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The optimal portfolio size of venture capital under staged financing

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Abstract

Traditional theory thinks that portfolio is not a fundamental characteristic of venture capital (VC), the literatures research on venture enterprise portfolio is relatively rare at home and abroad. Venture capital tends to hold a certain number of start-up firms to form a portfolio and at the same time to provide funds and value-added services for more than one start-up firm. Under the scarcity of resources such as attention, venture capitalists should consider how to determine the optimal portfolio size of start-up firms in venture capital finance. The previous studies generally neglected the characteristic that staged financing is the common method used by venture capitalists in most cases. Under the staged financing mechanism, based on double-size moral hazard, using optimization theory we get the expression about the optimal portfolio size of venture capital, and then we find that the optimal portfolio size decreases in start-up capital and following capital, and increases in earlier stage output and total output.

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Key words: venture capital; start-up firms; staged financing; portfolio size

1. Introduction

Venture capital (VC) is characterized as providing start-up firms which have high potential growth and entrepreneurial talent with finance and business skills to exploit market opportunities. It is a specific type of financial intermediaries that provide funds, but also expertise to innovative projects. Traditional theory thinks that portfolio is not a fundamental characteristic of venture capital, however, portfolio investment is superior to single investment in performance [1], and the suitable portfolio size helps investment diversification effectively [2]. Venture capital investment portfolio theory should be unique and be different from the traditional portfolio theory on account of its characteristics compared with the securities investment and the investment of financial derivatives and the industrial investment. This is worthy of our in-depth study of the subject.

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Kanniainen and Keuschnigg(2003, 2004)[3-4] first put forward the theory about venture capital portfolio, they pointed out that the existence of the optimal portfolio size is because: venture capitalists invest time and effort to manage and help the start-up firms to realize of innovation, then the resulting increase in the number of income portfolio firms also accordingly "diluted" the input to each enterprise's help and the value-added service quality meanwhile, which will reduce the probability of success of an each project and the entrepreneur(EN) incentive. This will force it to give entrepreneurs more shareholding ratio to maintain sufficient incentive, thus there must exist trade-off between value-added service strength and the number of portfolio firms. Based on double-size moral hazard, Bernile、Cumming and Lyandres(2007)[5]set up a model of the optimal portfolio size of venture capital based on double-size moral hazard and discussed the influence mechanism of some factors on the optimal portfolio size. Fulghieri and Sevilir(2009)[6]make a portfolio size selecting model based on the focus of investment. They pointed out that the more concentrated investment in the field of investment, the more conducive to the VC to play professional knowledge to provide better value-added services for the investment business to get better benefits. They find that the scarcity of venture capital will make venture capital institutions have a higher bargaining power. The model illustrates the impact of bargaining power and professional knowledge on the portfolio size of venture capital. But all of above studies have not considered the case of staged financing.

Cumming(2006)[7]indicated that staging finance is an important factor affecting the size of venture capital portfolio. In this paper, we will introduce the staged financing mechanism, and analyse the decision of the optimal portfolio size of venture capital under staged financing.

2. The model

We assumed that all agents are risk-neutral, and that entrepreneurs start one firm each, have no own funds, and are commercially inexperienced. Consequently, they need not only finance, but also managerial advice [8-9]. VC finances and advises a portfolio of i=1,…,n start-up firms. Generally speaking, venture capitalists are mainly to give capital and management support, and technological innovation is mainly dependent on entrepreneurs [10-11]. Neither the effort of entrepreneurs nor the extent of VC service is verifiable and contractible. Hence, in the different stages of the growth of the start-up firms, the role of venture capitalists and entrepreneurs is different [12]. We roughly divided the development phase into two stages, respectively called technological innovation stage (stage 1) and management innovation stage (stage 2). The phase is shown below in table 1:

Table 1. Investment phase

technological innovation stage (stage 1)				management innovation stage (stage 2)		
t=0	t=1	t=2	t=3	t=4	t=5	t=6
portfolio	deal	EN efforts	results	deal	VC efforts	results
n	$I_{1,i}$, $s_{1,i}$	e_i , c_{EN}	$R_{1,i}$	$I_{2,i}$, $s_{2,i}$	a_i , A , c_{VC}	$R_{2,i}$

Stage 1: In the first stage, the main activity of the start-up firm is technological innovation, and the main criterion of success or failure is the success or failure of technological innovation. In the stage, VC only provides to EN for start-up capital, to support entrepreneurial enterprises to carry out technological innovation activities.

t=0: Venture capitalists choose to the enterprise portfolio {EN_1, EN_2, ... , EN_n }, determine the size of the portfolio.

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