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# **The Staging of Venture Equity Capital and Venture Capitalist Bargaining Power**

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In this paper we look at the effects of bargaining power on the types of entrepreneurial projects chosen by venture capitalists and show that a wealth-constrained venture capitalist prefers to provide equity financing to a two-stage rather than to a similar single-stage project.

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While the venture capitalist does not have bargaining power over the entrepreneur of a single-stage project and is thus unable to extract any surplus, the venture capitalist does have this advantage in a two-stage project and, provided the project is good, can demand a portion of the surplus as a pre-condition for providing follow-on capital. This suggests that venture capitalists should stage their capital investments in order to improve their bargaining power, allowing them to earn greater profits from successful entrepreneurial projects.

## I. Introduction

Venture capital financing has received a great deal of attention lately from both empirical and theoretical researchers. But what is venture capital financing, and more specifically, what do venture capitalists do? Barry (1994) suggests that "...venture capitalists seek out promising ventures, eventually placing money in risky ventures managed by entrepreneurs with unknown skills and unpredictable future efforts. Such investments are often made in firms that have yet to register any revenue." It is perhaps due to these risks that venture capitalists tend to stage their capital investments. Sahlman (1988, 1990) shows that by staging capital to an entrepreneurial project, a venture capitalist is able to create an abandonment option that leads to an increase in the value of the investment. Admati and Pfleiderer (1994) find that the abandonment option may be valuable because entrepreneurs always prefer to continue bad projects as long as others finance them. In the same vein, Gompers (1995) demonstrates how staging can solve agency problems and create strategic options for the venture capitalist. Neher (1999) shows that by slowly transforming the human capital of the entrepreneur to tangible or 'fixed' capital, staging can reduce asymmetric information problems related to the venture, and make it easier for the entrepreneur to obtain outside financing. Studies have also found that staging capital can reduce moral hazard, i.e. make the entrepreneur exert greater effort, by allowing the venture capitalist to learn the value of the project incrementally in each project stage (e.g., Bergemann and Hege 1998; Noldeke and Schmidt 1998), and by giving the venture capitalist the ability to deny follow-on financing (e.g. Neher 1996; Landier 2002). Bergemann and Hege (1999, 2000) study the optimal compensation for the entrepreneur in a dynamic (staged) model, where the allocation of funds and the learning process are subject to moral hazard. Trester (1998) considers the problem of asymmetric information and compares the incentives of the entrepreneur to steal from the project under venture capitalist supplied preferred equity and debt financing.

In this paper, we examine how bargaining power affects the venture capitalist's decision to stage equity capital. We find that venture capitalists have greater bargaining power when equity capital is provided in two (or more) stages, allowing them to extract greater rents from profitable projects. Thus, venture capitalists may prefer to stage capital because of the superior bargaining position this provides them. We examine the effects of bargaining power on the ex-ante incentives of a wealth-constrained venture capitalist for providing equity financing to an entrepreneurial project. The models that we use herein, while similar in intuition to those developed by Rajan (1992) in his analysis of the well-known bank "hold-up" problem, are adapted to suit equity contracts. We also analyze the effects of constraining the initial wealth of the venture capitalist on the choice of projects.<sup>1</sup>

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<sup>1</sup> Constraints of time (and initial wealth) lead the venture capitalist to consider only the highest marginal return project(s) available to her. Furthermore, it is assumed that she has sufficient initial wealth to finance these marginal project(s) without additional external borrowing.

The first equity-financing model involves a project that requires a single investment at time 0 with a payoff at time 2. The contract, signed at time 0, gives the venture capitalist an equity share of the project payoff. The second financing model involves the staging of capital over two time periods. Initially, a wealth-constrained entrepreneur offers a venture capitalist an equity share of the proceeds from an entrepreneurial investment opportunity (a two-stage project), in return for funding at time 0 and additional funding one period later. The project may be of either good or bad quality, but this quality is not observable by either the venture capitalist or the entrepreneur when the first stage of the investment is made by the venture capitalist. At time 1, both the entrepreneur and the venture capitalist know the project's quality with certainty. The venture capitalist pursues the project, making a second-round investment if the project's quality is good, or does not pursue the project, by refusing to fund its second stage if the project's quality is bad. The one-stage model differs from the two-stage model in that no contractible interim information is available to the venture capitalist about project quality. Nevertheless, even if such information were available, because the contract involves equity, the venture capitalist is not able to liquidate the project at time 1, even if the project is a bad one.<sup>2</sup> The inability to liquidate is a major difference between Rajan's (1992) framework and ours.

The rest of this paper is organized as follows: Section II reviews some of the important literature in the area of venture capital financing. Section III sets up a model for a one-stage entrepreneurial project. Section IV considers a model for a two-stage entrepreneurial project. Section V examines the effect of bargaining power on the division of the surplus between the entrepreneur and venture capitalist in the two models presented in the previous sections. Section VI examines the effects endowment constraints of the venture capitalist have on her choice of entrepreneurial projects. Finally, Section VII provides some concluding remarks.

## II. Literature Review

Much of the theory on venture capital looks at moral hazard problems where the entrepreneur has private information about the project's cash flows and may therefore have incentives to expropriate its funds. Trester (1998) considers the problem of asymmetric information and compares the incentives of the entrepreneur to steal from the project under venture capitalist supplied preferred equity and debt financing. He finds that when costly auditing is not possible, debt financing is not feasible because it gives the venture capitalist a foreclosure option that provides an incentive to the entrepreneur to cheat, thus reducing the ex-ante compensation schedule for a risk-neutral entrepreneur. On the other hand, the entrepreneur's own capital investment in the venture makes the risk-averse venture capitalist more optimistic about its ex-ante returns and, therefore, more willing to commit equity financing. Casamatta (2003) looks at the joint provision of effort by an entrepreneur and an advisor to enhance the productivity of a project. In a moral hazard setting, she finds that when the entrepreneur's effort is more efficient (less costly) than the advisor's effort, the advisor is hired only if she provides financing for the project. However, without moral hazard, it is optimal that both the entrepreneur and the advisor exert maximal effort on the project's behalf. Bergemann and Hege (1998) examine venture capital financing in a dynamic agency setting. They find that the allocation of funds and the learning process are subject to moral hazard and derive the optimal equity contract, which provides inter-temporal risk sharing between the entrepreneur and the venture capitalist.

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<sup>2</sup> This is true even if a signal of project quality became available at time 1.

Some moral hazard problems can be solved with the use of convertible securities. Schmidt (2003) explains that by endogenously allocating cash flow rights (i.e. depending on the state of the world and the entrepreneur's effort), convertible securities can be employed to induce the entrepreneur and the venture capitalist to invest efficiently in the project. Cornelli and Yosha (2003) examine how convertible securities can reduce the incentive of the venture capitalist, created by the abandonment option, to engage in short-term "window-dressing".

Studies of the incentives of venture capitalists to engage in value reducing behavior have concentrated on the premature abandonment decision. Sahlman (1990) argues that premature abandonment (through an IPO) may come about due to the fact that the venture capitalist holds a more diversified portfolio of opportunities and has a higher opportunity cost of time (as more profitable ventures become available) than the entrepreneur. According to Gompers (1996), the venture capitalist may also bring about a premature IPO in order to both signal her reputation and cause a revision of the market value of their investments, thereby satisfying venture capital investors. Furthermore, as the empirical study of Chevalier and Ellison (1995) documents, a premature IPO helps the venture capitalist attract new investment capital.

Finally, Hellman (2002), while noting that some venture capitalists seek purely financial gains as opposed to others who invest in order to achieve strategic objectives, examines a model where strategic investors can achieve synergies, but can also incur a conflict of interest with the entrepreneur. He also explains why a strategic investor often pays a price based upon a higher valuation for participation in the project than does an independent venture capitalist.

### III. A One-Stage Entrepreneurial Project

In this model, an entrepreneurial opportunity requiring single-stage funding presents itself to the venture capitalist at time 0. The project requires an investment level  $I_{0b}$ , and leads to a certain payoff  $X_2$  at time 2. The rationality constraint for the venture capitalist at time 0 is therefore:

$$\alpha_b X_2 - I_{0b} \geq 0,$$

where the venture capitalist receives a fraction,  $\alpha_b$ , of the project payoff at date 2. The entrepreneur who owns this project receives as compensation:

$$(1 - \alpha_b) X_2 \geq 0,$$

which is always satisfied regardless of who gets the surplus. For example: if  $X_2 = 2$  and  $I_{0b} = 1$ , then  $\alpha_b \geq 0.5$ .

Thus, in a perfectly competitive market for venture capital, this entrepreneur captures the entire surplus of the project, making the rationality constraint of the venture capitalist (see above) hold with equality. We have assumed the reservation utilities of the entrepreneur to be equal to zero at time 0 and also at time 1. As the effort of the entrepreneur is assumed not to affect the success of the project, the cost of this effort is also assumed to be equal to zero for the entrepreneur, with no loss of generality.

#### IV. A Two-Stage Entrepreneurial Project

In this, the two-stage financing model, a venture capitalist contracts with an entrepreneur for a fraction of equity  $\alpha_a$ , in return for  $I_{0a}$  of initial financing and a level of financing  $I_{1a}$  at time 1 conditional on the quality of the project being good. The venture capitalist receives a noiseless signal of project quality at time 1. With probability ' $p$ ', the project is of good quality, in which case the project payoff is  $S_{2H}$  ( $=S_2$ ). With probability  $(1-p)$ , the project is of bad quality, in which case the payoff is  $S_{2L}$  ( $=0$ , with no loss of generality). Therefore, the venture capitalist does not provide second-stage financing to the entrepreneur if the signal is bad. However, in order to undertake the project, the venture capitalist expects to break even ex-ante:

$$pS_2\alpha_a \geq I_{0a} + pI_{1a} \quad (\text{holds with equality in equilibrium}),$$

provided that  $K \geq I_{0a} + I_{1a}$ , where  $K$  is the initial endowment of the venture capitalist. Hence, this condition implies that the venture capitalist has sufficient capital endowment to pursue the two-stage project successfully. Consequently, the rationality condition of the entrepreneur is:

$$p(1-\alpha_a)S_2 \geq 0.$$

To simplify the exposition, we assume the reservation utilities of the entrepreneur at time 0 and at time 1 to be zero. We further assume, as in the one-stage project in the previous section, that effort is costless to the entrepreneur. Hence, the entrepreneur always wants to pursue the project.

We must also consider the incentive compatibility of the venture capitalist at time 1. Given that the venture capitalist receives a favorable signal of project quality, she makes an additional investment,  $I_{1a}$ , in the entrepreneurial firm, because:

$$S_2\alpha_a - I_{1a} \geq 0 \quad (\text{if project is of good quality}).$$

The rationality condition of the entrepreneur is:

$$(1-\alpha_a)S_2 \geq 0 \quad (\text{if project is of good quality})$$

and

$$(1-\alpha_a)0 \geq 0 \quad (\text{if project is of bad quality}).$$

Hence, the entrepreneur wants to continue the project at time 1 even if the project is of bad quality. For example: If  $S_2 = 2$ , and  $I_{1a} = 1$ , then  $\alpha_a \geq 0.5$ .

#### V. The Effects of Bargaining Power

In the previous sections, we did not explicitly address the issue of the bargaining power of the venture capitalist. If we assume that entrepreneurs have all of the bargaining power at all stages of their respective projects, then the venture capitalist makes zero profits in equilibrium regardless of whether he chooses the single-stage or the two-stage project. Let us suppose,

however, that at time 1, the entrepreneur of the two-stage project is able to obtain alternate financing from an outside venture capitalist. The signal of project quality is assumed to be available only to the inside venture capitalist at time 1, since learning this information required an initial investment of  $I_{0a}$  by the inside venture capitalist. Therefore, the original venture capitalist knows the quality of the project with certainty at time 1, whereas the outside venture capitalist has a conjectured probability of the project being of good quality.

Thus, the rationality constraint at time 1 for the inside venture capitalist when the project is of good quality, is:

$$\alpha_a S_2 - I_{1a} \geq 0, \quad (\text{if project is of good quality})$$

whereas for an outside venture capitalist, the rationality constraint at time 1 is:

$$q(1-\alpha_a)\alpha_b S_2 + (1-q)(1-\alpha_a)\alpha_b 0 - I_{1a} \geq 0,$$

which reduces to:

$$q(1-\alpha_a)\alpha_c S_2 - I_{1a} \geq 0,<sup>3</sup>$$

where  $q \in [0, 1]$  is the conjectured probability by the outside venture capitalist that the project is of the good type, given that the entrepreneur is looking for outside venture capital financing at time 1, and  $\alpha_c$  is the share of the project payoff the external venture capitalist requires in order to provide funds to the project.

Now, we can find the limits of the conjectured probability of the outside venture capitalist in equilibrium:

$$q = \text{Prob}(\text{Project} = \text{Good} \mid \text{Seeks Capital From Outside Venture Capitalist}).$$

We denote this as  $q = P(G/SCFOC)$ . Using Bayes' rule:

$$q = P(G/SCFOC) = \frac{P(SCFOC \mid G) \times P(G)}{P(SCFOC \mid G) \times P(G) + P(SCFOC \mid B) \times P(B)},$$

where  $P(B)$  is the ex-ante probability that the project is bad, and  $P(G)$  is the ex-ante probability that the project is good. Next, we can substitute  $p$  for  $P(G)$  and  $(1-p)$  for  $P(B)$ . The term  $P(SCFOC \mid B)$  is the probability that the entrepreneur looks for external funding at time 1 given that the project is bad. We already know that the entrepreneur always wishes to continue the project (i.e., regardless of project quality), and that when the project quality is bad, the inside venture capitalist always refuses to commit any funds to the project at time 1. Thus, we conclude that in equilibrium  $P(SCFOC \mid B)$  is equal to 1. What about  $P(SCFOC \mid G)$ ? Short of finding a Nash equilibrium for this game, we can say that in equilibrium,  $P(SCFOC \mid G)$  must have a value between 0 and 1. Therefore, if we take  $P(SCFOC \mid G) = 0$ , we find that  $q = P(G/SCFOC) = 0$ , and by taking  $P(SCFOC \mid G) = 1$ , we find  $q = p$ , meaning that in equilibrium  $q \in$

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<sup>3</sup> Note that at time 1, the entrepreneur owns only  $1-\alpha_a$  of the project, which she can offer the external venture capitalist.

$[0, p]$ . The best the entrepreneur can hope for is that the external venture capitalist uses passive conjectures ( $q = p < 1$ ), in valuing her equity share of the project.

Therefore, combining the rationality conditions of the internal and external venture capitalists (see above) gives the equilibrium result:

$$\alpha_c > \alpha_a.$$

Thus, the entrepreneur's good quality project would be undervalued by external venture capitalists, meaning that the entrepreneur of a good quality project is worse off under an external venture capitalist than under an internal venture capitalist. This would imply that the internal venture capitalist has superior bargaining power than the entrepreneur in the case of the good quality two-stage project. Although the internal venture capitalist always wants to fund the good quality project in equilibrium, he also wants to extract some non-zero level of surplus from the entrepreneur as a pre-condition for further funding. Thus, the venture capitalist can be seen as using this discretion to 'hold up' the entrepreneur of the two-stage project. Solving the bargaining game, the entrepreneur gets  $(1-\mu) \times (1-\alpha_a)S_2$  ex-ante, while the internal venture capitalist gets  $\mu(1-\alpha_a)S_2$  (excluding investment costs), where  $\mu \in (0,1)$  is the share of the unallocated surplus the internal venture capitalist gets in return for the funds needed to continue the project until time 2, namely,  $I_{1a}$ . This is the same as in the short-term bank contract model of Rajan (1992).

Taking into account the bargaining power of the venture capitalist, we find that the expected return to the venture capitalist from undertaking the two-stage project at time 0 is:

$$p\mu(1-\alpha_a)S_2 + p\alpha_a S_2 - I_{0a} - pI_{1a}.$$

This can be rearranged as:

$$(\mu(1-\alpha_a) + \alpha_a) pS_2 - I_{0a} - pI_{1a} > 0,$$

which is strictly greater than zero in equilibrium, since  $\mu$  is strictly greater than zero.

It is easy to see that for the entrepreneur of the two-stage project, the time 0 rationality constraint is satisfied regardless of her relative bargaining power  $(1-\mu)$ :

$$p(1-\mu)(1-\alpha_a)S_2 \geq 0, \quad \forall \mu \in (0,1].$$

The entrepreneur, therefore, agrees to a contract in which she keeps none of the project surplus.

Our analysis in this section showed that the venture capitalist has greater bargaining power than the entrepreneur of the two-stage project. In a single-stage project, venture capitalists compete at date 0 only, since this is the only time when funding is required. Since all venture capitalists are equally informed about the return on the project (i.e., that it returns  $X_2$  with certainty at time 2), venture capitalists do not have greater bargaining power than the entrepreneurs in this type of project. Therefore, all venture capitalists providing funding to one-stage projects expect just to break-even in equilibrium (i.e., the entrepreneur receives all of the surplus). For example, if  $I_{0a} = 1$ , and  $I_{1a} = 1$ ,  $p = 0.5$ ,  $S_2 = 3$ ,  $\alpha_a = 0.5$ , and  $\mu \geq 0.75$ .



## VI. Project Choice of an Endowment Constrained Venture Capitalist

We assume that  $K$ , the initial capital endowment of the venture capitalist is common knowledge. Here, we consider the incentives for an endowment-constrained venture capitalist of choosing either of the two entrepreneurial projects presented in the previous sections. The first entrepreneurial firm requires a single-stage investment and the second a two-stage investment by the venture capitalist. The time 0 rationality conditions for the venture capitalist are as follows:

For taking the single-stage project:

$$\alpha_b X_2 \geq I_{0b}.$$

For taking the two-stage project:

$$p\alpha_a S_2 + (1-p)\alpha_a(0) \geq I_{0a} + pI_{1a} + (1-p)(0),$$

which implies that in equilibrium:

$$p\alpha_a S_2 = I_{0a} + pI_{1a}.$$

Also, because of her relative bargaining position with respect to the entrepreneur of the two-stage project, the venture capitalist receives an additional fraction of shares  $\mu(1-\alpha_a)$  at time 1 when the project is of good quality. Hence, the expected ex-ante profits of the venture capitalist under the two-stage project are:

$$p\mu(1-\alpha_a)S_2 + p\alpha_a S_2 - I_{0a} - pI_{1a}.$$

Meanwhile, the ex-ante rationality constraints for the two entrepreneurs are:

$$p(1-\alpha_a)(1-\mu)S_2 \geq 0 \quad (\text{two-stage project})$$

$$(1-\alpha_b)X_2 \geq 0 \quad (\text{one-stage project}),$$

which always holds in equilibrium, regardless of  $\mu$ ,  $\alpha_a$  and  $\alpha_b$ . Therefore, provided the initial endowment,  $K$ , of the venture capitalist is sufficient (i.e.,  $K \geq I_{0a} + I_{1a} + I_{0b}$ ), both of these positive net present value projects would be financed by the venture capitalist because she makes non-negative profits under each.

However, when the initial endowment of the venture capitalist,  $K$ , is limited (i.e.,  $K < I_{0a} + I_{1a} + I_{0b}$ ), then both projects cannot be pursued ex-ante, and one of the following occurs:

- If  $I_{0a} + I_{1a} \leq K < I_{0b}$ , then in equilibrium only the two-stage project is taken ex-ante.
- If  $I_{0b} \leq K < I_{0a} + I_{1a}$ , then the venture capitalist has insufficient capital to fund the two-stage project, given that it is of good quality. Therefore, in equilibrium, the venture capitalist funds the single-stage project at time 0.
- If  $K < I_{0a} + I_{1a} + I_{0b}$ , but  $K \geq I_{0a} + I_{1a}$  and  $K \geq I_{0b}$ , then the venture capitalist has sufficient capital at date 0 to fund only one of the projects, but not both.

Because we are interested in studying the venture capitalist's choice between two identical projects that differ only in how their investments are staged, we assume that  $K < I_{0a} + I_{1a} + I_{0b}$ ,  $K \geq I_{0a} + I_{1a}$  and  $K \geq I_{0b}$ , so that the venture capitalist's choice at time 0 is to fund either the two-stage project or the single-stage project.

The ex-ante expected profit of the venture capitalist if the two-stage project is chosen at time 0, is:

$$p\alpha_a S_2 + p\mu(1-\alpha_a) S_2 - I_{0a} - pI_{1a} > 0 \text{ (in equilibrium).}$$

If the one-stage project is chosen at time 0, the venture capitalist's ex-ante profit is:

$$\alpha_b X_2 - I_{0b} = 0 \text{ (in equilibrium).}$$

Therefore, a wealth-constrained venture capitalist would choose to finance the two-stage project as opposed to the one-stage project because her ex-ante profit is greater with the former project.

## VII. Conclusion

In this paper we examined the project choice of a wealth-constrained venture capitalist. We find that a wealth constrained risk neutral venture capitalist prefers to equity finance a project where investment capital is committed to the project in two-stages, over a project where the capital is committed in an initial lump sum. The reason for this preference stems from the superior bargaining position the venture capitalist has relative to the entrepreneur in the case of the two-stage project, which allows the venture capitalist to extract some of the project surplus. Therefore, the staging of the equity capital improves the venture capitalist's bargaining position, allowing her to benefit from the project at the expense of the entrepreneur.

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