Venture Capital Financing and Soft Budget Constraints

Haksoo Ko*

〈abstract〉

This paper analyzes the mechanism of venture capital financing and examines the government's role in fostering venture capital financing. Thispaper argues, consistent with the literature on the soft budget constraint, direct involvement of the government in the market for risky investments may result in inefficient investments. That is because, while venture capital funds have a limited lifespan as specified in the contract forming such funds and venture capitalists have reasons to abide by their commitment, the government does not have a commitment device assuring that projects will, whether successful or not, indeed be liquidated when they should.

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* Shin & Kim
Phone: (02) 316-4036 / Fax: (02) 756-6226
Email: hsko@shinkim.com

I. Introduction

The significance and rapid growth of the venture capital industry in the United States drew much attention of various observers of late. In particular, in late 1990s, excellent performance of many start-up companies in Silicon Valley produced namesakes in many countries around the world, such as Silicon Island (Taiwan), Silicon Plateau (India), Silicon Bog (Ireland), Silicon Fen (England), Silicon Wadi (Israel), and Silicon Glenn (Scotland).[1] Many of these developments are a reflection of the endeavor of various governmental entities in these regions to emulate the success of Silicon Valley, endorsing risky investment projects and nurturing entrepreneurship.

The unique success story surrounding Silicon Valley presents numerous puzzles and makes one wonder if it would indeed be possible to replicate the success story of Silicon Valley in other parts of the world. While the literature on path-dependence and regional clustering suggests such replication would not be a simple and easy task,[2] many governments outside the United States have tried strenuously for the reproduction of another Silicon Valley in their respective local or regional economies. In fact, given the development of the venture capital industry in the United States, which is the result of an evolutionary process in the marketplace among private parties with different goals and incentives, it is indeed ironic to observe rather active roles played by the governments in these economies. That naturally leads to the question regarding proper roles that a government should assume to foster

1) There also have been many contenders in the United States to be the next Silicon Valley. See Hilary Stout, The New Map of High Tech, *The Wall Street Journal*, November 23, 1999, B1.

2) An implication of the literature is that even a chance event may have a significant impact on future developments of a region and that each development may have many unique aspects, leading to different paths and making replication very difficult. See Nelson (1995) for the path-dependence literature and evolutionary theory and Krugman (1991) for regional clustering. Saxanian (1994) provides a sociologist's perspective on different paths taken by Silicon Valley and Route 128, near Boston.

entrepreneurship.

While this paper does not try to provide a direct answer to this question, it points out that the government should be wary of the problem arising from soft budget constraints and of failing to impose a strict fiscal discipline (Kornai (1980); Kornai et. al (2003)). Venture capital funds have a limited lifespan as specified in the contract that forms such funds and it is virtually impossible to change the period that is fixed at the outset. Different from this, governments are often influenced by the political decision-making process and lack a commitment device assuring that further funding would not be forthcoming in a later period. Thus, they may have incentives to provide and be capable of providing further resources for entrepreneurs if it would be *ex post* more efficient to do so, even in a situation where doing so would hurt the overall profitability. Also, compared to the more traditional credit allocation mechanism, venture capital investments are heavily information-intensive and venture capital contracts are written specifically for such purposes as encouraging and facilitating information gathering and processing. Indeed, the unique and perhaps the most important role of venture capitalists lies in their screening and monitoring capability of the ventures they invest in. As it will be shown, when the government itself establishes and manages a fund, the manager of such a fund may have a lesser incentive to screen and monitor and as such the role of the government must be limited to inculcating appropriate institutional environments to foster the development of an information-intensive credit allocation mechanism.

In this paper, in addition to explaining the development of the venture capital in the United States, we introduce the experience of Korea, where the government played a rather active role, with a view to providing a perspective on the role that the government can possibly assume for the development of the market for innovation.[3] It ranges from a rather simple tax-subsidy scheme

3) Arguably government's active involvement was first observed in the United States. Gompers (1994) contains a brief discussion of the scheme of the Small Business Investment

to a more direct involvement providing financial resources to establish venture capital funds. In particular, in 1997, the Korean government promulgated a law with the specific purpose of encouraging the development of the venture capital industry as a new source of financial and other important resources for entrepreneurial ventures. Some of the developments in Korea after the enactment have shown certain promising signs, while others have not. What we are trying to achieve in this paper is to point out certain inherent risks that would accompany government's direct involvement in this market, which can be characterized by strong incentives and intense information processing.

While there are a fair number of papers in the existing literature that deal with venture capital financing, not many papers deal with the institutional underpinnings of venture capital financing that we are interested in. Among them, Sahlman (1990) provides an overview of the mechanics of the venture capital financing with a focus on the governance structure of a venture capital fund. Regarding the development of the venture capital industry outside the United States, perhaps reflecting the lack of information, relatively few discussions have been made. Among the papers written in this regard, Black and Gilson (1998), after reviewing the development of the venture capital industry in a selected group of countries, argue that the existence of a mature capital market is a prerequisite for the development of the venture capital industry.[4] Thus, they suggest that proper institutional infrastructure must be

Companies, which is considered an ill-guided credit-subsidization policy initiated by the U.S. government in early years of the development of the venture capital industry in the United States. Lerner (1999), after considering the results of the Small Business Innovation Research Program in more recent periods, concludes that, while being designated as an awardee would have a signaling effect regarding such awardee firm's quality, various distortions could occur along the process. Outside the United States, recent examples of active government involvement include China's efforts through China Venture Investment Corporation. Begun with ambitious plans in the 1980s, it was declared bankrupt in 1998. See Debra Lau, Behind the Great Wall: China Opens its Doors to Domestic and Foreign Venture Capital Funds, *The Venture Capital Journal*, July 1999, pp. 48-50.

4) In a similar context, Blass and Yafeh (1996) try to answer why many Israeli technology companies list their stocks on the Nasdaq market, making Israel ranked third in terms of the number of companies that are listed in the United States.

built before the market for venture capital investment can fully develop. In another paper focusing on Japan, Milhaupt (1997) also ascribes the limited success of the venture capital in Japan to the underdevelopment of the necessary institutional infrastructure, including the lack of large, independent sources of venture capital funding and the lack of highly developed incentive structures. Building on this line of arguments, we try to review the institutional setting for venture capital investments in Korea and to establish a model identifying a potential problem area.

Regarding the role of the government as a source of financial resources, the model presented in this paper borrows from the idea in Dewatripont and Maskin (1995), showing that credit decentralization would help investors in making the commitment not to refinance or salvage a poor investment project at a later stage. Indeed, potential problems arising from soft budge constraints appear to persist whenever the government does not have a commitment device against bailing out a poor investment project and in this paper we strive to extend their model to examine incentives of venture capitalists to screen and monitor. Using a similar framework, Qian and Xu (1998) examine how investments for innovation take place under soft and hard budget constraints and shed light on different ways investment projects are undertaken in centralized and decentralized economies. They consider state's direct investments in technology-related areas, and it is shown that grandiose and massive projects tend to be undertaken more frequently in centrally planned economies.

Literature in soft budget constraints was also applied to analyze the financial crisis that took place in East Asia in 1997. Huang and Xu (1999) argue that, under hard budget constraints, information is dispersed rather quickly and investors are less likely to herd toward a wrong direction. They claim, among Asian countries, those with hard budget constraints comfortably in place could endure the 1997 crisis relatively well, whereas countries with severe soft budget constraint problems were more vulnerable to the crisis.

Specifically, they name Taiwan as a country with hard budget constraints and Korea as a country where soft budget constraints were prevalent.[5)]

While they focus on information dissemination under hard budget constraints and the reaction of individual investors to new information, this paper emphasizes the role of a venture capitalist as an institutional investor and as an active and crucial component of the market, processing and disseminating information. Also, in a paper discussing venture capital investments in recent years in Korea, Seong (2000) argues that there are undesirable side effects when the government is actively involved in the market. Different from our focus, however, she stresses the risk of crowding out private sector investments when the government becomes a *de facto* crucial investor in the market.

Built on the literature introduced above and analyzing the financing methods used in the venture capital industry, this paper argues that direct involvement of the government in the market for risky investments has a risk of incurring problems due to the lack of commitment devices, showing similar problems that are frequently observed in centrally planned economies. In particular, we note that, in venture capital financing, contracts are concluded to provide high-powered incentives for each party involved. Venture capital financing typically involves a situation where there are a great deal of uncertainties regarding future cash flows of a project. Facing such uncertainties, investments are normally made through several stages, or through staged financing. After an initial investment, at a later stage, it is possible that a project with poor quality would need further financing to generate positive cash flows. That is, for certain poor quality projects, it may be necessary to provide further financing in order to generate more cash flows *ex post*, even when it may be *ex ante* inefficient to do so. In such a situation, venture capitalists have incentives to provide funding at a later stage, if there are resources available

5) Also, see Wang (1995) for government policies toward venture capital as practiced in Taiwan, mostly composed of tax incentives granted to certified companies.

for such funding. Typical venture capital contracts, however, contain a built-in mechanism to prevent such potentially inefficient investment activities. That is, investments should become liquid at the end of the contract term to distribute proceeds to original investors and, as such, venture capitalist's investments are concentrated in relatively early stages. Thus, by the time further funding may be required, the venture capitalist is unable to provide further financial resources. On the other hand, such a mechanism for hard budget constraints may not exist when the government participates in the market as a *de facto* venture capitalist.

In venture capital financing, intense screening and monitoring accompanies investments so that information-intensive reputational funding is provided. Since reputation matters a great deal to venture capitalists, with the funding from venture capitalists, the option to reevaluate and the option to abandon become a credible threat for termination when projects go sour. Different from this, managers of public funds, if operating under soft budget constraints, would not have a device to make their commitment credible and it is shown that they may not have appropriate incentives to screen and monitor when doing so may enhance the overall value of the funds they manage.

In the following, first, the venture capital in the United States and its financing structure is introduced. It is followed by a brief description of the venture capital industry and the recently enacted law in Korea. A simple model of soft budget constraints is presented next. Then the model is extended to examine the role of an information-intensive credit allocation mechanism and to review incentives of venture capitalists and choices that policymakers can make. Conclusion follows.

II. Venture Capital Contracting in the United States and its Economic Structure

In the United States, the venture capital industry developed through an evolutionary process, responding to the market demand for risky investments. While the wealthy individuals called angels played an important role in the early years as a main source of funding,[6] it is a relatively recent phenomenon that institutional investors came to function as a principal provider of funding for venture capital investments. An important change in that respect came along with the 1979 amendment to the prudent man rule that is provided in the Employee Retirement Income Security Act (ERISA), which allowed pension funds to invest in venture capital. The amendment of the law and the resulting investments from pension funds made a long-lasting impact in terms of the component of major sources of venture capital funding, making pension funds one of the largest sources for venture capital investments. Thus, while only 15% of U.S. venture capital funds were derived from pension funds in 1978, the figure increased to 46% in 1988.[7] Overall, institutional investors now dominate the U.S. venture capital industry, representing over 75% of the total capital.

The availability of such funds was complemented by the development of a special form of financial contracts to bolster the financing of start-up companies. The economic structure of the venture capital contracting in the United States is inherently geared to the alignment of economic incentives of various players and to the heavy screening and monitoring conducted by venture capitalists.[8] Venture capitalists pool funds from investors and, after

6) Although their significance is reduced somewhat these days, angels still play an important role in providing financing for start-up companies. See Fenn et al. (1997)

7) In dollars terms, they represent $218 million and $3 billion, respectively.

8) In venture capital contract, various mechanisms are employed to foster and compensate venture capitalists' efforts to screen and monitor, including staged financing, option to abandon, use of convertible securities, and use of negative covenants. Examples and cases

active screening, invest the funds in start-up companies, which then become a part of their investment portfolios.

While venture capital funds are typically formed as limited partnerships, the relationship between entrepreneurs and venture capitalists is dictated by a unique set of financial contracts. Upon forming a venture capital limited partnership, outside investors become limited partners assuming a passive role, while venture capitalists become general partners. Limited partners provide most of the financial resources for the formation of a fund in return for the prospect of receiving a high return and it is general partners who practically control and manage portfolio companies. In practice, general partners usually put up only 1% of the capital for a fund and receive the total control over its management.[9] A venture capital fund is usually composed of blind pools. Also, limited partners are not allowed to participate in the day-to-day management of the fund's business operations. That way, general partners are given complete control over the fund management and the long term performance of the fund thus becomes practically the only way to indicate the capability of a general partner as a successful investors.

When it comes to the relationship between venture capitalists and entrepreneurs, it is expected that in most instances there exists an information asymmetry between them regarding future prospects of proposed projects, making it difficult for a venture capitalist to accurately gauge the likelihood of success of the projects proposed to them by entrepreneurs. In order to overcome this informational disadvantage, a special form of financial contracts is concluded between the two sides, encouraging venture capitalists to undertake intensive monitoring and other information gathering activities. As part of this financing arrangement, necessary funding is not provided all at once but is instead offered through several installments, using a method called staged financing.[10] Under the scheme of staged financing, venture capitalists

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of venture capital contracting can be found in Lerner (2000).

9) The rest of the funding, of course, comes from limited partners.

retain the option to reevaluate the business of a portfolio company at the end of each stage and reserve the right to exercise the option to abandon the company.[11] These options are normally exercisable by the discretionary judgment of venture capitalists. That way, venture capitalists maintain their opportunity to capitalize on the information they gather during each stage and to reduce their losses.

With the investment, also comes the expertise of venture capitalists as well. Such expertise includes management consulting and assistance, intensive monitoring of the portfolio companies' performance and the use of the funds' and venture capitalists' reputation to give the portfolio companies enhanced credibility with potential customers, suppliers, and employees. Thus, the funding they provide can indeed be considered reputational capital as well as fiduciary financial/investment capital. The compensation scheme for general partners is usually written to reflect their performance. General partners receive management fees for their service, which is normally 2.5% of the committed capital. The primary source of compensation to general partners, however, usually comes in the form of the right to claim a specified percentage from the profits realized: 20% is a common figure. Profits they realize are important not just for their compensation but also for the establishment of a new fund later on after exiting from their current investments. Their reputation and investment results are virtually the only signaling device they can use in drawing interests of potential investors and forming a new fund.

Venture capital investments normally focus on early-stage financing and have limited duration, usually spanning over about a 10-year period. Due to such

10) In 1991, based on 794 randomly selected venture capital companies, Gompers (1997) found 109 rounds of stage financing for the venture capital investments of $142 millions. Also, according to Sahlman (1990), venture capital funds typically invest one-third of their capital in new investments while two-thirds is used in later round financing of companies that are already in their investment portfolios.

11) Venture capital funds' equity investments in portfolio companies typically take the form of convertible preferred stock. See Gompers (1997).

limited duration, general partners try to raise capital for a new fund by the midpoint of the existing fund's life and, since the overall performance of the prior funds functions as an important determinant of their ability to raise new capital, early and successful exit of the existing funds becomes crucial. Exit is performed mainly through two methods, that is, by taking the portfolio company public through an initial public offering at a stock market or by selling the company to another company.[12)]

III. Venture Capital in Korea

a. A Brief History

During the past several decades, Korea realized a rapid economic growth, with exceptionally high growth rates. While many factors are cited for this rapid growth, it is no denying that the government played an important role. Also, while the availability of cheap but highly qualified labor force was a significant contributing factor in this economic development in early years, as the economy grew bigger and became mature, the cost of employment went up as well and Korea began to lose its comparative advantage in manufacturing labor-intensive goods. It was only natural that venture capital drew much attention as the government determined to promote knowledge-based industries.

In fact, although institutional support for the development of venture capital is a relatively recent phenomenon in Korea, several venture capital companies

12) Traditionally, an IPO has been considered the more desirable between the two exit strategies since it was often more lucrative for the investors. When the IPO market becomes less favorable to start-up companies, on the other hand, acquisitions are more commonly observed. These exit methods are available to those companies with viable business strategies or products: other companies are simply liquidated at an earlier stage.

were already incorporated in the early 1980s.[13] It was not until 1986, however, that a separate legal infrastructure for the venture capital industry was first introduced. The year saw the enactment of several laws related to venture capital, including the Law to Promote Small and Medium Size Companies and the Law to Assist the Financing of New Technology Ventures.[14] After these laws were enacted, the industry has seen a fairly rapid growth: in an approximately 10-year period from the mid-1980s, the number of venture capital firms grew to be 49 from 12 by 1995 and they invested in 1891 projects during 1987-97 totaling 1.5 trillion won.[15]

The enactment of these laws hardly reflected a well-orchestrated effort of the government, and different venture capital companies were established subjecting them to the administration of different government agencies. And, depending on their operational environments, different categories of venture capital companies showed different results. More specifically, stringent conditions were required to register under the Law to Assist the Financing of New Technology Ventures which was administered by the Ministry of Finance and Economy and, in return, companies under this Law were allowed to invest in a broader spectrum of investment projects with financial resources supported by public funds.[16] On the other hand, venture capital companies established under the Law to Promote Small and Medium Size Companies were subject to the regulation of the Ministry of Commerce, Industry and Energy. These companies, while comprising a majority in the industry,[17] had far less room

13) See Ko and Shin (2000) for a more detailed explanation on this and later developments in Korea.

14) This is in contrast to the way venture capital was developed in the U.S., where no legislative efforts or significant government initiatives accompanied initial developments of the industry.

15) See South Korean Firms: Wild Careers, *The Economist*, Feb. 14, 1998, p. 67.

16) It is thus not surprising that companies under this category had relatively better results. In 1993, these venture capital companies recorded the return on capital of 8.8%, while venture capital companies operating under the Law to Promote Small and Medium Size Companies made a meager 2.6% return.

17) By October 1999, there were 82 companies under this category, accounting for most of the

to maneuver. They were required to invest only in certain small companies as defined in the Law. Also, there were restrictions regarding industries in which these companies were allowed to invest. Further, in terms of the form of investments, they were not completely free either and were instead encouraged to make only equity investments.[18] With less leeway in their investment decisions, the operational results of these companies have been less than stellar.[19]

b. Enactment of the Special Law to Promote Venture Capital Companies

With this backdrop, in 1997, the Korean government enacted the Special Law to Promote Venture Capital Companies (SLPVCC) which is, in a nutshell, a scheme to grant financial and other forms of preferential treatments and to grant exemptions from otherwise applicable regulatory rules to the companies that satisfy the specific requirements to be qualified as a venture company, as provided in the law (Law No. 06891; Last amended May 29, 2003). In other words, the proposed scheme in this Law is to grant direct and indirect subsidies to a selected group of venture companies.

Specifically, the SLPVCC starts from providing a specific and descriptive definition of what a venture company is for purposes of the law. According to the SLPVCC, in order for a company to be qualified as a venture company, which would then be eligible for special treatments, it must satisfy fairly strict enumerated conditions (Article 2). And, only when a company is thus qualified as a venture company, it becomes eligible for special treatments. Once designated as a venture company, such a company becomes eligible to

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venture-invested companies in Korea.

18) Equity investments comprised 46% of the total investment by 1995. In recent periods, they also could receive public funds, in addition to their own private funds. The government encouraged equity investments and, in 1999, equity investments accounted for 75% of the total investment made by these companies.

19) In recent years, there have been signs that the KOSDAQ market might work as a viable exit market for investors.

receive a series of various financial supports from the government, directly or indirectly.

To supplement these legislative efforts, the government has established various funds mainly to invest in venture companies, directly managing or otherwise indirectly exerting influence over the allocation of the resources these funds have. For instance, there are funds established by several government agencies, including the Ministry of Information and Communications and the Small and Medium Business Administration. What is commonly observed with these funds is that, while the management is conducted by a private party, the government sets key rules and does not oversee day-to-day management activities. In addition, there are indirect ways that venture companies could gain access to governmental resources. To list a few, there are separate funds established mainly to help the incorporation of venture companies; once in operation, these venture companies can apply for loans to cover their operational expenses; they can later on get financial support for improvements in their internal information technology infrastructure; they may also be eligible for the export insurance supported by the government; they could apply for separate financial assistance which would help them cover their marketing expenses; if they need restructuring, there is a separate fund from which they may be able to receive financial support for such restructuring; further, if the restructuring is not successful, they may still receive assistance from a special fund established for the resuscitation of small and medium-sized companies.[20] Whereas there are various funds with somewhat different goals, it is not difficult to find common features of these funds. That is, most of them are established to grant financial resources at preferential terms to eligible entrepreneurial companies in the high-tech area. Many of these funds are administered by government agencies or private parties designated by the government. In the next section, we set up a simple

20) Also, the government distributes financial resources to various venture capital companies and funds, thus participating in the market indirectly as well.

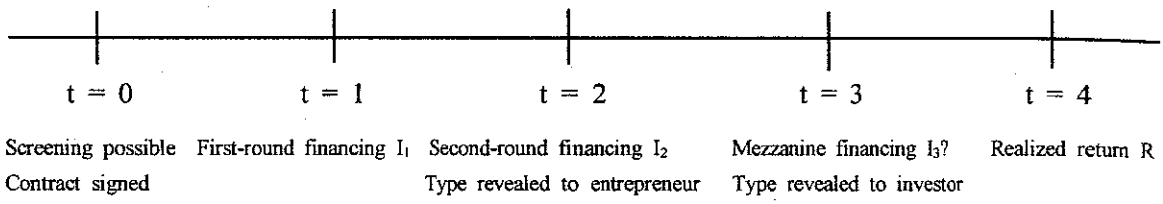
model to compare the structure of venture capital financing under hard and soft budget constraints and the incentives therein.

IV. Model

Venture capital contracting involves unusually high invpe. If a project is low-cost type, two rounds of financing in the form of first-round financing at t = 1 and second-round financing at t = 2 are enough before testment risks, mainly arising from uncertainty about the future profitability of investment projects and the information asymmetry between the entrepreneur and the venture capitalist. In our 5-period model, it is assumed that a project is either low-cost type or high-cost tyhe project generates cash flows at t = 4. For a high-cost type project, however, an additional round of financing or mezzanine financing is necessary at t = 3 before it can generate cash flows at t = 4. We assume that the *ex ante* probability of a project to be low-cost type is ρ. The actual cost type is unknown to either the entrepreneur or the venture capitalist at the outset, although the venture capitalist may engage in screening before making an investment to reduce the probability of investing in a high-cost type project. In the absence of screening, the entrepreneur becomes aware of the cost type of the project at t = 2 and the cost type is known to the venture capitalist at t = 3 unless the entrepreneur reveals the cost type at t = 2. The contract is structured so that once first-round investments are made at t = 1, second-round investments are also made at t = 2 unless the project is verified to be high-cost type. At t = 3, the cost type is made known to the venture capitalist and, for high-cost type, another round of investments of I_3 in the form of mezzanine financing is necessary in order for the project to continue and generate cash flows.

The venture capitalist has an option to abandon at the beginning of each stage, by which the decision on further investments is made at the discretion

of the venture capitalist. Investments already made are sunk costs and, if an option to abandon is exercised, the project is discontinued and generates no cash value. The timeline of our five-period model is provided below.



After all investments are made, revenues are generated at t = 4 which are then split between the venture capitalist and the entrepreneur. Revenues are either R_H with probability p or R_L with probability (1-p), where $R_H > R_L$. It is assumed that investments are overall profitable or generate positive net present value so that $pR_H + (1-p)R_L - I_1 - I_2 - (1-\rho)I_3 > 0$. It is also assumed that $pR_H + (1-p)R_L < I_2 + I_3$ and that $pR_H + (1-p)R_L > I_3$. That is, a high-cost type project has a negative net present value *ex ante* at the beginning of t = 2, while it is *ex post* efficient to provide mezzanine financing at t = 3. Financing decisions are made by the venture capitalist and, if the venture capitalist knows the cost type at t = 2, the venture capitalist will exercise the option to abandon for a high-cost project and refuse to provide further financing in order to minimize losses. Revenues generated at t = 4 are assumed to be shared by the venture capitalist and the entrepreneur only when R_H is realized, whereas the venture capitalist takes all the revenues to recoup investment losses when R_L is realized.[21] The share of revenues that the venture capitalist takes when R_H is realized is σ. Also, the entrepreneur is

21) This would be a simple way to characterize the use of convertible securities in that the entrepreneur is required to pay a fixed amount when revenue level is low, whereas revenues are shared (after conversion) when the state turns out to be a good one. On the implication of employing hybrid securities such as convertible securities in venture capital financing, see discussions in Cornelli and Yosha (1997), Gompers (1997), Repullo and Suarez (1998), and Marx (1998).

assumed to offer certain assets, which are used during the lifespan of the project. These assets are mostly comprised of project-specific assets so that a positive cash value of A is realized only when the project is not terminated before completion. Under this setting, venture capitalist's expected return from investments can be expressed as:

$$\Pi^{Hd} = \rho(A + p\sigma R_H + (1-p)R_L - I_1 - I_2) - (1-\rho)I_1 .$$

For the entrepreneur, on the other hand, we assume that there are personal benefits accruing from exerting control over the investment project, which makes the entrepreneur prefer managing the project until its completion even if it is a high-cost type.[22] We also assume that, if to be terminated, it is worse for the entrepreneur to be terminated at a later stage since the entrepreneur is unable to recoup anything once terminated any time before t = 4, while the entrepreneur has to continue to spend time and efforts until the completion of the project.

Specifically, let B^t denote control benefits accrued to the entrepreneur net of the value of the assets offered at the outset when the project is terminated (t = 2, 3) or completed (t = 4; $B^4 \equiv B$), then it is assumed that $B > B^2 > B^3 > 0$.

Unless and until the project is completed at t = 4 and revenues are generated, personal benefits are the only source of payoff for the entrepreneur. Thus, once a project is financed, the entrepreneur would not have an incentive to reveal the cost type at t = 2. Without entrepreneur's revelation of the cost type, the venture capitalist becomes aware of the cost type only at t = 3 and, once the project reaches that point, mezzanine financing is provided since it is *ex post* more efficient to do so. Thus, unless it becomes possible to persuade the entrepreneur to reveal the cost type, once initial funding is provided, mezzanine financing is also made regardless of the cost type of a project.

22) In the next part, we consider the monitoring effort exerted by the venture capitalist, which has an impact on the size of personal benefits extracted by the venture capitalist.

That way, without a commitment mechanism prohibiting the venture capitalist from providing financial resources at t = 3, high-cost type projects continue to get financed and thus it would not be possible to obtain the best outcome.

We assume, however, that each venture capitalist is endowed with a limited amount funding given from outside investors and that, by the time further investments may be required at t = 3, they run out of their financial resources (Cf. Dewatripont and Maskin (1995)). This works as a device for credible commitment signaling that mezzanine financing would not be forthcoming from the venture capitalist at t = 3 for a high-cost project.

This hard budget constraint is achieved since, as discussed above, the venture capitalist must liquidate their funds at the end of the period set out in the contract with the investors in the funds and thus has to concentrate his/her investments in early stages. By the midpoint of the funds' life, the venture capitalist must seek ways to cash out from his/her existing investment portfolio, instead of making any further investments.

It is common knowledge that the venture capitalist thus faces liquidity constraint after t = 2 and thus the entrepreneur will not seek to prolong the life of the project. The result is the revelation of the cost type at t = 2 by the entrepreneur and the termination of a high-cost type project before a further round financing is provided.[23]

On the other hand, when the government is involved as a *de facto* venture capitalist, it does not face the same liquidity constraint faced by private venture capitalists. Even when they manage funds with a set period of duration, additional funding can be made available when necessary through an external source for mezzanine financing at t = 3. Expecting this soft budget constraint, the entrepreneur does not reveal the cost type of the project at t = 2 and, instead of being terminated, high-cost type projects are continued with

23) Here, an implicit assumption is that mezzanine financing would not be forthcoming from a third-party investor either. This assumption can be justified given the prevalence of

additional financing at t = 3. Unless a high-cost type project is terminated at the beginning of t = 2, it is *ex post* efficient to provide mezzanine financing at t = 3 and cash flows are generated at t = 4. This inefficient result is inherently due to the lack of commitment device on the part of the government, being unable to make the threat to exercise the option to abandon credible.[24] Under soft budget constraints, the venture capitalist from the government receives the payoff:

$$\prod^{Sft} = [A + \sigma p R_H + (1-p)R_L - I_1 - I_2] - (1-\rho)I_3 .$$

We thus posit that a main characteristic of private sector venture capitalist is hard budget constraints, whereas the venture capitalist from the government operates under soft budget constraints. Under this setting, we first consider entrepreneur's assets that are offered at the outset as collateral to receive investments from the venture capitalist under hard and soft budget constraints and get the following proposition:

Proposition 1. *(1) Under hard budget constraints, in order to receive investments from the venture capitalist, the possession of certain amount of minimum assets* $A_{\min}^{Hd}$, *as defined below, is required from the entrepreneur.*
(2) Under soft budget constraints, in order to receive investment from the venture capitalist, the possession of certain amount of minimum assets $A_{\min}^{Sft}$, *as defined below, is required from the entrepreneur.*
(3) The minimum amount required under hard budget constraint, $A_{\min}^{Hd}$, *is lower than the minimum amount required under soft budget constraint,* $A_{\min}^{Sft}$.

Proof. (1) The Venture capitalist's participation constraint for investments

24) When the government is involved, investment activities are often performed by a third party designated by the government. Incentives of these investors are more clearly examined in the next part, along with the government's choice of rules.

under hard budget constraints is:

$$\rho(A + p\sigma R_H + (1-p)R_L - I_1 - I_2) - (1-\rho)I_1 \geq 0.$$

From this, the minimum amount of assets that are required from the entrepreneur in order to get financing is:

$$A \geq \left(\frac{I_1}{\rho} + I_2\right) - (p\sigma R_H + (1-p)R_L) \equiv A_{\min}^{Hd}.$$

(2) When soft budget constraints are in effect, venture capitalist's participation constraint becomes:

$$A + \sigma p R_H + (1-p)R_L - I_1 - I_2 - (1-\rho)I_3 \geq 0.$$

Thus, the minimum amount of assets required from the entrepreneur is:

$$A \geq I_1 + I_2 + (1-\rho)I_3 - (\sigma p R_H + (1-p)R_L) \equiv A_{\min}^{Sft}.$$

(3) $A_{\min}^{Sft} - A_{\min}^{Hd} = I_1 + (1-\rho)I_3 - \frac{I_1}{\rho} = (1-\rho)\left(I_3 - \frac{I_1}{\rho}\right).$

From the assumption that $pR_H + (1-p)R_L - I_1 - I_2 - (1-\rho)I_3 > 0$ and that $pR_H + (1-p)R_L < I_2 + I_3$ we derive $I_3 - \frac{I_1}{\rho} > 0$. Therefore, $A_{\min}^{Sft} - A_{\min}^{Hd} > 0$. Q.E.D.

Thus, there is a lower bound in the amount of assets that the entrepreneur must possess in order to attract investments and, in some situations, the entrepreneur would not be able to obtain investments for a project with a positive net present value due to the in sufficiency of his/her own assets that

can be offered. The minimum amount of such assets is lower with hard budget constraints and it can perhaps be said that venture capitalists operating under hard budget constraints provide access to financial resources to a broader group of entrepreneurs. An important reason for the Korean government's efforts to encourage the development of the venture capital industry would be to establish viable funding sources for many start-up companies that were previously unable to obtain financing through more traditional financing methods. Seen from this, having a lower $A_{\min}$ Would be conducive to providing investments to a wider group of those entrepreneurs who do not own sufficient amount of assets and who were thus unable to undertake their projects previously. It is possible that $A_{\min}$ is negative and, for such a case, the entrepreneur does not need to possess any assets. That happens when the expected return from investments is relatively high compared to investment costs. It is assumed in the following that $A_{\min}$ is non-negative. Also, regarding the maximum amount of assets offered by the entrepreneur, it is assumed that $A \leq (1-\rho) pR_H$.
That is, what is offered by the entrepreneur does not exceed the maximum amount that the entrepreneur may make after the completion of the project.

Before making an investment decision, as posited above, the venture capitalist may engage in screening at t = 0. It is assumed that, by engaging in screening activities at some costs, C_S, a signal θ is obtained about the cost type of a project. The signal is in the form of either θ_L or θ_H. For the signal θ_L, the probability of a project to be a low-cost type is μ and the project is a high-cost type with the probability of $1-\mu$, where $\mu > ½$. On the other hand, for the signal θ_H, the project is a high-cost type with the probability of μ and a low-cost type with the probability of $1-\mu$. Then, a project would be undertaken only when the signal is θ_L. The higher the value of μ, it can be said, the more accurate the signal is and the more valuable screening is. We now compare the cost-effectiveness of screening under hard and soft budget constraints and obtain the following proposition:

Proposition 2. *The minimum threshold value of the screening cost which makes screening more valuable than non-screening is lower under hard budget constraints than under soft budget constraints.*

Proof. Under hard budget constraints, venture capitalist's payoff without screening is $\Pi^{Hd} = \rho(A + p\sigma R_H + (1-p)R_L - I_1 - I_2) - (1-\rho)I_1$. After screening, the posterior probability of investing in a low-cost type project can be calculated using the Bayes' rule:

$$\frac{\rho\mu}{\rho\mu + (1-\rho)(1-\mu)} = \frac{\rho\mu}{1+2\rho\mu-\rho-\mu}.$$

If we let Π^{Hd}_{Scrn} be venture capitalist's payoff after screening,

$$\Pi^{Hd}_{Scrn} = \frac{\rho\mu}{1+2\rho\mu-\rho-\mu}(A + \sigma pR_H + (1-p)R_L - I_1 - I_2) - \frac{1+\rho\mu-\rho-\mu}{1+2\rho\mu-\rho-\mu}I_1 - C_S.$$

In order for screening to be valuable, it must be that $\Pi^{Hd}_{Scrn} - \Pi^{Hd} \geq 0$.

$$\Pi^{Hd}_{Scrn} - \Pi^{Hd} = \frac{\rho(1-\rho)(2\mu-1)}{1+2\rho\mu-\rho-\mu}(A + \sigma pR_H + (1-p)R_L - I_1 - I_2) + \frac{\rho(1-\rho)(2\mu-1)}{1+2\rho\mu-\rho-\mu}I_1 - C_S.$$

Thus, screening will take place if and only if

$$C_S \leq \frac{\rho(1-\rho)(2\mu-1)}{1+2\rho\mu-\rho-\mu}(A + \sigma pR_H + (1-p)R_L - I_1 - I_2) + \frac{\rho(1-\rho)(2\mu-1)}{1+2\rho\mu-\rho-\mu}I_1.$$

Similarly, if we let Π^{Sft} and Π^{Sft}_{Scrn} denote venture capitalist's payoff with and without screening, respectively, then

$$\Pi^{Sft}_{Scrn} - \Pi^{Sft} = \frac{\rho(1-\rho)(2\mu-1)}{1+2\rho\mu-\rho-\mu} I_3 - C_S,$$

and screening will take place if and only if

$$C_S \leq \frac{\rho(1-\rho)(2\mu-1)}{1+2\rho\mu-\rho-\mu} I_3.$$

Comparison between the two cases shows,

$$\frac{\rho(1-\rho)(2\mu-1)}{1+2\rho\mu-\rho-\mu}\left(A+\sigma pR_H+(1-p)R_L-I_1-I_2\right)+\frac{\rho(1-\rho)(2\mu-1)}{1+2\rho\mu-\rho-\mu} I_1$$
$$-\frac{\rho(1-\rho)(2\mu-1)}{1+2\rho\mu-\rho-\mu} I_3$$

$$= \frac{\rho(1-\rho)(2\mu-1)}{1+2\rho\mu-\rho-\mu}\left(A+\sigma pR_H+(1-p)R_L-I_2-I_3\right)$$

$$= \frac{\rho(1-\rho)(2\mu-1)}{1+2\rho\mu-\rho-\mu}\left(\left(pR_H+(1-p)R_L-I_2-I_3\right)-\left((1-\rho)pR_H-A\right)\right)$$

$$\leq 0,$$

the inequality comes form the assumptions that $\left(pR_H+(1-p)R_L-I_2-I_3\right)<0$ and $A \leq (1-\rho)pR_H$. Thus, the threshold value of the screening cost making screening more valuable than non-screening is lower under hard budget constraints. Q.E.D.

Screening inherently reduces the possibility of funding high-cost type projects, while there still remain possibilities of rejecting low-cost type projects after screening. On the other hand, without screening, the venture capitalist would accept high-cost projects relatively more frequently. The proposition

implies that screening would be conducted more frequently under hard budget constraints than under soft budget constraints. Considering that screening is a desirable trait for any financial resource allocation and that scarcest commodity a venture capitalist has is his/her time for screening, not capital (Kaplan and Stromberg (2001), p. 428), the implication is significant in that hard budget constraints would have an conducive impact of fostering screening under our model.

V. Conclusion

The relationship between entrepreneurs and venture capitalists is a complex one and the working of the screening, monitoring and incentive system is multifaceted. Trying to emulate the result of the evolution in one economy may not bring in the desired result in another economy unless the attempt is accompanied by the establishment of the necessary institutional infrastructure and also the appropriate incentive system for the parties involved. The role of the government as a venture capitalist establishing investment funds and allocating resources to eligible companies may be understood as an effort to overcome the difficulties owing to the lack of important institutional infrastructure, and to provide a new source of financing for the entrepreneurs that were previously unable to secure investments through traditional financing methods. As shown in this paper, however, if the problem of soft budget constraints persists, government's involvement will only achieve limited results. While this result does not necessarily negates the possibility that government's involvement may bring in a better result than otherwise, it does point out that, when the government is involved, it must strive to contain problems arising from soft budget constraints.

With the government's involvement, some funds could be established and managed by the government, while, in some other cases, funds could be

established by the government with key investment decisions being made by venture capitalists designated by the government. In both types of cases, it would be difficult to do away with soft budget constraints since the government lacks the commitment device not to provide further financing when it is *ex post* efficient to do so. The persistence of soft budget constraints would then have the impact of hindering the screening activities performed by venture capitalists, which would be crucial for the development of the capital market for the allocation of information-intensive financial resources.

References

Black, Bernard S. and Ronald J. Gilson, 1998, Venture Capital and the Structure of Capital Markets: Banks versus Stock Markets, *Journal of Financial Economics* 47, 243.

Blass, Asher and Yishay Yafeh, 1996, Vagabond Shoes Longing to Stray Why Israeli Firms List in New York-Causes and Implications, Working Paper.

Cornelli, Francesca and Oved Yosha, 1997, Stage Financing and the Role of Convertible Debt, Centre for Economic Policy Research Discussion Paper, No. 1735.

Dewatripont, Mathias and Eric Maskin, 1995, Credit and Efficiency in Centralized and Decentralized Economies, *Review of Economic Studies* 62, 541-555.

Fenn, George W. et al, 1997, The Role of Angel Investors and Venture Capitalists in Financing High-Tech Start-Ups, Working Paper.

Gompers, Paul A., 1997, Ownership and Control in Entrepreneurial Firms: An Examination of Convertible Securities in Venture Capital

Investments, Harvard Business School Working Paper.

Gompers, Paul A., 1995, Optimal Investment, Monitoring, and the Staging of Venture Capital, *Journal of Finance* 50, 1461.

Gompers, Paul A., 1994, The Rise and Fall of Venture Capital, *Business and Economic History* 23, 1.

Gompers, Paul A. and Josh Lerner, 2000, *The Venture Capital Cycle*, MIT Press.

Huang, Haizhou and Chenggang Xu, 1999, Financial Institutions and the Financial Crisis in East Asia, *European Economic Review* 43, 903-914.

Kaplan, Steven N. and Per Stromberg, 2001, Venture Capitalists as Principals: Contracting, Screening, and Monitoring, *American Economic Review Papers and Proceedings* 91, 426-430.

Ko, Haksoo and Hyun Young Shin, 2000, Venture Capital in Korea? - Special Law to Promote Venture Capital Companies-, *American University International Law Review* 15, 457-480.

Kornai, Janos, 1980, *Economics of Shortage*, Amsterdam; New York: North-Holland.

Kornai, Janos, Eric Maskin, Gerard Roland, 2003, Understanding the Soft Budget Constraints, *Journal of Economic Literature* XLI, 1095-1136.

Krugman, Paul, 1991, *Geography and Trade*, MIT Press.

Lerner, Josh, 1999, The Government as Venture Capitalist: the Long-Run Impact of the SBIR Program, *Journal of Business* 72, No. 3.

Lerner, Josh, 2000, *Venture Capital and Private Equity: a Casebook*, John Wiley & Sons.

Marx, Leslie M., 1998, Efficient Venture Capital Financing Combining Debt and Equity, *Review of Economic Design* 3, 371-387.

Milhaupt, Curtis J., 1997, The Market for Innovation in the United States and Japan: Venture Capital and the Comparative Corporate Governance Debate, *Minnesota Law Review* 91, 865.

Nelson, Richard, 1995, Recent Evolutionary Theorizing about Economic Change, *Journal of Economic Literature* XXXIII, 48-90.

Qian, Yingyi and Chenggang Xu, 1998, Innovation and Bureaucracy Under Soft and Hard Budget Constraints, *Review of Economic Studies* 65, 151-165.

Repullo, Rafael and Javier Suarez, 1998, Venture Capital Finance: A Security Design Approach, CEMFI Working Paper No. 9804.

Sahlman, William A., 1990, The Structure and Governance of Venture-Capital Organizations, 2 *Journal of Financial Economics* 27, 473.

Saxenian, AnnaLee, 1994, *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*, Harvard University Press.

Seong, Somi, 2000, *benchosanope kwanhan jaejongjiwon banghyang* [Policy Directions to Support Venture Industries], Korea Development Institute Working Paper.

Wang, Lee-Rong, 1995, Taiwan's Venture Capital: Policies and Impacts, *Journal of Industry Studies* 2, No. 1, 83-94.