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Why do venture capitalists use such high discount rates?

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Abstract

Purpose – Venture capitalists typically use discount rates in the range of 30-70 percent. During the startup stage of venture-capital financing, discount rates between 50 and 70 percent are common. The discount rate decreases from the first through fourth stage: from 60 to 30 percent. These rates of return are high compared to historical returns on common stocks or small stocks (12.1 and 17.8 percent, respectively). Such high discount rates cannot also be explained in the context of any existing asset pricing theory; that is, any reasonable risk-adjusted discount rates are not consistent with discount rates in the order of 30-60 percent. The paper provides a rational economic explanation why venture capitalists (VC) use such high discount rates. The paper aims to discuss these issues.

Design/methodology/approach – Let the discount rate of a venture project be 15 percent; this discount rate depends on the systematic risk of the cash flows from the project given that the project is successful. Using the procedure, a VC who estimates the probability of eventual success of the project between 60 and 40 percent will impose a discount rate between 42 and 74 percent. These discount rates are quite similar to the discount rates charged by VC in their startup and first stages.

Findings – The high rates of return charged by VC reflect the fact that not all their projects succeed in that they have no net cash-inflows. Adjusting for the probability of success of the project provides estimates of discount rates comparable.

Originality/value – The paper argues that reported rates of return of common stock are relevant for projects that have succeeded in that they have net cash-inflows.

Keywords IPO, Venture capital, Cost of capital, Exit via acquisition, Venture risk

Paper type Research paper

1. Introduction

Venture capitalists typically use discount rates in the range of 30-70 percent; (Damodaran, 2009; Metrick, 2007; Smith and Smith, 2004). During the startup stage of venture-capital financing, discount rates between 50 and 70 percent are common. The discount rate decreases from the first through fourth stage: from 60 to 30 percent. These rates of return are high compared to historical returns on common stocks or small stocks (12.1 and 17.8 percent, respectively; Ibbotson and Sinquefield, 1988). The purpose of this note is to provide a rational economic explanation why venture capitalists (VC) use such high discount rates. We also provide a simple procedure that will enable practitioners to calculate appropriate discount rates for the various stages of venture-capital financing.

The remainder of the note is organized as follows. In the next section we present and discuss the implications of our model. The final section summarizes the note.

2. Model and its implications

Consider a venture capital project that has only two stages: stages A and B[1]. In stage A the entrepreneur and the VC agree to invest in a project. This project could involve a new technology and/or a marketing approach. While both the entrepreneur and the VC own

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equity in the project, the VC provides the financing equal to I_A. In this stage of the project the technical and/or initial economic feasibility of the project is determined. If the project is determined feasible it is continued, otherwise it is terminated. Regardless of whether the project is continued or terminated, there are no cash inflows at this stage. The probability of eventual success of the project in stage A is p_A. We define eventual success of the project as the opportunity for the entrepreneur and the VC to cash-out their equity claims in the project through a successful initial public offering (IPO) or an acquisition. If the project is deemed feasible in stage A, the project moves to stage B.

In stage B, commercial production and marketing decisions are made. There are no cash inflows in this stage, cash outflow is I_B, and the probability of eventual success of the project is p_B. Note that p_B is greater than p_A since the probability of eventual success increases with each successive stage. If the product is well received in the market, plans to increase the scale of production, distribution, and marketing are initiated. Funds for this expansion are to be obtained through an IPO; assume this brings a cash inflow of X. If the product is not well received in the market then the project is terminated without any cash flow implications.

In equilibrium, the zero-profit condition must obtain in the venture-capital industry (as it does in all other industries). Hence:

$$I_A = \frac{p_A X + (1 - p_A)0}{(1 + r_A)(1 + r_f)}, \tag{1}$$

where r_A is the discount rate for stage A and r_f is the risk free rate.

From equation (1):

$$X = I_A \cdot \frac{(1 + r_A)(1 + r_f)}{p_A}. \tag{2}$$

In equation (2), $((1 + r_A)(1 + r_f))/p_A$ is the rate of return on funds invested into the venture-capital project in stage A.

Let:

$$(1 + r_A^*)^2 = \frac{(1 + r_A)(1 + r_f)}{p_A}. \tag{3}$$

Depending upon p_A, r_A^* can be significantly higher than r_A as illustrated in Table I. r_A^* is the discount rate that is typically noted in the venture-capital literature. Note that

$p_A \rightarrow$ $r_A \downarrow$	0.30	0.40	0.50	0.60	0.70
0.05	0.92	0.66	0.48	0.36	0.25
0.10	0.96	0.70	0.52	0.39	0.28
0.15	1.00	0.74	0.55	0.42	0.31
0.20	1.05	0.77	0.59	0.45	0.34
0.25	1.09	0.81	0.62	0.48	0.37

Notes: This table provides values of r_A^*, the discount rate used by VCs, where p_A is the probability of eventual success of the project, and r_A is the discount rate implied by the systematic risk of the project (given that it is successful); a risk-free rate of 5 percent is assumed

Table I.
Discount rate used by VC in first stage

r_A^* does take into consideration – via p_A – that not all venture-capital projects succeed. r_A is the discount rate of the project that depends on the systematic risk of the cash flows from the project given that the project is successful. Note that for even a conventional r_A of, say, 15 percent, a VC that estimates the probability of eventual success of the project between 60 and 40 percent will impose a discount rate (r_A^*) between 42 and 74 percent. These estimates of r_A^* are quite similar to the discount rates charged by VC in their startup and first stages; (Sahlman, 1990, Table 6)).

Next, let us consider the discount rates for stage B, r_B:

$$I_B = \frac{p_B X + (1 - p_B)0}{1 + r_B}. \tag{4}$$

From equation (4):

$$X = I_B . \frac{(1 + r_B)}{P_B}. \tag{5}$$

In equation (5), $(1 + r_B)/p_B$ is the rate of return on funds invested in the venture-capital project in stage B.

Let:

$$1 + r_B^* = \frac{1 + r_B}{p_B}. \tag{6}$$

Again, depending upon p_B, r_B^* can be significantly higher than r_B as illustrated in Table II. For example, if r_B is assumed to be 15 percent, a VC that estimates the probability of eventual success from 70 to 90 percent, will charge a discount rate from 64 to 28 percent. These estimates are quite similar to the range of discount rates reported by Sahlman (1990, Table 6) that VCs charge during the final stages of the venture-capital financing process.

2.1. How are r_A and r_B determined?

r_A (r_B) is the discount rate of the project in stage A (stage B) that depends on the systematic risk of the cash flows from the project given that the project is eventually successful. The systematic risk (or, risk that is non-diversifiable) of this project, like that of any other project, depends on:

$p_B \rightarrow$ $r_B \downarrow$	0.60	0.70	0.80	0.90	0.95
0.05	0.75	0.50	0.31	0.17	0.11
0.10	0.83	0.57	0.38	0.22	0.16
0.15	0.92	0.64	0.44	0.28	0.21
0.20	1.00	0.71	0.50	0.33	0.26
0.25	1.08	0.79	0.56	0.39	0.32

Table II.
Discount rate used by VC in second stage

Notes: This table provides values of r_B^*, the discount rate used by VCs, where p_B is the probability of eventual success of the project, and r_B is the discount rate implied by the systematic risk of the project (given that it is successful)

- cyclical nature of the industry the firm is in; and
- operating leverage.

The firm is unlikely to change its industry during the various stages of the venture-capital financing process or even any time soon thereafter. The operating leverage initially increases as the firm acquires capital equipment but once the firm commences production and distribution it is unlikely to change this substantially. This suggests that the systematic risk of the project increases somewhat initially and then stays fairly constant thereafter.

To estimate r_A (and r_B) we would have to estimate the systematic risk of the project, and assume some asset-pricing model. We do not wish to underplay the importance of accurately estimating the systematic risk of the project and selecting an appropriate asset-pricing model. However, we have nothing new to contribute to either of these topics. Given that the historical rate of return on small common stocks is 17.8 percent, we consider it unlikely that the discount rate for the venture-capital project (given that it is successful) will exceed 20 or 25 percent. For this reason we have varied r_A (and r_B) from 5 to 25 percent in Table I (and Table II) to illustrate how r_A^* (and r_B^*) varies with r_A (and r_B). It appears that r_A^* (and r_B^*) are more influenced by p_A (and p_B) than r_A (or r_B).

2.2. Additional explanations for the high discount rates

The venture-capital financing literature has provided several explanations why the discount rate used in venture-capital projects is so high. We note some of these explanations below:

- Funds invested by a VC are illiquid until the IPO or acquisition. Amihud and Mendelson (1986) provide evidence that illiquidity of an asset increases its expected rate of return.
- The VC is not a passive investor; (Metrick, 2007; Smith and Smith, 2004). VCs make a substantial time commitment to any project that they invest in: they provide managerial services, monitoring and their privileged access to customers and suppliers in the industry. Hence, the discount rate not only reflects the systematic risk of the project, but also compensation to the VCs for their time.
- It has been suggested (Damodaran, 2009) that entrepreneurs often provide an upward biased estimate of the cash inflows from the project. A higher discount rate corrects for this bias.

We consider the above explanations as complimentary to ours. It is possible that all explanations noted herein, including ours, might be relevant in explaining the high discount rates used in venture-capital financing projects.

3. Summary

Venture capitalists typically use discount rates that are high compared to historical rates of return on common stock and other financial assets. Such high discount rates also cannot be explained in the context of any existing asset pricing theory. We provide a rational economic explanation why VC use such high discount rates. We argue that reported rates of return of common stock are relevant for projects that have succeeded in that they have net cash-inflows. The high rates of return charged by VC reflect the

fact that not all their projects succeed in that they have no net cash-inflows. Adjusting for the probability of success of the project provides estimates of discount rates comparable to rates of return on common stocks and other financial assets.

The above formulation can also be used to incorporate the risk of regulatory rulings, marketing success, competitors' response, and in the case of capital investments in developing countries – political risk.

Note

1. The two-stage assumption is for simplicity. The intuition of the two-stage model can be easily generalized to more stages.

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