internal to the firm, that the VCs are more likely to be at a disadvantage on average.

Second, one might argue that some of the risks we classify as internal are not related to asymmetric information and moral hazard problems. For example, management risk may also measure managerial overconfidence as ascertained by the VC, or simply differences of opinion. We are more sympathetic to this type of argument. At this point, our results on internal risk are consistent with agency explanations. We suspect that theories of differences of opinion would make similar predictions, particularly with respect to contingencies. It also seems possible that differences of opinion might generate similar predictions for external risk.

#### *IV. The relationship between contracting and monitoring*

In the previous section, we find a relation between the VC risk factors and the financial contracts. In this section, we consider the relation between the contracts and VC actions.

As we showed in table 4, above, the VC evaluation 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, the control theories predict that 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

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<sup>12</sup> Garmaise (2000) presents a model that makes exactly this assumption.

“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.<sup>13</sup>

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 likely to agree to. We consider actions related to strengthening and replacing the management team as 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 lead to conflict.

The theories suggest that the first set of actions is 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.<sup>14</sup>

Table 10 reports the results of regressions of expected VC monitoring and support activities on contract characteristics. Panel A considers expected management team interventions as a function of VC board control.<sup>15</sup> The regressions in panel A indicate that expected management interventions are strongly increasing in VC board control. Expected management interventions are also more likely when the VC is the lead investor and after 1997.

The last regression in panel A regresses management intervention against VC equity ownership. Expected management intervention is not related to VC equity ownership confirming that VC control and equity ownership are two separate factors.

The regressions in panel B of table 10 analyze expected value-added support activities as a function of the VC's equity stake. VC value-added support is always increasing in the VC's equity

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<sup>13</sup> See Casamatta (2000), Cestone (2002), Dessi (2001), Inderst and Müller (2001), Renucci (2000), Repullo and Suarez (1998), and Schmidt (1999).

<sup>14</sup> See Lerner (1994), and Sorensen and Stuart (2001).

stake. The interaction of VC equity stake and syndicate size is always negative and is significant in all but one specification. This suggests that syndication does reduce the individual VCs incentive to provide support.

The last regression shows that value-added support is unrelated to board control. In other words, 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 10 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. Relation of VC Analyses and Subsequent Outcomes.*

In this section, we consider the relation between the VC analyses and subsequent outcomes. Before describing the analysis, we mention two important qualifications. First, this section should be viewed as descriptive because the theories do not make any predictions concerning subsequent outcomes. Second, measuring the outcomes is not a trivial matter because: (a) a number of the investments are still private and have an as yet uncertain outcome; and (b) the value (and success) of investments that have gone public can vary substantially depending on the date one chooses to measure value.

We determine subsequent outcomes using press reports, company websites, public security filings, and conversations with the VCs. We follow the companies, if they exist, through November 1,

2002. Because of the spectacular rise and fall of technology stocks and technology company performance over the post-investment period, 7 of the sample companies issued equity to the public at substantial market capitalizations only to subsequently fail or trade at much lower market capitalizations. To account for the time-specificity of success, we measure subsequent outcomes as of two dates. First, we create an early outcome that uses the company value or performance shortly after the IPO. Second, we create a current outcome that uses the company values as of November 1, 2002.

The current outcome measure is more indicative of the eventual quality or performance of the company. The early outcome measure may capture the VCs' returns more accurately to the extent the VCs were able to sell their shares at the early outcome valuation.<sup>16</sup> The early outcome measure, however, is clearly influenced by the extraordinary market condition of 1998 to 2000. We prefer the current outcome as most indicative of the investment outcome.

We assign subsequent outcomes one of three values. The outcome variable takes the value '0' if the investment has failed; '1', if the investment is moderately successful or if success is unknown because the company is still private; and '2' if the investment is successful.

We consider an investment a failure if the company subsequently filed for bankruptcy or if the company was sold or liquidated at a value less than 50% of the VC's investment.

We consider the investment a success if the VC appears to have earned at least 3 times its investment. We assess whether the VC earned 3 times its investment by comparing the company's stock market capitalization or sale price to the post-money value at the financing round adjusting for the likely effect of subsequent equity financings.

Although we are not able to calculate an exact value for every company, we are confident that we have classified most companies correctly. Furthermore, the results are not sensitive to the numerical definition of failure and success.

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<sup>15</sup> The board control variable is the same as the variable used in the control regressions, but scaled to vary between 0 and 1.

<sup>16</sup> We are not able to track this for the entire sample. We are aware of at least two of the spectacular cases in which the VCs did not sell before the substantial stock price decline.

The results also are not sensitive to excluding companies that are still private from the analysis. We include such companies in the reported regression because the fact that they are still operating suggests they are not failures; and the fact that they are still private suggests that they are not hugely successful.

Using post-IPO company value and performance, we classify 14 investments at failures, 20 as successes, and 33 as in-between. Using November 2002 company value and performance, we classify 18 investments at failures, 14 as successes, and 35 as in-between.

Table 11 reports ordered probit regressions of the outcome on our risk measures and the control variables. The regressions indicate that early outcome success is positively related to external risk and to investments made in 1996. Current outcome success is positively related to external risk and negatively related to internal risk. Interestingly, neither early nor current outcome success is related to net investment strength.

Given that theory makes no predictions, we interpret these results cautiously. The negative relation between internal risk and current outcome can be interpreted as suggesting that VCs should have put a higher penalty on internal risk in making their investment decisions. Anecdotal evidence suggests that they are doing just that in the current environment – e.g., investing in more senior, more proven management teams.<sup>17</sup> The positive relation between external risk and both outcomes is supportive of our assumption that external risk measures volatility or uncertainty rather than negatives about the transaction. Perhaps the deals with positive draws and greater volatility were more likely to succeed.

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<sup>17</sup> See Bengtsson et al. (2002).

## VI. *Summary and Discussion*

In this paper, we consider study the contemporaneous investment analyses by 11 VC firms for investments in 67 portfolio companies. We relate these analyses to the financial contracts for the investments.

Overall, we believe this paper makes three contributions. First, it adds to existing work by describing the characteristics and risks that VCs consider in actual deals.

Second, we 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. The internal risk results strongly suggest that agency problems are very important to contract design. The external risk results suggest that risk-sharing concerns are unimportant relative to other concerns such as monitoring. The results for execution risk are generally consistent suggest that VCs consider the issues described in multitasking and hold-up theories.

Third, we show that VCs expect to take actions with their investments and the actions are related to the contracts. Expected VC management intervention is related to VC board control while VC support or advice is related to VC equity ownership. These results highlight and expand on the differences between intervening and supporting actions analyzed in Hellman and Puri (2002).

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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. VC firm location includes California (CA), Midwestern US (MW), Northeastern US (NE), and diverse locations (DIV). Data on capital managed and funds raised by VC firms come from Venture Economics.

<u>A.:</u>	<u>N</u>												
Number of portfolio companies	67												
Pre-revenue	25												
First VC investments	44												
Repeat entrepreneur	14												
Memo written by lead investor	57												
Located in California	25												
Located in North-East US	13												
Located in Midwest	11												
<b><u>B.:</u></b>	<b>By year initial round financed:</b>	<u>Pre-1995</u> <u>1996</u> <u>1997</u> <u>1998</u> <u>1999</u>											
# companies		11                      14                      12                      29                      1											
<b><u>C.:</u></b>	<b>By industry</b>	<u>Biotech</u> <u>Internet</u> <u>IT/Softw.</u> <u>Telecom</u> <u>Health-</u> <u>Retail</u> <u>Other</u>											
		<u>7</u> 14 <u>other</u> 10                      10 <u>care</u> 10                      6 <u>Industries</u>											
# companies		7                      14                      10                      10                      10                      10                      6											
<b><u>D.:</u></b>	<b>By VC firm</b>	<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>											
# portfolio companies in current draft		7    3    3    15    4    4    2    10    2    10    7											
Location		CA    MW    NE    MW    CA    MW    CA    DIV    MW    DIV    DIV											
Rank in terms of capital managed 2002, <= top		50    100    25    150    150    50    550    25    250    25    100											
<u>E.:</u>	VC firm characteristics:											<u>Mean</u>	<u>Median</u>
<u>By financing round (N=67):</u>													
VC firm age at time of financing round, years										13.3	12.0		
Number of funds raised by firm since foundation										5.9	5.0		
Amount raised by partnership since foundation (\$ millions)										448.9	289.7		
<u>By VC firm (N=11):</u>													
VC firm age, November 2002										16.7	15.0		
Number of funds raised by November 2002										11.2	8.5		
Capital under management, November 2002 (\$ millions)										1747.2	846.7		
<b><u>F.:</u></b>	<b>Financing Amounts</b>											<u>Mean</u>	<u>Median</u>
Total financing committed (\$ millions)										9.7	6.0		
Total financing provided (\$ millions)										5.5	4.8		
<u>G.:</u>	Outcomes as of 10/31/02	<u>Private</u>				<u>Public</u>				<u>Sold</u>		<u>Liquidated</u>	
	# of companies	23				15				16		13	

**Table 2**  
**Investment Theses and Risks in Venture Capitalist Analyses**

Explicitly mentioned (1) reasons for investing, and (2) risks of investment, according to venture capitalist analyses for investments in 67 portfolio companies by 11 venture capital partnerships. Investments were made between 1987 and 1999.

**A. Internal factors: Management, previous performance, funds at risk, other investors,**

	Reason to invest / Strength			Risk of investment / Weakness		
	N	%	Examples	N	%	Examples
Quality of management	40	59.7	<ul style="list-style-type: none"> <li>Management team has extensive internet and website management experience.</li> <li>Management team is believed to be good in science, and at raising and conserving money.</li> <li>Experienced managers out of successful venture backed company</li> <li>Highly sought-after entrepreneur/founder, who co-founded company that went public.</li> <li>Experienced, proven and high-profile CEO</li> <li>Founder has high marks from existing investors</li> <li>Known CEO for a long time.</li> <li>Executive team has acquired a significant level of penetration and relationships in a fairly short time</li> <li>CEO/founder is capable of attracting necessary employees. Has developed excellent product while consuming modest amounts of capital</li> <li>CEO is very frugal and will not spend unwisely</li> <li>Founder very committed: quit job at competitor and mortgaged his house.</li> <li>Team is well-balanced, young and aggressive.</li> </ul>	41	61.2	<ul style="list-style-type: none"> <li>CEO is a "rather difficult person". Active involvement of Chairman will be crucial.</li> <li>CEO/founder has a strong desire for acquisitions. VCs have to devote substantial time evaluate</li> <li>Management has not shown in the past that it can effectively forecast financial progress</li> <li>Company is in many seemingly disparate businesses; a reflection of management's lack of focus?</li> <li>Will management be able to integrate acquisitions?</li> <li>The CEO's choice of past companies questionable.</li> <li>Management is young and relatively inexperienced</li> <li>Management team is incomplete</li> <li>Company is highly reliant on one individual (the CEO)</li> <li>Company needs CEO, CFO, COO, and control (operating, reporting, billing) systems.</li> <li>Need seasoned industry executive.</li> <li>Incomplete management team. A milestones for further funding is hiring VP of sales and marketing .</li> <li>Must strengthen management and ensure involvement of VC as chairman. Will have to hire CEO.</li> </ul>
Performance to date	18	26.9	<ul style="list-style-type: none"> <li>Demonstrated profitability of business model</li> <li>Company has a manageable cash burn rate and is expected to be cash-flow break-even in 12 months</li> <li>Significant sales growth and momentum.</li> <li>Has developed product, well positioned to achieve revenue target.</li> </ul>	5	7.5	<ul style="list-style-type: none"> <li>Company is making losses and performing below plan</li> <li>Bad debt problem, which significantly changed the profitability of the company, because of past business procedures.</li> </ul>
Funds at risk / Downside	13	19.4	<ul style="list-style-type: none"> <li>Participating preferred protect VC if mediocre performance.</li> <li>Equipment can be funded with debt</li> <li>Investors have ability to control growth</li> <li>Minimize downside by only providing limited funds until milestones met</li> <li>VC commitment will be invested over time.</li> <li>Cash-efficient early stage thanks to future company acquisitions with stock</li> <li>Can take company to leading industry position with a minimum of capital.</li> </ul>	9	13.4	<ul style="list-style-type: none"> <li>Uncertainty about what proper milestones should be.</li> <li>Large amount of capital for a start-up enterprise. Will require strong management oversight.</li> <li>Aggressive bank loan assumptions. Might require either slower expansion or more equity capital</li> <li>Company has little in the way of underlying asset value and thus offers limited downside protection.</li> <li>Company expects to need additional financing next year. No assets of value except for employees.</li> <li>Need sufficient checks and balances regarding drawdown of funds</li> </ul>
Influence of other investors	4	6.0	<ul style="list-style-type: none"> <li>Investing partners include investors who previously invested early in some extremely successful companies</li> <li>Co-Investor also involved as active chairman and interim CEO.</li> </ul>	4	6.0	<ul style="list-style-type: none"> <li>Lead VC will not have unilateral control, but have to reach agreement with 3 other VCs.</li> <li>Previous investor (who is selling all shares to VCs) is anxious to get out at a deep discount</li> <li>Other VC previously decided not to finance deal.</li> </ul>
VC investment portfolio fit	12	17.9	<ul style="list-style-type: none"> <li>Adds additional breath to VC portfolio within this market segment</li> <li>VC is strong in this geographic region</li> <li>Good strategic fit with VC.</li> <li>VC has board seat on company in complementary business; marketing partnership possible.</li> <li>New market segment for VC, which should stimulate some additional opportunities.</li> <li>Potential for (Non-California) VC to lead a Silicon Valley deal.</li> </ul>	10	14.9	<ul style="list-style-type: none"> <li>Complicated legal and financial due diligence needed</li> <li>May require too much time from VC.</li> <li>Geographical risk – US corporate and overseas R&amp;D</li> <li>VCs have to devote substantial time to evaluate acquisitions.</li> <li>Heavy involvement of investor as interim CEO, (replacing founder) is critical to success.</li> <li>Have to ensure active involvement of one of VC investors as chairman.</li> </ul>
Valuation	14	20.9	<ul style="list-style-type: none"> <li>Low valuation: IRR of 46% in conservative case.</li> <li>Exit multiples are shooting up</li> </ul>	13	19.4	<ul style="list-style-type: none"> <li>Are the valuation and financial projections realistic?</li> <li>High valuation because of competition between VCs.</li> </ul>

**B. External factors: Market size, competition, customers, financial markets and exit conditions.**

	Reason to invest / Strength			Risk of investment / Weakness		
	N	%	Examples	N	%	Examples
Market size and growth	46	68.7%	<ul style="list-style-type: none"> <li>• Large market amenable to rapid growth</li> <li>• Very large market in which incumbents earn high profit margins</li> <li>• Company could dramatically impact the evolution of the computer industry</li> </ul>	21	31.3%	<ul style="list-style-type: none"> <li>• Regulatory uncertainty</li> <li>• Country risk.</li> <li>• Currency risk</li> <li>• New, largely unproven, marketplace</li> <li>• General downturn in industry</li> </ul>
Competition and Barriers to Entry	22	32.8%	<ul style="list-style-type: none"> <li>• Strong proprietary and patent position</li> <li>• Company is targeting a significant market segment that is underserved by incumbents</li> <li>• Early mover advantages from being pioneer of concept and largest player</li> <li>• Highly fragmented industry, which makes it ripe for consolidation</li> <li>• No competitors.</li> <li>• There is more than enough room for several competitors.</li> </ul>	27	40.3%	<ul style="list-style-type: none"> <li>• Customers might become competitors once they learn company's business model</li> <li>• Patent protection alone might not provide enough barriers to entry.</li> <li>• Many new entrants - price competition could drive down margins</li> <li>• Competitive and tight labor market, competing with larger established firms for employees.</li> <li>• New technology might be long-term threat.</li> <li>• Low barriers to entry. Low switching costs.</li> <li>• Product can be copied by large entrenched firms</li> </ul>
Likelihood of customer adoption	20	29.9%	<ul style="list-style-type: none"> <li>• Conceptual acceptance by professional community</li> <li>• Beta arrangements with large customers</li> <li>• Solid base of customers</li> <li>• Customers are positive regarding the product and the management team</li> </ul>	15	22.4%	<ul style="list-style-type: none"> <li>• Uncertain whether can convince customers to bet on an unproven technology</li> <li>• Customers may not want to pay enough of a premium for product</li> <li>• Target customers have not historically been speedy adopters.</li> <li>• Financial viability of customers and existing contracts questionable.</li> <li>• Challenge is to broaden the product beyond the initial customer segment.</li> </ul>
Financial market and exit conditions	11	16.4%	<ul style="list-style-type: none"> <li>• If successful, possibility for early exit or acquisition</li> <li>• Expect to have access to both public debt and equity on attractive terms</li> <li>• Quick flip potential for the investment</li> <li>• Many strategic buyers available</li> <li>• Recent public market enthusiasm for e-commerce companies might enable public equity financing to mitigate future financing risks</li> <li>• 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.</li> </ul>	5	7.5%	<ul style="list-style-type: none"> <li>• What will the leverage be and what happens to leverage if the IPO is delayed?</li> <li>• Would maybe be better to sell company</li> <li>• Financial market and political fluctuations.</li> <li>• How will public markets treat the company?</li> </ul>

### C. Difficulty of Execution: Product and Technology, Strategy

	Reason to invest / Strength			Risk of investment / Weakness		
	N	%	Examples	N	%	Examples
Product and/or technology	27	40.3	<ul style="list-style-type: none"> <li>• Late stages of product development (first product launch planned in 15-18 months)</li> <li>• Superior technology with large market potential</li> <li>• Revolutionary new technology</li> <li>• Has developed excellent product</li> <li>• Has built a robust, scalable system that can meet the current market demands.</li> <li>• Best product on the market.</li> <li>• Well tested technology/product.</li> <li>• Early stage company with post-beta product with competent/experienced technology team</li> </ul>	21	31.3	<ul style="list-style-type: none"> <li>• Outcome of clinical tests and development: Must prove that technology is superior to other marketed alternatives, in terms of efficiency and side effects.</li> <li>• Early stage research project: Project is elegant, ambitious and, consequently, difficult.</li> <li>• Ability to make technology work at target cost point</li> <li>• No guarantee product will work in a full production environment</li> <li>• Identification and development of a more compelling product..</li> <li>• Product scalability is to be fully tested.</li> </ul>
Business strategy/ model	36	53.7	<ul style="list-style-type: none"> <li>• Company significantly reduces costs while maintaining quality</li> <li>• Compelling business strategy. Presence or likelihood of validating corporate alliances</li> <li>• Outsourcing means less for company to manage</li> <li>• Attractive and demonstrated profitability of business model</li> <li>• Excellent new concept</li> <li>• Favorable acquisition opportunities, which will be driver of growth.</li> <li>• Distinctive strategy</li> <li>• High value-added, high margin strategy for very little capital upfront.</li> <li>• "Lean and mean" operation with few employees and good customer focus</li> <li>• Pure play / focused</li> </ul>	34	50.7	<ul style="list-style-type: none"> <li>• 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?</li> <li>• Are there enough candidates available for acquisition?</li> <li>• Will company be able to ensure quality while pursuing a growth-through-acquisition strategy?"</li> <li>• How scalable is the business? Is there any operating leverage in the business model?</li> <li>• Lack of focus?</li> <li>• Vulnerable strategy</li> <li>• Execution of business model has yet to be proven.</li> <li>• Will company be able to attract employees?</li> <li>• VC due diligence showed that margins and expense percentages of existing stores have to be brought into line with prototype model</li> <li>• Key partnerships not nailed down.</li> <li>• Geographical risk – US corporate and foreign R&amp;D</li> </ul>



**Table 3**  
**Relations between VC strengths, risks, 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. Internal risk is the average of the dummy variables for the presence of management quality, previous performance, funds-at-risk / downside, influence of other investors, and costly monitoring risks (strengths). External risks (strengths) is the average of the dummy variables for the presence of market, competition, customer adoption, and financial market / exit risks (strengths). Execution risks (strengths) is the average of the dummy variables for product / technology and business model / strategy risks (strengths). Sum of risks (strengths) is the sum of all 11 risk (strength) dummy variables. Strengths minus risks is the difference between Sum of risks and Sum of strengths. Pre-revenue stage rounds are financing rounds for companies that had no revenues at the time of the financing. First VC investments refer to the rounds involving the first time any venture capital fund invested in the company. Industry R&D/Sales is the aggregate R&D expense to sales for public firms in the venture's 3-digit SIC industry according to COMPUSTAT. CA (Non-CA) investment indicates that the portfolio company was (not) located in California at the time of financing. Lead investor indicated that the memo was written by the VC firm providing the largest amount of financing among the VCs investing in the round. Data on funds raised by VC firms are taken from Venture Economics. In panel B asterisks indicate significant differences using either a Mann-Whitney or a Kruskal-Wallis (for VC dummies) test, while in panel A asterisks indicate significant correlation coefficients at: 1% \*\*\*; 5% \*\*, and 10% \* levels.

**A. Correlations between strengths and risks (bivariate Pearson correlation coefficients)**

	Internal Strengths	Internal Risks	External Strengths	External Risks	Execution Strengths	Execution Risks	Strengths minus Risks	No. of pages in memo
Internal Strengths	1.000	0.051	0.022	-0.095	0.005	-0.038	0.527***	0.132
Internal Risks	0.051	1.000	0.315***	0.291**	-0.125	-0.012	-0.47***	0.558***
External Strengths,	0.022	0.315***	1.000	0.334***	-0.002	-0.006	0.256**	0.442***
External Risks	-0.095	0.291**	0.334***	1.000	0.089	0.089	-0.45***	0.215*
Execution Strengths	0.005	-0.125	-0.002	0.089	1.000	0.264**	0.254**	-0.025
Execution Risks	-0.038	-0.012	-0.006	0.089	0.264**	1.000	-0.284**	0.024
Strengths minus Risks	0.527***	-0.47***	0.256**	-0.45***	0.254**	-0.284**	1.000	-0.085
No. of pages in memo	0.132	0.558***	0.442***	0.215*	-0.025	0.024	-0.085	1.000

**B. Relation of risk factors and strengths to deal characteristics**

	All obs. (N=67)	Pre- (N=21) / Post (N=46) revenue	1 <sup>st</sup> (N=44) / subsequent (N=23) round	Ind. R&D/Sales <9% (N=32) / >=9% (N=34)	Before (N=37) / After (N=30) Jan. 1 1998	CA (N=25) / Non-CA (N=42) investment	Lead (N=57 ) / non-lead (N=10) investor	VC raised >6 (N=33) / <=6 funds (N=34)	VC dummies $\chi^2(10)=$
Internal Strengths	26.0	26.7 / 25.6	24.6 / 28.7	23.1 / 28.2	24.1 / 28.6	27.2 / 25.2	25.3 / 30.0	25.4 / 26.5	8.6
Internal Risks	20.9	22.9 / 20.0	23.2 / 16.5	29.4 / 12.4***	19.0 / 23.6	12.8 / 25.7**	22.1 / 14.0	21.2 / 20.6	32.4***
External Strengths,	36.9	38.1 / 36.4	39.2 / 32.6	39.8 / 34.6	37.8 / 35.7	28.0 / 42.3**	38.2 / 30.0	39.6 / 35.3	20.5**
External Risks	25.0	21.4 / 26.6	27.8 / 19.6	31.2 / 19.8**	25.6 / 24.1	17.0 / 29.8***	26.3 / 17.5	24.2 / 25.7	27.1***
Execution Strengths	47.0	33.3 / 53.2**	44.3 / 52.2	37.5 / 55.9**	46.2 / 48.2	52.0 / 44.0	49.1 / 35.0	47.0 / 47.1	7.7
Execution Risks	41.0	31.0 / 45.6*	40.9 / 41.3	35.9 / 45.6	41.0 / 41.1	40.0 / 41.7	42.1 / 35.0	43.9 / 38.2	13.6
Sum of Strengths	3.72	3.52 / 3.80	3.68 / 3.78	3.50 / 3.92	3.64 / 3.82	3.52 / 3.83	3.77 / 3.40	3.76 / 3.68	16.1*
Sum of Risks	2.87	2.62 / 2.98	3.09 / 2.43	3.44 / 2.32***	2.79 / 2.96	2.12 / 3.31***	3.00 / 2.10	2.91 / 2.82	37.8***
Strengths minus Risks	0.85	0.90 / 0.83	0.59 / 1.35*	0.06 / 1.59***	0.85 / 0.86	1.40 / 0.52	0.77 / 1.30	0.85 / 0.85	25.2***
No. of pages in memo	6.23	7.14 / 5.82	6.91 / 4.96	7.66 / 4.92	6.69 / 5.61	4.80 / 7.10**	6.84 / 2.80**	5.79 / 6.68	43.7***

**Table 4**  
**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		
Help 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 5**  
**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 <sup>st</sup> year after inv.			2 <sup>nd</sup> year after inv.			3 <sup>rd</sup> year after inv.			4 <sup>th</sup> 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 6**

**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. Founder equity % is the percentage of equity owned by the founders if performance benchmarks are met and all founder and employee equity vest, fully diluted. % of founder equity s.t. benchmarks (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 Founder equity %. 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, funds-at-risk / downside, negative influence of other investors risk, and costly monitoring risk. Degree of execution risk is the average of the dummy variables for product / technology risk and business model / strategy risk. Sum of risks (strengths) is the sum of all 11 risk (strength) dummy variables. Strengths minus risks is the sum of all 11 risk dummy variables minus the sum of all 11 strength dummy variables. 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. Industry R&D/Sales is the aggregate R&D expense to sales for public firms in the venture's 3-digit SIC industry according to COMPUSTAT. California deal is a dummy variable indicating that the portfolio company was located in California at the time of financing. White (1980) robust standard errors are in parentheses. Asterisks indicate significant differences at: 1% \*\*\*, 5% \*\*, and 10% \* levels.

	Founder equity %		Founder equity %		% of founder equity s.t. benchmarks		% of founder equity s.t. benchmarks		% of founder equity s.t. vesting		% of founder equity s.t. vesting	
Degree of internal risk	-14.51	(10.44)	-13.48	(9.50)	34.8	(13.7) **	32.34	(14.58) **	2.0	(25.3)	21.08	(26.50)
Degree of external risk	-10.78	(7.54)	-10.89	(8.21)	14.2	(5.8) **	11.63	(5.82) **	17.8	(17.4)	25.16	(21.03)
Degree of execution risk	0.03	(7.14)	-0.70	(7.84)	-2.4	(5.0)	1.35	(4.76)	24.5	(14.6) *	31.11	(15.32) **
Strengths minus risks	21.52	(16.16)	17.29	(17.19)	23.3	(10.5) **	23.70	(13.10) *	7.7	(30.5)	16.93	(29.23)
First VC fin. round	16.63	(4.89) ***	15.08	(5.80) **	1.7	(2.5)	4.72	(2.58) *	-4.4	(8.9)	-1.07	(9.67)
Repeat entrepreneur	-3.52	(6.22)	-3.40	(6.40)	-5.2	(3.3)	-2.97	(2.69)	-3.2	(11.6)	2.06	(12.22)
Pre-revenue venture	4.77	(4.80)	0.64	(6.52)	11.3	(4.4) **	9.21	(5.49) *	25.4	(11.6) **	11.55	(15.22)
Industry R&D / Sales, %			-1.61	(1.22)			-0.92	(0.53) *			3.73	(2.13) *
California deal			-0.63	(3.99)			-3.92	(2.49)			3.13	(10.47)
1998-99 dummy			-5.09	(4.44)			-1.00	(5.85)			-9.25	(11.28)
Biotech			17.89	(11.49)			5.67	(8.37)			25.53	(21.66)
Internet			5.25	(6.80)			4.13	(6.81)			17.35	(14.54)
Other IT / Software			7.34	(6.41)			1.89	(4.42)			16.37	(18.18)
Telecom			-4.09	(8.68)			11.50	(9.45)			69.80	(21.70) ***
F-test Industry [p-val.]			0.79	[0.54]			0.54	[0.71]			2.98	[0.03] **
VC dummies	Yes		Yes		Yes		Yes		Yes		Yes	
F-test VC dum. [p-val.]	4.05	[0.00] ***	3.11	[0.016] **	1.29	[0.28]	1.58	[0.18]	1.67	[0.16]	2.14	[0.08] *
Adjusted R-squared	0.39		0.38		0.40		0.45		0.14		0.17	
Sample size	67		67		67		67		67		67	

Table 7

**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 the first four regressions the dependent variable takes the value of one if the VC always controls more than half the board seats, and zero otherwise. In the last two regressions 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 or if the VC controls the board only if the firms fails to meet some milestone or covenant, and two 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, funds-at-risk / downside, negative influence of other investors risk, and costly monitoring risk. Degree of execution risk is the average of the dummy variables for product / technology risk and business model / strategy risk. Sum of risks (strengths) is the sum of all 11 risk (strength) dummy variables. Strengths minus risks is the sum of all 11 risk dummy variables minus the sum of all 11 strength dummy variables. 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. Industry R&D/Sales is the aggregate R&D expense to sales for public firms in the venture's 3-digit SIC industry according to COMPUSTAT. California deal is a dummy variable indicating that the portfolio company was located in California at the time of financing. Standard errors are in parentheses (for the simple probit regressions, White robust standard errors are shown). Asterisks indicate significant differences at: 1% \*\*\*, 5% \*\*, and 10% \* levels. In specification 3, 10 observations had to be dropped because of collinearity: one of the VC funds, specializing in the retail industry, did not initially have a majority of board seats for any of their investments in our sample.

	VC has majority of board seats (probit)		VC has majority of board seats (probit)		VC has majority of board seats (probit)		VC has majority of board seats (probit)		Degree of VC board control (ord. probit)		Degree of VC board control (ord. probit)	
Constant	-2.34	(0.76) ***	-3.4	(1.1) ***			-3.19	(1.59) **				
Degree of internal risk	3.12	(1.02) ***	2.26	(0.97) **	3.85	(1.39) ***	3.22	(1.20) ***	1.94	(0.97) **	1.68	(0.98) *
Degree of external risk	2.46	(0.96) ***	2.08	(0.95) **	3.02	(1.06) ***	3.33	(1.43) **	2.06	(0.78) ***	2.37	(0.84) ***
Degree of execution risk	-0.29	(0.70)	-0.14	(0.70)	-0.93	(1.05)	-1.50	(0.90) *	-0.18	(0.63)	-0.13	(0.65)
Strengths minus risks	1.99	(1.60)	1.69	(1.55)	-0.76	(2.03)	0.89	(1.98)	0.59	(1.31)	1.37	(1.41)
First VC fin. round	-1.47	(0.45) ***	-0.94	(0.54) *	-2.20	(0.57) ***	-2.43	(0.78) ***	-1.89	(0.50) ***	-2.13	(0.57) ***
Repeat entrepreneur	0.91	(0.58)	0.78	(0.57)	1.07	(0.70)	0.91	(0.55) *	0.63	(0.53)	0.48	(0.56)
Pre-revenue venture	1.19	(0.51) **	1.06	(0.52) **	1.13	(0.54) **	2.45	(0.82) ***	1.13	(0.47)	2.40	(0.65) ***
% VC equity			2.38	(1.29) ***								
Industry R&D / Sales, %							0.05	(0.11)			0.02	(0.06)
California deal							-1.44	(0.58) **			-0.70	(0.46)
1998-99 dummy							1.13	(0.61) *			1.43	(0.54) ***
Biotech							-1.15	(1.56)			-1.17	(0.99)
Internet							1.29	(0.96)			0.10	(0.65)
Other IT / Software							0.79	(1.13)			0.20	(0.65)
Telecom							-0.08	(0.97)			-0.39	(0.66)
$\chi^2$ -test Industry [p-val.]							6.14	[0.189]			2.93	[0.570]
VC dummies	No		No		Yes		No		Yes		No	
$\chi^2$ -test VC dum. [p-val.]					1.34	[0.854]			4.72	[0.451]		
Pseudo R-squared	0.33		0.36		0.39		0.49		0.31		0.37	
Ordered probit cut-offs:												
0 to 1									-1.59	(1.24)	-0.33	(1.14)
1 to 2									1.40	(1.19)	2.98	(1.19)
Sample size	66		66		56		66		66		66	

Table 8

**Relation Between Milestone Financings, 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. % of VC funding in round contingent denotes the fraction of the VCs' funding commitment that is released upon meeting future milestones. 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, funds-at-risk / downside, negative influence of other investors risk, and costly monitoring risk. Degree of execution risk is the average of the dummy variables for product / technology risk and business model / strategy risk. Sum of risks (strengths) is the sum of all 11 risk (strength) dummy variables. Strengths minus risks is the sum of all 11 risk dummy variables minus the sum of all 11 strength dummy variables. 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. California deal is a dummy variable indicating that the portfolio company was located in California at the time of financing. Industry LTD/Assets is the median ratio of long-term debt to assets; Industry R&D/Sales is the aggregate R&D expense to sales; and Industry Mkt -to-Book is the median of (book value of assets – book value of equity + market value of equity) / (book value of assets); all calculated for public firms in the venture's 3-digit SIC industry according to COMPUSTAT. White (1980) robust standard errors are in parentheses. Asterisks indicate significant differences at: 1% \*\*\*; 5% \*\*, and 10% \* levels.

	% of VC funding in round contingent (OLS)		% of VC funding in round contingent (OLS)		% of VC funding in round contingent (OLS)		Number of months until next VC round (OLS)		Number of months until next VC round (OLS)		Number of months until next VC round (OLS)	
Constant	5.90	(12.37)					13.54	(2.67) ***				
Degree of internal risk	59.50	(15.75)***	44.53	(17.51)**	40.00	(15.48)**	-5.18	(3.20)	-6.09	(3.90)	-6.18	(4.10)
Degree of external risk	13.80	(9.17)	10.25	(9.66)	2.36	(8.82)	-7.71	(2.90) ***	-8.88	(3.11) ***	-9.17	(3.73) **
Degree of execution risk	-14.35	(10.98)	-10.09	(11.00)	-3.97	(10.60)	1.66	(2.48)	1.28	(3.35)	0.73	(3.54)
Strengths minus risks	8.50	(23.01)	-11.26	(21.46)	-16.44	(21.14)	-9.36	(6.64)	-5.63	(7.91)	-5.18	(7.62)
First VC fin. round	-2.05	(7.86)	-1.82	(6.16)	4.53	(6.72)	1.67	(1.86)	2.03	(1.93)	1.94	(1.93)
Repeat entrepreneur	-5.50	(8.22)	-7.07	(6.83)	-2.12	(6.45)	2.12	(1.75)	2.57	(1.69)	2.55	(1.89)
Pre-revenue venture	5.89	(7.16)	-8.15	(7.42)	-13.49	(8.91)	-0.70	(1.87)	0.41	(1.99)	1.52	(2.44)
Industry R&D / Sales, %					-1.33	(1.54) *					0.40	(0.33)
California deal					-10.74	(5.43)					-0.23	(1.96)
1998-99 dummy					-5.77	(6.96)					0.45	(1.93)
Biotech					8.36	(15.76)					-6.33	(4.79)
Internet					11.52	(12.59)					-1.25	(3.70)
Other IT / Software					1.04	(12.68)					0.74	(4.13)
Telecom					22.32	(17.92)					-2.48	(4.72)
F-test Industry [p-val.]					0.66	[0.624]					0.73	[0.577]
VC dummies	No		Yes		Yes		No		Yes		Yes	
F-test VC dum. [p-val.]			6.18	[0.000]***	5.02	[0.001]***			1.17	[0.336]	1.34	[0.248]
Adj. R-squared	0.25		0.48		0.53		0.10		0.09		0.02	
Sample size	67		67		67		62		62		62	

Table 9

**Relation Between Allocations of Liquidation Rights, Anti-dilution 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. VC liq. claim > cumulative investment is a dummy variable for whether the VCs liquidation claim is larger than the accumulated VC investment, through cumulative dividends, participating preferred, or other liquidation preference provisions. 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, funds-at-risk / downside, negative influence of other investors risk, and costly monitoring risk. Degree of execution risk is the average of the dummy variables for product / technology risk and business model / strategy risk. Sum of risks (strengths) is the sum of all 11 risk (strength) dummy variables. Strengths minus risks is the sum of all 11 risk dummy variables minus the sum of all 11 strength dummy variables. 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. California deal is a dummy variable indicating that the portfolio company was located in California at the time of financing. Industry LTD/Assets is the median ratio of long-term debt to assets; Industry R&D/Sales is the aggregate R&D expense to sales; and Industry Mkt -to-Book is the median of (book value of assets – book value of equity + market value of equity) / (book value of assets); all calculated for public firms in the venture's 3-digit SIC industry according to COMPUSTAT. White (1980) robust standard errors are in parentheses. Asterisks indicate significant differences at: 1% \*\*\*, 5% \*\*, and 10% \* levels.

	VC has redemption rights (probit)		VC has redemption rights (probit)		VC liq. claim > cumulative investment (probit)		VC liq. claim > cumul. investm.(probit)		VC has full-ratchet anti-dilution (probit)		VC has full-ratchet anti-dilution (probit)	
Constant	0.30	(0.66)			0.96	(0.67)			-1.78	(0.68)		
Degree of internal risk	0.03	(1.04)	2.44	(1.80)	1.18	(0.91)	2.59	(1.32) **	1.52	(0.80) *	4.81	(1.67) ***
Degree of external risk	2.00	(0.95) **	4.75	(2.20) **	1.68	(0.95) *	2.28	(1.02) **	0.18	(0.70)	1.24	(0.91)
Degree of execution risk	0.03	(0.74)	1.92	(1.42)	-1.13	(0.68) *	-1.56	(0.95) *	0.45	(0.63)	0.86	(0.85)
Strengths minus risks	3.04	(1.25) **	6.64	(3.19) **	2.48	(1.33) *	2.15	(1.16) *	1.99	(1.15) *	5.26	(1.99) ***
First VC fin. round	0.37	(0.46)	1.09	(0.72)	-0.35	(0.44)	-0.40	(0.52)	0.61	(0.42)	0.54	(0.60)
Repeat entrepreneur	-0.68	(0.46)	-0.78	(0.51)	-0.74	(0.49)	-0.69	(0.69)	-0.58	(0.64)	0.38	(0.82)
Pre-revenue venture	-0.35	(0.50)	1.37	(0.88)	-0.43	(0.48)	-1.65	(0.71) **	-0.19	(0.43)	-0.69	(0.76)
Industry R&D / Sales, %			0.03	(0.13)			-0.11	(0.14)			0.14	(0.23)
California deal			1.59	(0.83) *			-0.30	(0.45)			0.82	(0.59)
1998-99 dummy			-0.78	(0.70)			-1.09	(0.55) **			-1.83	(0.77) **
Biotech			0.26	(1.21)			3.16	(1.44)			Dropped due to collinearity	
Internet			2.43	(1.19) **			1.22	(1.00)			0.89	(0.82)
Other IT / Software			Dropped due to collinearity: predicted success perfectly				0.80	(0.88)			0.17	(0.82)
Telecom			1.19	(1.59)			3.76	(1.82)			Dropped due to collinearity	
$\chi^2$ -test Industry [p-val..]			6.13	[0.106]			6.49	[0.165]			1.40	[0.498]
VC dummies	No		Yes		No		Yes		No		Yes	
$\chi^2$ -test VC dum. [p-val.]			9.78	[0.281]			7.79	[0.555]			13.11	[0.011]
Pseudo R-squared	0.18		0.40		0.23		0.38		0.13		0.35	
Sample size	67		57		66		66		67		48	

**Table 10**  
**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 if the founder always control a majority of the board seats, 0.5 if (a) outside board members are always pivotal or (b) the VC controls the board only if the firms fails to meet a milestone, and 1 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. First VC investments refer to the rounds involving the first time any venture capital fund invested in the company. Industry R&D/Sales is the aggregate R&D expense to sales for public firms in the venture's 3-digit SIC industry according to COMPUSTAT. California deal indicates that the portfolio company was located in California at the time of financing. Lead investor indicated that the memo was written by the VC firm providing the largest amount of financing among the VCs investing in the round. White (1980) robust standard errors are in parentheses. Asterisks indicate significant differences at: 1% \*\*\*; 5% \*\*, and 10% \* levels. In regressions 2 and 4, 9 observations had to be dropped, since one VC dummy (for a fund specialized in healthcare investments) 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 execution risk.

	VC intervening in mgt team (Probit)		VC intervening in mgt team (Probit)		VC intervening in mgt team (Probit)		VC intervening in mgt team (Probit)		VC intervening in mgt team (2SLS)		VC intervening in mgt team (Probit)	
Constant	-0.53	(0.29)			-2.91	(1.29) **					-0.18	(0.44)
Degree of board control	1.77	(0.72) **	2.40	(0.90) ***	2.18	(0.92) **	4.43	(1.30) ***	1.57	(0.91) *		
Board ctl*syndic. size	-0.15	(0.10)	-0.21	(0.12) *	-0.11	(0.17)	-0.12	(0.22)	-0.19	(0.16)		
VC equity stake					-0.17	(1.60)	0.91	(3.20)			0.95	(1.12)
VC equity* syndic. size					-0.20	(0.32)	-0.78	(0.45) *			-0.12	(0.10)
Syndicate size					0.29	(0.20)	0.78	(0.38) *				
VC is lead investor					1.02	(0.60) *	2.18	(1.22) *				
Pre-revenue venture					-0.45	(0.42)	-0.07	(1.03)				
Repeat entrepreneur					-0.12	(0.42)	-0.50	(0.58)				
First VC fin. round					1.14	(0.57) **	2.51	(1.40) *				
Ind. R&D / Sales, %							0.31	(0.15) **				
California deal							1.20	(0.65) *				
1998-99 dummy							1.06	(0.54) **				
Biotech			0.23	(0.84)			-1.89	(1.23)	0.14	(0.34)		
Internet			0.07	(0.63)			-1.48	(0.81) *	-0.09	(0.27)		
Other IT / Software			-0.03	(0.66)			-0.67	(0.84)	-0.02	(0.27)		
Telecom			-1.32	(0.82)			-1.79	(1.28)	0.14	(0.34)		
χ <sup>2</sup> -test Industry [p-v]			4.67	[0.332]			4.58	[0.333]	1.47	[0.224]		
VC dummies	No		Yes		No		Yes		Yes		No	
χ <sup>2</sup> -test VC dum. [p-v]			0.90	[0.924]			5.14	[0.273]	0.26	[0.932]		
(Pseudo) R-squared	0.08		0.15		0.16		0.45		0.05		0.02	
Sample size	66		57		66		57		67		67	

**Table 10, continued.**  
**Relation Between Contracts and VC Monitoring and Support, continued.**

	VC value-added support (Probit)		VC value-added support (Probit)		VC value-added support (Probit)		VC value-added support (Probit)		VC value-added support (2SLS)		VC value-added support (Probit)	
Constant	-1.03	(0.47)**			-3.67	(1.47) ***					-0.72	(0.30) **
Degree of board control					-0.98	(0.96)					0.76	(0.63)
Board ctl*syndic. size					0.47	(0.21)**					-0.04	(0.09)
VC equity stake	2.06	(1.17) *	2.39	(1.44) *	4.86	(1.85) ***	6.23	(2.67) **	3.94	(1.71) **		
VC equity* syndic. size	-0.17	(0.10) *	-0.17	(0.12)	-1.10	(0.45) **	-1.60	(0.57) ***	-0.24	(0.12) **		
Syndicate size					0.38	(0.24)	0.71	(0.34) **				
VC is lead investor					0.97	(0.76)	0.84	(0.75)				
Pre-revenue venture					-1.00	(0.47) **	-0.84	(0.94)				
Repeat entrepreneur					0.41	(0.44)	0.84	(0.46) *				
First VC fin. round					0.82	(0.63)	0.35	(0.85)				
Ind. R&D / Sales, %							-0.02	(0.09)				
California deal							-0.14	(0.50)				
1998-99 dummy							0.85	(0.48)				
Biotech			0.59	(0.91)			0.66	(0.89)	0.53	(0.52)		
Internet			0.14	(0.67)			-1.04	(0.78)	0.27	(0.39)		
Other IT / Software			0.31	(0.71)			0.47	(0.74)	0.50	(0.43)		
Telecom			-0.22	(0.78)			-0.60	(1.03)	-0.16	(0.47)		
$\chi^2$ -test Industry [p-v]			1.27	[0.866]			6.79	[0.148]	1.08	[0.377]		
VC dummies	No		Yes		No		Yes		Yes		No	
$\chi^2$ -test VC dum. [p-v]			6.00	[0.306]			6.29	[0.279]	1.13	[0.356]		
(Pseudo) R-squared	0.04		0.11		0.17		0.32		-		0.02	
Sample size	67		67		66		66		67		66	

**Table 11**  
**Relation Between VC analyses and subsequent outcomes: Multivariate Analysis**

Relationship between venture capitalist (VC) risk analyses and degree of investment success for investments in 67 portfolio companies by 11 venture capital partnerships. Investments were made between 1987 and 1999. The dependent variable takes the value '0' if the investment was a failure, '1' if the investment was moderately successful, or if success is unknown, and '2' if the investment was successful. 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, funds-at-risk / downside, negative influence of other investors risk, and costly monitoring risk. Degree of execution risk is the average of the dummy variables for product / technology risk and business model / strategy risk. Sum of risks (strengths) is the sum of all 11 risk (strength) dummy variables. Strengths minus risks is the sum of all 11 risk dummy variables minus the sum of all 11 strength dummy variables. 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. Months since financing is the number of months since the financing round took place (measured as of October 2002). Asterisks indicate significant differences at: 1% \*\*\*, 5% \*\*, and 10% \* levels.

	Degree of success based on value at time of initial exit (ordered probit)			Degree of success based on value at 11/01/2002 (ordered probit)		
Degree of internal risk	-0.80 (0.68)	-0.09 (0.79)	-0.03 (0.89)	-1.59 (0.70) * *	-1.50 (0.79) *	-1.64 (0.92) *
Degree of external risk	0.61 (0.59)	1.08 (0.65) *	1.22 (0.71) *	0.63 (0.58)	0.74 (0.63)	1.31 (0.70) *
Degree of execution risk	-0.90 (0.52) *	-0.75 (0.57)	-0.83 (0.59)	0.02 (0.51)	0.11 (0.55)	0.02 (0.59)
Strengths minus risks	-0.94 (1.07)	-0.50 (1.21)	-1.08 (1.29)	-1.95 (1.08) *	-1.51 (1.20)	-1.92 (1.31)
Pre-revenue venture	0.18 (0.34)	0.29 (0.42)	0.23 (0.50)	-0.21 (0.34)	-0.15 (0.41)	-0.35 (0.49)
First VC fin. round	-0.36 (0.32)	-0.09 (0.36)	-0.14 (0.41)	-0.05 (0.32)	0.20 (0.36)	0.11 (0.41)
1998-99 dummy	0.18 (0.41)	0.63 (0.51)	0.85 (1.13)	0.10 (0.41)	0.40 (0.50)	1.77 (1.14)
1997 dummy	-0.12 (0.48)	0.22 (0.56)	0.49 (0.97)	0.02 (0.49)	0.33 (0.55)	1.52 (0.98)
1996 dummy	0.79 (0.49)	1.09 (0.54) **	1.26 (0.85)	0.18 (0.48)	0.23 (0.50)	1.07 (0.84)
Months since financing			0.01 (0.01)			0.02 (0.01) **
Biotech			0.77 (1.07)			2.00 (1.03) *
Internet			1.31 (0.76) *			1.28 (0.77) *
Other IT / Software			0.83 (0.74)			1.07 (0.74)
Telecom			0.47 (0.83)			0.48 (0.82)
F-test Industry [p-val.]			3.81 [0.433]			6.11 [0.191]
VC dummies	No	Yes	Yes	No	Yes	Yes
F-test VC dum. [p-val.]		12.7 [0.026] **	9.71 [0.084] *		4.83 [0.437]	3.65 [0.600]
Ordered probit cut-offs:						
'Bad' to 'Moderate'	-1.31 (0.56)	-0.21 (0.79)	1.09 (1.79)	-1.04 (0.56)	-0.28 (0.78)	3.22 (1.81)
'Moderate' to 'Good'	0.13 (0.54)	1.42 (0.81)	2.79 (1.81)	0.52 (0.55)	1.36 (0.79)	5.07 (1.85)
Pseudo R-squared	0.08	0.17	0.21	0.07	0.11	0.21
Sample size	67	67	67	67	67	67