1 Introduction

1.1 Problem Definition

Venture Capital (VC) is a segment of the private equity industry, which focuses on investing in new companies with high growth potential and accompanying high risk. This risk profile of such investments is related to high market and technology uncertainties as well as high information asymmetry and agency cost between VC investors and company management. In this uncertain environment, it is not possible for VC investors to predict with reasonable certainty the future performance of an investee company and to derive a reliable estimate of company value at the outset of the investment. Instead, investors address this issue by designing and negotiating complex investment contracts. These contracts provide them with information and management rights to actively monitor and influence the investee company's performance as well as with decision rights related to future corporate events (see Klausner, 2001; Sahlman, 1990; Schertler, 2001).

The academic literature on the design of VC contracts has shed considerable light on the structure and function of these agreements, initially

focusing on the U.S. market only and increasingly expanding the scope of analysis to other countries. Research has been hampered by the lack of data availability (given the private nature of VC investments) and by the heterogeneity of VC practices across countries, specifically in terms of contract design. The combinations of terms used and their specification vary substantially across countries, since they are adapted to the specific institutional and regulatory frameworks. Theoretical research on optimal contract design traditionally takes on a *functional* perspective. It derives optimal incentive and control structures that mitigate the information asymmetry and agency problems between the VC investors and company management and translates these structures into specific financial instruments and legal provisions applicable for different countries.[1] Empirical studies on VC contracting practices, on the other hand, take on a *formal* approach. They analyze the choice and specification of terms used in different countries and mirror their findings with the theoretical predictions.[2] This traditional focus on *form* and *function* brings about major difficulties. First, optimality arguments cannot be derived on a general basis, but must be derived and validated individually for each country, since a specific function may be fulfilled by different forms in different countries. This explains that empirical findings in European countries are not fully aligned with the theoretical predictions developed in the U.S.

[1] Theoretical studies include, among others, Bergemann & Hege (1998, 2000), Admati & Pfleiderer (1994), Nöldeke & Schmidt (1998), Bascha & Walz (2001).

[2] Empirical findings are presented, for example, in Gompers (1995), Kaplan & Strömberg (2002a, 2002b), Lerner (1994), or Gompers & Lerner (1996a).

(see Jung-Senssfelder, 2006, pp. 44-45; Schertler, 2000, p. 17). Secondly, the existing approaches cannot address the full complexity of interactions among individual terms and of the shared ownership of rights between parties (see Cossin, 2002).

Neither theoretical nor empirical research on VC contract design accounts for the *economic value* of contract terms, although this approach is widely used in the literature covering other types of financing agreements such as debt contracts or joint venture agreements.[3] It has been shown that the terms of contractual agreements generate exotic options that can be priced using advanced option pricing techniques such as Monte Carlo simulation with probability distribution modeling (see Ashkeboussi, Juan and Olmos, 2007). For VC contracts, this *economic value* approach is still in a nascent stage. Woronoff and Rosen (2005a) show that VC contract terms can significantly affect the distribution of value among the parties upon exit, and should therefore be quantified at the outset of the investment. They suggest to capture the economic value of terms indirectly, by accounting for their influence on the expected distribution of payoffs among the parties at exit. However, they do not employ asset pricing techniques to quantify this effect. Chemla, Habib and Ljungqvist (2004) analyze shareholder agreements in general and find that the major clauses in these agreements can be interpreted as options, whether they represent explicit options (as in the case of put and call clauses), or implicit options (as in the case of drag-

[3] See Merton (1974), Ingersoll (1977), Black & Cox (1976), and Anderson & Sundaresan (1996).

along rights or catch-up clauses). In their study, the real option approach is essentially used to gain a better understanding of incentive and control mechanisms, but not to assess the economic value of contract features. The first systematic analysis of VC contract values based on option pricing is performed by Cossin, Leleux and Saliasi (2002). Their framework addresses some of the major covenants found in VC contracts (i.e. liquidation preference, staging, conversion and anti-dilution) and shows how they can be priced in interaction, using closed-form solutions and numerical analysis (based on finite differences). However, it excludes various provisions used in practice (such as voting rights, drag-along rights or redemption rights) and does not account for the fact that provisions become exercisable upon future events such as share issues or exit transactions. Finally, the analysis is performed in a setting with a single investor and a single series of preferred shares, which does not reflect the reality of VC financings.

To the author's best knowledge, there is no comprehensive model of VC contract pricing, which covers the majority of provisions used in practice and accounts for interaction effects and shared ownership of rights, in a realistic setting with several investors and multiple financing rounds. When practitioners make trade-offs on individual contract terms, they rely on "rule of thumb" estimates, since they have no tool at hand to measure the value of such terms.