2014

ISSN : 0974 - 7435 Volume 10 Issue 18

BioTechnology

An Indian Journal

FULL PAPER

BTAIJ, 10(18), 2014 [10677-10682]

Countermeasures and research on adverse selection of venture capital under asymmetric information

Ling Zhang[1,*] , Yi Cui[1], Mian-Bin Zheng[2], Yao Xiao[1]

[1]School of Business Administration, South China University of Technology, Guangzhou 510640, (CHINA)

[2]Guangdong BD-LOGAN Information Technology Co., Ltd., Guangzhou 510640, (CHINA)

E-mail : scutlingzhang@gmail.com

ABSTRACT

Adverse selection between venture capitalists and entrepreneurs may lead to inefficiency of investment. Sometimes it may be make the investment fail. The purpose of this study is to eliminate or reduce the negative impact of adverse selection on investment decisions, so as to improve the decision-making efficiency. This study describes the adverse selection between venture capitalists and entrepreneurs in the process of projects selection, analyzes the impact of venture capitalists' contract design and venture entrepreneurs' signal mechanism on adverse selection. By introducing stock proportion of venture capital into the contract design between venture capitalists and entrepreneurs, we construct an equilibrium model and enrich the signaling theory in venture capital circumstances. Analysis shows that the decision whether a venture capitalist and an entrepreneur can reach an investment agreement or not is determined by the total expected return and stock proportionate of entrepreneurs. Reasonable stock proportionate, sufficient total expected revenue, reduction of adverse selection cost can all reduce the phenomenon of adverse selection under asymmetric information.

KEYWORDS

Venture capital; Adverse selection; Signal display; Information screening.

INTRODUCTION

Information asymmetry is one of the important features of venture capital. Information asymmetry refers to the imbalance of power between two parties in transaction, resulting from the different degrees of knowledge and probability distribution. It means one of the party has more or better information than the other, in addition, the imbalance cannot be verified even by a third party, and it would cost tremendously if it could[1]. The main bodies involved in the activity are venture capitalist and entrepreneurs, whose information for both sides is not symmetrical in the process of transaction. Generally, the entrepreneur has more information about investment projects and operating conditions of the company that cannot be evaluated accurately by venture capitalist. For example, the risk degree of the project, development potential, marketability, the probability of success, the quality of managers, the demand for funds and capital structure, etc. In this case, due to the driving force of opportunism and utility maximization, entrepreneur may hide some information about investment project quality to get venture capital, leaving the venture capitalist with great risk of adverse selection in project decision[2].

The purpose of this study is to investigate these issues that relate to the behavior of adverse selection, focusing on the decisions of venture capitalists to fund a venture or not. Within a principal-agent framework that captures the essence of the venture capital/entrepreneur relationship, we examine several questions including: who decides to enter into an agreement with ventures? Why? How is this decision related to the unobservable ability of the entrepreneur, the stock proportionate, sufficient total expected revenue, or the signal cost? Would it be worthwhile for the venture capitalist to investigate the ability of entrepreneur before involving them in the venture? By solving these questions, this paper tries to provide a basis for reducing investment risk and improving investment decision-making efficiency under asymmetric information.

LITERATURE REVIEW

Many scholars have researched on adverse selection problems in venture capital with in a principal-agent framework both home and abroad. Amit[3] argued that the downturn of American venture capital market in the 1980s was resulted from the adverse selection of venture capitalists under asymmetric information. Under the assumption that the uncertainty of the quality of venture project and the ability of entrepreneur in advance[4], this paper analyzed the problem of adverse selection and the consequences in the project selection process. The goal of venture capitalists is to find a project of good quality, which means the quality of entrepreneurs and ventures. In most cases, it is private information which it is out of the reach for the venture capitalists. The inability of outsiders to assess the venture founders' core attributes, namely their entrepreneurial skills and abilities and company quality, may confuse venture capitalist in decision making, such as the decisions of entrepreneurs to involve outsiders and the prices venture capital firms may be willing to pay for new ventures. They may have difficulty in distinguishing a good project from a poor one, which in turn will decrease the attraction of the good one and make it hard for funding.

Usually, venture capitalists choose to offer a lower price to the entrepreneurs based on the average estimation of the market and venture capitalist, in order to reduce the losses of the bad decision. The lower price result in a phenomenon like Gresham`s law, which means good venture capitalists and good venture will exit as they think it is unprofitable, but bad venture capitalists and bad venture will take risk to try. After all, it reduces the overall quality of the project and endangers the whole venture capital industry. As a fact, the result is the same as "lemon market" described by Akerlof, which is the most profitable and credible venture fails to be financed by the venture capitalist due to the adverse selection problem associated with asymmetric information[5]. Based on contract theory, Yuan and Liu(2013)[1] elaborated the forms and governance modes of bilateral moral hazard in venture capital, analyzed the current situation of moral hazard risk in China, and proposed some recommendations in how to prevent and control the bilateral moral hazard between entrepreneurs and venture capitalists. Zheng Hui (2007) constructed a two-stage signaling and screening model to solve the adverse selection under asymmetric information in venture capital[2]. Zhou and Zhu(2014)analyzed adverse selection under the context of patent quality[6]. On the base of existing theories, this study explained the adverse selection in the process of selecting investment project and analyzed the impact of venture capitalists` contract design and entrepreneurs` signaling on adverse selection on adverse selection. The conclusion is that whether an entrepreneur can reach an investment agreement or not is determined by the total expected return and the proportion of shares of entrepreneurs, which provided the foundation of reducing the adverse selection in venture capital.

ADVERSE SELECTION IN PROJECT SELECTION

The adverse selection in venture capital results from the asymmetric information between venture capitalists and entrepreneurs. Without any information of the quality of the project, venture capitalists require a higher return for those high-quality projects and lower for those of poor quality in equilibrium, as the risk of the project with average quality is lower than the project with high quality but higher than that with poor quality. As a result, it increases the cost of venture capital for the project with higher quality than average. As the project with high quality can be financed in other financing channels at a lower cost, the entrepreneurs will prefer another way rather than venture capital. As for the project whose quality is below average, its finance cost may be higher than the return required by venture capitalist, therefore, they will be more interested in participating in the transaction. In this way, project with high quality is driven out of the market, leaving the market with

project of poor quality. Then rational venture capitalists increase their respected return and thus the problem becomes worse and forms the phenomenon of adverse selection in project selection[2].

In this paper, we analyze the problem of adverse selection in selecting investment projects based on the following assumptions:

1)Venture capitalists are risk neutral, which means the expected utility is equal to the expected revenue. the utility function of entrepreneurs is $U_{(X)}$, which is increasing gradually by concave function, that is $U_{(X)}' > 0, U_{(X)}'' < 0$;

2)The utility function of venture capital is $U_{(X)}$, $U_{(X)}$ is increasing and concave function, that is $U_{(X)}' > 0, U_{(X)}'' < 0$;

3)A series of continuous investment projects existed in the market, their difference is denoted by the success rates of the project P, where $[P_1, P_2] \in R$, and $[0 \le P_1 < P_2 \le 1]$;

4)As for the specified project whose quality is known by the entrepreneurs, but unknown to venture capitalist, is denoted as $P_{(\mathrm{R})}$, its distribution function is $F_{(\mathrm{P})}$ and density function is $\mathrm{f}_{(\mathrm{P})}$[7];

5)The result of all investment projects are two outcomes: Success or failure, and the retain rate is $R > 0$ and 0 respectively.

When entrepreneurs are seeking for financial support from venture capitalists, they usually shares part of equity to the venture capitalists[8]. We assumed the share proportion of venture capitalist and entrepreneurs is K and (1-K) respectively. Then the respected share proportion of the venture is K after obtaining venture capital venture, and its expected investment income is

$$\mathrm{U_{VC}}=\mathrm{K}\cdot\mathrm{E}(R)=K\cdot\mathrm{R}\cdot\mathrm{P_R}$$

where *R* is the Current short-term Treasury bill rate;

The screening and regulatory costs of venture capitalists is the mean of respected return, computed by

$$\mathrm{E(R)}=\mathrm{R}\cdot\mathrm{P_R}$$

Assuming venture capitalists invest I and get $\mathrm{C_{VI}}$ shares, here $\mathrm{C_{VI}}$ is based on the entrepreneurs' professional ability, intermediary services, information availability, signaling and other information of ventures. The stock proportion of the entrepreneur is $1-K$, then the respected return of the entrepreneur is

$$\mathrm{U_{VE}}=(1\text{-K})\cdot\mathrm{E}(R)=(1\text{-K})\mathrm{R}\cdot\mathrm{P_R};$$

Assumed R_0 is the respected return by share transfer or self-management, $\mathrm{C_{VE}}$ is the finance costs of entrepreneur, which refers to the cost for investment, including sending a signal to venture capitalists to demonstrate the technology competence and projects potential. If companies do not get venture capital, the expected return for both sides is zero.

What the venture capitalists want is to maximize the returns through investment, and what the entrepreneur consider is to maximize the income of management layer by accepting the venture capital.

Based on the above assumptions, we get the objective function for venture capitalists as

$$\mathrm{U_{VC}}=\max\int\left[R_{(P)}-S_{(X)}\right]\mathrm{dF}(p)-C_{VI}=\max\int\left[KE(R)\right]\mathrm{dF}(p)-C_{VI} \quad \textbf{(1)}$$

And the objective function for entrepreneur as

$$U_{VE}=\max\int\left[R_{(P)}\right]\mathrm{dF}(p)-\mathrm{C_{VE}} \quad \textbf{(2)}$$

Constraints for entrepreneurs to participate in the transaction as

$$s.t.\int\left[R_{(P)}\right]\mathrm{dF}(p)-\mathrm{C_{VE}}\ge\mathrm{R_0} \quad \textbf{(3)}$$

We define $R_{(P)}$* and $S_{(R)}$* as the optimum solution for function (1), U_{VC}*$(R_{(P)})$ as the maximum value of function (1), and U_{VE}*$(R_{(P)})$ as the maximum value of function (2).

Assuming U_{VC}*$(R_{(P)})$ is an increasing function of P, we define ϖ as the minimum income required for the best quality risk project, in which $\varpi>0$, and $U(\varpi)=U(p_2)$; we define ω' as the minimum income required for the worst quality risk project, in which $\omega'>0$, and $U(\omega')=U(p_1)$.

Since U_{VC}*$(R_{(P)})$ is increasing function of P, entrepreneurs will accept a venture capital when $P\leq U^{-1}(R_{(P)})$, and if the revenue $\omega=\omega'$, there will be no entrepreneurs applying for venture capital, so the expect return of venture capitalists is zero. On the other side, if $\omega=\varpi$, all the entrepreneurs in market will apply for this venture capital, and the expected return of venture capitalists is $E_P[U_{VC}$*$(R_{(P)})]$. If $\omega'<\omega=\varpi$, then only entrepreneurs whose quality is $P\leq U^{-1}(R_{(P)})$ will apply for the venture capital. Therefore, there exists a critical value $R^*_{(P)}$, if and only if $R < R^*_{(P)}$, a venture will apply for venture capital. As for $R^*_{(P)}$, there exists a critical value of success probability P^*, if and only if $P < P^*$, the ventures will apply for venture capital for their projects.

Defining $P^*=U^{-1}(R_{(P)})$, we know that the projects with quality $P\leq P^*$ will receive venture capital while those projects with quality $P>P^*$ would not, when the information of project quality is private information of entrepreneurs in venture capital market. In an information asymmetry situation, venture capitalists choose to offer a lower price to the entrepreneurs based on the average estimation of the ventures, which leads to good ventures will exit as they think it is unprofitable, but bad ventures will apply for venture capital. After the projects with high quality $P>P^*$ exit the capital markets, the overall quality of the project declines and endangers the whole venture capital industry. To compensate for the higher risk, rational venture capitalists increase K and make P reduce again. The more P reduces, the more ventures with high quality will exit, thus the problem becomes worse and forms the phenomenon of adverse selection in project selection.

IMPACT ANALYSIS OF ADVERSE SELECTION

The signaling model, screening model in contract theory and information economics provide us with a theoretical guidance to solve adverse selection[2]. In this paper, two methods are used to prevent and reduce the risk of adverse selection between venture capitalists and entrepreneurs: One is to design different contracts for entrepreneurs with different abilities in advance. In this way, the venture capitalists can obtain entrepreneurs' ability information based on the entrepreneurs' selection. The other is to design investment principles based on entrepreneurs' signaling.

Equilibrium Strategy for adverse selection

Considering the constraints of venture capitalists participation

Subtract the screening and regulatory costs C_{VI} from Expectation expected return of venture capitalists $K\cdot E(R)$, and only if the subtraction result is greater than the opportunity cost of invested capital $I(1+r)$ will he decide to invest. Therefore, constraints of venture capitalists participation are as follows:

$$KE(R)-C_{VI}\geq I(1+r) \text{ or } KE(R)\geq I(1+r)+C_{VI} \quad \textbf{(4)}$$

The equity ratio requirements of venture capitalists is induced by

$$K\geq [I(1+r)+C_{VI}]/E(R) \quad \textbf{(5)}$$

Constraints of entrepreneurs' participation

Subtract the Finance costs C_{VE} from Expectation expected return of entrepreneurs $(1-K)\cdot E(R)$, and only if the subtraction result is greater than R_0 will they decide to invest. Therefore, constraints for entrepreneurs' participation are as follows:

$$(1-K)E(R)-C_{VE}\geq R_0 \text{ or } (1-K)E(R)\geq R_0+C_{VE} \quad \textbf{(6)}$$

The equity ratio requirements of entrepreneurs is induced by

$$K \le [E(R) - C_{VE} - R_0] / E(R) \quad \textbf{(7)}$$

From the analysis above, we know that only if both sides derive respected return and stock proportion will an agreement be established in this transaction. Moreover, equilibrium strategy for both sides is:

$$E(R) \ge I(1+r) + C_{VI} + R_0 + C_{VE} \quad \textbf{(8)}$$

$$[I(1+r) + C_{VI}] / E(R) \le K \le [E(R) - C_{VE} - R_0] / E(R) \quad \textbf{(9)}$$

That means venture capitalists and entrepreneurs will cooperate only when the expected total revenue meet (8) and the stock proportion meet (9).

From the analysis above, we know that the decision whether a venture capitalist and an entrepreneur can reach an investment agreement or not is determined by the total expected return and stock proportion of entrepreneurs. The total expected revenue should be large enough to attract the cooperation, and a reasonable share proportion must be set up in order to achieve incentive compatibility. When the above conditions are met, a cooperation strategy for venture capitalists to accept investing in the business plan of entrepreneurs will be reached.

Impact analysis of signaling on adverse selection

We consider whether adverse selection be reduced in financing markets when the technology signaling by an entrepreneur for the project quality is available. If the cost of signaling is not too high, some venture capitalists may think it is valuable to invest based on such a signaling[4]. Assuming the cost to create such a signal is C, and entrepreneurs will not develop their ventures independently after they set up the signal, therefore, the entrepreneurs has the following three strategies for financing:

S_1: Do not signal and develop by their self, the utility is $U[R_0]$.

S_2: $U[R_0]$ Do not signal and price based on an equilibrium price ω^*.

S_3: Signal and price based on a competitive price $\omega^S(p)$.

If an entrepreneur creates a signal and sell shares, he will get the utility $U[\omega^S(p)]$. For entrepreneurs, only if the utility $U[\omega^S(p)]$ he obtained in this strategy is greater than that in the other two available strategies, would he prefer to create a signal and offer a competitive price to sell the stake. When the cost of signaling C is very low, all the entrepreneurs prefer to sell the shares, and then the adverse selection problem is eliminated. When the cost of creating signal C is very high, entrepreneurs will not choose strategy S_3. In this case, the adverse selection problem is still as bad as before. And when the cost of creating signal C is neither too high nor too low, the medium-ability entrepreneurs have the possibility of self-management. The behavior above can be explained by two reasons. On one hand, it is not worth signaling for a medium-ability entrepreneur to signal his Lower quality projects; on the other hand, real value of the project will be underestimated at an equilibrium price while not signaling. Then the medium-ability entrepreneur prefers to self-employment in the risk projects. Therefore, the adverse selection problem will be relieved at some degree in the two cases.

CONCLUSION

The conclusions for analysis of adverse selection in venture capital under asymmetric information are as follows:

1)The expected return of risk project is dependent on the success rate of the project, including project quality and entrepreneurial ability, among which the project quality is a key factor in the process of pricing. Adverse selection occurs when the project quality is unavailable for venture capitalists in the capital market. The projects with low expected rate of return are sold out and those with high expected rate of return will be retained by the entrepreneurs.

2)The decision whether venture capitalists and entrepreneurs can reach an investment agreement or not, is determined by the total expected revenue and stock proportion of entrepreneurs. Possible solutions for relieving adverse selection phenomenon may include reasonable incentive and equity allocation mechanism, enough total expected return, and reduced signaling cost.

3)Signaling may be a mitigation measure for adverse selection problems when the project quality is available for venture capitalists in capital market. It is worth signaling for a high-ability entrepreneur to signal at a low cost, in this situation, all the entrepreneurs prefer to sell the stake of ventures, the adverse selection problem is eliminated. When the cost of creating the signal is not too low nor too high, the high capacity entrepreneurs need to Consider to sell at an average price

or at a competitive price, then adverse selection may appears. Meanwhile, in this case the medium -ability entrepreneurs usually choose self-employment.

ACKNOWLEDGEMENT

This work was supported by the soft sciences plan project of Guangdong province (2012B070300022), the soft sciences plan project of Guangzhou City, Guangdong Province (2013Y4300012). Gratitude is also extended to all authors of literatures cited in this article.

REFERENCES

[1] Yuan Tian-Rong, Liu Wei; Study on bilateral moral hazard of venture capital based on contract theory. Communication of Finance and Accounting, **7**, 76-78 **(2013)**.

[2] Zheng Hui; Solutions of Adverse Selection, Signaling and Screening in Venture Capital. Journal of Industrial Technological Economics, **3**, 132-136 **(2007)**.

[3] R.Amit Brander, C.Zot; Why Do Venture Capital Firms Exist? Therory and Canadian Evidence. Journal of Business Venturing, **18**, 441-466 **(1998)**.

[4] R.Amit, L.Glosten, E.Muller; Entrepreneurial ability, venture investments, and risk sharing. Management Science, **36**, 1232-1245 **(1990)**.

[5] G.Akerlof; The market for"lemons": Qualiative uncertainty and the market mechanism. Journal of Economics, **84**, 488-500 **(1970)**.

[6] Zhou Lu, Zhu Xue-Zhong; Analysis of lemons market effects under the context of patent quality. Studies in Science of Science, **32(2)**, 1012-1018 **(2014)**.

[7] Wang Yan-Qian, Zhou Qi-Gong; Adverse Selection and Moral Hazard in the Investing of Venture Capital. Science Research Management, **23(3)**, 105-111 **(2002)**.

[8] Wang Xue-Xia; A Study on the Pricipal-agent Model of Three Sides in Venture Capital with Their Stock's Proportionate. Journal of Quantittative & Technical Economics, **2**, 121-126 **(2005)**.