

# Staged Financing Strategy in Venture Capital

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**Abstract:** In this paper we study the impact of the bargaining process on the staged funding strategy in venture capital. Staged funding strategy can alleviate the problems of asymmetric information. Using the cooperative bargaining theory we show that the venture capitalist can profit from her position using the fact that the venture can be sold with a low price and that she can fire the manager and replace the manager with a professional management team. The venture capitalist provides the fired manager with a replacement cost. The venture capitalist demands an important equity share at time zero to accept to provide funds to the manager. The bargaining process can mitigate the contradictory incentives of the manager and the venture capitalist.

**Key words:** Staged funding, Cooperative bargaining theory, venture capital.

## 1. Introduction

Venture capital firms are financial intermediaries focused on providing capital to small, fast-growth start-up companies that are typically high risk and not amenable to more traditional financing alternatives. In comparison with traditional sources of funds, venture capital firms have some particular characteristics. According to Gompers [1995], venture capital's investments entail higher intensities of uncertainty, asymmetric information and in general higher intangible assets and development opportunities. Sapienza and Gupta [1994] assert that venture capitalists obtain an equity position in the corporation and play an active role in the corporate governance. In other words, they sit in the board of directors and regularly monitor performance (Shalman [1990]).

Key characteristics in venture capital financing are staging the infusion of capital and preserving the option to abandon the project. Instead of providing all the necessary capital upfront, venture capitalists invest in stages to keep the project under control. Staged investment allows venture capitalists to monitor the firm before they make refinancing decisions. The information about the viability of a project acquired through such monitoring helps venture capitalists to avoid throwing money at bad projects. It reduces losses from inefficient continuation and creates an exit option for venture capitalists.

According to Black and Gilson [1998], staged funding allows the venture capital to behave opportunistically in the second round financing at an inequitable price for the manager. Based on their result, we focus on the following main question: What permits the venture capitalist to act opportunistically?

Using the cooperative bargaining theory, we examine the bargaining process between a venture capitalist and a manager that establishes the price at which capital is introduced over stages.

According to the terms and conditions of the contracts between the venture capitalist and the manager, the venture capitalist acquires the following rights<sup>1</sup> further than equity shares associated with staged funding:

- The venture capitalist can invest more if the company needs and warrants additional funds. This right is conserved by insisting on rights of first rejection or preventative rights. In other words, the manager cannot “*walk away*” after the first period and negotiate with another firm.

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<sup>1</sup> Shalman [1988, 1990], Hellmann [1998] and Kaplan and Stromberg [2000]

But venture capitalists are not obliged to supply funds at any stage in the process and they have the alternative to abandon the project.

- The venture capitalist can change the manager with a *specialized management team* and pay him a fixed amount, independent of his verified ability and succeeding cash flows of the firm. The payment to the manager can also be a certain share that has previously vested at the time of replacing. The venture capitalist can apply this option through his effective monitoring over the board and reinforce this right by the employment contracts, vesting schedules and buy-back provisions. In reality according to Hellmann [1998], a generous compensation for the fired manager is fundamentally unheard of in the venture capital industry.

The control rights examined above are very important to the venture capitalist because these rights can protect his asset in a setting filled with improbability and information asymmetry (Shalman [1990]). Moreover, and according to Smith [1998], these rights allow the venture capitalist to behave opportunistically due to the imperfection of venture capital contracts.

In this paper, we discuss the bargaining procedure from the side of the manager throughout the probable opportunistic actions of the venture capitalist.

When the performances of both the manager and the project are suitable, it is better to maintain the manager controlling the project. Both the manager and the venture capitalist know the second round financing is still necessary and they need to bargain the price at which the second round fund is provided. According to Kaplan and Stromberg [2000], if specified performance thresholds are realized, the manager is assured to remain.

Then if the manager and the venture capitalist cannot achieve an accord, we assume that the project will be sold to a third party and they will share the earnings.

Although the performance of both the manager and the venture are satisfactory, the venture capitalist can still threaten to fire the manager when these two parties bargain over the price of the second round of capital. The post replacing payoff of the venture capitalist relative to that of the manager may be favourable than that obtained from selling the project. In this case, the venture capitalist can menace to opt to replacement as the breakdown of the negotiation instead of selling the venture. As consequence, when the payoff pair after all attains an agreement it is likely to be more favourable to the venture capitalist. This is the case when the venture capitalist can obtain a higher allocation by threatening to fire the manager, even though he knows it is better for him to maintain the manager. This is inequitable to the manager, since the possibility to fire the manager is originally intended to defend the venture capitalist from the manager's opportunistic behaviour. The replacement price can be either a certain share or a fixed amount. Payment in the form of a certain share allows the fired

entrepreneur to obtain higher payoff if he should not be fired, which means that the project goes well.

The venture capitalist should look for a professional manager, if it previews that the benefits from replacing the manager are sufficiently high. As for compensation, the manager gets a larger equity stake in the first round of financing. In other words, the manager incurs a lower cost of capital when financing the project initially. But, when the venture capitalist uses this right at the negotiation of the price of the second of capital, the manager is held up and does not benefit from of lower cost.

Using a cooperative bargaining theory, the bargaining result is determined by the bargaining power and the threat point<sup>2</sup> (Nash [1950] and [1953], Binmore [1992]). In our case the threat point is the payoff pair when both parties fail to reach an agreement. Control rights affect the threat point. Indeed, the opportunistic behaviour of the venture capitalist makes the treat point and consequently the bargaining result more favourable to the venture capitalist, and the manager will be in a unfavourable position at the second stage bargaining. The critical position of the manager is due to:

- First, the manager cannot seek for other financing resources;
- Second, the control rights and cash flow rights are interconnected over stages;
- Last, the execution of control rights is *not verifiable*.

The paper is organized as follows. In section 2 we present the model. In section 3, we provide arithmetical applications for the model. Finally, section 4 concludes.

## 2. The Model

Staged investment, which creates the option to abandon a venture, is an important mean for venture capitalists to minimize the present value of agency costs. The active involvement of venture capitalists in the operations of their invested companies may also mitigate the moral hazard problem. Staging capital allows the venture capitalist to gather information and monitor the progress of the firms with maintaining the option to periodically abandon projects.

We assume that there are three time periods ( $t=0, 1, 2$ ). At  $t=0$ , the manager ( $M$ ) endowed with an investment project approaches a venture capitalist ( $VC$ ) for funds. If the venture capitalist find the manager's idea interesting and decides to finance the project, the venture capitalist will agree to invest the first round capital  $I_0$ . In other side, the venture capitalist will

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<sup>2</sup> The threat point is the point where the players will be if they bargain and fail to agree (Friedman [1990]).

demand a certain equity share  $E_0$  and control rights. The remaining part  $(1 - E_0)$  is the share split of the manager before it is replaced. At  $t=1$ , we assume that the performance cannot be verified. As consequence, there are two cases happening respectively with probability  $p$  and  $(1-p)$ . In this model we are interested on the bargaining process between the venture capitalist and the manager and how they split of the cash flow right and control right.

**In the first case (A):** Although the performance of the project is not verifiable, we assume that it is better to the venture capitalist and the manager to have the same manager on the three stages of the project. We allow the possibility of renegotiation ex post. When the uncertainty is resolved ex post, the project may turn out to be bad or mediocre so that the venture capitalist is unwilling to continue investing given the existing contract. In this case, the manager and the venture capitalist have to renegotiate for a new contract. Before renewing the contract at  $t=1$ , the venture capitalist still preserve the right to fire the manager. Possessing the control rights, the venture capitalist gets all the efficiency gain from ex post renegotiation.

If they reach an agreement, the manager will remain in control of the project, and the venture capitalist will supply the second round capital  $I_1$ . The venture capitalist will demand a renewed equity share split equal to  $E_1$ .

If the manager is not replaced, the expected cash flow at time 2 is  $CF_A$ . And if the manager is replaced, the expected cash flow at time 2 is  $(CF_A - C)$  where  $C$  is the cost due to the replacement of the manager. If the manager is replaced, the payment of the manager is equivalent to a certain share  $\alpha$  such that  $\alpha < (1 - E_0)$ .

If the venture capitalist and the manager do not reach an agreement, the project will be sold to a third party at a selling price  $RT$ . The venture capitalist and the manager will split this earning such that:  $E_0$  is the rate share of the venture capitalist, and  $(1 - E_0)$  is the remaining part of the manager.

**In the second case (B):** Since the performance of the project is not verifiable, we assume that the venture capitalist will replace the manager at  $t=0$ , and will find a professional manager to control the project. At time 2, the expected cash flow is  $CF_B$ .

**Assumption:** We assume that the expected return in the first case when the manager is replaced at time 1 is higher than the expected return obtained in the second case. In other words, to obtain higher payoff, the professional manager should take over the project (not well managed) at time 1. Thus,  $\alpha(CF_A - C) > \alpha CF_B$

This can mitigate the problem when the venture capitalist threatens to fire the manager, we assume that:  $\alpha(CF_A - C) > \alpha CF_B$

**Assumption:** We assume that in case of replacement, the manager will receive a fixed payment equal to  $R = \alpha CF_B$ .

We will analyze the influence of the replacement right on the bargaining result by considering the ideal case, which means that the venture capitalist will not behave opportunistically. Let us assume, for example, that this opportunism is governed by certain existing systems such as the reputation market.

We assume that the venture capitalist and the manager are risk neutral; and all the values are discounted to time one with discount factor  $\delta$ . We have to study two possibilities: the venture capitalist behaves opportunistically and when she does not.

### 2.1- The VC does not behave opportunistically:

In a two person cooperative game, we consider the case of games in which cooperation between two players is allowed. Until a decade ago, cooperative games avoided dealing with individual decisions as such and tended to focus on the set of possible outcomes and the conditions that might be “reasonable” or “appealing” or fair to impose on an acceptable outcome. This approach is sometimes referred to as axiomatic bargaining theory. We have to choose a pair of utility functions for the two players ( $U_{VC}$  for the venture capitalist and  $U_M$  the manager). To find the bargaining solutions, and according to the cooperative bargaining theory, we need to find the utilities and the threat point of the two players. The venture capitalist and the manager will cooperate to obtain the final payout  $\alpha CF_A$ . In general, the two players engaged in the bargaining process have not the same bargaining power. In this model, we assume that the venture capitalist and the manager have the same bargaining power.

*Let us consider the first case (A):*

The utilities of the venture capitalist and the manager at time one are given by:

$$U_{VC}^{A,1} = U_{VC} \left( E_1, CF_A - I_1 \right)$$

$$V_M^{A,1} = V_M \left( -E_1, CF_A \right)$$

The threat point of the venture capitalist and the manager are respectively:

$$\bar{U}_{VC}^{A,1} = U_{VC} \left( E_0, RT \right)$$

$$\bar{V}_M^{A,1} = V_M \left( -E_0, RT \right)$$

**Lemma 1:** If there are any points  $(U, V) \in S$  (a given set) such that  $U > \bar{U}, V > \bar{V}$ , then there is a unique point  $(U^*, V^*)$  which maximizes the function:

$$g(U, V) = (U - \bar{U})(V - \bar{V})$$

Thus, the bargaining result is the solution to the following maximization problem:

$$\underset{E_1}{Max} \left( U_{VC}^{A,1} - \bar{U}_{VC}^{A,1} \right) \left( V_M^{A,1} - \bar{V}_M^{A,1} \right)$$

$E_1^*$  is the bargaining result at  $t=1$ .

**Proposition 1:** the payoff of the venture capitalist and the manager at  $t=1$  will be  $\delta(-E_1^*, CF_A)$  for the manager and  $\delta E_1^*, CF_A - I_1$  for the venture capitalist.

Let consider the second case (B):

The utilities of the venture capitalist and the manager at time one are given by:

$$U_{VC}^{B,1} = U_{VC} \left( CF_B - R - I_1 \right)$$

$$V_M^{B,1} = V_M \left( R \right)$$

The utilities used in the bargaining at time  $t=0$  are the expected utilities from the two cases, thus:

$$U_{VC}^0 = p U_{VC} \left( E_1^*, CF_A - I_1 \right) + (1-p) \bar{U}_{VC} \left( E_0, RT - I_1 \right)$$

$$V_M^0 = p V_M \left( -E_1^*, CF_A \right) + (1-p) \bar{V}_M \left( R \right)$$

At  $t=0$ , if the venture capitalist and the manager fail to find an agreement, their payoff will be equal to  $(0, 0)$ .

**Proposition 2:** the bargaining result at  $t=0$  will be the solution of the following maximization problem:

$$\underset{X_0, R}{Max} \left( U_{VC}^0 - 0 \right) \left( V_M^0 - 0 \right)$$

## 2.2- The VC behaves opportunistically:

In this model, the manager ignores the opportunistic behaviour of the venture capitalist at time zero. Thus the bargaining process will happen at time one. The venture capitalist and the manager will bargain how they will divide the expected return and control rights on the two stages by considering the opportunistic behaviour of the venture capitalist.

Let consider the first case (A):

The utilities of the venture capitalist and the manager at time one are given by:

$$U_{VC}^{A,1} = U_{VC} \left( E_1 \left( CF_A - I_1 \right) \right)$$

$$V_M^{A,1} = V_M \left( -E_1 \left( CF_A \right) \right)$$

The bargaining results depend on the choice of the threat point by the venture capitalist. The first threat point (threat I) considers the possibility to sell the venture to a third party. The second threat point (threat II) considers the possibility to replace the manager by a professional team. The venture capitalist will choose the threat strategy which provides her the higher benefits.

### ***Threat I: To sell the venture to a third party.***

This case is similar to the possibility that the venture will not behave opportunistically.

The threat point of the venture capitalist and the manager are respectively:

$$\bar{U}_{VC}^{A,1} = U_{VC} \left( E_0 \cdot RT \right)$$

$$\bar{V}_M^{A,1} = V_M \left( -E_0 \left( RT \right) \right)$$

Thus, the bargaining result is the solution to the following maximization problem:

$$\text{Max}_{E_1} \left( U_{VC}^{A,1} - \bar{U}_{VC}^{A,1} \right) \left( V_M^{A,1} - \bar{V}_M^{A,1} \right)$$

$E_1^*$  is the bargaining result.

### ***Threat II: To replace the manager by a Professional Team.***

The venture capitalist can threaten the manager to replace him with a professional team. If the manager is replaced, the expected cash flow at time 2 is  $CF_A - C$  where  $C$  is the cost due to the replacement of the manager. The payment of the manager is equivalent to a fixed amount  $W$  and the second round investment is  $I_1$ .

The threat point of the venture capitalist and the manager are respectively:

$$\bar{U}_{VC}^{B,1} = U_{VC} \left( CF_A - C - R \right) - I_1$$

$$\bar{V}_M^{B,1} = V_M \left( \bar{R} \right)$$

Thus, the bargaining result is the solution to the following maximization problem:

$$\underset{E_1}{Max} \left( U_{VC}^{A,1} - \bar{U}_{VC}^{B,1} \right) \left( V_M^{A,1} - \bar{V}_M^{B,1} \right)$$

$E_1^*$  is the bargaining result.

The venture capitalist will choose the threat point that makes the bargaining result favourable to him.

The utilities used in the bargaining at time  $t=0$  are the expected utilities from the two cases, thus:

$$U_{VC}^0 = p U_{VC} \left( E_1^* \left( CF_A \right) - \delta I_1 - I_0 \right) + (1-p) \bar{U}_{VC} \left( \delta R - \delta I_1 - I_0 \right)$$

$$V_M^0 = p V_M \left( -E_1^* \left( CF_A \right) \right) + (1-p) \bar{V}_M \left( \bar{R} \right)$$

At  $t=0$ , if the venture capitalist and the manager fail to find an agreement, their payoff will be equal to  $(0,0)$ .

At time zero, the bargaining result is the solution to the following maximization problem:

$$\underset{E_0, R}{Max} \left( U_{VC}^0 - 0 \right) \left( V_M^0 - 0 \right)$$

We have to determine  $E_0$  and  $R$ .

### 3. Arithmetical Application

Let assume the identity function for the utilities of the agent, thus:  $U_{VC} \left( a \right) = V_M \left( a \right) = a$ .

Suppose that:

$$\delta = 0,87, p = 0,5, \left( CF_A \right) = 300, \left( CF_B \right) = 150, RT = 125, C = 75, I_0 = 40 \text{ and } I_1 = 80.$$

#### 3.1- The VC does not behave opportunistically:

Let consider the first case (A):

The utilities of the venture capitalist and the manager at time one are given by:

$$U_{VC}^{A,1} = U_{VC} \left( E_1 \left( CF_A \right) - I_1 \right) = \delta E_1 \left( CF_A \right) - I_1 = 0,87 E_1 \cdot 300 - 80 = 261 E_1 - 80$$

$$V_M^{A,1} = V_M \left( -E_1 \left( CF_A \right) \right) = \delta \left( -E_1 \left( CF_A \right) \right) = 0,87 \left( -E_1 \right) \cdot 300 = 261 E_1 - 261$$

The threat point of the venture capitalist and the manager are respectively:

$$\bar{U}_{VC}^{A,1} = U_{VC} \left( E_0 \cdot RT \right) = \delta E_0 \cdot RT = 0,87 E_0 (125) = 108,75 E_0$$

$$\bar{V}_M^{A,1} = V_M \left( -E_0 \cdot RT \right) = \delta \left( -E_0 \right) \cdot RT = 0,87 \left( -E_0 \right) \cdot 125 = 108,75 - 108,75 E_0$$

Thus, the bargaining result is the solution to the following maximization problem:

$$\text{Max}_{E_1} \left( u_{VC}^{A,1} - \bar{u}_{VC}^{A,1} \right) \left( v_M^{A,1} - \bar{v}_M^{A,1} \right)$$

The solution to the program above is:

$$\begin{cases} u_{VC}^{A,1} - \bar{u}_{VC}^{A,1} = \frac{\left( u_{VC}^{A,1} - \bar{u}_{VC}^{A,1} \right) + \left( v_M^{A,1} - \bar{v}_M^{A,1} \right)}{2} \\ v_M^{A,1} - \bar{v}_M^{A,1} = \frac{\left( u_{VC}^{A,1} - \bar{u}_{VC}^{A,1} \right) + \left( v_M^{A,1} - \bar{v}_M^{A,1} \right)}{2} \end{cases}$$

Thus:

$$\begin{cases} u_{VC}^{A,1} - 108,75E_0 = \frac{(61 - 80) + (61 - 261 - 108,75)}{2} = 36,125 \\ v_M^{A,1} - 108,75 + 108,75E_0 = \frac{(61 - 80) + (61 - 261 - 108,75)}{2} = 36,125 \end{cases}$$

Which is equivalent to:

$$\begin{cases} u_{VC}^{A,1} = 108,75E_0 + 36,125 \\ v_M^{A,1} = 108,75 - 108,75E_0 + 36,125 = -108,75E_0 + 144,875 \end{cases}$$

Let consider the second case (B):

The utilities of the venture capitalist and the manager at time one are given by:

$$U_{VC}^{B,1} = U_{VC} \left( \delta CF_B - R - I_1 \right) = \delta \left( CF_B - R - I_1 \right) = 0,87 \cdot 300 - 300\alpha - 100 = 161 - 300\alpha$$

$$V_M^{B,1} = V_M \left( R \right) = R = \alpha \left( CF_B \right) = 300\alpha$$

The utilities used in the bargaining at time  $t=0$  are the expected utilities from the two cases, thus:

$$\begin{aligned} U_{VC}^0 &= p U_{VC} \left( \delta^2 E_1 \left( CF_A \right) - \delta I_1 - I_0 \right) + (1-p) \bar{U}_{VC} \left( \delta^2 \left( CF_B \right) - \delta R - \delta I_1 - I_0 \right) \\ &= 0,5 * 0,87 * \left( 108,75E_0 + 36,125 \right) + 0,5 * 0,87 * \left( 61 - 300\alpha \right) - 50 \\ &= 47,31E_0 + 15,71 + 70 - 130,5\alpha - 50 \\ &= 47,31E_0 - 130,5\alpha + 35,71 \end{aligned}$$

$$\begin{aligned} V_M^0 &= p V_M \left( -E_1 \left( CF_A \right) \right) + (1-p) \bar{V}_M \left( R \right) \\ &= 0,5 * 0,87 * \left( -108,75E_0 + 144,875 \right) + 0,5 * 0,87 * \left( 300\alpha \right) \\ &= -47,31E_0 + 63 + 130,5\alpha \end{aligned}$$

At  $t=0$ , if the venture capitalist and the manager fail to find an agreement, their payoff will be equal to  $(0,0)$ . Thus the threat point is  $(0,0)$ .

The bargaining result at  $t=0$  will be the solution of the following maximization problem:

$$\text{Max}_{X_0, R} \left( U_{VC}^a - 0 \right) \left( U_M^a - 0 \right)$$

Then, we have to resolve the following program:

$$\text{Max}_{X_0, \alpha} \left( 7,31E_0 - 130,5\alpha + 35,71 \right) \left( 47,31E_0 + 63 + 130,5\alpha \right)$$

Subject to:

$$\begin{cases} \alpha(1 - E_0) \\ \alpha, E_0 \in [0, 1] \end{cases}$$

The resolution of the program above provides us important results:

- If the venture capitalist's share at time 0 is low, which means less than 0,3 ; the venture capitalist will not threat to fire the manager.
- The bargaining result is such that  $0,3 < E_0 < 1$ ,  $0 < \alpha < 0,25$  and  $\alpha < 1 - E_0$

We get,  $E_0 = 0,8$  and  $\alpha = 0,18$

### 3.2- The VC will behave opportunistically:

**Threat I: To sell the venture to a third party.**

The utilities of the venture capitalist and the manager at time one are:

$$\begin{cases} u_{VC}^{A,1} = 108,75E_0 + 36,125 \\ v_M^{A,1} = 108,75 - 108,75E_0 + 36,125 = -108,75E_0 + 144,875 \end{cases}$$

**Threat II: To replace the manager by a Professional Team.**

$$\bar{U}_{VC}^{B,1} = U_{VC} \left( CF_A - C - R \right) - I_1 = 115,75 - 130,5\alpha$$

$$\bar{V}_M^{B,1} = V_M \left( R \right) = 130,5\alpha$$

$$\begin{cases} u_{VC}^{B,1} = \bar{u}_{VC}^{B,1} + \frac{\left( U_{VC}^{A,1} - \bar{U}_{VC}^{B,1} \right) \left( V_M^{A,1} - \bar{V}_M^{B,1} \right)}{2} = 148,375 - 130,5\alpha \\ v_M^{B,1} = \bar{v}_M^{B,1} + \frac{\left( U_{VC}^{A,1} - \bar{U}_{VC}^{B,1} \right) \left( V_M^{A,1} - \bar{V}_M^{B,1} \right)}{2} = 130,5\alpha + 32,625 \end{cases}$$

$$U_{VC}^* = \text{Max} \left( U_{VC}^{A,1}, U_{VC}^{B,1} \right)$$

Since  $U_{VC}^1 = \delta E_1^* \left( CF_A \right) - I_1$  and  $U_M^1 = \delta \left( -E_1^* \right) \left( CF_A \right)$ . Thus:  $U_M^1 = 181 - U_{VC}^1$ .

The venture capitalist will choose the threaten strategy which gives her a higher expected profit. Thus:

$$U_{VC}^1 = \text{Max} \left( U_{VC}^{A,1}, U_{VC}^{B,1} \right)$$

By substituting  $E_1^*$  in  $V_M^1 = 181 - E_1^*$  we obtain:

$$E_1^* = \frac{1}{261} \left( \text{Max} \left\{ U_{VC}^{A,1}, U_{VC}^{B,1} \right\} + 80 \right)$$

The utilities used in the bargaining at time  $t=0$  are the expected utilities from the two cases, thus:

$$\begin{aligned} U_{VC}^0 &= pU_{VC} \left( E_1^* \left( CF_A \right) - \delta I_1 - I_0 \right) + (-p)U_{VC} \left( CF_B \right) - \delta R - \delta I_1 - I_0 \\ &= p\delta \left( E_1^* \right) - I_0 + (-p) \left( CF_B \right) - \delta R - \delta I_1 \\ &= 0,44 \cdot \text{Max} \left\{ U_{VC}^A, U_{VC}^B \right\} + 40 + (0,5 - 130,5\alpha) \\ &= 0,44 \cdot \text{Max} \left\{ U_{VC}^A, U_{VC}^B \right\} + 10,5 - 130,5\alpha \\ V_M^0 &= pV_M \left( -E_1^* \left( CF_A \right) \right) + (-p)V_M \left( R \right) \\ &= 0,44 \left( 81 - \text{Max} \left\{ U_{VC}^A, U_{VC}^B \right\} \right) + 56,77\alpha \end{aligned}$$

At  $t=0$ , if the venture capitalist and the manager fail to find an agreement, their payoff will be equal to  $(0,0)$ . Thus the threat point is  $(0,0)$ .

The bargaining result at  $t=0$  will be the solution of the following maximization problem:

$$\text{Max}_{X_0, \alpha} \left( U_{VC}^0 - 0 \right) \left( V_M^0 - 0 \right)$$

Subject to:

$$\begin{cases} \alpha(1 - E_0) \\ \alpha, E_0 \in [0,1] \end{cases}$$

To solve this program we have to consider two cases:

- If  $U_{VC}^A \leq U_{VC}^B$
- If  $U_{VC}^A > U_{VC}^B$

For these two cases, we obtain an additive constraint which must be taken into account.

We compare the expected utility for the venture capitalist in the two cases we obtain:

When  $U_{VC}^A > U_{VC}^B$ , the venture capitalist obtains 418,6 and when  $U_{VC}^A \leq U_{VC}^B$ , the venture capitalist obtains 1572,3.

The solution when the venture capitalist behaves opportunistically is:

We get,  $0 < E_0 < 0,76$  and  $\alpha = 0,4$  ( $\alpha$  is higher than in the case where the venture capitalist does not behave opportunistically). This is a logic result, since during the bargaining process; the manager has the incentive to obtain high  $\alpha$  and to offer a low  $E_0$ . In contrast, the venture capitalist will try to obtain high  $E_0$  and to offer a low  $\alpha$ .

## 4. Conclusion

Using cooperative bargaining theory, we build a model to study the return of a two stages negotiation between the venture capitalist and the manager. We study the price at which the second round of capital is provided by the venture capital. We show that the venture capitalist demand a high share from the expected return of the project. The manager threatened by the fact to be fired, will accept a low share, since the project will be achieved.

In this model, we have considered two cases: the venture capitalist does not behave opportunistically and the venture capitalist will behave opportunistically. Our study has shown that the bargaining process gives an adequate result. The bargaining process takes into account the contradictory incentives of the two agents of the model.

In general, the venture capitalist has an opportunistic behaviour and this is due to her dominant position. Moreover we have assumed that two players: the venture capitalist and the manager have the same bargaining power. But this hypothesis does not hold since the venture capitalist has an important power in the negotiation, and this is due to his capacity to provide funds and her ability to finance this kind of project. In our further research we will consider these limitations.

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