

Non-technical Summary

Start-ups in innovative branches require a substantial amount of capital. Their founders may not have sufficient funds to finance the implementation of the ideas alone and might therefore look for outside financing. Additionally, new firms typically do not need only capital but also managerial advice. The banking sector does generally not want to take the extreme risks connected with young innovative firms on the one hand and, on the other hand, typically does not carry out advisory functions. High costs in combination with informal opacity are the reasons why small firms usually do not engage in public equity and debt underwriting, which leaves private capital as the most appropriate possibility. A special subgroup of private capital designed for young innovative firms is venture capital.

The interactions between venture capitalists and their portfolio firms are characterized by high asymmetry of information, high risk, and uncertainty. The founder usually has only limited resources and her human capital is essential for the success of the project. Normally, there is no collateral available. Different kinds of agency problems are present in venture capital markets: moral hazard, adverse selection, hold-up problems, window dressing, etc. With the provision of capital, the VC firm takes over part of the risk and of the surplus from a project. This entails an incentive problem, since the founder may exercise less effort than if she had taken the whole profit on herself. Even if the effort of the founder is very high, a failure of the project may occur due to other circumstances. In such cases, the founder typically does not want to admit the failure and stop the project - as long as the venture capitalist finances it - which may lead to a continuation of loss-making projects and wasting of scarce resources. Additionally, the danger arises that the founder could squander or misuse the money she gets from the venture capitalist. The founder might invest in strategies and projects that have high personal returns but low expected monetary payoffs to the venture capitalist. If the founder participates in the profits but does not bear a large enough part of the losses, she might take too much risk.

The relationship between a venture capitalist and an entrepreneur goes beyond the standard “principal – agent” framework. Venture capitalists’ effort is essential for the success of the investment because the entrepreneur usually has neither enough business experience nor the necessary networks. Using its networks, a VC firm can help the company find appropriate staff, suppliers, customers, or other partners. Furthermore, the VC firm offers experience in managerial activities so that it may collaborate on the establishing of the optimal structure of the firm and participate in organizational, financial, strategic, and other decisions. It often assists in obtaining additional financing.

Entrepreneurs and venture capitalists enter into contracts that influence their behavior and mitigate the agency costs. Typically, the contracts between venture capitalists and their portfolio firms include the following elements: a staging of capital infusions, the use of special financing instruments such as convertible debt or convertible preferred stock, an active involvement of venture capitalists in their portfolio companies, distribution of certain control rights to venture capitalists, etc. Additionally, before a contract is signed, the entrepreneur and her project are very intensively screened. Often, several venture capitalists join together in order to finance a project. Several theoretical and a few empirical papers deal with the topic of how these particular features of the venture capital investment process help mitigate agency costs.

What Do Economists Tell Us about Venture Capital Contracts?

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Abstract

Venture capital markets are characterized by multiple incentive problems and asymmetric information in an uncertain environment. All kinds of agency problems are present: moral hazard, adverse selection, hold-up problems, window dressing, etc. Entrepreneurs and venture capitalists enter into contracts that influence their behavior and mitigate the agency costs. In particular, they select an appropriate kind and structure of financing and specify the rights as well as the duties of both parties. The typical features of venture capital investments are: an intensive screening and evaluation process, an active involvement of venture capitalists in their portfolio companies, a staging of capital infusions, the use of special financing instruments such as convertible debt or convertible preferred stock, syndication among venture capitalists, or a short investment horizon.

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1 Introduction

A commercial exploitation of innovative ideas is the driving force of the market economy. New firms with pioneering ideas and with a flexible structure can react to the concerns of the customers more appropriately than old established enterprises. But start-ups in innovative branches require a substantial amount of capital. Their founders may not have sufficient funds to finance the implementation of the ideas alone and might therefore look for outside financing. Additionally, new firms typically do not need only capital but also managerial advice. The banking sector does generally not want to take the extreme risks connected with young innovative firms on the one hand and, on the other hand, typically does not carry out advisory functions. High costs in combination with informal opacity are the reasons why small firms usually do not engage in public equity and debt underwriting, which leaves private capital as the most appropriate possibility. A special subgroup of private capital designed for young innovative firms is venture capital (VC). Venture capitalists serve as specialized financial intermediaries who use various mechanisms that can mitigate agency costs. In this paper, we try to answer the following question: *How do the typical features of VC contracts help solve agency conflicts?*

Viewing start-up investment as a key source of employment, innovation, and growth, policy makers often emphasize the need to promote entrepreneurship and venture capital activity. Several empirical studies show the positive influence of young innovative firms on economic development.¹ Understanding the problems of the VC investment process and the mechanisms which have been developed in order to deal with these problems may be important for all participants in the VC market as well as for policy makers in order to create an appropriate environment for more efficient allocation of capital to start-up firms.

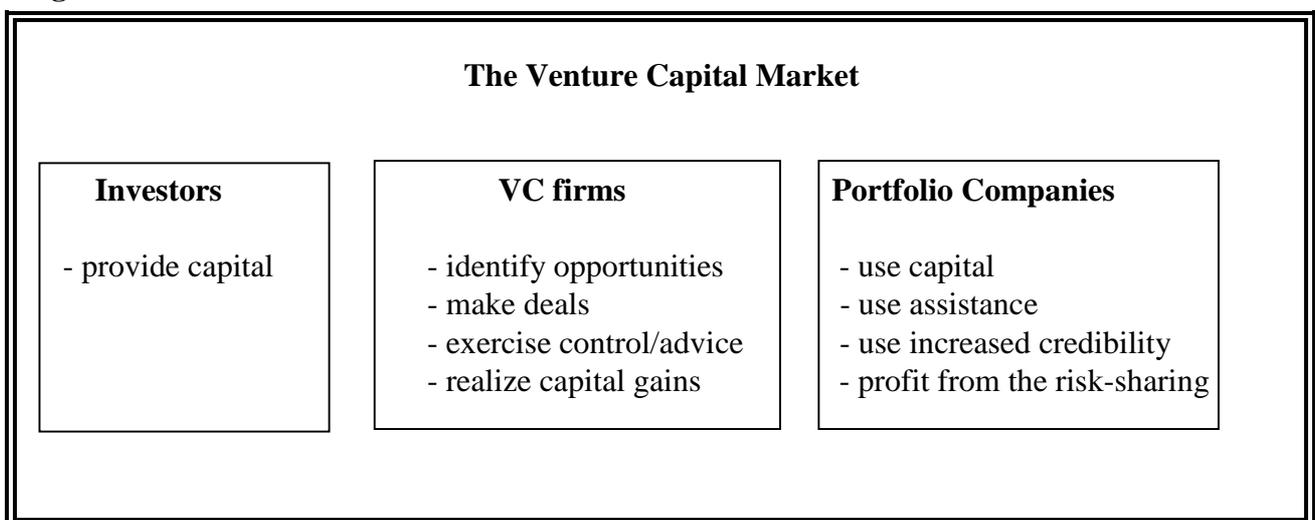
In the past decade, a wide range of theoretical and empirical literature on VC has been published. This paper offers a critical systematized overview of this literature and proposes several future research topics. It is organized as follows. In section 2 we line out the mechanisms of the venture capital market. Based on this description, the phases of the venture capital investment process, namely the selection (chapter 3), investment (chapter 4), and exit (chapter 5), are analyzed. Chapter 6 draws conclusions and discusses further research topics.

¹ For an overview see Keuschnigg et al., 1999.

2 Structure of the Venture Capital Market

A seminal overview of the mechanisms and the instruments in VC markets, particularly of contracts between venture capitalists and their investors, on the one hand, as well as on the other hand between venture capitalists and their portfolio firms, offer descriptive papers by Sahlman (1988 and 1990) and Barry (1994). Figure 1 depicts the typical VC market. A VC firm raises capital from outside investors and invests in potentially high-reward projects on behalf of these investors. Many high-technology companies (including Apple Computer, Cisco Systems, Microsoft, Lotus, Genentech, or Intel) and many successful service firms (e.g. Federal Express, Starbucks, or Staples) in the USA have received venture financing.

Figure 1



The main problem in the process of the transformation of an innovative idea into a realizable project is in many cases the lack of capital. Additionally, since most young innovative firms are owner-managed, the poor managerial background of the founder could typically be an obstacle to a successful start-up or the expansion of a young innovative firm as she² very often is a natural scientist with no or an insufficient business experience. Venture financing offers a joint provision of capital and managerial experience. While banks mostly monitor only the financial health of firms they lend money to, venture capitalists also check the strategy very profoundly. They usually take an active role in advising the firm, in taking principal decisions, and in providing the firm with necessary contacts to consultants, lawyers, investment bankers, or qualified managers. The control and advisory activities by a venture capital firm significantly raise the chances for the survival of the young firm.

² Throughout the paper we refer to the entrepreneur as she and to the venture capitalist as he.

Another benefit provided by venture capitalists is the risk sharing. As risk neutral investors with diversified portfolios, venture capitalists share risks with (typically) risk averse entrepreneurs. Additionally, a founder may profit from an increase in the credibility of her company if a renowned VC firm finances her idea. The returns of venture capitalists from their investments flow as capital gains upon completion of the investment rather than through on-going dividend returns.

The interactions between venture capitalists and their portfolio firms are characterized by high asymmetry of information, high risk, and uncertainty. The founder usually has only limited resources and her human capital is essential for the success of the project. Normally, there is no collateral available. With the provision of capital, the VC firm takes over part of the risk and of the surplus from a project. This entails an incentive problem, since the founder may exercise less effort than if she had taken the whole profit on herself. Even if the effort of the founder is very high, a failure of the project may occur due to other circumstances. In such cases, the founder typically does not want to admit the failure and stop the project - as long as the venture capitalist finances it - which may lead to a continuation of loss-making projects and wasting of scarce resources. Additionally, the danger arises that the founder could squander or misuse the money she gets from the venture capitalist. The founder might invest in strategies and projects that have high personal returns but low expected monetary payoffs to the venture capitalist. If the founder participates in the profits but does not bear a large enough part of the losses, she might take too much risk.

Typically, the “principal - agent” framework where the entrepreneur is the agent and the venture capitalist is the principal has been used to deal with the issues mentioned above. However, venture capital financing has some particular features which go beyond the typical “principal - agent” relationship. As, for example, the effort of the venture capitalist is essential for the success of the investment as well, not only the question of how to set the right incentives for the entrepreneur but also of how to set the right incentives for the venture capitalist - as the agent for the entrepreneur - are relevant.

In this paper, the analysis of the interactions between venture capitalists and their portfolio firms is carried out according to the following three phases of the venture capital investment process: the selection, the investment, and the exit. The role of the typical characteristics of VC markets such as specialization, syndication, stage financing, use of convertible securities, distribution of control rights to the financiers, and management support by the venture capitalists is explained and supported by the existing theoretical research. If available, empirical evidence is mentioned.

The literature on the relationship between outside investors and venture capitalists is not very extensive. Theoretical research is lacking. Several empirical papers exist

which concern the US venture capital market and which deal with the consequences of the information asymmetry between venture capitalists and their investors.³

3 Selection Phase

In the USA, only about five percent of proposals submitted to the venture capitalists receive financing (see OECD, 1996). A selection of those firms that promise high future profits is a very difficult task for venture capitalists. Even if a firm has a history, it is often very short, forcing the VC firm to evaluate other issues, particularly the person and the character of the founder, the originality of her idea, or the structure of the relevant market. Prior to investment, a due diligence is carried out by the venture capitalist.

VC firms are typically specialized in a particular industry or in a relatively narrow set of industries as well as in investments in certain firms' stages or regions. Since their employees often have a long practical managerial experience in a particular industry, they are supposed to be highly competent in management. Specialization and high competence in management make the evaluation of uncertain projects easier.

Amit, Glosten, and Müller (1990) deal with the ex-ante uncertainty of venture capitalists regarding the quality of the submitted projects and the capabilities of the entrepreneurs. They model the consequences of the adverse selection problem. Venture capitalists in their model are not able to distinguish between good and bad projects and do therefore not offer conditions which would be attractive enough for the best entrepreneurs to apply for funding. This results in a "market for lemons" as described by Akerlof (1970). The most promising projects do not involve a venture capitalist. If there were no risk aversion by entrepreneurs, the market would brake down completely. In the extension of this basic model, a signal which certifies either

³ An important result of these papers is that the reputation of VC firms plays an important role. The sensitivity of the compensation of VC funds to their performance is analyzed by Gompers and Lerner (1999). They confirm the "learning model" which claims that reputational concerns induce young VC funds to exert large efforts. Therefore, the compensation of young VC funds is less sensitive to performance than that of older funds. Gompers (1996) finds out that young VC firms take their portfolio companies public earlier and at more underpricing than older VC firms in order to establish a reputation and successfully raise capital for new funds. This behavior is called grandstanding. Gompers and Lerner (1998) analyze whether VC firms distribute profits to their investors in kind (as shares) or in cash after having sold the shares on the stock markets. Gompers and Lerner (1996) deal with the use of covenants in the contracts between venture capitalists and their investors. The interactions between venture capitalists and their investors are further not subject of our analysis in this paper.

the quality of the founder (e.g. a diploma, a business plan of a high quality) or her own confidence in the success of the project (the entrepreneur's ex-ante acceptance of penalties in case of bad firm's performance) can diminish the adverse selection problems in the VC market and lead to separating equilibria. By providing a signal, the founder signifies that her project is superior to other available projects of unknown quality. However, the assumptions of this model are questionable. It is assumed that founders can finance their projects "on their own". Often, a start-up does not have any other possibility of financing than venture capital (see chapter 1) so that the founder may be forced to accept also worse conditions in case signaling is not possible. Our criticism concerns further the assumption that venture capitalists cannot differentiate between good and bad projects in this model. After a due diligence, venture capitalists are certainly able to some extent to recognize the quality of the projects. Notwithstanding the predictions of this model, namely that most promising projects do not involve a venture capitalist, several very successful multinational firms were venture-backed (see chapter 2 for some examples). Further, the consequence of this model would be that VC firms make only "moderate" gains which might have been true in the second half of the 1980's in the USA as the paper was being written, but has no more been relevant during the 1990's.⁴

Berglund and Johansson (1999) model another feature of the selection process, namely why investments rather take place during later stages of the firm's development than during earlier stages. The reason they give is that the entrepreneur does not want to get VC financing in the start-up phase because her bargaining position is bad. She is afraid that the venture capitalist could "steal" her ideas. Later on, when her bargaining position gets better when she, for example, obtains a patent protection for her product, she can get a higher share on the net present value. However, the waiting is inefficient because the total net present value of the project decreases with time. Berglund and Johansson assume, like Amit, Glosten, and Müller (1990), that entrepreneurs can survive without venture capital as they are able to get initial funding from other sources. Using a simple model of venture capital investments based on an assessment of available data, Murray (1998) gives reasons for why venture capitalists are not interested in funding small young enterprises, but prefer more established larger firms. VC firms can profit from economies of scale and scope by financing more established enterprises rather than start-ups. Similarly to Berglund and Johansson (1999), Murray comes to the conclusion that young small firms are probably not financed by VC. Neither the founder (Berglund and Johansson, 1999) nor the venture capitalist (Murray, 1998) is

⁴ E.g. in the USA in 1998, the average internal rate of return was slightly larger than 21 % (see Burgel, 1999: 45), in Germany in 1995 – 1996 it was more than 18 % (see Schefczyk, 1999b: 7).

interested in such a deal. This conclusion might be relevant for Europe but does not hold in the USA, where more than one third of VC investments is in early stages.⁵

Several descriptive and empirical papers deal with the topic of selection. Based on interviews with 18 VC firms, Fried and Hisrich (1994) list the phases of the selection process and the criteria relevant for the decision in each phase. Macmillan et al. (1987) carry out a survey from among 100 venture capitalists. The most important criterion for the decision on funding is the quality of the entrepreneur.⁶ Zacharakis and Meyer (1998) show that during the selection process venture capitalists largely rely on an intuitive approach. The three papers mentioned above deal with the US market.

The selection of projects by venture capitalists is a complex process which involves a profound screening of the financial and personal characteristics of the venture, its products, and potential markets. Additionally, the contracts between entrepreneurs and venture capitalists have features which should prevent low ability entrepreneurs from applying for funding. Through acceptance of certain issues in the contracts (e.g. the buyout option, staging, convertible securities), highly skilled entrepreneurs may demonstrate their capabilities and their self-confidence towards the venture capitalists. However, it may happen that the high quality projects of high quality entrepreneurs are not financed, either because the entrepreneur is afraid of a hold-up by the venture capitalist or because the venture capitalist cannot recognize the potential of such a project and does not offer appropriate conditions, or because of the small scale of such a project.

In most papers, the decision process of venture capitalists is analyzed. However, also the entrepreneurs have to decide which venture capitalist to tap for financing. As venture capitalists carry out some essential tasks in their portfolio firms, their competence can decide about success or failure of a firm. This fact is mentioned by Smith (1998) and empirically assessed by Smith (1999) where the selection process by the entrepreneurs and their selection criteria (value-added services, reputational factors, valuation, venture capitalists attributes) are analyzed.

⁵ Between 1992 – 1996, 33.6 % of venture capital investments in the USA occurred in early stages compared to 5.8 % in Europe (see Schefczyk, 1998: 98).

⁶ Based on an ex-post analysis, Schefczyk (1999a) and Schefczyk and Gerpott (1998) show empirically that the person of the entrepreneur and her qualification has a significant impact on the success of VC investments in Germany. Also Murray (1996) stresses the extraordinary importance of the exceptional competence and track records of the founder managers for the success of the firm.

4 Investment Process

Venture capital contracts have some particular features such as a special security design (usually convertible debt or convertible preferred equity), a separation of control and ownership, a staging of the investments, and an active involvement of the investors in the activities of the company. Chapter 4 describes typical characteristics of VC investment contracts and gives reasons for particular arrangements.

4.1 Monitoring

Because of the high uncertainty, the asymmetry of information, and the extensive risk, venture capitalists continuously control the portfolio firms in which they invest. They usually sit on the board of directors. Gompers (1995) assesses empirically how the monitoring activities depend on different characteristics of the firm. He finds that the monitoring frequency rises with increasing expected agency costs. In particular, the lower the asset tangibility, the higher the growth options, the greater the asset specificity of a firm are, the more intensive do venture capitalists monitor it. However, despite the control, various states and actions still remain non-observable or non-verifiable. Therefore, a variety of incentive mechanisms are used in the contracts between venture capitalists and their portfolio firms.

4.2 Management Support

Venture capitalists act as active investors with a deep involvement in the company's management. Using its networks, a VC firm can help the company find appropriate staff, suppliers, customers, or other partners. Furthermore, the VC firm offers experience in managerial activities so that it may collaborate on the establishing of the optimal structure of the firm and participate in organizational, financial, strategic, and other decisions. It often assists in obtaining additional financing.

Venture capitalists' effort is essential for the success of the investment because young enterprises and their founders usually have neither enough business experience nor the necessary networks. As the venture capitalists' effort is typically unobservable and non-contractible, the question arises of how venture capitalists can be induced to put enough effort in the management support activities. Since entrepreneurial behavior is subject to an incentive problem as well, the venture capitalist and the entrepreneur must share the success returns. The stronger incentives are given to the one agent, the less the other agent is induced to increase his effort. The double moral hazard problem in the VC industry is the topic of several theoretical papers. The more powerful incentives can be implemented by using different payoff functions in different states. Such a modus can be reached through convertible securities.

In a model developed by Repullo and Suarez (1998) there are three parties – the entrepreneur, the initial financier who provides capital in the early stage but no managerial support, and the venture capitalist who offers financing as well as managerial support in the later stage of the project. The efforts of the venture capitalist and of the entrepreneur – which are put forth in the later stage - have a direct impact on the success probability. Therefore, the entire returns of the project should compensate these two parties. If the initial financier participated in the success as well, the incentives of the venture capitalist and entrepreneur to exert effort would be reduced. The first finding of Repullo and Suarez is that the claim of the initial financier should be bought back. However, paying the initial financier off produces an additional burden on the project in the later stage. Repullo and Suarez show that if returns from the project are low, the initial financier should get no compensation. The reason is that if returns are low, the shares of the venture capitalist and of the entrepreneur are already largely distorted in order to compensate the former for his contribution and satisfy his participation constraint. From a certain return level the initial investor gets compensation. The higher the returns, the higher the payment. The expected compensation should cover his investment. Repullo and Suarez show that the contract for the initial financier can be approximated with convertible preferred equity which, however, is never converted because either the project is terminated or the shares are repurchased by the venture capitalist. One of the central assumptions of the model that no effort by the entrepreneur or by the financier is needed in the first phase of the development is highly questionable to us. In practice, particularly at the beginning when the firm has to be built up, the effort of both parties is essential.

Schmidt (1999) shows that convertible securities mitigate the double moral hazard problem between the entrepreneur and the venture capitalist and can – under certain conditions – implement the first best solution. The time structure of this model is the following: After the state of the world is determined by nature, the entrepreneur and the venture capitalist invest sequentially their efforts. Under good conditions, the venture capitalist wants to invest his effort and to converge only if the entrepreneur already has invested enough effort. The entrepreneur knows this decision rule. Despite the fact that she loses a part of her equity when the venture capitalist converges, the entrepreneur is – under good conditions – induced to invest enough effort because afterwards she can profit from the effort of the venture capitalist. There are several quite strong assumptions in this model concerning the parameters and the relationships which must hold between them in order to implement the first best solution by using convertible securities.

Lülfesmann (2000) also asks the question of what the initial governance and financial structure should be in order to induce both parties to expend efficient levels of effort in a framework of uncertainty, unverifiable firm value, and the possibility of a renegotiation about the transfer of the ownership. In his model, as in the model

by Schmidt (1999), efforts are spent sequentially, first by the entrepreneur and later on – after a second investment by the venture capitalist is made – by the venture capitalist. Lulfesmann argues that since the entrepreneur has no productive role in the later development, the venture capitalist should get the ownership (and become the residual claimant) after the entrepreneur has invested her effort. He compares the following arrangements: a convertible debt, mixed ownership, and a standard debt. Under a convertible debt, the venture capitalist has the best incentives to put forth effort in case of an unsuccessful renegotiation about the ownership transfer because he not only increases his payoff (in states where he exercises his option) but also raises the likelihood that he exercises his conversion rights. A properly designed convertible debt contract leads the entrepreneur to invest more effort than under mixed ownership because she expects a larger effort by the venture capitalist. However, in equilibrium, the initial contract is always renegotiated to full venture capitalist ownership after the entrepreneur has spent her effort. Therefore the venture capitalist puts forth an efficient level of effort. The assumptions of this and the preceding model about sequential investments of the entrepreneur and the venture capitalist does not seem to be very realistic as usually both have to invest effort at the same time.

Casamatta (1999) analyses in her theoretical model the optimal security design depending on the size of the investment. In her model, the probability of the success of a project depends on the joint effort of the venture capitalist and the entrepreneur. If the monetary investment of one of the agents is low, then - under a setting where he participates in returns proportionally to his investment - his incentives to spend effort are not strong enough. Casamatta argues that he should get higher powered incentives that enhance his revenue in case of success relatively to the case of failure in order to induce him to invest more effort. Hence, dependent on the size of the investment, different kinds of securities should be used. If the monetary investment of a venture capitalist is low, he should get common stocks and the entrepreneur preferred equity. Under such security design, the venture capitalist is proportionally better remunerated in good states which gives him incentives to exert effort. The opposite case – a low investment by the entrepreneur - can be treated similarly. If the monetary contribution of the entrepreneur is rather low, it is harder to induce her to work. In this case, the venture capitalist should get convertible bonds or preferred equity which gives him relatively better remuneration in bad states. Casamatta mentions that her results are consistent with empirical findings. Business angels who invest smaller sums often get common stocks whereas venture capitalists whose participation is larger usually get convertible debt or preferred equity. However, this holds true only for the US market. In Europe, the security design is quite different.

In a model by Marx (1998), the venture capitalist is under normal circumstances not involved in the management of the business. He intervenes only if the firm performs badly. His involvement in this case can prevent low returns. If the development of

the portfolio firm is good, an intervention of the venture capitalist would have no impact on returns. The intervention causes the following costs for both agents: The venture capitalist has to spend costly effort and the entrepreneur loses her private benefits stemming from being a single decision maker in the firm. If pure debt is used, the venture capitalist is the sole residual claimant when the development of the firm is bad. Therefore, he has too great incentives to intervene in order to avoid bad returns. Under the debt contract, the venture capitalist does not consider the disutility which his intervention causes to the entrepreneur. If equity is used, the venture capitalist might intervene too much, too little, or efficiently depending on the part of the equity that he holds. The conclusion of Marx is that an efficient venture capitalist's intervention can be achieved through a combination of debt and equity or through a convertible preferred equity. In this model, the involvement of the venture capitalist damages the entrepreneur, in the four models mentioned above, the opposite has been true. Also another assumption of this model seems to be open to discussion, namely that the venture capitalist can raise low returns to a certain level but his intervention has no impact in case of high returns.

Several models have been discussed which deal with the dual role of venture capitalists as supplier of finance and managerial expertise. This dual role is an important reason for the use of convertible securities.

4.3 Control Rights over the Firm

The problem of the selection of an optimal control and governance structure is closely related to the problem of choosing an optimal financing structure. A venture capitalist has different control rights if he holds different types of securities. Venture capitalists usually retain a significant share in the equity of the company they finance. They typically become members of the boards of directors in their portfolio firms and retain important economic rights which are often disproportionately larger than the size of their equity investment. Usually, the entrepreneur has a large equity share in order to induce her to put forth enough effort and the venture capitalist has control over certain fields in order to avoid future agency conflicts. The contracts between entrepreneurs and venture capitalists usually include numerous restrictive covenants concerning the rights and the duties of the entrepreneur. Frequently, control rights are contingent on firm performance: If the firm performs badly, the venture capitalist gets more rights. In different papers, different issues are considered under the term "control rights", e.g. the control over the production decision, the buyout option (the right to dismiss the founder under certain circumstances), the exclusivity rights (the portfolio firm is not allowed to seek de novo lending), or the veto power over important decisions (such as e.g. large expenditures or issuance of new securities).

Chan, Siegel, and Thakor (1990) analyze theoretically the following typical features of a contract between venture capitalists and entrepreneurs:

- 1) ownership and control are specified independently,
- 2) any outside funding from other sources (de novo lending) is prohibited,
- 3) the entrepreneur is allowed to retain control if she demonstrates a minimum skill level (which is at the beginning unknown to both), otherwise the venture capitalist takes over the productive control,
- 4) the payoffs of both are dependent on the entrepreneur's skills if she remains in control.

In their model, control means the right to make production decisions which requires a costly effort by the controlling party. The effort of the party in control has a direct impact on the probability distribution of bad and good states, whereas his skills influence the cash flow. In the beginning, the entrepreneur has the control. The first period cash flow reveals her skill level. If she is insufficiently skilled, it is efficient to pass the control to the venture capitalist whose skills are publicly known. In this case, the entrepreneur should be compensated by a fixed amount which achieves an efficient resolution of moral hazard (as the venture capitalist whose effort matters is made a residual claimant) and an optimal risk sharing (as the entrepreneur is assumed to be risk averse and the venture capitalist risk neutral). If the entrepreneur remains in control, her payoff depends on her skills (and therefore on the cash flow since the skill level directly influences the cash flow). This provision induces highly skilled entrepreneurs to exert more effort. Finally, the entrepreneur prefers to oblige herself contractually not to search out any other outside funding. The reason is that if she did not make this commitment, she would get worse conditions from the venture capitalist at the beginning. The model assumes that the cash flow in the first period reveals the skills of the entrepreneur which is questionable in reality. Further, the costs of control are not considered in other models (which are discussed later in this chapter). Rather the very opposite is the case: private benefits of having control are often assumed.

Aghion and Bolton (1992) develop a "pecking order" theory of governance structures in a partnership between a wealth constrained entrepreneur who has private non-monetary benefits from running a project and a financier who cares only for monetary returns. As the coincidence of objectives of these two agents cannot be achieved, the allocation of control rights matters. Aghion and Bolton consider the possibility of a renegotiation and assume two states of nature and two possible actions by the controlling party. The extent of the monetary and the non-monetary benefits depends on the state and on the action taken. According to Aghion and Bolton, the pecking order theory of control implies the following sequence: the

entrepreneur's control (non-voting equity for the venture capitalist), the contingent control (debt or convertibles), and the venture capitalist's control (voting equity). Another finding of the paper is that sometimes the entrepreneur's control is not feasible because the investor could not be compensated sufficiently. In this case the allocation of control rights should be contingent on the signal about the state of nature. Under these features, debt is the optimal form of financing. Debt comprises a protection for the venture capitalist because it enables him to take over the firm if it performs badly and if the entrepreneur defaults. At the same time, the entrepreneur may get some private benefits under debt arrangement.

Hellmann (1998) considers a venture capitalist and a wealth constrained entrepreneur who has private non-monetary benefits from managing the firm. She may increase her private benefits at the expense of expected profits. The central issue of this model is the venture capitalist's right to dismiss the entrepreneur. This right is not state contingent and it is independent of the financial structure. The role of the venture capitalist thereby is to find a new, more productive manager (rather than replace her by himself as in the model by Chan, Siegel, and Thakor (1990) discussed above). The costs of finding a new manager play an important role by Hellmann. In his model, the entrepreneur sometimes relinquishes control voluntarily, not - as in the model by Aghion and Bolton (1992) discussed above - because she is forced to by the venture capitalist's participation constraint. The intuition behind Hellmann's model is that if the entrepreneur is in control, the incentives for the venture capitalist to engage in searching activities may be low as - after costly search - the entrepreneur may decide not to be replaced or may demand a large severance payment for her approval of the replacement. Hellmann analyses how the compensation in case of a replacement and in case of a non-replacement should be designed in order to set incentives for the entrepreneur (monetary vs. private benefits) and to bring about an optimal replacement decision. He shows that the entrepreneur accepts vesting⁷ and modest severance payments. The venture capitalist's control and the change of management is more likely if the founder is less productive compared to professional managers, the private benefits of the entrepreneur are lower, and if the venture capitalist has larger bargaining power.

The model of Kirilenko (2000) considers a continuous allocation of control rights between an entrepreneur and a venture capitalist (in contrast to the papers mentioned above which assume control to be a binary variable: one party has control and the other party has no control). The reallocation of control may lessen some incentive problems and make the outcomes more efficient. The contract between an entrepreneur and a venture capitalist specifies the control allocation, the number of

⁷ Under vesting, the entrepreneur's shares are originally held by the firm and the entrepreneur gets them step by step according to some contracted schedule. If she leaves, the company retains or can cheaply buy any unvested shares.

shares which are distributed to the venture capitalist and their price. The entrepreneur has a private value of control which is not observed by the venture capitalist. The higher the venture capitalist's uncertainty about the value of control for the entrepreneur, the more control rights are allocated towards the entrepreneur. Additionally, the entrepreneur gets a signal about the future returns of the project which is as well not observable by the venture capitalist (the author calls it "adverse selection"). The higher the adverse selection, the more rights are delegated to the venture capitalist. The impacts of the allocation of more control rights to the venture capitalist are the following:

- 1) a smaller dilution of entrepreneur's ownership at higher share prices,
- 2) the allocation of more risks to the venture capitalist who is risk neutral (whereas the entrepreneur is risk averse).

The entrepreneur is compensated for her loss of control benefits through better financing terms and a better risk sharing. The optimal contract can be reached by a competitive market for control or by bilateral bargaining.

Several empirical papers deal with the allocation of control. Lerner and Tsai (1999) show that the allocation of control rights depends on the conditions for raising capital. If these conditions are bad, the control rights are by the venture capitalists. This is according to Lerner and Tsai not an optimal allocation because the control rights should be assigned to that party which has the greatest marginal ability to influence the returns which is usually the entrepreneur. Lerner and Tsai show empirically the consequence: venture-backed firms perform worse if conditions for raising capital are bad. Kaplan and Stromberg (2000) consider a wide range of various control rights such as cash flow rights, voting rights, board rights, or liquidation rights. They support empirically many of the theoretical findings mentioned above. Their main results are that the various rights are separately allocated, are interrelated, shift gradually with performance and are contingent on the development of the firm. Particularly if the company performs badly than the control is assigned to the venture capitalist. Non-compete⁸ or vesting provisions which protect the venture capitalist against dilution are typical. Very often, convertible securities are used.

The topic of control in venture capital backed firms is very complex. Different aspects of control allocation can be explained through different models. Various control rights can be considered. Their allocation between the entrepreneur and the venture capitalist depends on the asymmetry of information, skills, participation

⁸ A non-compete contract prohibits the entrepreneur from working for another firm in the same industry for some period after having left the firm.

constraints, efforts, benefits (costs) of control, the bargaining power, or the realization of random variables. The venture capitalist's control rights are usually separated from his ownership rights in order to improve efficiency. This can be reached by using particular financing instruments and various covenants or restrictions in the contracts between venture capitalists and their portfolio firms.

4.4 Stage Financing

A typical feature of VC contracts is the stage financing. The entrepreneur does not receive the whole investment sum at the beginning, but rather in stages corresponding to significant developments in the life of the company (e.g. the development of a prototype, the first production, etc.). The capital invested at each point should be sufficient to bring the company to the next stage of its development. Since the majority of assets in innovative firms is highly intangible and since the tangible assets have a high degree of specificity, each individual investment is typically sunk. During the development of the firm, the venture capitalist learns more about the project as well as about the founder and can decide on the optimal investment sum for the next stage or – in case of an inappropriate development – stop the financing. The possibility to enforce stopping of the project is important for the venture capitalist because the entrepreneur is almost always interested in continuing the firm as long as the venture capitalist provides capital. Through e.g. conversion of his securities, changing the entrepreneur's share on the firm etc., the venture capitalist can accommodate not only the investment sum but also the payoff function of the entrepreneur. The impact of the firm's performance on the entrepreneur's payoffs on the one hand and the threat that unprofitable projects might even be stopped on the other hand help avoid the moral hazard behavior of the entrepreneur. Additionally, under stage financing the entrepreneur is motivated to make the company successful and to put forth more effort in order to achieve less dilution. If the company is doing well and its value increases, the venture capitalist gets (for the same amount of capital) fewer shares than he would have got at the beginning when the value of a share had been lower. Therefore, if stage financing is employed the entrepreneur can retain a higher share on the company. The acceptance of the stage financing by the entrepreneur can serve as a signal of her confidence in her own abilities.

Several theoretical papers deal with the contract design under stage financing and with the optimal stopping rule. Bergemann and Hege (1998) model a learning process and a moral hazard problem in a project financed in stages. The entrepreneur controls the allocation of the capital (which is provided by the venture capitalist) and may divert the funds to her private consumption. This diversion cannot be observed by the venture capitalist. This model has several periods. At the end of each period, the project either yields a payoff (and is successfully terminated) or brings no payoff. In this case the venture capitalist either liquidates it or he finances it further

in the next period. Good and bad projects exist and neither the entrepreneur nor the venture capitalist can distinguish between them at the beginning. Bad projects bring no returns. Over time, the entrepreneur and the venture capitalist learn more about the quality of the project. The more periods without success, the lower the confidence that the project might be good and bring returns in the future. As the probability of the success of good projects in each period is influenced by the invested sum, if in some period the entrepreneur diverts the funds for her private consumption, she lowers the probability that the project could succeed in that period. She further diminishes the venture capitalist's belief that the project will bring success in the future because the venture capitalist cannot observe the diversion and thinks that the money was invested in the project and that – despite this investment – no success arrived. Hence, a danger arises that the project could be stopped too early as the venture capitalist is too pessimistic about its future prospects. In order to give the entrepreneur the right incentives, Bergemann and Hege propose a contract in which the share of the entrepreneur on the project decreases over time. Under this arrangement, the entrepreneur gets an incentive not to postpone the successful realization of the project through fund diversion. If there is a liquidation value, either a mixture of debt and common equity or convertible preferred stock with time-varying conversion price can be employed. If the venture capitalist has the possibility to monitor or to replace the entrepreneur, the efficiency increases.

Cornelli and Yosha (1998) analyze a “window dressing” problem which can arise when stage financing is used. As the entrepreneur has no own funds in their model, the entire capital comes from the venture capitalist. The consequence is that the entrepreneur always wants to proceed with the project. Under stage financing, every time before the venture capitalist takes a decision on further funding or liquidation, the entrepreneur has incentives to manipulate short-term signals in order to reduce the probability that the project will be liquidated. The orientation towards short term goals may negatively influence long term prospects of the project. Cornelli and Yosha show that convertible debt can prevent the entrepreneur from manipulating a signal. The reason is that if the entrepreneur improves short term signals, the probability that the venture capitalist converts rises and the share of the entrepreneur on the profit decreases. Cornelli and Yosha show how the convertible debt arrangement should be designed in order to outweigh the gains and the losses from a manipulation and to induce the entrepreneur to “tell the truth”.

Hansen (1992), as well, deals with the problem of optimal stopping. He considers a project which requires a sequence of sunk cost investments by the venture capitalist. Further, the information is revealed asymmetrically (with a certain probability the entrepreneur knows earlier than the venture capitalist that the project is bad) and the managerial contribution of the venture capitalist as well as the effort of the entrepreneur, which are both non-verifiable, increase the returns. Bad projects require greater input of managerial expertise by the venture capitalist. There is a

joint problem of the optimal stopping and of effort incentives for the entrepreneur. Debt induces high levels of entrepreneur's effort. However, under asymmetric information, the entrepreneur has an incentive to keep "bad news" secret and profit from the venture capitalist's managerial contribution if a simple debt contract is used. Hansen proposes a contract where the entrepreneur may send a message on the project quality before the venture capitalist learns about it. The entrepreneur receives a payment for sending a message that the project is bad and such a project is terminated. In that way the entrepreneur is compensated for the loss of benefits she could gain through not telling the truth and profiting from the venture capitalist's investment. Another feature of an optimal contract is that the face value of debt depends on the project quality. Hansen shows that the face value of debt on unprofitable projects should be higher than on profitable projects. This induces the entrepreneur to put forth more effort. This contract can be implemented by using conversion options.

Also Trester (1998) looks for an optimal contract between an entrepreneur and a venture capitalist for a stage financed project under asymmetric information. At the beginning, the information about the quality of the project is unknown to both parties. However, at intermediate stages the information may be distributed asymmetrically. The entrepreneur knows with some probability the quality of the project - which determines the returns - before the venture capitalist does. Since auditing is impossible or prohibitively costly, in case of asymmetrically distributed information the entrepreneur may take the intermediate returns, default on the debt, and abandon the project. If the project is not abandoned, a second investment by the venture capitalist may be made and additional returns realized. In particular, two financing contracts - debt and preferred equity - are compared. The only difference between them is that a debt contract incorporates a foreclosure option. Trester shows that for sufficiently high probabilities of asymmetric information, debt is neither desirable nor feasible. If a debt contract is used and the probability of the asymmetric information is high, the entrepreneur will be afraid that the venture capitalist will foreclose. This option encourages the entrepreneur to behave opportunistically even if both parties prefer to continue the project. The foreclosure option leads to an inefficient liquidation under debt. Preferred equity is therefore superior to debt. In an empirical survey, Trester demonstrates the wide usage of preferred stock in the USA. However, the assumption that the entrepreneur may "take all the available assets and disappear" because monitoring is impossible seems to us not to be realistic.

The model of Neher (1999) assumes a perfect certainty and symmetric information. The human capital of the entrepreneur is necessary for the existence of the firm. The agency problem arises because after the investment by the financier, the entrepreneur can try to renegotiate down the financier's claim and she cannot credibly commit not to renegotiate. Staging could help to mitigate this hold-up

problem. In each period, the financier decides either to continue or to liquidate the project depending on the value of liquidation, the present value of continuation and the constraint imposed by the possibility of renegotiation. Neher shows that any new investment is made equal to the debt capacity of the firm (the liquidation value minus the present value of investment done). The invested sum increases during the development as the physical capital invested becomes more and more tangible and the entrepreneur's human capital more and more embodied in the physical capital. Neher notes that a useful place to consider the predictions of his model is the VC market because investment is often staged there. However, several assumptions of his model seem not to be relevant for the VC market, for example, perfect certainty, symmetrical information, or the absence of effort costs.

Several theoretical papers show that stage financing may mitigate the moral hazard behavior of the entrepreneurs (low effort, diversion of funds). In an empirical paper, Gompers (1995) argues that staging is important for lowering agency costs. In the models described in this chapter, the activities of venture capitalists are not analyzed under moral hazard aspects (as discussed in chapter 4.2). Some of the theoretical papers described here deal with various problems which are caused by the stage financing (e.g. manipulation of short-term signals, danger of a renegotiation, failure in the reaching the optimal stopping decision) and propose mechanisms which help solve these issues.

4.5 Syndication

Syndication with other venture capitalists improves the portfolio diversification of a VC firm as it can, with a limited amount of resources, participate in more projects. Additionally, Brander, Amit, and Antweiler (1998) confirm empirically that syndicated projects offer higher returns than projects which are financed only by a single venture capitalist (stand-alone project). They test the selection hypothesis against the value-added hypothesis. According to the selection hypothesis, stand-alone projects should perform better because they are of a higher quality than syndicated projects. The "story" behind this assumption reveals that a venture capitalist can recognize if a project is of a low, a middle, or a high quality. A high quality project is financed, a low quality project is rejected. If the project is of a middle quality, the venture capitalist wants to consult another venture capitalist on prospects of the project. On the other hand, the value added hypothesis implies that syndicated projects perform better because more venture capitalists offer an improved managerial support, a higher reputation, and a larger variety of contacts for their portfolio firms than a single VC investor. However, there is another "story" imaginable, which is not considered and which also results in a better performance of syndicated investments: the syndication is important already during the selection process since more venture capitalists may reduce the asymmetries of information and pick out the projects of the highest quality better than a single venture capitalist

who cannot alone distinguish between good, middle and bad projects. Often, the decision to invest is made conditional on the finding of a partner who is prepared to co-finance the project because he agrees that it is attractive (see Gompers and Lerner, 1999).

Two theoretical papers deal with the optimal design of a financing contract among syndicated venture capitalists in a world with asymmetric information. However, they come to different results. In both papers, a single venture capitalist finances the early stage and gets some inside information about the firm. In the expansion stage, a new venture capitalist who does not have this information co-finances the firm. Admati and Pfleiderer (1994) give reasons for a fixed fraction contract where the initial (lead) venture capitalist holds a constant share on equity independently of any newly issued securities and carries the same fraction on any future investment. This contract is according to their model the only one which is robust with respect to optimal continuation in a stage financing agreement. In this case, syndication is necessary in later stages of a venture to make the continuation decision optimal. As the lead venture capitalist has more information than the co-investor, every other contract would lead to a suboptimal investment decision. If the share of the lead venture capitalist on future returns was high compared to the sum he invests, he would overinvest (support non-profitable projects instead of stopping them) and vice versa. Further, as the payoff for the lead venture capitalist is independent of the price of securities issued to the new investor, the venture capitalist has no incentive to misrepresent their value. In our opinion, the model could be extended and include also reputational issues. It would certainly be interesting to investigate in how far the fear of losing reputation can force the lead venture capitalist to behave optimally.

Cumming (2000b) argues for preferred equity for the lead venture capitalist and for convertible debt for the follow-on venture capitalist. He shows that this arrangement can induce an efficient new venture capitalist's participation, limit a mispricing of securities, and mitigate a misstatement of capital requirements. Under this arrangement, the lead venture capitalist credibly passes the true information on the firm (on its quality, the capital requirements, the value of newly issued securities) because his payoff is independent of the payoff and on the contribution of the new venture capitalist. In that way, the lead venture capitalist serves as an intermediary between the new venture capitalist and the entrepreneur. The new venture capitalist is necessary for the project because without him, the entrepreneur would be subject to a renegotiation hold-up by the initial venture capitalist as a single supplier of capital who would be able to extract all rents from her. The main difference to the model of Admati and Pfleiderer (1994) is that Cumming considers additionally the moral hazard problem of the entrepreneur. Under a fixed fraction contract as proposed by Admati and Pfleiderer (1994), the lead venture capitalist has an incentive to misrepresent the value of securities to outside venture capitalists if the moral hazard problem is relevant. Through mispricing, he may influence the

entrepreneur's share on the firm which has an impact on her effort and hence on the returns of the firm and on the lead venture capitalist's claim. However, the contract proposed by Cumming offers no effort incentives for the venture capitalists.

Some empirical evidence for the results of both discussed papers exist. Lerner (1994b) confirms the constant share equity hypothesis of Admati and Pfleiderer (1994) and shows additionally some further features of syndicated investments. Cumming (2000a) provides some support for the contracts proposed in Cumming (2000b) .

In the USA, about 90 percent of deals in the VC industry are carried out as syndicated investments (see OECD, 1996; Barry et al., 1990), whereas in Germany it is only about 30 percent (see BVK, 1999). Syndication might be profitable for the entrepreneur as well as for the venture capitalist. However, the agency problems are aggravated as more participants with various information sets and different preferences are involved when financing is syndicated.

5 Exit

The life of a VC fund is limited. In the USA it is usually set at a maximum of ten years (see Sahlman, 1990). After this period, capital providers want to evaluate venture capitalists and harvest the results of their investments. Therefore, the investment period of venture capitalists in their portfolio firms is short, usually 3 to 7 years (see Barry, 1994). At the end of this period, venture capitalists want to get the invested sum plus a premium back. Hence, exit is critical for the operation of the VC market.

According to Bascha and Walz (1999), an entrepreneur and a venture capitalist may in some cases have diverging interests with respect to the selection of the exit channel. In a theoretical model they compare two exit possibilities: an initial public offering (IPO) and a trade sale (TS). The following issues play a role: emission costs which make an IPO more expensive than a TS, a synergy premium which an acquiring firm is prepared to pay for synergy effects in case of a TS, private benefits of the entrepreneur if she retains control (in case of an IPO), and a reputation gain for the venture capitalist (which increases as the value of the firm grows) when he brings a good firm on the IPO market. In their analysis, the first best solution is to use an IPO for large firm values and a TS for low firm values. For high firm values, the reputation gains by the venture capitalist are large enough to outweigh the emission costs, the lost synergy premium, and the loss of control benefits by the entrepreneur. If the venture capitalist is allowed to decide on the exit route, he prefers an IPO for large values and a TS for low values due to reputational issues. If the entrepreneur has the possibility to decide over the kind of exit, she considers only her own costs and gains - namely her part of the emission costs and of the

synergy premium as well as her control benefits. Since in this model these issues remain constant for different firm values, the entrepreneur decides, other things being equal, on the optimal exit route independently of the firm value. If there is no switch in the entrepreneur's payoff structure for different firm values, she will always choose one and the same exit way. In order to maximize the overall utility, the control during the implementation phase should be by the entrepreneur because she profits from control benefits. Therefore a change in the payoff structure for high and low firm values and eventually (depending on the parameters of the model) a switch in control must occur in order to induce the first best exit way. Bascha and Walz show that the optimal solution can be implemented by using convertible securities. Depending on the parameters of the model, the first best solution is achievable with a conversion either into non-voting or into voting equity. The larger the reputation effect, the more likely is the use of non-voting equity. Concerning the assumptions of the model, it seems to be questionable why only the extent of reputational gains should depend on the value of the firm. Other variables, such as emission costs, synergy premium, or control benefits are in this model constant (independent of the firm value). However, a synergy premium for a well performing firm would normally be larger than for a badly performing firm. Also the control benefits of the entrepreneur are probably larger for firms with higher value. Changing these assumptions would considerably change the results of the model. Another limitation of the model is that it considers only two exit possibilities – the trade sale and the IPO.

Berglöf (1994) considers a situation in which one of the parties involved – either the venture capitalist or the entrepreneur – has a majority and wants to sell it to a new owner. The other party might get damaged through this action. If the venture capitalist sells the control stock to a new owner, the entrepreneur may be dismissed and lose her private benefits. On the other hand, if the entrepreneur has the majority and sells it, the new buyer may carry out asset stripping which has negative implications on the venture capitalist. In this model, private benefits of the entrepreneur play a role in good states whereas asset stripping occurs in bad states. Berglöf shows how potential conflicts can be mitigated by allocating the decision to trade to the more vulnerable party. This can be reached by using convertible securities under which the venture capitalist may convert his debt into non-voting equity. A state contingent allocation of control protects the initial contracting parties as much as possible against dilution and extracts from a future buyer. In good situations where the entrepreneur is more vulnerable as she has high private benefits, the right to sell is allocated to her. She sells her shares and the venture capitalist converts his debt and profits from future value increases. In bad states (in which the

entrepreneur cannot repay her debt), the venture capitalist takes over the control⁹ and has the right to sell the firm. In this case, the venture capitalist is more vulnerable (as there is a high risk of asset stripping) and has therefore the right to decide about the sale. Only two exit ways are considered in this model – either a trade sale or a liquidation. Another limitation of the model is that the probability of finding a buyer is set to one and does not depend on the structure of securities.

Black and Gilson (1998) stress in an empirical and largely descriptive paper that not only the availability of any exit channel but also the form of exit is important for a viable VC industry. They explain the higher vitality of the US venture capital market compared to the German market by institutional differences in corporate governance systems, namely the stock market-centered system in the USA vs. the bank-centered system in Germany. Stock markets make available a particular kind of exit: the IPO. An IPO is beneficial for both, the venture capitalist and the entrepreneur. The entrepreneur can reacquire control over the firm which gives her in the implementation phase incentives to invest effort and to increase the value of the firm. This intuition is formally modeled by Burghof (1998) who shows that markets for IPO make some projects feasible which would not be carried out without these markets. Through an IPO, the venture capitalist diminishes his bargaining power and the danger of a hold-up which avoids costly future renegotiations. This gives the entrepreneur an incentive to put forth more effort. Several empirical papers confirm the positive role of a viable IPO market on VC activity: Jeng and Wells (2000) find that IPOs are the strongest driver of VC investing. Gompers (1998) sees two main reasons for the dramatic increases in VC commitments in the USA during the last few years: one of them is a surging market for venture-backed IPOs.

The empirical literature on exit channels in the VC industry usually concentrates on IPOs and mostly deals only with the US market where IPO is the most frequently used exit channel.¹⁰ Several empirical articles are devoted to particular aspects of venture-backed IPOs, to comparisons between venture-backed and non-venture-backed IPOs, or to differences between the IPOs of more and less mature VC firms. A survey of the empirical literature on VC and IPOs gives Norton (1993). Megginson and Weiss (1991) empirically confirm the certification role of venture capitalists. Venture-backed firms are able to attract higher quality underwriters and auditors than their non-venture-backed counterparts. Further, the quality of the venture capitalists' monitoring skills reduces investor uncertainty which results in less underpricing. The presence of a venture capitalist in the issuing firm lowers the

⁹ The right to choose the timing and the kind of the exit can be labeled as a particular control right. However, the exit is crucial in the venture capital markets so that it deserves to be discussed in a separate chapter and has not been integrated into chapter 4.3 where control issues has been dealt with.

¹⁰ In Europe, only 20.7 % of the divested sum in 1999 originated from IPOs (see EVCA, 2000).

total costs of going public and maximizes the net proceeds to the offering firm. Barry et al. (1990) show that higher quality venture capitalists provide IPOs of better quality. Often venture capitalists retain a significant portion of their holdings in the firm after the IPO (Barry et al., 1990; or Megginson and Weiss, 1991). Gompers (1996) demonstrates that young VC firms in the USA take companies public earlier and at more underpricing than older VC firms. His explanation is that they want to establish a reputation and successfully raise capital for new funds. This effect is called “grandstanding”. Lerner (1994a) shows out in an empirical paper that venture-backed biotechnology firms in the USA go public when equity valuations are high and employ private financing when they are lower. Cumming and MacIntosh (2000) demonstrate empirically that the efficient pattern of exit depends on the quality of the firm, on the nature of its assets and on the duration of the VC investment. IPOs are most often used for the highest quality firms. Bygrave and Timmons (1992) calculate the relation of the net profit to the investment for various divestment channels. An IPO is by far the most profitable exit channel.

Most articles on exit from venture capital investments deal with the IPO. The theoretical research on diverse exit possibilities, the selection of exit routes, and the timing of exit has been very limited until now.

6 Conclusions

Various aspects of venture capital markets are ideal research topics for economic theorists who deal with information asymmetry. The reason is that venture capital markets are characterized by multiple incentive problems and asymmetric information in an uncertain environment. As venture backed projects are typically very complex, it is unfeasible to specify ex-ante actions for all states of the world. Even if they can be specified, it is typically impossible to enforce them. Most actions and states have only a very limited observability and are typically non-verifiable. All kinds of agency problems imaginable are present: moral hazard, adverse selection, hold-up problems, free-riding, window dressing, etc.

Entrepreneurs and venture capitalists enter into contracts that influence their behavior and mitigate the agency costs. In particular, they select an appropriate kind and structure of financing and specify the rights as well as the duties of both parties. Each aspect of the venture capital process has to be seen as being interrelated with several other aspects. In order to structure the literature on venture capital investments, we have created an artificial division in this article. But each topic of

the venture capital financing which is analyzed in a single chapter must be seen as an integral part of a whole.¹¹

The typical features of venture capital investments are: an intensive screening and evaluation process before an investment in a new company is made, an active involvement of venture capitalists in their portfolio companies (control and managerial support), a staging of capital infusions, the use of special financing instruments such as convertible debt or convertible preferred stock, a syndication among venture capitalists, or a short investment horizon.

Throughout the paper, the extraordinary role of convertible securities has repeatedly been mentioned in different contexts. Since no single chapter has been devoted to the security design, the advantages of convertibles should be summarized here. Convertible securities cannot be replicated by a simple mix of debt and equity because the former offer the possibility that during the development of the project, as more information is revealed, the venture capitalist may change the payoff structures. Convertibles can implement a contingent control allocation as well. Compared to debt, they mitigate entrepreneurial risk shifting. They can help solve the moral hazard problem of the venture capitalist and induce his active participation as he can disproportionately participate in the success. The entrepreneur is encouraged to more effort as well. Further, convertible securities mitigate the window dressing problem and lead to optimal stopping. They may serve as a self selection mechanism which prevents low ability entrepreneurs from participation. Additionally, they may implement an optimal exit decision.

A large number of papers on the venture capital market have been written in the last decade. The majority of them deal with the relationship between entrepreneurs and venture capitalists. The interactions between investors vs. venture capitalists and the process of raising capital and structuring funds have been analyzed only sporadically. The market for capital acquisition where venture capital firms search for investors is - similarly to the market for venture capital deals - characterized by incentive problems, asymmetric information, and an uncertain environment. Theoretical research in this field is lacking. A few empirical papers deal with the information asymmetry between venture capitalists and their investors in the US venture capital market. The interactions between all three groups – investors, venture capitalists, and their portfolio firms (entrepreneurs) - and the impact

¹¹ So is e.g. the *stage financing* closely related to the security design. Further, the stage financing could be considered as a control mechanism. Additionally, it makes monitoring easier. Last, the decision on further investment or termination is closely related to the topic of exit.

contracts between two players can have on the third party are analyzed only very rarely.¹²

From the topics discussed in chapters 3 – 5, particularly the syndication and the exiting process remain little theoretically explored. Additionally, several assumptions usually accepted in theoretical models deserve reconsideration, e.g. the risk neutrality of the entrepreneurs, perfect competition among venture capitalists, rather a single entrepreneur (founder) than a whole firm facing the venture capitalist etc. Only a few models assume risk aversion by entrepreneurs which, however, seems to be more plausible than risk neutrality as the entrepreneurs usually invest a large part of their wealth into one single project and cannot diversify their portfolio. Typically, perfect competition in the venture capital market is assumed which leads to zero profits and to a large bargaining power by the entrepreneurs. The real venture capital market is rather very diversified (due to specialization) and the contract conditions depend largely on supply and demand of venture capital. Here, a direct link to the topic discussed above (the interactions between investors, venture capitalists and entrepreneurs) occurs since venture capitalists can be seen as intermediaries between supply (investors) and demand (entrepreneurs). The impact of the supply side on the features of the contracts between venture capitalists and entrepreneurs has been shown empirically, based on the US data (see Gompers and Lerner, 2000; Lerner and Tsai, 1999), but not incorporated into theoretical research. Further, most models consider a single founder who bargains with the venture capital firm. However, usually there is an entrepreneurial team who cannot be treated as a whole but the incentives of the single members of this team must be considered.

Venture capital is widely assumed to be a driving force behind innovation and growth. However, there is only a very limited literature on the impact of venture capital on macroeconomic variables (see Kortum and Lerner (1998) for empirical research on the impact of venture capital on innovation, Schertler (1999) for a theoretical model of venture capital in an open economy). It would be desirable to further explore the ways how venture capital influences the economic development.

¹² One example of this impact is the “grandstanding” where the relationship between venture capitalists and their investors influences the timing of venture capitalists exit from their portfolio companies.

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Annex – Typical Agency Problems in the Venture Capital Market

Phase	Problem	Literature	Mitigated through
Selection of the deal	Adverse selection	Amit, Glostén, and Müller, 1990 Chan, Siegel, and Thakor, 1990 Hellmann, 1998	Signaling Exclusivity rights, contingent control allocation, payoff structure Right to dismiss E allocated to VC
	Danger of a hold-up through the VC in an early-stage firm	Berglund and Johansson, 1999	Investment in later stages
	High fixed costs of an investment	Murray, 1998	Investment in larger deals
Investment process	Moral hazard of E - Low effort - Private value of control for E	Gompers, 1995 Chan, Siegel, and Thakor, 1990 Hansen, 1992 Aghion and Bolton, 1992 Hellmann, 1998	Monitoring Contingent control allocation, payoff structure Special security design Contingent control allocation Right to dismiss E allocated to VC, vesting
	- Fund diversion by E - Window dressing - E stealing the unobservable revenues - Renegotiation and hold-up through E	Kirilenko, 2000 Bergemann and Hege, 1998 Cornelli and Yosha, 1998 Trester, 1998 Neher, 1999	Allocation of control Special security design Convertible debt Preferred equity Staging, special security and investment design
	Double moral hazard (of both: E and VC)	Repullo and Suarez, 1998 Schmidt, 1999 Lülfesmann, 2000 Casamatta, 1999	Convertible securities

	Moral hazard in syndicated investments	Admati and Pfleiderer, 1994 Cumming, 2000b	Fixed fraction contract Special security design
	Non-optimal level of the VC involvement	Marx, 1998	Comb. of debt and equity or convertible securities
Termination of the investment	Disagreement on the exit channel	Bascha and Walz, 1999	Convertible securities
	Danger of a hold-up by the new owner	Berglöf, 1994	Convertible securities

E – entrepreneur, VC – venture capitalist