

The Impact of Financial Instruments on Ownership and Risk-Return in Venture Capital Investment

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Abstract

This study provides an analytical framework to split cash flows, risk and value of a venture project between the venture capitalist and the entrepreneur under various financial instruments. By introducing the degree of risk aversion of the venture capitalist and the opportunity cost of the entrepreneurial labor services over the life of the project, this report addresses an important issue of the selection of financial instrument (s) which is acceptable to both parties. Through an extended example, the results of the theoretical discussion are derived numerically. A discussion of the restrictive assumptions has been developed for the analysis, and a list of possible extensions is also provided.

Introduction

Venture capital has emerged as an important area of finance for academic researchers for the last 15 years or more. This interest lags well behind the development of the industry both in US and elsewhere [Wright and Robbie, 1997]. Studies have done that include the origin of venture idea, how it does work in the economy, contribution of venture capitalist in development of sound venture capitalism, sources and types of funds and process of investing, agency issue and information asymmetric problem in venture investment, financial contracting and different instruments, stages of financing and venture termination issue, risk and return strategies, and others.

Most of the researches have addressed these issues either from venture capitalists (VCs) and investors or only from VCs point of views. Few studies have addressed the entrepreneurial issues in-depth. For example, different financing structures and risk-return strategies in between VCs

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and entrepreneurs are investigated in exploratory research, not in a modeling format. The main focus of this study is to contribute to fill up this gap of existing research in venture capital investment.

Relevant Literature in Venture Capital

The traditional concept of venture capital (VC) investment belongs to independent sources of funds and independent firms tend to be seen as the more traditional type of venture capitalist. These funds typically funded through limited life closed-end funds and are highly committed to generate return for investors through realizing a capital gain within a very specified period of time [Wright and Robbie, 1997]. In more recent years, the captive venture capitalists, which are part of banks or insurance companies and do not have to raise capital from third parties, are increasing day by day [Abbott and Hay, 1995]. Captive venture capitalists tend to invest primarily in later-stage projects such as development capital and management buy-outs and buy-ins.

Since the very beginning of theoretical research and its practical application, agency problem is being considered a major issue in venture capital investments. Venture capitalist as an agent of fund providers or investors has agency relationship and a significant agency problem may arise in the valuation of investments for the purpose of reporting to investors [Wright and Robbie, 1997]. Venture capitalist as an agent is responsible for such valuations and on which their performance will be judged [Fried and Hisrich, 1994].

The adverse selection issue is another dimension of research in venture capital investment. Institutions are faced with a potential adverse selection problem in that they are unable to gauge the managers' performance in the enterprise prior to deal completion [Amit and et al, 1990]. Adverse selection issues also raise crucial problems in the potential effectiveness of post-transaction monitoring by institutional investors [Stiglitz and Weiss, 1981]. These situations lead investors to misjudge a proposed investment in a venture and a deal and accompanying financial structure to be agreed may be inappropriate and possibly unattainable [Wright and Robbie, 1997].

Another study points out that entrepreneur's familiarity with the industry, personal characteristics, and track records can provide some insight for the venture capitalist, these criteria are at best partial predictors of future success. They argue that if venture capitalists are unable to assess private information about an entrepreneur's capabilities, low-ability entrepreneurs will accept the venture capitalist's price offer while high-ability entrepreneurs will not [Amit and et al, 1990]. The nature of the relationship between the venture capital and the entrepreneur has a very high impact on the level of returns [Barry, 1994]. But it is not clear from the current literature what are the determinants of this important relationship and how these determinant factors have impact on the distribution of risk and return in between venture capitalist and entrepreneur. Among these, we believe, nature of financial contracting/structures is one of the most important determinants to this relationship. However, negotiating appropriate financial structures using individualized investment instruments is an important attribute in venture capital investment [Best and Mitra, 1995].

Tyebjee and Bruno (1984) argue that VC investment differs from equity financing in publicly traded companies in four ways. First, VCs generally invest in firms that do not have a proven history. Second, the investment is placed in small firms, implying a higher degree of involvement between the VC firm and the entrepreneur. Third, VC investments are illiquid in the short-term because no secondary market exists for shares in a privately held company. Finally, when VCs commit to an investment, they do so with the understanding that rewards will not be seen immediately. In another study they made a major contribution to identifying the stages in the venture capital process [Tyebjee and Bruno, 1985].

Research study shows that venture capitalists favored the use of preference stock regardless of the presence or absence of deal specific influences. The use of debt financing is subject to several exceptions: that the investment would shortly generate taxable income, would have collateralizable assets, would have products resistant to the economic cycle and are more likely to be later stage financing [Norton and Tenenbaum, 1992].

Another study by the same writers examines the link between financing structures, financing stages and venture capitalists' characteristics. They

find that smaller and less diversified venture capitalists make greater use of ordinary equity instruments; however, the use of preferred stock did not increase in early stage investments. [Norton and Tenebaum, 1993]

A particular problem concerns the consequences of the venture capitalist and the entrepreneur failing to agree on the degree to which the venture will be profitable, with consequent implications for splitting the equity stake attributable to each. This is due to differences in regard to uncertainties. Chua and Woodward, [1993] suggest that this problem can be addressed through the use of stock options in the financing structures and it could induce them to act in a very professional manner to get the added advantages of stock options in future.

Structure of Financial Contracting

As mentioned earlier, the very specific objective of this study is to identify different structure of financing in venture capital investment and their impact on distribution of risk-return on both venture capitalist (VCs) and entrepreneur. The relationship between venture capitalist and entrepreneur is very important compare to the relationship between venture capitalist and investors in achieving the ultimate goals of venture capital investment. The structure of financial contracting is most important determinant to identify relationship between them. There are three forms of financial contracting in venture capital investment: (1) equity or common stock financing, (2) preferred stock financing, and (3) debt financing. Each of these three has some exclusive features that differentiate with each other. For example, under common stock financing both parties share risk and return proportionately to their ownership into the venture. But venture capitalist has pre-emptive right over cash flows under preferred stock financing. Venture capitalist will also has pre-emptive right over cash flows under debt financing without any ownership interests.

Distribution of Ownership and Risk

Ownership is an important source of risk and return both under common stock and preferred stock financing. There is no hard and fast rule of determining the share of ownership of venture capitalist and entrepreneur onto the venture investment. Indeed, the contribution of respective parties to venture investment as against total expected present value (PV)

of all potential future benefits (cash flows) is an important criteria to determine share of ownership in venture capital investment. Distribution of cash flows and risk as well are directly associate with degree of ownership under common stock financing whereas this distribution pattern affects in different ways under preferred stock financing depending on terms and conditions attach with preferred stock.

Ownership pattern has virtually no impact on debt financing where interest on debt payment is committed irrespective of future outcomes. Moreover, debt financing requires only the payment of principal at the end of maturity or as agreed upon. But venture capitalist has pre-emptive demand on terminal value of venture investment under both preferred stock and common stock financing. As a result, degree of ownership is the only way to distribute the potential terminal value in between venture capitalist and entrepreneur.

In all cases, the risk factor associates with the variation of cash flows during the potential life of venture investment. In general, more certain and stable cash flows means a lower risk while uncertain and unstable cash flows introduce a higher risk for both parties. Let us assume a venture investment with the following assumptions:

- (a) It requires initial investment or cash outflows (COF) of \$250 and no other investment requires in the subsequent stages,
- (b) expected life of the venture is 6 years,
- (c) there are two economic scenario, bad and good with equal probability i.e. 50% chance in both cases,
- (d) project will start generating cash at the end of third year and expected cash inflows (CIF) including terminal value at the end of six year would be:

Cash Flow Information

Period		0	1	2	3	4	5	6		
								CF	TV	Total
Economy	Probability	CASH FLOWS								
Bad	0.5	0	0	0	50	100	200	200	600	1000
Good	0.5	0	0	0	400	500	800	800	1200	2000
E(CIF _t)		0	0	0	270	300	500	500	1000	1500

$$E(CIF_t) = CIF(B_t) \times P(B) + CIF(G_t) \times P(G) \text{-----(1)}$$

where,

CF = Cash Flows

TV = Terminal Value

$E(CIF_k)$ = Expected cash inflows in kth year

$P(B)$ = probability of bad economic condition

$P(G)$ = probability of good economic condition

$CIF(B_k)$ = CIF in kth year under bad scenario

$CIF(G_k)$ = CIF in kth year under good scenario, for example, expected cash inflows in third year is :

$$E(CIF_3) = (50 \times 0.5) + (490 \times 0.5) = \$270,$$

(e) project discount rate is assumed at 50% and risk is distributed uniformly over the life of the project.

$$E(PV) = PV(B) \times P(B) + PV(G) \times P(G) \text{-----(2)}$$

where,

$PV(B)$ = expected present value of project under bad scenario, and

$PV(G)$ = expected present value of project under good scenario.

$$PV(B) = \sum_{k=1}^n \frac{CIF(B_k)}{(1+R)^k} \text{-----(3)}$$

where R = discount rate which is 50% in our example.

K = number of year

$$PV(B) = \frac{50}{(1.5)^1} + \frac{100}{(1.5)^2} + \frac{200}{(1.5)^3} + \frac{1000}{(1.5)^4} = \$149$$

$$PV(G) = \sum_{k=1}^n \frac{CIF(G_k)}{(1+R)^k} \text{-----(4)}$$

$$PV(G) = \frac{490}{(1.5)^1} + \frac{500}{(1.5)^2} + \frac{800}{(1.5)^3} + \frac{2000}{(1.5)^4} = \$525$$

Now, if we apply the value of $PV(B)$ and $PV(G)$ into equation #2, the expected present value of the project as a whole would be:

$E(PV) = (\$149 \times 0.5) + (\$525 \times 0.5) = \$337$ and we assume that venture capitalist provides all the initial investment of \$250. In this case, venture capitalist could demand 74% ownership and the rest goes to the entrepreneur that is 26%. The proportion of ownership is determined as follows:

Venture capitalist's implied ownership proportion = $250/337 = 74\%$, and
Entrepreneur's implied ownership proportion = $1 - 0.74 = 26\%$.

The ownership proportion is an important factor in allocating risk and to some extent it has direct impact on the distribution of return and risk. The standard deviation (σ_p) as a measure of risk in venture capital investment is determined by using equation # 5 mentioned below.

$$\begin{aligned}\sigma_p^2 &= [E(PV) - PV(B)]^2 \times P(B) + [E(PV) - PV(G)]^2 \times P(G) \text{ -----(5)} \\ &= (337 - 149)^2 \times 0.5 + (337 - 525)^2 \times 0.5 \\ &= 35344\end{aligned}$$

$$\sigma_p = \sqrt{\sigma_p^2} = \sqrt{35344} = 188, \text{ where } \sigma_p = \text{standard deviation or total risk of project.}$$

The financial contracting between venture capitalist and entrepreneur does not have any direct influence on the cash flows of project as long as project moves forward as planned initially. So, we assume that expected present value = $E(PV)$ of 337, net present value (NPV) of 87 ($NPV = 337 - 250$), and standard deviation of 188 (σ_p) will be kept intact through out our analysis unless we change our original assumptions. The distribution of risk and return is a direct function of terms and conditions attach with respective financing structure or financial contracting.

Common Stock Financing

Under common stock financing both venture capitalist and entrepreneur has legal ownership depend on their relative contribution to the venture. In our example, venture capitalist holds 74% ownership and entrepreneur portion is 26%. They will get cash flows and other benefits in accordance with their respective share of ownership.

Distribution of Risk and Return

Economic Scenario	Party	CF	E(PV)			E(CF)			E(PV)	E(CF)	E(PV)	E(CF)
			VC	Entrepreneur	Total	VC	Entrepreneur	Total				
Economic Scenario 1	VC	111	250	111	361	111	111	222	111	111	111	
	Entrepreneur	87	87	87	87	87	87	87	87	87	87	
	Total	198	337	337	337	198	198	309	198	198	198	
Economic Scenario 2	VC	389	250	389	639	389	389	778	389	389	389	
	Entrepreneur	136	87	136	87	87	87	87	87	87	87	
	Total	525	337	639	639	476	476	865	476	476	476	

In both economic scenarios, venture capitalist and entrepreneur will share cash flows including terminal value at a rate of 74% and 26% respectively. We assume that the discount rate of both parties is 50% (project discount rate is also 50%). Now, if we apply equation # 2,3 and 4, we will get expected present value E(PV) of 250 for VCs and expected present value E(PV) of 87 for the entrepreneur. These give us a net present value [NPV = E(PV) - present value of COFs] of \$0 and \$87 for venture capitalist and entrepreneur respectively. Again, if we apply equation # 5 to measure the variations in cash flows of each party, we will get standard deviations as follows:

$\delta_v = [(250 - 111)^2 (0.5) + (250 - 389)^2 (0.5)]^{1/2} = 139$, δ_v = standard deviation of VCs

$\delta_e = [(87 - 38)^2 (0.5) + (87 - 136)^2 (0.5)]^{1/2} = 49$, δ_e = standard deviation of entrepreneur.

This is important that their degree of risk is equal to their proportion of ownership in common stock financing. We know, the total risk of (σ_p) the project is 188. Venture capitalist bears 74% of total project risk (139/188) and entrepreneur takes other 26% (49/188) of total project risk. So, there is a perfect positive correlation between distribution of risk-return and share of ownership under common stock financing in venture capital investment. Venture capitalists assumes the majority of the risk in equity financing as the investment is not secured with any assets [Best and Mitra, 1997]

Preferred Stock Financing

Venture capitalist has preferential right on cash flows and other benefits over the life of the venture. By default, the remaining portion will go to entrepreneur. Financial contract in venture capital investment includes usually preferred stock financing because it gives preferential rights to VCs over cash flows and assets that common stock does not [Best and

Mitra, 1997). The nature of pre-emptive right of venture capitalist depends on the terms and conditions attach with preferred stock. Five most commonly used structure of preferred stock financing are available in practice and these are (1) simple or plain vanilla preferred stock (PS), (2) cumulative preferred stock (CPS), (3) CPS with warrant (CPSW), (4) PS with warrant (PSW), and (5) cumulative preferred stock with convertible (CPSC). Each of these structures has some unique features and has influenced in different ways over the distribution of risk and return in between venture capitalist and entrepreneur. This study includes the analysis of plain vanilla preferred stock and cumulative preferred stock. Three more assumptions have been made to analyze these structures of preferred stock financing. These are (a) 50% discount rate for both venture capitalist and entrepreneur, (b) entrepreneur will get cash/return/benefits only after paying all claims of venture capitalist at first place, and (c) venture capitalist will get terminal value at the end of venture life at a rate of 74% which is equal to his implied share of ownership under equity financing at a similar discount rate of 50%.

Simple Preferred Stock (PS) Financing

This is the simplest form of PS financing. Venture capitalist has preferential right over current and future cash flows. Usually, venture capitalist will get dividend at a constant rate. In venture capital financing it is not possible to get a dividend rate that is available in the market. In any way, venture capitalist will not accept any deal or dividend that does not satisfy minimum expectation or requirement as against a risk factor of 50% discount rate. This means, the internal rate of return (IRR) of venture capitalist must be at least 50% and annual preferred dividend starting at third year would be calculated as follows:

$$NPV = \frac{X}{0.50^1} + \frac{X}{0.50^2} + \frac{X}{0.50^3} + \frac{X}{0.50^4} + \frac{0.74(200)}{0.50^5} \cdot P(G) - \left(\frac{X}{0.50^1} + \frac{X}{0.50^2} + \frac{X}{0.50^3} + \frac{X}{0.50^4} + \frac{0.74(200)}{0.50^5} \right) \cdot P(B) \quad (6)$$

where,

X = annual preferred dividend,

P(B) = probability of bad which is 0.5, and

P(G) = probability of good which is 0.5,

After solving equation # (6) for X the value is as follows:

The expected present value of cash inflows for venture capitalist is 250 that is equal to his initial investment onto the venture leaving a zero net present value (NPV) with 50% return as implied discount rate. Entrepreneur has a NPV of 87 similar to equity financing. Compare to equity financing, the risk (σ_v) of venture capitalist is less in preferred stock financing that is only 120 ($\sigma_{vc} = 120$) or $120/188 = 64\%$ of total project risk than a risk of 139 or 74% of total risk in equity financing. On the other hand, risk (σ_e) of entrepreneur increases to 68 which is 36% ($68/188$) of total project risk compare to a 26% in equity financing. The shift of risk from venture capitalist to entrepreneur is due to the commitment of payment of preferred dividend to venture capitalist under preferred stock financing.

Cumulative Preferred Stock (CPS) Financing

The unpaid dividend in any year will carry forward and is payable immediately as soon as CIFs are sufficient to pay off these previously accumulated unpaid preferred dividend. Venture capitalists' financial interest is more protected with this type of financing structure. Now, what would be the annual preferred dividend in cumulative preferred stock financing? Again go back to equation # 6, we find a minimum annual preferred dividend of \$259.40 without cumulative condition. With cumulative condition it would be higher than this amount. But at this stage, we do not know the exact amount of annual preferred dividend. Let us apply the trial and error method taking into consideration of minimum dividend payment \$ 259.40 without having any cumulative condition to test whether it is enough to satisfy venture capitalists' claim with cumulative condition under bad scenario. The starting point of our equation is third year.

Determination of Annual Preferred Dividend Cumulative Preferred Stock Financing

Year	Annual preferred dividend (Eq. 6)	Maximum available cash to pay dividend	Yearly unpaid dividend	Cumulative Unpaid dividend
3	259	50	209	209
4	259	100	159	368
5	259	200	59	427
6	259	200	59	486

The cumulative unpaid preferred dividend at the end of sixth year is 486. If we assume that entrepreneur will be willing to pay this unpaid dividend to VCs from his share on terminal value of project at the end of sixth year, even cash flow pattern of the project does not satisfy this argument. Because, the total unpaid amount (486) at the end of sixth year is much higher than entrepreneur's 26% share on terminal value which is only 208 (26% of 800 = 208). Even, entrepreneur's share is not enough to pay all unpaid claims of venture capitalist at the end of venture under bad state of economy. So venture capitalist could easily demand the whole TV of \$800 under bad scenario and if so, then annual preferred dividend would be:

$$0.5 \left[\frac{50}{(0.5)^1} + \frac{100}{(0.5)^2} + \frac{200}{(0.5)^3} + \frac{200}{(0.5)^4} + \frac{200+800}{(0.5)^5} \right] + 0.5 \left[\frac{X}{(0.5)^2} + \frac{X}{(0.5)^3} + \frac{X}{(0.5)^4} + \frac{X}{(0.5)^5} + \frac{0.74(200)}{(0.5)^6} \right] = 250 \tag{6-B}$$

$$X = \frac{250 - 74.35 - 38.98}{0.3566529} = 383$$

The annual preferred dividend of \$383 as calculated above is less than expected CIFs in each year under good scenario. The distribution of cash flows and risk as well in between venture capitalist and entrepreneur are show below.

**Distribution of Risk and Return
(Cumulative Preferred Stock Financing)**

		Year	1	2	3	4	5	6	E(PV)	σ _v	σ _e
Venture Capitalist (26% of \$800)	Condition	Good									
		Bad									
		Good	101	101	101	101	101	101	101	54%	101
		Bad	0	0	0	0	0	0	0	0	0
		Expected	101	101	101	101	101	101	101	54%	101
Entrepreneur (74% of \$800)	Condition	Good									
		Bad									
		Good	87	87	87	87	87	87	87	46%	87
		Bad	0	0	0	0	0	0	0	0	0
		Expected	87	87	87	87	87	87	87	46%	87

Again, we apply equation # 2, 3 and 4 to calculate expected present value E(PV) of cash flows of VCs and entrepreneur as well. Equation # 5 is used to calculate the variation in cash flows i.e. risk of venture capitalist (σ_v) and risk of entrepreneur (σ_e). We find, σ_v = 101 or 54% of (101/188) total project risk and σ_e = 87 which is 46% of (87/188) total project risk.

Compare to non-cumulative or simple preferred stock financing, venture capitalist risk again decreases to $\sigma_e = 101$ in cumulative preferred stock financing from 120 in previous case. That is a 10% decrease (64%-54%) from non-cumulative or simple preferred stock and 20% (74%-54%) decrease from equity financing structure compare to share in total project risk. Any decrease in risk to VCs' part has a direct impact of increase in risk to entrepreneur. The more certain and/or committed cash flows to venture capitalist means a less variation in CFs and hence decrease in risk. Entrepreneur always gets remaining portion (after paying to VCs) of CFs in preferred stock financing means a higher degree of variability in CFs that leads to an increase in risk (σ_e) to entrepreneur.

Conclusion

We have identified two possible scenarios where both parties may act or react with respect to a financial instrument. If the financial instrument is undesirable to both parties, then there is no question of any investment to a venture project. The conflict of interest arises, if the financial instrument is desirable to only one party but not to the other party. An appropriate instrument is one that is acceptable and desirable to both parties. With respect to the choice of financial instruments, this study supports the conclusion of Norton and Tenenbaum (1992) that the venture capitalist favored the use of preferred stock. But, the entrepreneur side is ignored in the current literature, although an appropriate choice is one that is acceptable to both parties. A partial choice by one party is not enough to get start a venture project in the market place. A complete choice with due consideration of both parties interests is a must for an effective financial contracting.

The findings of the study give direction to do further research in this area. Research study can be done to find out an optimal solution with respect to develop a financial instrument that is desirable to both the venture capitalist and the entrepreneur. Qualitative factors like, market potential, competition, managerial competence, entrepreneur's commitment etc. might have impact to see the decision problems in a different way than what we explained the same purely on a financial basis. However, in any way, a mutual acceptance is an important element in the choice of financial instruments in venture capital.

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