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Karoline Jung-Senssfelder

Equity Financing and Covenants in Venture Capital

An Augmented Contracting Approach to Optimal German Contract Design

DUV

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Karoline Jung-Senssfelder

Equity Financing and Covenants in Venture Capital

An Augmented Contracting Approach to Optimal German Contract Design

With a foreword by Prof. Ulrich Hommel, Ph.D.

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Foreword

Contract design is currently at the center of interest in venture capital research. The existing literature points out that German venture capital contracts differ significantly from Anglo-Saxon contracting practices in their choice of financial instruments and covenants. Contract comparisons have, however, so far neglected the complementary role covenants play in the allocation of entrepreneurial cash flow rights to the contracting parties.

Against this background of diverse contract designs, this dissertation provides a first comprehensive analysis of cash flow incentives implemented through financial instruments in combination with covenants in German venture capital contracts. The author begins with a contract-theoretical analysis of the cash flow effects implemented by common contract designs. This is followed by an empirical study that presents new evidence on the contracting patterns used in the German venture capital market. Integrating theoretical and empirical findings, the author derives implications for an improved incentive-driven contract design in Germany.

With its state-of-the-art analyses, the dissertation contributes extensively to the existing international theoretical and empirical literature on venture capital contracting. Furthermore, it provides significant value added for venture capitalists and portfolio companies operating in the German market.

This dissertation makes a significant contribution to current venture capital research and will, without doubt, become widely accepted by and give impetus to venture capital researchers and practitioners alike.

Professor Ulrich Hommel, Ph.D.
Rudolf-von-Bennigsen-Foerder-Foundation Professor of Finance and
Rector of the EUROPEAN BUSINESS SCHOOL

Preface

This dissertation was written during my time as a doctoral candidate at the Endowed Chair for Corporate Finance and Capital Markets at the European Business School, Oestrich-Winkel. Throughout the dissertation process, I was supported by several people and institutions. At this point, I would like to express my sincere thanks.

I owe special thanks to my academic supervisor Professor Ulrich Hommel, Ph.D, who continually facilitated my research project and academic development, and to my second advisor Professor Corinne Faure, Ph.D. I am also grateful to the team members and alumni of the Endowed Chair for the friendly and cooperative working atmosphere. In particular, I would like to thank Philipp N. Baecker for his relentless advice and moral support.

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Most of all, I would like to express my deepest gratitude to my parents and my sister. This dissertation is dedicated to them.

Karoline Jung-Senssfelder

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List of Abbreviations

AG	Aktiengesellschaft (German legal form for a public limited company)
AktG	Aktiengesetz (German stock companies act)
BVCA	British Venture Capital Association
BVK	Bundesverband Deutscher Kapitalbeteiligungsgesellschaften (German Private Equity and Venture Capital Association)
corr. coeff.	Correlation coefficient
DCF	Discounted cash flow
EU	European Union
EUR	Euro
ERP	European Recovery Programme
EStG	Einkommenssteuergesetz (German income tax law)
EVCA	European Private Equity and Venture Capital Association
GDP	Gross domestic product
GEM	Global Entrepreneurship Monitor
GmbH	Gesellschaft mit beschraenkter Haftung (German legal form for a private limited company)
GmbH & Co. KG	German legal form for a non-commercial partnership
HGB	Handelsgesetzbuch (German commercial code)
IPO	Initial public offering
IRR	Internal rate of return
KfW	Kreditanstalt für Wiederaufbau (Reconstruction Loan Corporation)
KMO	Kaiser-Meyer-Olkin measure of sampling adequacy
LBO	Leveraged buy-out

MBI	Management buy-in
MBO	Management buy-out
MDA	Multiple discriminant analysis
MSA	Measure of sampling adequacy
OLS	Ordinary least squares regression
sig.	Significance
SMEs	Small and medium-sized enterprises
std. deviation	Standard deviation
UK	United Kingdom
US	United States
USA	United States of America
VAT	Value added tax

List of Symbols

α , $(1-\alpha)$	Shares of final return allocated to A and B
γ	Eigenvalue
Γ	Discriminant criterion
λ , $(1-\lambda)$	Relative productivities of A and B
Λ	Wilk's lambda
θ	Project profitability
Θ_i , $i \in \{H,M,L\}$	States of the world: high, medium, and low
a	Factor loading/discriminant coefficient
a_k , $k \in \{FB,SB\}$	Effort of A: first-best efficient and second-best efficient
A	Venture capitalist
b_k , $k \in \{FB,SB\}$	Effort of B: first-best efficient and second-best efficient
B	Entrepreneur
c	Canonical correlation coefficient
C_i , C_j	Clusters i and j
$C_A(\cdot)$, $C_B(\cdot)$	Cost of effort to A and B
$CB(\cdot)$	Private benefits of control to B
d	Cumulated interest payment under combinations of straight equity and straight debt
$d(e_i,e_j)$	Squared Euclidean distance measured between the objects e_i and e_j
$D(C_i,C_j)$	Distance or dissimilarity measure between the clusters C_i and C_j
e_A , e_B	Effort parameter of A and B
e_i , e_j	Objects i and j
E	Binary indicator of option exercise by A
f	Factor value
G	Number of groups

h^2	Variable communality
I	Initial investment by A
J	Group size
n	Number of objects in a cluster
N	Number of cases and clusters
p	p-value
$p(\cdot)$	Probability of success
P	Number of variables
$P(\cdot)$	Final return of the project
Q	Number of factors
r	Cumulated interest/dividend payment
R	Redemption payment
s	Standard deviation
SS_b, SS_w	Between- and within-groups variance
$U_A^j(\cdot)$, $U_B^j(\cdot)$, $j \in \{SE, SD, CED, CS, RC, LP\}$	Utility of A and B under straight equity contracts, straight debt contracts, combinations of straight equity and straight debt, convertible securities contracts, straight equity with redemption option, and liquidation provisions
$V_{A+B}^j(\cdot)$, $j \in \{SE, SD, CED, CS, RC, LP\}$	Total social welfare under straight equity contracts, straight debt contracts, combinations of straight equity and straight debt, convertible securities contracts, straight equity with redemption option, and liquidation provisions
x	Multiplier of A's claims in liquidation provisions
$\overline{x}$	Observation mean
x_i, x_j	Observations i and j
Y	Discriminant score
$\overline{Y}$	Centroid/overall mean
z	z-score

1 Introduction

1.1 Motivation

During its comparably short 40-year history, the German venture capital market has developed into one of the largest and most important national venture capital markets in Europe. Smaller only than the British (EUR 3.958 bn), French (EUR 1.689 bn), and Spanish (EUR 1.295 bn) venture capital markets, it ranks fourth in terms of new investments with EUR 1.079 bn invested in 2004. As a result of this significant investment activity, venture capital is one of the fastest growing and most visible segments of the German economy, with new investments growing at an annual growth rate of 10.6% over the past ten years and representing 0.50‰ of the German gross domestic product (GDP) in 2004.[1] Venture capital investments are believed to substantially contribute to the German economy's structural change because they are systematically employed to support "creative destruction" through innovation and growth.[2]

Venture capital investments fill in the financing gap faced mainly by those German small and medium-sized enterprises (SMEs) which are active in high-technology and innovation-intensive industries and engage mainly in research and development or product development. This financing gap results from the fact that their revenues and the founders' private resources are not sufficient to cover expenses. Furthermore, debt financing through banks and other credit institutions is not available to them due to the high risks associated with their business model and a lack of collateral. Thus faced with special investment characteristics, venture capital companies attach great importance to the contracts governing their financing relationships.

Such contractual relations and underlying contracts are the subject of contract theory. From a theoretical perspective, they even constitute the essence of the

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1 See BVK (2005a), p. 27, and BVK (2005d), pp. 21–23, 28.
2 See Frommann and Dahmann (2003), pp. 16–19, and Schefczyk (2000), p. 23.

firm.[3] Furthermore, venture capital companies are considered to most closely approximate the investor of theory. The venture capital financing relationship is almost fully described by focusing on a few key aspects discussed in the following.

Due to diverging interests, asymmetric and imperfect information, and multiple incentive problems between the venture capital company and its portfolio company, a transfer of capital in a complex and highly unpredictable world and under significant business risk leads to (double-sided) opportunistic and aberrant activities, observable and hence controllable by neither party.[4] From these activities result (agency) costs which can be minimized by implementing incentive-compatible contracts. The complexity of venture capital investments, however, makes the ex-ante specification of the contracting parties' actions and obligations in all future states of the world infinitely costly and thus impossible. Therefore, the parties resort to incomplete contracts which automatically realign incentives and define governance structures for the contracting parties, and thus adapt more effectively to the ex-post realized states of the world.[5] These incentive and governance mechanisms are modeled by allocating cash flow and control rights which are specified by the two distinct contract components: financial instruments and contractual covenants.

The financial instrument most commonly employed in the German venture capital market is straight equity.[6] In the US venture capital market, convertible securities are the predominant financial instrument.[7] Venture capital practices, such as the use of financial instruments, are usually benchmarked against the US venture capital market because it is the oldest worldwide, with 60 years of investment experience, and the largest in terms of new investments

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3 "[M]ost organizations are simply legal fictions which serve as a nexus for a set of contracting relationships among individuals." Jensen and Meckling (1976), p. 310. Legal fiction, in this citation, circumscribes the fact that an organization is, by law, treated as an individual. See Jensen and Meckling (1976), p. 310. See also Hart and Holmström (1987), p. 73.

4 See Holmström (1979), pp. 74–75.

5 See Williamson (1988), p. 570.

6 See Bascha and Walz (2002), p. 13, and Hommel et al. (2003), p. 328.

7 See, for example, Kaplan and Strömberg (2000b), p. 284, and Sahlman (1990), pp. 480–481.

(EUR 15.390 bn), representing 1.80‰ of the US GDP.[8] There are thus remarkable differences between the US and German venture capital markets, especially in attributes of sophistication such as market age and size: The German venture capital market is significantly younger and smaller.[9] According to common belief, the use of convertible securities therefore implies a higher level of sophistication on the side of US venture capitalists regardless of different legal and institutional settings – with potentially significant implications for their counterparts across the Atlantic. This view has also been expressed in recent empirical literature.[10] The comparison between German and US venture capital contracting has so far been limited to these empirical comparisons of the use of financial instruments.[11] Covenants, in contrast, have not yet been included in the analyses, which is largely due to a lack of empirical data on the contracting practices of German venture capitalists.

Contract-theoretical analyses also focus on the use of financial instruments in venture capital and most frequently repeat the proposition that convertible securities create an incentive-compatible allocation of cash flow and control rights between the contracting parties,[12] while only little support exists for straight equity. This implies that theory backs the abovementioned view on the sophistication of US venture capital companies. Other than financial instruments, covenants are included only in a handful of analyses.

Contrary to common practice in current research, however, it can be argued that the sophistication of venture capital markets is not sufficiently captured by examining financial instruments alone because covenants can also be employed to create incentive and governance mechanisms. It can further be argued that specific aspects of German venture capital contracting are captured sufficiently only if theoretical analyses are adapted to recent empirical evidence

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8 See Frommann and Dahmann (2003), p. 217, and BVK (2005e), p. 13.
9 See Kaplan et al. (2003), p. 16.
10 See Cumming (2002a), pp. 3, 7, Cumming (2004), p. 560, Kaplan et al. (2002), pp. 4, 6, and Kaplan et al. (2003), p. 21.
11 See, for example, Bascha and Walz (2002), p. 13.
12 See, above all, Schmidt (2003), p. 1158.

on common contract designs. This thesis therefore sets out to link *empirical* and *theoretical* analyses on the combination of *financial instruments* and *covenants*.

1.2 Objective

Introducing the term "augmented contracting" to denote the combined use of financial instruments and covenants in the creation of incentive mechanisms for the contracting parties, this thesis presents the first analysis of the German venture capital market that focuses explicitly on the interaction of both contractual elements. Incentive mechanisms are implemented by the allocation of *cash flow rights* through financial instruments and cash flow-allocating or "cash flow-related" covenants. Governance mechanisms implemented by control rights are excluded from the analysis because, specific to venture capital finance, these can be allocated separately through control covenants.

The *objective* of the thesis is to compare *German real-world contracting practices* with *related theoretical incentive considerations* and, if necessary, to derive *implications* for an improved augmented venture capital contract design in the German market. This objective is achieved through theoretical and empirical analyses:

A *theoretical analysis* in the form of a double moral hazard model with simultaneous investments compares the incentive structures created by a variety of augmented venture capital contracts consisting of financial instruments and cash flow-related covenants. It determines whether the incentive structure created by straight equity financing in combination with covenants is suited to effectively replicate the incentive-compatible allocation of cash flow rights obtained with convertible securities. It finds that in combination with redemption rights and liquidation provisions for the venture capitalist, straight equity defines even better incentives, as long as convertible securities contracts are not complemented with similarly defined redemption rights. All results are summarized in the form of a pecking order of venture capital

contracting which contradicts Myers' (1984) pecking order for large and established businesses.

An *empirical analysis* in the form of a survey among 43 German venture capital companies identifies augmented contracting patterns of financial instruments and cash flow-related covenants and their determinants relating to the characteristics of venture capital companies. It thereby analyzes whether contracts including convertible securities or straight equity are frequently employed in the German market and whether the contract choice by German venture capital companies is influenced by their level of sophistication. It finds that the most sophisticated venture capital companies use convertible securities and redemption rights, whereas straight equity investors do not include redemption rights in their contracts. All results are summarized in the form of a ranking of common German contract designs by the sophistication of the venture capital companies employing these contract designs.

A *synthesis* of the theoretical and empirical analyses reveals deviations in the German contracting practice from the newly established pecking order. It derives recommendations how less sophisticated German venture capital companies can improve their contracting practices. These include the advice to always write convertible securities contracts, and if the use of convertible securities is restricted by law, to write straight equity contracts with redemption rights for the venture capital company. With these recommendations, this thesis contributes substantially to the body of knowledge regarding the issue of incentive-driven augmented contracting upon which German venture capital companies may draw to increase risk-adjusted performance.

1.3 Outline

The thesis is organized in seven chapters, of which three chapters represent stand-alone papers: a literature review (Chapter 3), a theoretical analysis (Chapter 4), and an empirical analysis (Chapter 5). These papers nevertheless build on each other and their results are finally compared.

Chapter 2 introduces the reader to venture capital and contracting in general. It briefly describes the fundamentals of *venture capital* investing as well as the main *contracting* issues.

Chapter 3 critically reviews the existing *theoretical* and *empirical* literature on cash flow incentive mechanisms in venture capital contracting and identifies significant research gaps in the field of augmented contracting. Thereupon, it formulates the research question for the theoretical analysis in Chapter 4 and frames testable hypotheses for the empirical analysis in Chapter 5. Important theoretical concepts and empirical methodologies underlying these analyses are presented in the subsequent chapters.

Chapter 4 offers a new explanation for the incentive-compatible use of straight equity as prevalent financial instrument in the German venture capital market. After a detailed explanation of the underlying *theoretical concepts*, the *model* presents *analyses* of cash flow allocations implemented by different combinations of financial instruments and covenants and checks the obtained findings for *robustness*. Finally, the *results* are summarized in a pecking order of venture capital contracting.

Chapter 5 offers new insights into the real-world practices of contract negotiations and design in the German venture capital market. After a detailed explanation of the underlying *sample and methodology*, the *empirical findings* present newly identified augmented *contracting patterns* and their *determinants* related to venture capital company characteristics. Finally, the *results* are summarized in a ranking of contracts determined by venture capital company sophistication.

Chapter 6 presents a *synthesis* of the analyses in Chapters 4 and 5. It compares their results and derives implications for an improved contract design by German venture capital companies.

Chapter 7 concludes and proposes directions for future empirical and theoretical research.

2 Venture Capital and Contracting

This chapter introduces the reader to venture capital and contracting, thereby laying the conceptual foundations of venture capital investing and contracting. In a brief introduction to venture capital, it presents important definitions, explains the investment process, and portrays the German venture capital market and the prevailing legal environment. It then moves on to describe venture capital contracts, their legal documents and components. Finally, the augmented contracting approach underlying the subsequent theoretical and empirical analyses is defined.

2.1 Venture Capital Fundamentals

2.1.1 Definitions

The term "venture capital" was created in the USA in the 1960s and later became accepted in the UK and subsequently on the continent. When venture capital slowly developed into a mainstream asset class, it was more and more often referred to as private equity in the USA and later across Europe.[13] As a result, the boundaries between the terms "venture capital" and "private equity" are blurred and with them market segmentation. It is therefore necessary to define how the term "venture capital" is used throughout this thesis and how it is distinguished from the term "private equity".

Venture capital and private equity refer to the financing provided to companies by institutional investors acting as financial intermediaries charged with investing the funds provided by a number of private and/or institutional investors. The capital is invested into the investee or portfolio companies in order to support a positive and profitable development, for example in the form of growth,

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[13] See Leopold et al. (2003), p. 3.

market success, reorientation, restructuring, or innovation marketing. [14] Additional support is provided by the investors in the form of intensive guidance and advice on various managerial aspects. This is referred to as "hands-on management".[15] In return, the investors hold equity stakes or equity-like claims without collateral in the companies and therefore also bear the associated entrepreneurial risks. To diversify these and other portfolio company-specific risks, they hold a portfolio of stakes in different companies. Their goal is to participate in the companies' value-added and to profitably divest their equity stakes or equity-like claims in the medium or long term, that is, after five to ten years.[16] Despite resemblances with respect to the investment process, venture capital can be distinguished from private equity by the companies' evolutionary stage at which financing is provided.[17]

Venture capital refers to investments in companies in their early (seed and start-up) and later lifecycle stages (expansion, bridge, turnaround). It does, however, include neither informal business angel investments[18] nor buy-out investments. The lifecycle stages can be defined as follows:[19]

- *Seed capital* finances the research, assessment, and development of ideas and initial concepts up to the production of a prototype.
- *Start-up capital* finances product development as well as initial marketing activities. The financed companies have only recently started their business activities, and have therefore not yet reached the break-even point.
- *Expansion capital*, also referred to as development capital, finances the growth or expansion in the form of increases in production capacities,

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[14] See Leopold et al. (2003), p. 3.
[15] See Frommann and Dahmann (2003), pp. 5–7.
[16] See Schefczyk (2000), p. 9, and Schmidt (1985), p. 421.
[17] For an overview of the definitions of the terms "venture capital" and "private equity", see Figure 2-1.
[18] Business angels are wealthy private individuals, mainly experienced entrepreneurs, who invest personal assets and share their business management and industry expertise and know-how in order to advise and actively support the entrepreneur in the early days of his or her business's existence. They invest smaller amounts of capital than seed and start-up venture capitalists and are invested on average in only three to six companies. See Grabherr (2001), pp. 34, 37–38.
[19] See BVK (2005b), p. 1.

product and market development, or working capital. The financed companies have mainly reached the break-even point.

- *Bridge capital* is provided to companies preparing for an Initial Public Offering (IPO) with the main goal to improve the capital ratio.
- *Turnaround capital* is provided to companies that have experienced difficulties, for example, sales or trading problems, with the goal of restoring company success and profits.

This thesis focuses on the financing relationship between venture capital companies and their portfolio companies. With respect to their investment activities, venture capital companies are also referred to as "venture capital investors" throughout the subsequent chapters. This is common practice in the venture capital literature.[20]

Private equity refers to investments in companies at the buy-out stage. The different buy-out transactions can be defined as follows:[21]

- A *management buy-out* (MBO) is a transaction in which the target company's management team acquires a business unit of the target company or the entire target company from the current shareholders with the financial support of private equity investors.
- A *management buy-in* (MBI) is a transaction in which an external management team from outside the target company acquires a business unit of the target company or the entire target company from the current shareholders with the financial support of private equity investors.
- A *leveraged buy-out* (LBO) is a transaction in which the newly bought target company has a particularly high level of debt in its capital structure.

The definitions of the terms "venture capital" and "private equity" correspond to the official definitions introduced by the BVK and the European Private Equity

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[20] See, for example, Cumming (2002c), Denis (2003),Gilson and Schizer (2003) Sahlman (1990), Farag et al. (2004), and Achleitner (2002).

[21] See BVK (2004c), pp. 9–10.

and Venture Capital Association (EVCA).[22] The British Venture Capital Association (BVCA) works with the same definition for the term "venture capital" but uses the term "private equity" to describe the industry as a whole, encompassing both venture capital and buy-out investments.[23]

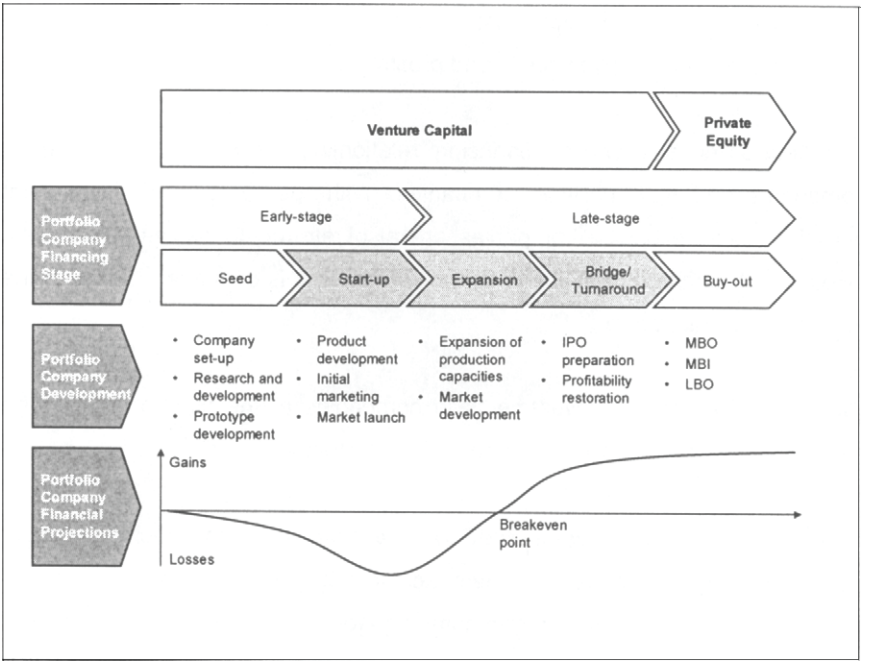


Figure 2-1: Definitions of Venture Capital and Private Equity
Source: Illustration adapted from Schefczyk (2000), p. 24, and Grabherr (2001), p. 34.

While developing along the lifecycle or financing stages, the venture capital-backed companies enter into financing relationships with venture capital companies. This financing relationship is described in the following section.

2.1.2 Venture Capital Cycle

As outlined above, investments by venture capital companies follow a five-to-ten-year investment process, for which Gompers and Lerner (1999) have

[22] See BVK (2004c), pp. 11, 15, and EVCA (2002), pp. 17, 21.
[23] See BVK (2005e), p. 1, and BVCA (2004), p. 6.

coined the term "venture capital cycle". It includes a selection phase, a contracting phase, a development phase, and a divestment phase.[24] These phases are described in detail below:

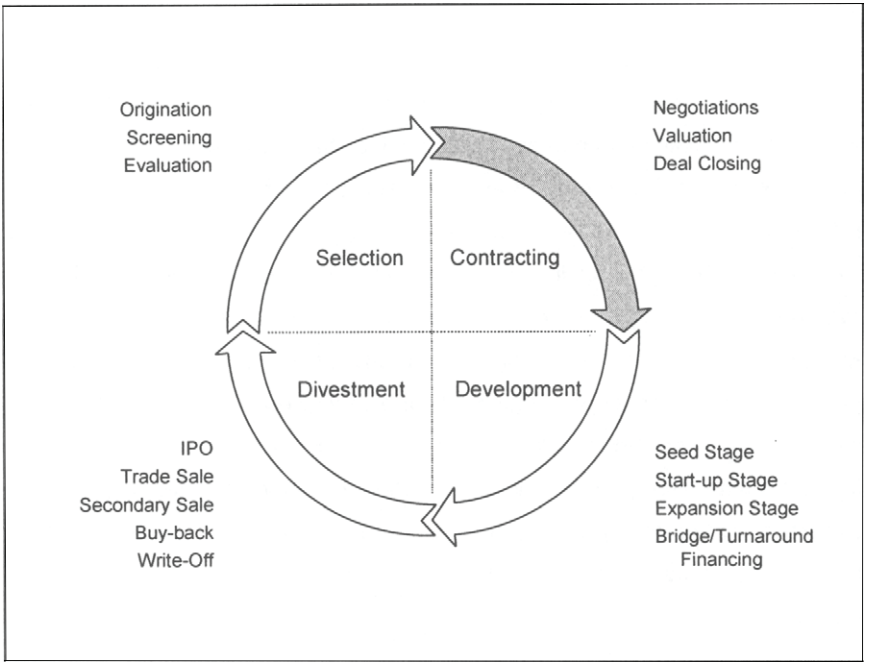


Figure 2-2: Venture Capital Cycle

Company selection starts with *deal origination*, which is the process of finding investment prospects. Due to their small size and market recognition, SMEs in particular at an early lifecycle stage may be difficult to identify in a poorly defined environment. Venture capital investors therefore use different mechanisms to generate their deal flows. On the one hand, they actively search for prospects at conferences, other conventions, or through informal networks. On the other hand, they follow up on unsolicited ("cold") calls they receive from entrepreneurs or on referrals they receive from within the venture capital community, mainly from venture capital companies acting as lead investors and

[24] See Gompers and Lerner (1999), pp. 1–16, and Tyebjee and Bruno (1984), pp. 1051-1057. For an illustration of the venture capital cycle, see Figure 2-2.

searching for syndicate partners.[25] In a next step, *deal screening* is employed to reduce the deal flow to a small number of investment prospects. The venture capital companies analyze the prospects' business plans first according to decision criteria such as the venture capital companies' specialization in terms of lifecycle stage, technology or market sector, location, and size of the required investment. Second, they analyze the business plans according to criteria such as the viability of the business model, the potential market size, and the projected financial performance.[26] Companies that have successfully passed the screening receive a *letter of intent* or *term sheet* from the investors, which outlines the broad terms on which they intend to proceed with the proposed investment.[27] The letter of intent furthermore contains provisions allowing the investors to subject the companies to a thorough *deal evaluation*. During the evaluation process, business plans and any other requested material are analyzed in great detail with respect to the perceived risks included and the expected return on the investment. This evaluation, or *due diligence,* includes detailed examinations of all business-related, technological, financial, human resources-related, legal, and tax-related issues. Based on the outcome of the due diligence, venture capital companies take the decision whether to invest or not to invest.[28]

Contracting begins with *contract negotiations* on the basis of company valuations and ends with the closing of the contract. The venture capital investors and the entrepreneurs negotiate over the contract design which reconciles their differing needs and concerns and lays down their rights and duties throughout the subsequent development and exit phases.[29] The term "contract" stands for a number of different legal agreements of formal nature, containing the two main contractual components: financial instruments and contractual covenants. The composition of contracts and the definitions of contractual components vary from investment to investment and depend mainly

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[25] See Tyebjee and Bruno (1984), pp. 1052, 1055–1056.
[26] See Tyebjee and Bruno (1984), pp. 1052, 1056–1057, and Tyebjee and Bruno (1986), pp. 47–50.
[27] See Schäfer and Stephan (2003), pp. 22, 177–183.
[28] See Leopold et al. (2003), pp. 138–139.
[29] See Tyebjee and Bruno (1986), pp. 47–50.

on the *company valuation*. The most common valuation methods applied in the German venture capital market are discounted cash flow (DCF) techniques and multiple-based valuations. Once the parties have agreed on a contract, it is signed and the *deal is closed*.[30]

Company development covers the process of portfolio company professionalization. Once the investors have made their capital contributions, the companies throughout this stage develop from entrepreneur-dominated businesses to differentiated and formally structured organizations along a four-step process from the *seed stage* to the *start-up stage*, the *expansion stage*, and the final stage including *bridge* or *turnaround financing*. The investors actively support this process by engaging in post-investment activities to assist the companies in different management issues.[31]

Divestment is the final phase of the venture capital cycle, during which the investors exit their investments. Since venture capital investments are individual agreements, the venture capital market is unorganized, with little transparency and no standardized trading. Venture capital investments are thus illiquid assets. This lack of liquidity complicates their sale, suggesting that venture capital investments ought not to be undertaken unless an exit scenario is conceivable and credible. In the worst case, portfolio companies are liquidated and the investments are *written off*. Otherwise, the investors are rewarded for their capital contribution, risk taking, and active support with returns from capital gains which they realize by selling their shares and thereby exiting their investments through the following exit channels:[32]

- In a *buy-back*, the existing shareholders repurchase all shares from the venture capital company.
- In a *secondary sale*, the venture capital company sells its shares to another venture capital company or a financial investor.

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30 See Golder (1998), p. 64, Dittmann et al. (2002), pp. 14–19, and Leopold et al. (2003), pp. 127–133.
31 See Hellmann and Puri (2002), p. 169, and Tyebjee and Bruno (1984), pp. 1051, 1054.
32 See BVK (2004c), pp. 3, 8, 12, 15.

- In a *trade sale*, the venture capital company sells its shares to an industrial investor.
- In an *IPO*, the venture capital company publicly distributes its shares to the public via a stock exchange.

After the divestment of a portfolio company through one of the above exit channels, the venture capitalist starts again from the beginning of the venture capital cycle and searches for a new portfolio company.

This overview of the venture capital cycle emphasizes the importance of contracting in venture capital investing. Venture capital contracts define the rules of the investment for both contracting parties throughout their entire contracting relationship from the initial capital commitment to the investment exit. They have the potential to impact the success of the business and the venture capital company's return. Therefore, after a brief overview of the German venture capital market and the prevailing legal environment below, Section 2.2 provides detailed information on venture capital contracts.

2.1.3 Venture Capital in Germany

The foundations of German venture capital were laid in 1965 with the formation of the first four venture capital companies.[33] However, an active market for venture capital did not develop until the 1980s. The economic upturn of the 1980s provided a favorable investment climate and led to a first growth period in the venture capital industry with several IPOs of venture-backed SMEs. This was succeeded by the second growth period subsequent to the German Unification in 1989. Increased venture capital activity resulted from investments in start-up companies in the New Laender as well as from privatizations of businesses formerly owned by the German Democratic Republic. This period

[33] The first venture capital companies in the German market founded between June and September 1965 were "BONA Kapitalbeteiligungs-GmbH & Co. KG", "Beteiligungsgesellschaft für Industrie und Handel mbH", "Indufina Industrie- und Finanzbeteiligungsgesellschaft mbH & Co. KG", and „Deutsche Beteiligungsgesellschaft mbH". See Hellmann and Fiedler (2001), pp. 32–33, and Leopold et al. (2003), p. 42.

was followed by a boom phase from 1997 to mid-2000, in which the venture capital companies' investment focus shifted from expansion to early-stage investments and from investments in established industries like industrial products and services to computer-, communication-, and biotechnology investments. In addition, the introduction of the first German stock exchange growth segment "Neuer Markt" offered new exit opportunities. This development culminated in record levels of fundraising, investments, and exit volumes by venture capital companies. After the New Economy bubble had burst in mid-2000, the German market stagnated and entered a period of consolidation. In an environment of low economic growth, the venture capital companies were subject to immense market pressures and streamlined their portfolios. Since the beginning of 2003, venture capital activity in the German industry has followed a modest upward trend.[34]

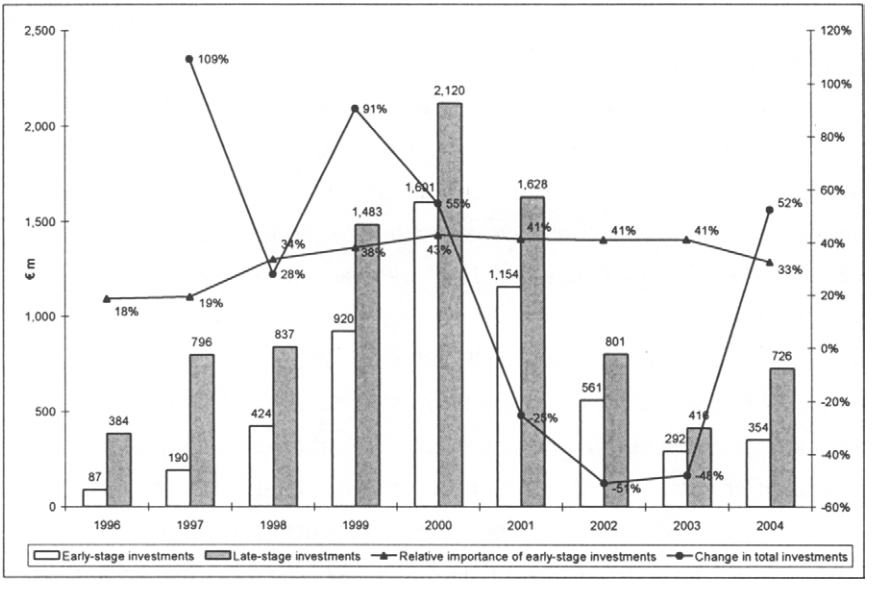


Figure 2-3: Annual Venture Capital Investment Volumes 1996–2004
Source: Illustration adapted from BVK (2005a), p. 20.

The development of the German venture capital activity since the mid 1990s is reflected by the annual venture capital investment volumes, as illustrated

[34] See Leopold et al. (2003), pp. 43–80.

above.[35] Over this period, the relative importance of early-stage investments as compared to late-stage investments has decreased from a maximum of 43.0% in 1999 to a minimum of 32.7% in 2004. For 2004, BVK statistics on 80 venture capital investors report total venture capital investments of EUR 1,079 m, representing 0.5‰ of German GDP,[36] in 890 portfolio companies. 51.5% of the investment volume was invested in medical or health-related, biotechnology, communication, and computer businesses. At the same time, investors realized an exit volume of EUR 961 m by exiting investments in 576 portfolio companies. 41.6% of the exit volume (or 43.8% of exited companies) was written off. The most successful exit channel was trade sales (21.3%), followed by loan and silent partnership repayments (15.5%), IPOs (8.9%), and secondary sales (3.3%).[37]

Specific to the German venture capital market is the significant involvement of public venture capital companies. These so-called "Mittelstaendische Beteiligungsgesellschaften" are venture capital companies working according to the European Recovery Programme (ERP), under which small and medium-sized companies are granted long-term low-interest loans refinanced and guaranteed with the help of special assets of the German Federal Government.[38] As a result of their connection to the ERP, their contracts are standardized to a high degree and they invest almost exclusively in the form of silent partnerships.[39] For 2004, BVK statistics on 14 public venture capital investors[40] report investments of EUR 160 m in 473 portfolio companies, which equals 14.8% of total venture capital investments and 53.1% of total venture capital-backed companies. They invested 17.3% of funds in early-stage, 78.6% in expansion stage, and 4.1% in other late-stage portfolio companies. Investments mainly concentrated on industrial products and services. Exits from 330 portfolio companies realized EUR 100 m. 32.5% of the exit volume were

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35 For an illustration of German early-stage and late-stage annual venture capital investment volumes, see Figure 2-2.

36 See Wiesheu (2005), p. B1.

37 See BVK (2005b), pp. 7–9.

38 See Leopold et al. (2003), pp. 44–45, 48, 52, and Blanckenburg (2001), p. 276.

39 See Leopold et al. (2003), p. 54.

40 These 14 public venture capital investors are included in the total venture capital statistics presented above.

realized through loan and silent partnership repayments, which are the only forms of financing employed by public investors. The remaining 64.8% of the exit volume (or 53.9% of exited companies) were write-offs. The number of 178 written-off investments represents 70.6% of total exited venture capital-backed companies.[41]

It can be concluded that the investment activity of public investors is very different from that of private investors. They provide venture financing to more than half of all venture capital-backed companies in the German market but invest less than one sixth of total funds invested. They furthermore write off approximately three-fourths of total exited venture capital investments. This is evidence that their investment behavior differs significantly from that of private venture capital companies and implies that the related public interventions impact venture capital activity in the German market.[42] As a result, this thesis' analysis of German venture capital contracting and comparison with that in the US market, where there exist no public venture capital investors,[43] focuses exclusively on private venture capital companies.

2.1.4 German Legal Environment

Venture capital activity is not influenced by the development of capital and growth markets as well as government interventions alone, but also by the prevailing legal environment created by company and tax law.[44]

A recent European tax and legal benchmarking paper published by the EVCA in EVCA (2004) analyzes the effectiveness of 21 European countries' tax and legal environments with respect to their ability to support private equity and venture capital investors on the supply-side of the industry and their portfolio companies on the demand-side. It ranks Germany on position 17.[45] The Global

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41 See BVK (2005c), pp. 4–6.
42 See Gebhardt and Schmidt (2002), pp. 246–247, and Sternberg et al. (2003), p. 27–28.
43 See Leopold et al. (2003), p. 224.
44 See Rudolph and Haagen (2004), pp. 10–11.
45 See EVCA (2004), pp. 8–9.

Entrepreneurship Monitor (GEM), presented by Sternberg et al. (2003), comes to a similar result. In its international benchmarking of entrepreneurial activity and environment in 31 countries worldwide, Germany ranks on position 23 in terms of regulation and taxes and on position 13 overall.[46] According to these analyses, unfavorable legal regulations in the German market mainly concern venture creation, bankruptcy and insolvency, and taxation. Examples include the following:

- With regard to *venture creation*, the time to set up German private limited companies (GmbH) and public limited companies (AG) is between 30 and 40 business days (European average: 25.7 business days) and the minimum issued capital for private limited companies is set at EUR 25,000 (European average: EUR 13,946).[47]
- With regard to *bankruptcy and insolvency*, Germany does not provide a legal protection to companies anticipating financial difficulties for a certain period of time and the average amount of time required between the opening of insolvency and the closure of proceedings is between three and five years, or 1,008 business days (European average: 566 business days).[48]
- With regard to *taxation*, the company tax rate in Germany varies between 38% and 40%, depending on the municipality of the company (European average: 29%), the maximum income tax rate for private individuals including solidary surcharge is 48% (European average: 45%), and the maximum capital gains tax is 24% (European average: 16%). In addition, there exists no specific company tax rate for SMEs and no tax incentive for private individuals to invest in venture capital.[49]

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[46] See Sternberg et al. (2003), pp. 24–25.

[47] See EVCA (2004), pp. 24, and Sternberg et al. (2003), p. 52. Favorable legal regulations with regard to venture creation include below-average administrative costs for setting up public and private limited companies and below-average issued capital requirements for public limited companies. See EVCA (2004), pp. 23.

[48] See EVCA (2004), pp. 24. Favorable legal regulations with regard to capital gains taxation were introduced in 2004 in the form of the "Gesetz zur Foerderung von Wagniskapital", a law promoting venture capital in Germany. See Friederichs and Köhler (2004), p. 1638.

[49] See EVCA (2004), pp. 24, and Sternberg et al. (2003), p. 28.

Certain unfavorable regulations directly influence the design of contracts between venture capital companies and their portfolio companies. The most important restrictions are the following:

- The issuing of convertible debt for private limited companies is prohibited.[50]
- Preplanned IPO exits restrict the choice of legal form of the portfolio company to a public limited company.[51] Setting up a public limited company, however, requires a high minimum issued capital of EUR 50,000 and involves a high administrative effort and cost.[52]
- The taxation of stock options occurs at exercise and thereby distorts stock option incentives.[53]

These legal restrictions may impact the choice of the financial instrument and the legal form, the selection of the ex-ante exit channel, and the incentives for the management of the portfolio companies. Nevertheless, legal regulations are not at the center of the analyses in this thesis: The theoretical analysis in Chapter 4 studies different augmented contract designs and thereby abstracts from legal regulations. The empirical analysis in Chapter 5 is limited to the German venture capital market, and therefore, the impact of the prevailing legal environment cannot be identified. However, the empirical analysis in the form of a survey will permit to question participants on their subjective importance of legal regulations on contract design. The latter is presented in the following.

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50 See § 221 AktG (German Stock Companies Act). This restriction can be evaded by replicating convertible debt using profit participation certificates in combination with options on nominal capital. See Kirchner and Schrell (2003), p. 19.

51 See § 3.2 AktG

52 See EVCA (2004), p. 24.

53 See §§ 23 and 34 EStG (German income tax law) and EVCA (2004), p. 24.

2.2 Venture Capital Contracting

2.2.1 Contract Documents

The venture capital contract is designed on the basis of the *letter of intent* or *term sheet*. The venture capital company usually submits a contract proposal similar to that of the term sheet but extended to a number of standard provisions to the entrepreneur or the management of the portfolio company, who return a mark-up version after a detailed revision. If the contracting parties disagree on certain issues, they begin to negotiate. Once all dissents are eliminated and contract negotiations are closed, the contract is drawn up before a notary.[54]

The term "contract" stands for a number of different legal agreements of formal nature. These are listed and explained below:

- The *participation or investment agreement* is the main contractual document in venture capital agreements. It includes the terms of the venture capitalist's participation in the portfolio company and thus defines the financial instrument, the included milestones, any changes that occur in subsequent financing rounds and in the case of syndication, and other related issues.[55]
- The *memorandum or articles of association* regulate the portfolio company's common business purpose, location, issued capital, the allocation of information and control rights, any regulations associated with an exit of one invested party or with liquidation, and other related issues. They may be complemented by *collateral contracts* supplementary to the articles of association.[56]
- The *rules of procedure* specify the procedures according to which the management of the portfolio company executes the company's common

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[54] See Schäfer and Stephan (2003), pp. 24–25, and Weitnauer (2001), pp. 1066–1069.

[55] See Schäfer and Stephan (2003), pp. 29–55, 78–106, and Weitnauer (2001), pp. 1070–1072.

[56] See Schäfer and Stephan (2003), pp. 56–71, 107–119, and Weitnauer (2001), pp. 1066–1069.

business purpose. It defines internal decision-making processes, financial planning and reporting, legal relationships with third parties, and other related issues.[57]

- The *employment contracts* of the portfolio company's management can also be part of the venture capital contract if the venture capitalist demands any changes in the existing employment contracts.[58]
- Finally, any *additional arrangements* can be contractually agreed upon, for example, employee stock options and consultancy agreements, in the case that the venture capitalist wishes to lay down the conditions of his management support to the portfolio company.

The contracting parties use the participation agreement and possibly some or all of the remaining documents to specify the financial instrument and to formulate the covenants regulating their relationship throughout the venture capital company's investment period. Financial instruments and contractual covenants are therefore referred to as contract components and are explained in detail below.

2.2.2 Contract Components

2.2.2.1 Financial Instruments

Financial instruments are standardized financial contracts traded in the financial markets and are therefore also employed in the venture capital practice. They may include contractual provisions that can be used similarly to standalone covenants. Financial instruments are laid down in the term sheet and the participation or investment agreement. The following groups of instruments are frequently employed in German venture capital deals:[59]

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[57] See Schäfer and Stephan (2003), pp. 72–77, and pp. 120–128.
[58] See Weitnauer (2001), p. 1073.
[59] See Cumming (2004), p. 552, Bascha and Walz (2002), p. 13, and Hommel et al. (2003), p. 328.

- *Equity* capital is an ownership interest in a company. Equity instruments are *straight equity* and *preferred equity*.
- *Debt* capital is an amount owed to a person or company for funds borrowed.
- *Mezzanine* capital represents hybrid forms of financing that incorporate characteristics of equity and debt capital. Mezzanine instruments include *combinations of debt and equity*, *convertible securities* and *silent partnerships*.[60]

These financial instruments and their sub-categories are described below:

Straight equity ownership is the holding of either stocks or shares in the company, depending on the legal form of the portfolio company. With the exception of legal forms with limited liability, the holders of equity carry the business risk. In return, they are granted information and control as well as cash flow rights (dividends, earnings, capital appreciation). In liquidation, they have a sub-ordinate claim on the portfolio company's assets after the holders of debt and preferred equity.[61]

Preferred equity ownership is a partial ownership in the portfolio company. It differs from straight equity in the definition of voting, subscription, and dividend rights as well as liquidation provisions. The standard preferred equity instrument does not grant the holders any voting rights. In return, they obtain fixed dividend payments and claims on the portfolio company's assets in liquidation. Both are super-ordinate or senior to those of holders of straight equity. Rare exceptions to preferred equity instruments are the definition of variable dividends and the inclusion of superior or event-related voting rights.[62] Different types of dividend payments to holders of preferred equity exist:

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[60] See Brokamp et al. (2004), p. 9.
[61] See Achleitner (2000), p. 20.
[62] See Thommen and Achleitner (1998), p. 440.

- *Cumulative:* The dividend payments are cumulated if the portfolio company defaults on the payment agreement.
- *Non-cumulative:* The dividend payments are not cumulated if the portfolio company defaults on the payment agreement.
- *Participating:* The fixed dividend payments are increased if the dividends paid to holders of straight equity exceed a certain amount. Participating preferred equity is employed mainly in the US venture capital market.[63]

Debt financing, unlike equity financing, does not represent ownership in the portfolio company. Instead, the company borrows money in the form of non-transferable credits or transferable securities (bonds, loan notes, mortgages) until a certain maturity. In exchange, it pays the creditor a fixed or variable interest which depends on the credit rating of the debtor. With the exception of subordinated or junior debt, the creditor's repayment takes precedence over the claims of equityholders in liquidation.[64]

Combinations of debt and equity are *mezzanine* instruments composed of debt capital in combination with straight or preferred equity capital. Under these instruments, the investor simultaneously holds both financial instruments and is not granted a conversion option.

Convertible securities are *mezzanine* instruments consisting of debt or preferred equity which can be converted into an ex-ante specified amount of straight equity of the issuing company at the option of the holder. The conversion option can be exercised either at maturity or conditional on an ex-ante specified event. Depending on the underlying initial instrument, the following forms of convertible securities exist:

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63 See Kaplan and Strömberg (2000a), pp. 13, 55, and Kaplan and Strömberg (2000a), p. 3.
64 See Achleitner (2000), p. 21, and Brokamp et al. (2004), pp. 17–18.

- *Convertible preferred equity:* This security consists of preferred equity combined with an option to convert it into straight equity.
- *Convertible debt:* This security consists of debt in the form of a bond or debenture[65] combined with an option to convert it into straight equity.[66]

Silent partnerships are *mezzanine* instruments which are mainly employed in the German market. By a capital contribution, the venture capital company enters into a mutually cancelable contractual relationship with the portfolio company rather than becoming a shareholder and thus affecting existing shareholders' rights. The legal construct of a silent partnership[67] allows for a flexible design of this relationship. Legal practice in Germany distinguishes two forms:

- *Typical silent partnership:* The silent partner makes a cash contribution to the portfolio company, participates in company profits, has limited control rights and can be granted limited liability protection to the company's creditors. Upon termination of the partnership or in liquidation, he has a subordinate claim to repayment of his contribution. In addition, the company agreement can be altered to extend the silent partner's control rights, grant information and veto rights, or contain an equity kicker in form of an option on nominal capital. According to German commercial and tax laws, typical silent partnerships do not effectuate extensive initiative and risk-taking by the silent partner and thus represent a liability position in the balance sheet.
- *Atypical silent partnership:* This is an extension of the typical silent partnership where the silent partner participates in full not only in company profits but also in company growth and in liquidation losses and

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65 A debenture is unsecured debt backed not by collateral but only by the integrity of the borrower and documented by an agreement called indenture. An example for a debenture is an unsecured bond.

66 See Brokamp et al. (2004), p. 22, and Thommen and Achleitner (1998), pp. 484–485.

67 For the legal regulations on the silent partnership, see §§ 230 ff. HGB.

proceeds. As a result, German commercial and tax laws assign atypical silent partnerships to the equity position in the balance sheet.[68]

This overview of the main financial instruments shows that they allocate both cash flow and control rights to the contracting parties. Besides financial instruments, however, contractual covenants can also be used to allocate cash flow and control rights.

2.2.2.2 Contractual Covenants

Contractual covenants are agreements defining the contracting parties' rights but also duties, whereby affirmative *(negative)* covenants describe acts which must *(not)* be performed. They are common contractual agreements between the contracting parties that have become accepted in general venture capital contracting practice. Although sometimes found in the form of contractual provisions included in financial contracts, they are mainly encountered as standalone agreements. Covenants can be laid down in any of the abovementioned contract documents.[69] The following five groups of covenants can be identified:[70]

- *Information rights* define the extent to which investors are given access to information on the portfolio company.
- *Control rights* summarize the investor's rights to exert control over the portfolio company's business activity.
- *Venture capitalist's safeguards* cover covenants protecting the position and influence of the investor if certain events take place.

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[68] See Bascha and Walz (2000), p. 417, Brokamp et al. (2004), pp. 19–20, 25, Hellich et al. (2004), pp. 14–15, Rudolph and Haagen (2004), pp. 18–19, Leopold et al. (2003), pp. 141–143, and Weitnauer (2000), pp. 152, 254–255.

[69] See Weitnauer (2001), pp. 1070–1073.

[70] The definitions of covenants are adopted from the following publications: Bagley and Dauchy (1997); BVK (2004c); Cornelius (1997); EVCA (2002); Sahlman (1990); Schäfer and Stephan (2003); Weitnauer (2001); Wilmerding (2003).

- *Entrepreneur's penalties* are clauses penalizing the entrepreneur or the management of the portfolio company for leaving the company in breach of contract.
- *Cash flow rights* or *cash flow-related covenants*, in addition to the financial instruments, define the cash flow allocation between the contracting parties, mainly in the case of the venture capitalist's exit.

With the exception of the information rights, these groups of covenants each subsume several covenants which are explained below:

The second group includes covenants on control rights.

- *Board representation* defines the number of board representations designated by the investor.
- *Board supermajority rights* allow investors to require supermajority consent for major decisions.
- *Board veto rights* guarantee the investor special veto rights in board decision-making.
- *Protective provisions* protect investors holding non-voting preferred equity from unfavorable shareholder decisions on the operation of the company in the way that they require approval of a majority of the affected preferred shareholders.
- *Voting rights* stipulate equal treatment of all straight equity shares in the event of a shareholder vote. They can also be formulated for certain preferred equity financings in the form of superior or event-related voting rights.

The third group includes covenants on the venture capitalist's safeguards.

- *Anti-dilution provisions* are a subscription privilege granted to investors to enable them to maintain their fractional ownership in the portfolio company.

- *Registration provisions* provide investors with the right to an IPO or to include their shares in the IPO or subsequent registration.
- *Rights of first refusal* ensure that if a founder or other shareholder in the portfolio company wishes to sell shares, he must offer them first to the investors.

The fourth group includes covenants on the entrepreneur's penalties.

- *Non-compete clauses* restrict founders or managers of portfolio companies to sign contracts with the portfolio company's competition for a certain amount of time.
- *Vesting provisions* specify the process by which shares or stock options contractually granted to the founder or management of the portfolio company are transferred.

The fifth group includes cash flow-allocating covenants, which are in the following referred to as "cash flow-related" covenants.

- *Conversion provisions* permit the investor and holder of preferred equity or debt to convert into common shares at his option.
- *Co-sale agreements* include drag-along and tag-along rights. Drag-along rights allow the investor upon sale of his shareholdings to require other shareholders to sell their shares to the same purchaser at the same time and on the same terms; tag-along rights allow the investor to insist on selling his shares to the same purchaser at the time as another shareholder sells his shares and on the same terms.
- *Dividend provisions* allow investors to protect their investment and to exit an investment with at least some prospect of a return in the event of portfolio company liquidation.
- *Liquidation rights* specify that liquidation preference will be given to investors in preference to holders of other classes of stock in the case of portfolio company liquidation.

- *Redemption rights* grant the investor the right to demand that his shares are redeemed by the portfolio company after an ex-ante specified number of years.
- *Staged financing* is the successive financing of portfolio companies in stages where new financing is provided only upon achievement of pre-defined milestones.

These definitions of financial instruments and covenants apply throughout the entire thesis, where both contractual components are combined for different analyses of augmented contracting.

2.2.3 Augmented Contracting

The term "augmented contracting" is defined for the purpose of this thesis as the analysis of the interactions between financial instruments and contractual covenants in the allocation of cash flow rights, as opposed to the isolated analyses of either financial instruments or covenants. It thereby analyzes the comprehensive incentive mechanisms created for the contracting parties by the entire contract in a venture capital setting, where the abovementioned active contributions of both parties to the management of the portfolio company are similarly important. An augmented contracting analysis therefore permits to analyze the entire venture capital contract with respect to the allocation of cash flow rights. While augmented contracting analyses can also be performed on the allocation of control rights, these are not at the center of the analysis because, specific to venture capital finance, they can be allocated separately through the allocation of the above control covenants.[71]

In the following, a review of the theoretical and empirical literature on venture capital contracting, in particular on financial instruments and cash flow-related covenants, identifies augmented contracting as a research gap in theoretical analyses but also in empirical analyses on the German venture capital market.

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[71] See Kaplan and Strömberg (2003), p. 286, 294–295.

3 Review of Academic Literature

3.1 Introduction

This chapter presents a critical overview of theoretical and empirical literature on cash flow incentive mechanisms in venture capital contracting and identifies significant research gaps.

Existing academic literature on venture capital contracting proposes the *allocation of cash flow rights* (Grossman and Hart (1986), Schmidt (2003); Kaplan and Strömberg (2003), Gompers (1997)) and the *specification of control rights* (Chan et al. (1990), Hellmann (1998); Kaplan and Strömberg (2003), Lerner (1995)) as solution mechanisms to agency problems arising from the contractual relation between the venture capital company and its portfolio companies. This review, however, focuses on literature related to cash flow incentive properties of *augmented contracts* as defined by financing instruments and cash flow-related covenants. Control rights are neglected for the following reasons. The venture capitalist is given control rights independent of the financial structure through the use of covenants. This implies that the optimal allocation of control rights can be achieved separately from that of cash flow rights. [72] In addition, direct control rights are difficult to model situation-specifically in theoretical analyses and difficult to measure on a deal-by-deal basis in empirical analyses.[73]

The review is thus more focused than comparable existing literature reviews: Tykvová (2000) critically reviews theoretical literature analyzing the agency conflict resolution potential of typical financial instruments and covenants in venture capital contracts. She groups existing works as to their focus along the venture capital investment process, that is, on the selection, investment, and

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[72] See Gompers (1997), p. 20, Hellmann (1998), p. 70–71, Kaplan and Strömberg (2003), pp. 286, 294–295, and Schmidt and Wahrenburg (2003), p. 1142.

[73] For a review of the literature on the allocation of direct control rights, see Schertler (2000), pp. 13–17, and Neff (2003), pp. 114–125.

exit phases. Neff (2003) also presents the main findings from existing theoretical models but concentrates on (double) moral hazard models.[74] Denis (2003) only briefly summarizes the findings from theoretical and empirical literature on the allocation of cash flow and control rights. The empirical findings discussed refer primarily to the US market. Schertler (2000) presents a survey of the recent theoretical and empirical venture capital contracting literature on cash flow and control right allocations as solution mechanisms to agency problems. She compares theoretical findings with findings from empirical literature on mainly US contracting practices. While the review in this thesis is most closely related to Schertler (2000), it provides a more detailed discussion in two respects: It considers only literature on the allocation of cash flow rights and it discusses empirical studies with US, Canadian, European, and especially German samples. As a result of this wider geographical scope, it determines striking differences in contract design across the globe.

Finally, research gaps are identified from the summary of theoretical and empirical findings. They concentrate on the so-far-neglected notion of augmented contracting, that is, on the complementary interaction between financial instruments and cash flow-related covenants in the allocation of cash flow rights. A research question is then formulated for the theoretical analysis in Chapter 4 and hypotheses and expectations are framed for the empirical analysis in Chapter 5. Expectations are formulated on data analyzed by means of cluster analysis. Since cluster analysis is a structure-discovering and not a structure-testing method, hypotheses cannot be formulated and tested. Expectations are therefore introduced to serve a similar purpose.

The rest of the chapter is organized as follows. Section 3.2 reviews theoretical foundations, and Section 3.3 reviews empirical evidence. Both sections separately consider literature on financial instruments and on cash flow-related covenants,[75] identify research gaps, and formulate a research question, expectations, and testable hypotheses for the theoretical and empirical papers

[74] See Neff (2003), pp. 125–151.
[75] For an overview of the papers discussed in the literature review, see Table 3-1.

in this thesis. They end with overview tables of the reviewed literature. Section 3.4 concludes.

	Financial Instruments	Cash Flow-Related Covenants
Theoretical Foundations	Bascha and Walz (2001) Bergemann and Hege (1998) Berglöf (1994) Casamatta (2003) Cornelli and Yosha (2002) D'Souza (2000) Garmaise (2001) Green (1983) Hellmann (2002a) Houben (2002) Marx (1998) Schmidt (2003) Trester (1998) Repullo and Suarez (2004)	Chemla et al. (2003) Cornelli and Yosha (2002) Houben (2002) Repullo and Suarez (2004)
Empirical Evidence	Bascha and Walz (2002) Brettel et al. (2004a) Bottazzi et al. (2004) Cumming (2004) Cumming (2002b) Cumming (2002c) Cumming et al. (2004) Gilson and Schizer (2003) Hommel et al. (2003) Kaplan and Strömberg (2003) Kaplan et al. (2003) Lerner and Schoar (2004) Schäfer et al. (2004)	Barney et al. (1994) Cumming (2002b) Isaksson et al. (2004) Kaplan et al. (2003) Lerner and Schoar (2004)

Table 3-1: Overview of the Reviewed Literature

3.2 Theoretical Foundations

3.2.1 Findings on Financial Instruments

Starting point of the review of the theoretical literature is the recent paper by Schmidt (2003), which offers a new and straightforward explanation for the widespread use of convertible securities in venture capital contracting.

Schmidt (2003) subjects his model to venture capital-specific assumptions, whereby the entrepreneur is wealth-constrained and has limited liability, and the

venture capitalist's effort and support are vital for the success of the portfolio company. Based on these assumptions, convertible securities *(esp. convertible debt)* are shown to endogenously allocate cash flow rights to the contracting parties so that, across all states of the world, both the entrepreneur and the venture capitalist sequentially provide efficient efforts, without both being residual claimants on the margin. To solve the underlying *double moral hazard problem* and attain the first-best result (which is robust to renegotiation), the model uses the following incentive mechanism in incomplete contracting: The entrepreneur is induced to provide the efficient amount of effort because he knows that the venture capitalist, in turn, will only invest the efficient amount of effort if he exercises his conversion rights, which he will only do if the entrepreneur provides the efficient amount of effort. Any mixture of debt and equity does not create this incentive mechanism, and is thus outperformed by convertible securities. Regarding his focus on cash flow rights, Schmidt (2003) argues that additional control rights can be allocated separately with covenants on control rights and, therefore, "the most important function of convertible securities is to allocate cash flow rights."[76] The model's implications are consistent with the empirical findings on venture capital finance. It offers an explanation for the popularity *(unpopularity)* of convertible securities with venture capital investors *(uninvolved outside investors)* and the frequent use of automatic conversion clauses with the IPO as exercise date. Furthermore, it is consistent with the finding that the venture capitalist's share of the cash flow decreases with increasing performance of the portfolio company.

Tykvová (2000) severely criticizes the strong assumptions concerning parameters and relationships in the model by Schmidt (1999a), an earlier version of Schmidt (2003), which must hold for the first-best solution to be implemented under convertible security financing.[77] Nevertheless, this research program is most closely related to Schmidt (2003) because he introduces a very general double moral hazard venture capital investment model without additional focus on information revelation, control rights, or exit choice in

[76] Schmidt (2003), p. 1142. It has to be noted that Schmidt (2003) hereby disregards the fact that additional cash flow rights can also be allocated via cash flow-related covenants.

[77] See Tykvová (2000), p. 8.

venture capital contracting. For this reason, we adopt the following simplified main finding from Schmidt (2003):

Finding 1: *(Optimal Convertible Securities).* Convertible securities optimally and endogenously allocate cash flow rights to the contracting parties.

Besides Schmidt (2003), several other papers analyze convertible securities and their ability to mitigate different agency problems. They all support "the proposition that convertible [securities are] optimal" [78], meaning that they dominate all other forms of finance by inducing the contracting parties to exert efficient investing or controlling efforts or other behavior such as information revelation and exit choice. These papers can be divided into four groups:

- Most closely related to Schmidt (2003) are Houben (2002), Repullo and Suarez (2004), and Casamatta (2003), which present convertible securities as optimal financial instrument in *double moral hazard* models in the form of *hidden action.*
- Green (1983), Trester (1998), and Bergemann and Hege (1998) analyze *moral hazard hidden action* models which show convertible securities to mitigate opportunistic behavior by the entrepreneur in the form of excessive risk-taking and diversion of capital by the entrepreneur.
- In Cornelli and Yosha (2002) and D'Souza (2000), convertible securities effectuate truthful *information revelation* by the entrepreneur and thus solve *moral hazard* models in the form of *hidden information.*
- Marx (1998), Berglöf (1994), Bascha and Walz (2001), and Hellmann (2002a) develop models in which convertible securities are used to optimally allocate *control rights.* With the exception of Marx (1998), the models focus on the optimal *choice of an exit channel.*

[78] Cumming (2004), p. 551.

Due to their varying setups and analyses, the theoretical papers in these groups and throughout the remainder of this review are each summarized individually below:

The first group of papers analyzes double moral hazard problems and includes the most recent papers in the field.

Houben (2002) extends the model by Schmidt (1999b), an earlier version of Schmidt (2003), to a double adverse selection and double moral hazard model supporting the optimal allocation of cash flow rights by convertible securities *(esp. convertible preferred equity)* in combination with a redemption covenant.

Repullo and Suarez (2004) present a contract or security design approach to a double moral hazard problem with the venture capitalist as supplier of funds and advisor, where financing is provided in stages. They thereby extend the model by Schmidt (2003) to a staged financing context, also with convertible securities as optimal contract: The venture capitalist, who finances the first stage, obtains a cash flow of zero in the bad state of the world and a fixed cash flow in the good state of the world. This leaves enough cash flow to be used as an incentive for the venture capitalist, who finances the second stage and is also the advisor. Repullo and Suarez (2004) argue that this cash flow allocation resembles that of a convertible security *(esp. convertible preferred equity)*.

Casamatta (2003) assesses the performance of financial instruments in a double moral hazard model with the venture capitalist as supplier of funds and advisor, in which the efforts of the entrepreneur and the venture capitalist are substitutes. She shows that the optimal form of outside financing depends on the amount invested: Small investments are best financed with straight equity, and large investments are best financed with convertible securities *(esp. convertible debt)*. The underlying reason is that the amount of outside financing influences incentives: Straight equity provides strong incentives to the venture capitalist, convertible debt to the entrepreneur.

The second group of papers analyzes moral hazard problems in the form of hidden action:

Green (1983) is the first to theoretically support the optimality of convertible securities, although not in a venture capital setting. He argues that convertible securities *(esp. convertible debt)* mitigate the problem of excessive risk taking by the entrepreneur. While the entrepreneur will always choose to invest in a high-risk as opposed to a low-risk project under debt financing, under convertible securities the outside investor is given the option to obtain a share in the company. For high profit realizations, this reduces the entrepreneur's payoff making it less attractive for him to invest in the high-risk project.[79]

Trester (1998) looks at asymmetric information on the realized state of the world with resulting monitoring difficulties for the venture capitalist and opportunistic behavior by the entrepreneur. In this environment, convertible securities *(esp. convertible preferred equity)* but also preferred equity contracts are shown to dominate debt contracts and straight equity contracts. According to the model, these financial instruments eliminate the foreclosure option, while preserving the venture capitalist's seniority in the event of bankruptcy. Under the foreclosure option, the entrepreneur is induced to behave opportunistically and commit outright theft until he defaults on the debt and abandons or forecloses the project to the venture capitalist. It has to be noted, however, that Thakor (1998) severely criticizes the fact that Trester (1998) precludes the optimality of debt by assumption.[80]

Bergemann and Hege (1998) develop a dynamic moral hazard model, where venture capitalist and entrepreneur continuously update their beliefs on project success. The entrepreneur allocates funds to research and development, unobserved by the venture capitalist. He can thus divert capital for his perquisites, and thereby intentionally slow down innovation discovery. Under the assumptions of positive liquidation values, convertible securities *(esp.*

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[79] Schmidt (2003), however, argues that the same result can be obtained by combining debt and straight equity. See Schmidt (2003), p. 1141.

[80] See Thakor (1998), p. 701.

convertible debt) and combinations of straight equity and debt are shown to optimally allocate cash flow rights: The entrepreneur is rewarded only in the case of success. Otherwise the venture capitalist holds a senior claim.

The third group of papers analyzes moral hazard problems in the form of hidden information:

Cornelli and Yosha (2002) is based on the model by Admati and Pfleiderer (1994) and shows that, in a staged venture capital investment, convertible securities *(esp. convertible debt)* reduce the entrepreneur's incentive to engage in window dressing in order to obtain financing for the second stage of the project. Under a debt and equity contract, the entrepreneur is induced to bias short-term performance and to thus prevent the venture capitalist from abandoning the project. Under convertible securities, however, window dressing is less profitable, making the venture capitalist exercise his conversion option and thereby reducing the entrepreneur's fraction of the profit.

D'Souza (2000) develops a model with informational asymmetries and private benefits of control where convertible securities *(esp. convertible debt)* can be used as a revelation mechanism rewarding the entrepreneur with private benefits of control for truthful information revelation to the venture capitalist on the state of the world.

The fourth group of papers analyzes control right allocations, mainly related to the choice of the exit channel:

Marx (1998) presents a model showing that convertible securities *(esp. (participating) convertible preferred equity)* and debt-equity combinations dominate only-debt and only-straight equity contracts. In her model, the venture capitalist is given the option to costly intervene in the project – which is necessary if the performance is poor – and at the same time eliminate the entrepreneur's private benefits of control. Marx (1998) finds that, whereas debt gives the venture capitalist too much and straight equity too little of an incentive

to intervene, convertible securities excite the optimal level of venture capitalist intervention or control.

Berglöf (1994) demonstrates that convertible securities *(esp. convertible debt)* optimally allocate cash flow and, more importantly, control rights between the contracting parties, if both parties agree to sell the company via IPO or trade sale in the future. In his model, the allocation of control rights determines whether the venture capitalist or the entrepreneur bargains with the new owner or manager of the firm, and is thus able to protect his own interests: In the "bad" state of nature, the venture capitalist wishes to have control and thus be protected against dilution through asset stripping. In the "good" state of nature, he wishes to free-ride on potential efficiency improvements resulting from the sale and converts his debt into equity. Thereby, control rights and benefits are transferred to the entrepreneur, who then bargains with the potential buyer.

Bascha and Walz (2001) analyze the interaction between exit decisions and choice of financial instrument in venture capital contracting. They argue that venture capitalists invest only for a limited period and, at one point in time, wish to divest their share in the portfolio company. Since the venture capitalist and the entrepreneur have diverging interests with respect to different exit channels – Bascha and Walz (2001) focus on IPO and trade sale –, control problems arise and cause inefficiencies. Convertible securities *(esp. convertible debt)* are found to dominate debt and/or equity contracts. They allocate cash flow and, more importantly, control rights as well as non-monetary benefits to the contracting parties such that they achieve the ex-ante agreed optimal exit policy, despite the parties' diverging interests with respect to different exit solutions. With its ex-ante-defined contractual flexibility, a convertible securities contract implements an implicit contract over control and thereby also over the exit mode. It thereby avoids renegotiation.

Hellmann (2002a) also shows that convertible securities *(esp. (participating) convertible preferred equity)* optimally allocate cash flow and control rights ex ante to optimize the ex-post exit decision of exiting via IPO or trade sale. This is achieved through its automatic conversion in the case of an IPO, which

redistributes some cash flows from the venture capitalist to the entrepreneur and eliminates potential disagreements about the decision to go public.

All of the above papers have in common their support of the proposition of optimality of convertible securities in venture capital finance.[81] They thereby suggest that no other financial instrument achieves similar results, not even equity financing,[82] which is commonly contracted upon in the German venture capital market. It is not surprising, therefore, that in the following only three papers on equity financing in venture capital contracting are listed, of which only one demonstrates (partial) dominance of equity over convertible securities:

- Casamatta (2003) proves that *straight equity* dominates convertible securities only in the case of small venture capital investments.[83]
- Trester (1998) shows that *preferred equity* achieves the same results as convertible securities.[84]
- Garmaise (2001) finds that *straight equity* dominates debt financing:

Garmaise (2001) proposes a pecking order of securities for new firms, whereby entrepreneurs prefer to be financed by *straight equity* rather than debt. He demonstrates that optimistic investors are allocated small junior equity claims and that pessimistic investors are given large debt claims. These results are in direct contrast to the pecking order of Myers (1984), which Garmaise (2001) argues to be more appropriate for mature firms.[85] He does not include convertible securities in his analysis.

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[81] In the models by Bergemann and Hege (1998) and Marx (1998), combinations of debt and equity and, in the model by Trester (1998), preferred equity lead to the same results as convertible securities. Casamatta (2003) restricts the dominance of convertible securities to large investments.

[82] With the exception of the papers by Casamatta (2003) and Trester (1998), as shown below.

[83] See above for a summary explanation of the model.

[84] See above for a summary explanation of the model.

[85] Myers (1984) and Myers and Majluf (1984) produce the financial pecking order theory of capital structure suggesting that, in imperfect capital markets with informational asymmetries, firms follow a pecking order in raising funds for new investment opportunities, financing first with internal funds, second with debt, and only in the last resort with external equity. See Neff (2003), pp. 109–110.

This overview clearly points out that theory by and large does not support the use of straight equity in venture capital investments. Interestingly, German practice deviates from this recommendation. Since the existing theoretical literature does not provide an empirically tested explanation for the lackluster popularity of convertible securities in German venture capital contracting, the empirical analysis in Chapter 5 aims at analyzing the underlying reasons.

3.2.2 Findings on Cash Flow-Related Covenants

As shown above, cash flow rights can, besides financial instruments, also be allocated to the contracting parties with cash flow-related covenants. These are similarly powerful as financial instruments in allocating cash flow rights – mainly in the case of the venture capitalist's exit – and include the following: conversion provisions, co-sale agreements, dividend provisions, liquidation rights, redemption rights, and staged financing.

We can distinguish two groups of theoretical papers involving cash flow-related covenants:

- Houben (2002), Cornelli and Yosha (2002), and Repullo and Suarez (2004) incorporate single covenants into their models on financial instruments (*redemption rights* and *staged financing*).[86]
- Chemla et al. (2003) present a contract-theoretical analysis of several isolated covenants (*co-sale agreements* and *redemption rights*):

Chemla et al. (2003) provide an explanation for the use of *co-sale agreements* and *redemption rights*, among other covenants. In their dynamic double moral hazard model, they show that these covenants represent state-dependent options which maximize the parties' incentives to make value-creating investments, and at the same time minimize the parties' incentives to engage in value-destroying transfers. Furthermore, they show that these covenants

[86] See above for a summary explanation of the models.

achieve the efficient ex-post allocation of stakes in the portfolio company through renegotiation.

This short list of theoretical papers is an indication that only a handful of papers account for the fact that cash flow rights can also be allocated by specifying cash flow-related covenants. Nevertheless, they adopt rather isolated approaches and do not analyze the interaction of cash flow-related covenants and financial instruments. They thereby disregard augmented contracting as a central aspect of contracting reality. This is the research gap to be filled by the theoretical analysis in Chapter 4. It analyzes whether straight equity financing in combination with at least one cash flow-related covenant is suited to effectively replicate the optimal allocation of cash flow rights obtained with convertible securities, and thus no single optimal form of financing exists. It thereby extends the existing theoretical literature in several ways: The analysis is based on several real-world phenomena in venture capital and focuses on straight equity financing as the main financial instrument in the German venture capital market. This makes it the first theoretical analysis of venture capital contracting in capturing usages of the German market. Furthermore, it uses a contract design approach to identify whether straight equity contracts in combination with at least one cash flow-related covenant can define similar incentives for the contracting parties as convertible securities contracts.

This section concludes with a summary table of the discussed theoretical papers on financial instruments and cash flow-related covenants.[87]

[87] For a summary overview of the reviewed theoretical literature, see Table 3-2.

Theoretical Literature	Considered (Principal-Agent) Problem	Identified Mitigation Mechanism	Dominated Financial Instruments [a]	Included Cash Flow-Related Covenants [b]
Schmidt (2003)	Double moral hazard: hidden action	Convertible debt	Combinations of debt and equity	Automatic conversion provisions
Houben (2002)	Double moral hazard: hidden action	Convertible preferred equity		Redemption rights
Repullo and Suarez (2004)	Double moral hazard: hidden action	Convertible preferred equity		Staged financing
Casamatta (2003)	Double moral hazard: hidden action	Convertible debt/*straight equity* (for large/*small* investments)		
Green (1983)	Moral hazard: hidden action	Convertible debt	Straight debt	
Trester (1998)	Moral hazard: hidden action	Convertible preferred equity, preferred equity	Straight debt, straight equity	
Bergemann and Hege (1998)	Moral hazard: hidden action	Convertible debt, combinations of debt and equity		
Cornelli and Yosha (2002)	Moral hazard: hidden information	Convertible debt	Combinations of debt and equity	Staged financing
D'Souza (2000)	Moral hazard: hidden information	Convertible debt		
Marx (1998)	Control right allocation	Convertible preferred equity, combinations of debt and equity	Straight equity, straight debt	
Berglöf (1994)	Control right allocation for exit decision	Convertible debt		
Bascha and Walz (2001)	Control right allocation for exit decision	Convertible debt	Straight equity, straight debt, combinations of debt and equity	
Hellmann (2002a)	Control right allocation for exit decision	Convertible preferred equity		
Garmaise (2001)	Adverse selection	Straight equity		
Chemla et al. (2003)	Double moral hazard: hidden action	Co-sale agreements, redemption rights		

[a] This column lists the financial instrument(s) that is (are) shown to be dominated by the financial instrument(s) identified as mitigation mechanism(s) to the considered problems.

[b] This column lists cash flow-related covenants that are included in the setup of the theoretical analyses.

Table 3-2: Summary Overview of the Theoretical Literatur

3.3 Empirical Evidence

3.3.1 Findings on Financial Instruments

Starting point of the review of empirical literature are the recent papers by Kaplan and Strömberg (2003) and Cumming (2002b), which both represent pioneering work in the field of venture capital contracting.

Kaplan and Strömberg (2003) present the first detailed empirical study on venture capital contracts with focus on the *United States* venture capital market and compare their results to those of financial contract theory. Besides the use of securities – mainly *convertible preferred equity (95%)*[88] –, they measure the dynamic allocation of cash flow (and control) rights to the contracting parties: The frequency of cash flow-related covenants like *liquidation rights (99%)*, *automatic conversion provisions (94%)*, and *redemption rights (84%)*[89] is very high compared to non-US contracts, as shown by Kaplan et al. (2003).[90] The main findings by Kaplan and Strömberg (2003) have significantly shaped the succeeding body of theoretical and empirical literature, and are for this reason emphasized as key findings below.

Kaplan and Strömberg (2003) find that venture capitalists are able to write contracts in which control rights are allocated independently of cash flow rights via covenants.[91]

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[88] Throughout Section 3.3, all lists of financial instruments and covenants are reduced to the predominant financial instrument and most frequently used covenants. For reasons of uniformity, percentages are given as integers. For a detailed overview of the mix of financial instruments and of the lists of covenants used as well as sample and methodological information, see Appendix A.

[89] In the following, we have listed all cash flow-related covenants included in the empirical papers. Since different publications include different covenants, results are not directly comparable.

[90] See Kaplan et al. (2003), pp. 8–9.

[91] See Kaplan and Strömberg (2003), pp. 286, 294.

Finding 2: *(Separate Cash Flow and Control Right Allocation).* Venture capital contracts allow for a separate allocation of cash flow and control rights to the contracting parties.

Venture capitalists simultaneously use different governance mechanisms in their contracts. Kaplan and Strömberg (2003) therefore propose covenant complementarity, which Cumming (2002b) extends to financial instruments.[92]

Finding 3: *(Complementarity of Financial Instruments and Covenants).* Financial instruments and covenants allocating cash flow and control rights are used as complements, not as substitutes.

Furthermore, the cash flow and control right allocation obtained with convertible preferred equity is observed to be frequently replicated using other forms of finance in combination with different covenants. This supports Merton's (1995) argument on functional equivalents:[93]

Finding 4: *(Functional Equivalence of Venture Capital Contracts).* Contracts consisting of financial instruments and covenants can indeed be functional equivalents.

A synthesis of Findings 1 to 4 reasons that, since convertible securities are optimal, and different combinations of financial instruments and covenants can be functional equivalents, the cash flow right allocation implemented by convertible securities can possibly be replicated using other financial instruments in combination with covenants. Cumming (2004) therefore states: "There is no single optimal form of venture finance."[94] This strongly supports the research question underlying Chapter 4.

Cumming (2002b) presents the first and only study which identifies contractual patterns in venture capital, consisting of persistent combinations of financial

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92 See Kaplan and Strömberg (2003), pp. 308–312, and Cumming (2002b), p. 11.
93 See Merton (1995), p. 32.
94 Cumming (2004), p. 581.

instruments and covenants. In his dataset on *European* venture capital investments, *straight equity (44%)* is identified as the dominant financial instrument, and *co-sale agreements (61%)* are the most common covenant, followed by *redemption rights (36%)*. The data indicates that portfolio company characteristics (development stage, amount invested, industry, and others) determine contractual patterns, which again determine the exit channel selected:[95] Contracts with late-stage portfolio companies include mainly straight equity in combination with incentive clauses and are exited via IPO, whereas contracts with early-stage portfolio companies include convertible preferred equity in combination with control rights and are exited via acquisition. Cumming (2002b) argues that venture capital contracts are thus heterogeneous with respect to the included securities and covenants and that contrary to the findings by Kaplan and Strömberg (2000b), an earlier version of Kaplan and Strömberg (2003), contracts are not functional equivalents constructed to replicate one another. However, Cumming (2002b) supports their proposition that covenants are complements and extends it to financial instruments.

Like Kaplan and Strömberg (2003) and Cumming (2002b), several other papers analyze venture capital contracting in different countries. All of these papers, which are outlined below, can be divided into two groups with varying principal financial instruments:

- *Convertible preferred equity* is the dominant financial instrument
  - in venture capital contracts in the *USA* (Kaplan and Strömberg (2003)) and
  - across a sample of 23 *non-US countries* worldwide (Kaplan et al. (2003)).
- *Straight equity* is the main financial instrument
  - in *25 developing countries* worldwide (Lerner and Schoar (2004)),
  - in *Canada* (Cumming (2004)), also in investments by US venture capitalists in Canada (Cumming (2002c)),

[95] In addition, Cumming (2002b) finds that the contractual architecture is an important determinant of exit choice and IRR.

- in *Europe* (Bottazzi et al. (2004); Cumming (2002b)), and
- in *Germany* (Bascha and Walz (2002); Brettel et al. (2004a); Hommel et al. (2003); Schäfer et al. (2004)) – alongside silent partnerships and preferred equity.

While these findings on the predominant use of convertible preferred equity are consistent with Finding 1 extracted from the theoretical literature,[96] theory does not provide sufficient support for the observed importance of straight equity financing in the majority of non-US samples. Furthermore, empirical evidence on contracting in the German market does not agree in that straight equity is the main financial instrument, as shown by Bascha and Walz (2002) and Schäfer et al. (2004). These findings allow the formulation of the first expectation about the data in this empirical paper:

Expectation 1: *(Dominance of Straight Equity Contracts).* Straight equity is the main financial instrument in the German venture capital market.

Most of the abovementioned papers identify determinants of security choice; Cumming (2002b), Kaplan et al. (2003), and Lerner and Schoar (2004) even of security and covenant choice. The papers, which are outlined below, can be divided into three groups of analyzed and supported determinants:

- Cumming et al. (2004), Cumming (2002c), and Lerner and Schoar (2004) show that the use of financial instruments (and covenants) is driven by the prevailing *legal, tax, and institutional environments* in the country of investment and, if different, in the home country of the venture capital company. Gilson and Schizer (2003) support certain taxation arguments.
- Bascha and Walz (2002), Schäfer et al. (2004), Cumming (2004), and Cumming (2002b) find that *characteristics of the portfolio company*, such as development stage, amount invested, and industry, as well as related

[96] A majority of theoretical papers demonstrate the optimality of convertible debt (Bergemann and Hege (1998); Berglöf (1994); Casamatta (2003); Cornelli and Yosha (2002); D'Souza (2000); Schmidt (2003); Bascha and Walz (2001)) rather than convertible preferred equity (Hellmann (2002a); Houben (2002); Marx (1998); Repullo and Suarez (2004); Trester (1998)).

agency problems determine the use of financial instruments (and covenants).

- Kaplan et al. (2003) identify size, age, and US investment experience, summarized to the construct of venture capitalist sophistication, as *characteristics of the venture capital company* which determine the use of financial instruments and covenants.[97]

Due to their different samples and methodologies, the empirical papers in these groups and throughout the remainder of this review are each summarized individually below:

The first group of papers analyzes the importance of legal, tax, and institutional environments as determinants of contract architecture across different countries.

Cumming et al. (2004) analyze the influence of legality on governance structures and security choice of venture capital investments across a sample of *39 countries* worldwide. Regarding security choice, they do not consider specific types of securities but rather the allocation of cash flows to the venture capital company: They distinguish between periodic cash flows and upside potential. In this way, Cumming et al. (2004) wish to account for the fact that contracts of different forms may be functionally equivalent.[98] Overall, they find that legal systems clearly affect the structure of contracts.

Cumming (2002c) analyzes financing structures employed by *US* venture capital firms when investing in *Canadian* portfolio companies. *Straight equity (35%)* is most frequently contracted upon, followed by convertible preferred equity (21%) and convertible debt (12%). Cumming (2002c) thereby reveals differences in the use of financial instruments between domestic and international US venture capital contracting, and ascribes them mainly to tax, legal and institutional differences.

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[97] See Kaplan et al. (2003), p. 16.
[98] See Cumming et al. (2004), pp. 3, 6–7, 10.

Lerner and Schoar (2004) analyze contract structure in *25 developing countries*. They find that transactions are financed mainly with *straight equity (55%)* and that *redemption rights (31%)* and *automatic conversion provisions (26%)* are not employed as often as in the United States or other common law countries. The contractual architecture is shown to be driven by mainly legal but also economic circumstances of the developing countries and the investing venture capital companies.

Legal, tax, and institutional environments are largely neglected in the theoretical literature, whereas agency problems and, to a certain extent, venture capital and portfolio company characteristics identified in practice are usually included in the models. This is sharply criticized by *Gilson and Schizer (2003)*, whose "analysis suggests the difficulty of financial modeling for activities in which low-visibility, "practice"-level patterns are of first-order significance. Unless informed by institutional knowledge deep enough to reveal such patterns, models will miss a significant factor that is influencing behavior."[99] Gilson and Schizer (2003) further present support of taxation arguments explaining the optimality and ubiquity of convertible preferred equity in the US venture capital market: "By awarding convertible preferred [equity] to venture capitalists, portfolio companies seek to lower the tax burden on management's incentive compensation. Because such high-powered incentives are central to venture capital contracting, this tax advantage is a key reason for the security's pervasiveness."[100]

The second group of papers analyzes the importance of portfolio company characteristics and related agency problems as determinants of contract architecture across different countries.

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[99] Gilson and Schizer (2003), p. 878, as cited by Cumming (2004), p. 563.

[100] Gilson and Schizer (2003), p. 889. The self-executing tax subsidy is explained in more detail at Gilson and Schizer (2003), p. 876, as cited by Cumming (2004), p. 563: "Portfolio companies issue convertible preferred [equity] to achieve more favorable tax treatment for the entrepreneur and other portfolio company employees. The goal is to shield incentive compensation from current tax at ordinary income rates, so managers can enjoy tax deferral (until the incentive compensation is sold, or longer) and a preferential tax rate."

Bascha and Walz (2002) investigate the financing practices in the *German* venture capital market. In their sample, *silent partnerships (33%)* and *equity (27%)* are the predominant financing instruments. They analyze the importance of agency problems related to the exit as determinants of security choice and find that convertible securities *(debt-like instruments)* are employed in cases where the venture capitalist expects a high probability of an exit via IPO *(exit via buy-back)*.

Schäfer et al. (2004) analyze the choice of financial instruments in venture capital investments of *German* public promotional programs. With their focus on public venture capital investments, they narrow the financial instruments down to *equity (55%; including straight equity, silent partnerships, and shareholder loans)*, which is more frequently used than debt (45%). They find that security choice is related to indicators of financial risk embedded in the portfolio companies, whereas no conclusive results are obtained for indicators of intrinsic project risk.

Cumming (2004) analyzes security choice and its determinants for the *Canadian* venture capital market. He finds that there is no ubiquitous financial instrument in the Canadian market, and *straight equity (37%)* is the most common instrument. Security choice is shown to depend on portfolio-company-specific and transaction-specific aspects which he interprets to result from expected agency problems.[101] Furthermore, he rejects his hypothesis on "neutral mutation", whereby different securities are assumed to be functional equivalents.[102] He thereby refers to combinations of debt and preferred equity as well as other securities resembling convertible preferred equity in that they also grant the venture capital company downside protection and upside potential. Cumming (2004) obtains this result focusing only on financial

[101] While Cumming (2004) focuses on agency problems of (double) moral hazard, free riding, hold-up, window dressing, underinvestment, adverse selection and others, Cumming (2001) focuses on adverse selection and concludes that different types of portfolio companies attract contracts with different financial instruments.

[102] Cumming (2004) hereby refers to combinations of debt and preferred equity as well as other securities resembling convertible preferred equity in as far as they also grant the venture capital company downside protection and upside potential.

instruments, not on the entire contractually defined allocation of cash flow rights considered in Cumming et al. (2004).

The third group of determinants of contract architecture is related to venture capital company characteristics, which are the least analyzed determinants in the existing literature.

Kaplan et al. (2003), an expanded version of Kaplan et al. (2002) examine in how far legal, tax, and institutional factors as well as venture capitalist sophistication (defined by size, age, and US investment experience of the venture capital company) affect contract architecture.[103] For this purpose, they compare data on venture capital investments in *23 countries* to the US data in Kaplan and Strömberg (2003) and find that international venture capital contracts differ significantly from US venture capital contracts: The mix of securities employed is broader with *convertible preferred equity (54%)*, *straight equity (28%)*, and *preferred equity (15%)*; the use of *liquidation rights (89%)* and *redemption rights (35%)* is not as popular. Furthermore, they find that the specifications of liquidation and exit covenants are significantly weaker. Despite the fact that contracts are shown to differ across legal regimes, Kaplan et al. (2003) find evidence that more experienced venture capitalists are able to replicate US-style contractual mechanisms elsewhere, namely by replacing primary characteristics of contract components with comparable financial instruments and covenants: The liquidation preference included in convertible preferred equity is mimicked through the use of combinations of straight equity with preferred equity or debt; vesting provisions and redemption rights are imitated with specific put options or drag-along rights. Overall, results indicate that the sophistication of venture capital companies significantly influences the structure of contracts, whereas legal, tax, and institutional factors do not. In addition, Kaplan et al. (2003) find that a restrictive local legal, tax, and institutional environment is generally considered to be avoidable through reincorporation of the portfolio company in a less restrictive country.

[103] See Kaplan et al. (2003), p. 16.

Finally, there exists a group of papers which study the use of financial instruments in European venture capital but do not include analyses of contract determinants.

Bottazzi et al. (2004) study the investment activity of *European* venture capital companies. According to their survey results, *straight equity (> 60%)* is the principal financial instrument contracted upon by European venture capital companies. Regarding the use of covenants, they show that *co-sale agreements (54%)* are employed in approximately every second contract, followed by *liquidation rights (33%)* and *staged financing (26%)*.

Hommel et al. (2003) analyze the investment behavior of German venture capital companies after the downturn of the market in 2001. Their survey of venture capital contracts finds that *straight equity (4.6; on a 5 (almost always) to 1 (almost never) Likert scale)* and *preferred equity (3.9)* are included most frequently in contracts. Furthermore, they show that covenants are employed only infrequently to alter the allocation of cash flow rights: *redemption rights (3.5)* and *staged financing (3.2)*.

Brettel et al. (2004a) analyze contract design by German venture capital companies and its contribution to the reduction of adverse selection and moral hazard problems and thereby to investment success. In their sample, *straight equity (46%)* is the most important financing instrument. Regarding covenants, *co-sale agreements (61%)* are most important and followed by *liquidation rights* and *staged financing (both 42%)* and finally *redemption rights (22%)*. The venture capitalists in the sample agreed that certain covenants, such as staged financing, contribute to the reduction of agency problems. Nevertheless, the majority of venture capitalists reported not to employ these elements in their contracts.

This overview demonstrates that the majority of empirical publications on venture capital contracting not only focuses on financial instruments but also includes analyses of covenants.

3.3.2 Findings on Cash Flow-Related Covenants

The above empirical Findings 3 and 4 reflect the importance of covenants in allocating cash flow (and control) rights complementary to financial instruments and in enabling functional equivalence of different contractual architectures. This emphasizes the importance of empirical research on the use of covenants.

As shown above for the financial instruments, the existing literature distinguishes two groups of papers involving cash flow-related covenants with different geographical focus:[104]

- In the *United States*, cash flow-related covenants are included in almost all venture capital contracts. The use of *liquidation rights*, *automatic conversion provisions*, and *redemption rights* is reported (Kaplan and Strömberg (2003)).
- In *non-US countries*, cash flow-related covenants are included in between one third and one half of all venture capital contracts. The inclusion of mainly *co-sale agreements*, followed by *liquidation rights*, *redemption rights*, and *staged financing*, is reported (Bottazzi et al. (2004); Brettel et al. (2004a); Cumming (2002b); Hommel et al. (2003); Kaplan et al. (2003); Lerner and Schoar (2004)).

From this follows the conclusion that in non-US countries with mainly straight equity financing several and partly identical cash flow-related covenants are used, though at a lower frequency than in the United States. However, for a straight equity contract to replicate the complex incentive structure realized by convertible securities, it has to include at least one covenant which is not also always used in convertible securities contracts or other standard venture capital contracts and is therefore non-ubiquitous. This implies that the following second expectation has to hold:

[104] This summary of results may be subject to a covenant selection bias in the empirical papers.

Expectation 2: *(Combinations of Straight Equity and Cash Flow-Related Covenants).* Straight equity is used in combination with at least one non-ubiquitous cash flow-related covenant.

Besides the geographically distinctive use of covenants, papers also analyze the determinants of covenant inclusion in venture capital contracts:

- Cumming (2002b), Kaplan et al. (2003), and Lerner and Schoar (2004) analyze the design and the determinants of venture capital contracts consisting of financial instruments and (cash flow-related) covenants.[105]
- Barney et al. (1994) and Isaksson et al. (2004) limit their analyses to the determinants of the use of contractual covenants (*agency problems related to the portfolio company* and *characteristics of the venture capital company*), including at least one cash flow-related covenant:

The determinants of covenant choice for Barney et al. (1994) and Isaksson et al. (2004) fall into the previously identified groups of determinants of security (and covenant) choice.

Barney et al. (1994) conduct a survey among *US* venture capitalists. They find that the "terms and conditions" (including *liquidation rights*) in a venture capital contract vary across different investments, and show that they depend on the possibility and importance of portfolio company opportunism.

Isaksson et al. (2004) conduct a survey among *Swedish* venture capitalists and analyze variables describing the venture capitalists' characteristics as determinants of covenant use. They include 79 possible contractual clauses, including *co-sale agreements*, *dividend provisions*, *redemption rights*, and *staged financing*, and find that the greatest differences in the structure of covenants occur among venture capitalists with different investment stage preferences, as opposed to different ownership structure or venture capitalist experience. Their findings are contradictory to those by Kaplan et al. (2003),

[105] See above for summary overviews of the papers.

showing that contractual structures are determined by venture capitalist sophistication in the form of size, age, and US investment experience.

From these insights, we can derive hypotheses to be tested in the empirical analysis. The focus lies on characteristics of the venture capital company as determinants of contractual architecture,[106] not only because they are the least analyzed determinants in the literature (Kaplan et al. (2003); Isaksson et al. (2004)), but also because existing findings are contradictory with regard to venture capitalist sophistication:

Hypothesis 1: *(Sophisticated Use of Convertible Securities).* Sophisticated venture capital companies use convertible securities as dominant financial instrument in their contracts.

Against this view by Kaplan et al. (2003), Isaksson et al. (2004) find that the investor type of venture capital companies discriminates most between contracts. As implied by Cumming (2002b), each investor type, defined as investment focus on early-stage or late-stage investments, is confronted with specific agency problems related to early-stage or late-stage portfolio companies, which have been shown to influence contract design:

Hypothesis 2: *(Investor Type Influence).* The investor types of venture capital companies determine the implemented contractual architecture.

Although less than investor type, Isaksson et al. (2004) show that ownership of the venture capitalist also discriminates between contracts. Results by Schäfer et al. (2004) on contracts of a public venture capital company can be similarly interpreted:

[106] Portfolio company characteristics and related agency problems cannot be analyzed with the available survey data raised at portfolio level; tax, legal, and institutional environments require an international sample of venture capitalists.

Hypothesis 3: *(Venture Capitalist Ownership Influence).* The ownership categories of venture capital companies determine the implemented contractual architecture.

Summarizing Expectations 1 and 2 as well as Hypotheses 1 to 3, the empirical analysis in Chapter 5 attempts to identify the main financial instrument contracted upon in the German venture capital market as well as prevalent contractual patterns, and to test these for determinants relating to the venture capital companies' characteristics. It thereby significantly extends existing empirical evidence in several ways: It is the first detailed analysis of German venture capital contracts, especially of the use of cash flow-related covenants and their interaction with financial instruments. It is the first paper to use cluster analysis as a methodology to identify patterns in venture capital contracting. It provides a new detailed analysis of determinants of contractual architecture relating to the characteristics of venture capital companies. Furthermore, it presents the first descriptive empirical evidence on initial contract negotiations in the German venture capital market as well as on reasons against the use of convertible securities by German venture capital companies.

This section concludes with a summary table of the discussed empirical papers on financial instruments and cash flow-related covenants.[107]

[107] For a summary overview of the reviewed empirical literature, see Table 3-3.

Empirical Literature [a]	Country Focus [b]	Determinants of Contract Architecture	Main Financial Instruments [c]	Main Cash Flow-Related Covenants [c]
Kaplan and Strömberg (2003)	United States		Convertible preferred equity: 95%	Liquidation rights: 99%
Cumming (2002b)	Europe	Portfolio company characteristics	Straight equity: 44%	Co-sale agreements: 61%
Cumming et al. (2004)	39 countries worldwide	Legal, tax, and institutional environment		
Cumming (2002c)	United States (US-investments by Canadian venture capitalists)	Legal, tax, and institutional environment	Straight equity: 35%	
Lerner and Schoar (2004)	25 developing countries	Legal, tax, and institutional environment	Straight equity: 55%	Automatic conversion provisions: 26%
Bascha and Walz (2002)	Germany	Venture capital company characteristics	Silent partnerships: 33%	
Schäfer et al. (2004)	Germany	Portfolio company characteristics	Equity (straight equity + silent partnerships + shareholder loan): 55%	
Cumming (2004)	Canada	Portfolio company characteristics	Straight equity: 36%	
Kaplan et al. (2003)	23 non-US countries	Portfolio company characteristics	Convertible preferred equity: 54%	Liquidation rights: 89%
Bottazzi et al. (2004)	Europe	Venture capital company characteristics	Straight equity: > 50%	Co-sale agreements: 54%
Hommel et al. (2003)	Germany		*Data reported on 5-point Likert scale:* Straight equity: 4.6	*Data reported on 5-point Likert scale:* Redemption rights: 3.5
Brettel et al. (2004a)	Germany		Straight equity: 46%	Co-sale agreements: 61%
Barney et al. (1994)	USA	Portfolio company characteristics		
Isaksson et al. (2004)	Sweden	Venture capital company characteristics		

[a] For detailed information on the sample and methodology of each paper, see Appendix A.
[b] For detailed information on the country focus of each analysis, see Appendix A.
[c] For a detailed list of the reported frequencies of all financial instruments and covenants included in each analysis, see Appendix A.

Table 3-3: Summary Overview of the Empirical Literature

3.4 Conclusions

This review of the academic literature extends existing reviews on venture capital contracting by Tykvová (2000), Neff (2003)[108], and Schertler (2000) to a detailed analysis of cash flow incentive mechanisms in the theoretical and empirical literature. It categorizes existing works by their focus on financial instruments and cash flow-related covenants and identifies that the notion of augmented contracting, which simultaneously considers both contractual elements in the creation of incentives to the contracting parties, has so far largely been neglected. Furthermore, it points out striking differences in findings by empirical literature on US and mainly European or German samples.

As a result, this review suggests the possibility that augmented contracting, as opposed to the isolated use of standard financial instruments, allows for the replication of the incentives allocated by US contracts in the German market. This research question will be analyzed in the theoretical model in Chapter 4. It furthermore calls for a detailed empirical analysis of German venture capital contract design and its determinants. This is presented in the empirical analysis in Chapter 5. Together, both analyses close the identified research gap on augmented contracting in the German venture capital market and derive implications for an improved venture capital contract design in the German market.

[108] See Neff (2003), pp. 125–151.

4 Contract Design Approach to Cash Flow Incentive Mechanisms

4.1 Introduction

This chapter offers a new explanation for the use of straight equity as the prevalent form of financing in German venture capital. Starting point of the analysis is the observation by Cumming and Walz (2004) that "[t]here is no single optimal form of venture finance"[109] despite the fact that theory claims that only convertible securities always optimally and endogenously allocate cash flow rights to the contracting parties and thereby induce them to exert ex-ante efficient efforts.[110] As already formulated in the literature review in Chapter 3, the present work aims at investigating whether the incentive-compatible allocation of cash flow rights obtained with convertible securities can effectively be replicated by straight equity financing in combination with at least one cash flow-related covenant. The chosen contract design approach enables the author to analyze augmented venture capital contracting with a focus on the allocation of cash flow rights to the contracting parties. Augmented contracting considers the interaction of financing instruments and cash flow-related covenants as they are combined in venture capital contracts, and has so far rarely been examined. Control rights are not at the center of the analysis because their allocation can be carried out separately from the allocation of cash flow rights in venture capital.[111]

Related models such as Schmidt (2003) and Hirsch (2005) consider a sequential double moral hazard problem and narrow their analyses to whether contracts attain first-best efficient effort levels. This model, however, focuses on the incentive properties of venture capital contracts. In a second-best world

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[109] Cumming and Walz (2004), p. 32.

[110] See Schmidt (2003), p. 1139. On the optimality of convertible securities contracting in venture capital, see also Bascha and Walz (2001), Bergemann and Hege (1998), Berglöf (1994), Casamatta (2003), Cornelli and Yosha (2002), D'Souza (2000), Hellmann (2002a), Houben (2002), Marx (1998), Repullo and Suarez (2004), Schmidt (2003), Trester (1998).

[111] See Kaplan and Strömberg (2003), pp. 286, 294.

resulting from a simultaneous double moral hazard model, three contract properties are identified, based on which augmented contracting patterns are compared. These properties include the level of the parties' utilities realized and special incentives directed specifically towards the entrepreneur.

The model is built around important real-world phenomena in venture capital that have been identified by the existing literature because, as Schmidt (2003) puts it, "[i]n the specific context of venture capital finance, there are several stylized facts that can be used to impose more structure on the model."[112] The stylized facts take a form similar to that of assumptions underlying the model. They include the importance of the *venture capitalist support* for the profitable joint realization of the project, *project continuation* as the super-ordinate goal of the entrepreneur, *private benefits of control* accruing to the entrepreneur in situations where she is the sole owner of the project, the legal *structure of liquidation provisions*, and a classification of portfolio companies into "high flyers", "living dead", and "write-offs" corresponding to high, medium, and low *states of the world*.[113]

The so-called *living dead phenomenon* has so far been empirically investigated by Ruhnka et al. (1992) but has not attracted much attention in the theoretical literature. "Living dead" investments are economically self-sustaining businesses which nevertheless do not promise to yield the expected rates of return to the venture capital company at the end of the holding period. For this reason, the venture capital investor attempts to liquidate the business immediately upon recognition of this fact in order to minimize actual and potential losses. Exit options for the venture capitalist, which influence the allocation of cash flow rights, are therefore of outstanding importance in this state. With poor exit opportunities, the venture capitalist is locked into an illiquid investment and thus minimizes his effort and financial support. As a result, the majority of "living dead" businesses do not remain self-sustaining for a longer period of time despite the fact that, without venture capital financing, the

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[112] Schmidt (2003), p. 1148.

[113] For an explanation of "high flyers", "living dead", and "write-offs", see Stylized Fact 1 and the underlying empirical evidence.

entrepreneurs might have wished and managed to sustain this state.[114] Ruhnka et al. (1992) therefore conclude that "the living dead phenomenon is unique to the context of [venture capital]-backed companies and represents primarily a failure of investor expectations rather than a financial failure of the venture."[115] This underlines the importance of incentive-compatible contracting, particularly in the "living dead" state.

The model focuses on four of the six previously identified cash flow-related covenants, which arrange for state-contingent cash flow allocations across the different states of the world: *Dividend provisions* are assumed to always be arranged under preferred equity financing. *Conversion provisions* are the main component of convertible securities,[116] which are included as a reference case for straight equity contracts. *Redemption rights* and *liquidation provisions* are then added to these financial instruments, and the contracts' incentive properties are analyzed. In the existing literature, Chemla et al. (2003) show that redemption options prevent the parties from engaging in opportunistic behavior in the form of monetary transfers but not in the form of effort reduction. Furthermore, Berglöf (1994) and Marx (1998) consider liquidation exits and liquidation decisions in venture capital but do not consider the specific definition of liquidation preferences. The model in this chapter does not cover the two remaining cash flow-related covenants, that is, *co-sale agreements* and *staged financing*, for the following reasons: On the one hand, the feasibility of a co-sale depends on an external buyer whose appearance is rare and staged financing is an option to continue rather than an option to abandon the joint realization of the project. On the other hand, both cash flow-related covenants have been sufficiently covered by the existing literature.[117]

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[114] See Gorman and Sahlman (1989), p. 237, and Ruhnka et al. (1992), p. 145.
[115] Ruhnka et al. (1992), p. 153.
[116] For a list of papers on the optimality of convertible securities, see Table 3-2.
[117] For theoretical literature on staged financing, see, for example, Bergemann and Hege (1998), Repullo and Suarez (2004), Admati and Pfleiderer (1994), Cornelli and Yosha (2002), Neher (1999), and Wang and Zhou (2002). For theoretical literature on co-sale agreements, see, for example, Bascha and Walz (2001), Black and Gilson (1998), Berglöf (1994), and Chemla et al. (2003).

This model is most closely related to Schmidt (2003), who presents a double moral hazard model with incomplete contracting and sequential investments by the contracting parties. He focuses on the allocation of ownership rights to both venture capitalist and entrepreneur without inclusion of information revelation problems and control right allocations. His main finding is that, other than combinations of straight equity and straight debt, convertible securities endogenously allocate cash flow rights to the contracting parties such that they choose to invest first-best efficient effort levels across all states of the world. From Schmidt (2003), this model adopts the concentration on ownership rights, the definitions of payoffs resulting from straight equity, straight debt, and convertible securities contracts, as well as the time structure of the model, which it extends to a more realistic simultaneous definition of the parties' effort contributions over time. Like Schmidt (2003), other double moral hazard models by Casamatta (2003), Houben (2002), and Repullo and Suarez (2004) also focus on incentives with respect to the venture capitalist's and the entrepreneur's contributions to the joint project. From Repullo and Suarez (2004), this model adopts the continuous Cobb-Douglas specification of the entrepreneur's final return rather than its discrete and assumption-based specification in Schmidt (2003) and Houben (2002). It further adopts their continuous specification of the venture capitalist's effort rather than its binary specification in Schmidt (2003), which is even extended to the entrepreneur's effort in Houben (2002). Finally, the model draws upon Kim and Wang (1998) for the optimization problem of the double moral hazard under risk-neutrality of both agents.

The main findings of the model are summarized in the form of a pecking order of venture capital contracting. According to this pecking order, convertible securities contracts with redemption option outperform straight equity contracts with redemption option and liquidation provisions with respect to the abovementioned contract properties, because straight equity contracts do not allow for a Pareto-optimal exercise of the redemption option. They nevertheless replicate the payoff structure of convertible securities contracts with redemption option. The implications are consistent with existing empirical evidence on the US market. However, so far, no empirical evidence on German augmented

contracting practices exists, which would allow conclusions as to the design of incentive-compatible venture capital contracts. This gap is filled in Chapters 5 and 6.

The rest of the chapter is organized as follows. Section 4.2 introduces the main theoretical concepts underlying the model. Section 4.3 presents the model itself: Section 4.3.1 contains the setup of the model, and Section 4.3.2 analyzes and compares different forms of financial instruments with respect to their incentive properties across all states of the world. In line with the principal research question, by introducing a redemption option, Section 4.3.2.5 extends the stand-alone analysis of a straight equity contract to the analysis of augmented contracting. Similarly, Section 4.3.3 offers several extensions to all contracts previously analyzed, including earlier straight debt contract maturity, a redemption option, and liquidation provisions. In Section 4.3.4, the results of the model are shown to be robust to changes in its information structure, uncertainty, and timing. Section 4.4 summarizes the main findings and compares them to existing evidence on the US and German venture capital markets. Section 4.5 concludes. Throughout the rest of this chapter, the venture capitalist is referred to by the male gender and the entrepreneur by the female gender, as is common practice in agency models.

4.2 Theoretical Concepts

The model represents a contract design approach to incomplete venture capital contracting under double moral hazard. This section briefly reviews contract theory, agency theory, and incomplete contract theory. With the help of individual publications on venture capital contracting, the problems discussed are related to the context of venture capital. Furthermore, this section demonstrates the importance of game theory for contract theory and introduces two game-theoretical concepts applied in the model.

4.2.1 Theory of Contracts

The theory of contracts[118] was born in the 1970s mainly from the work by Akerlof (1970), Arrow (1971), and Stiglitz (1977).[119] Other than in neoclassical theory, it considers the firm not as an individual but as a multitude of complex relationships reflecting the heterogeneous interests of the individuals involved;[120] other than in general equilibrium theory, it does not focus on general equilibrium models but instead analyzes partial equilibrium models on the strategic interaction between privately informed parties;[121] and, other than in transaction cost economics, it does not consider transaction costs but rather defines explicitly the information distribution between the asymmetrically informed contracting parties.[122]

Due to its new view of the firm as "a nexus for a set of contracting relationships among individuals"[123], contract theory focuses on the economic relationships between privately informed individuals, and thereby on elementary social structures regulating the individuals' bilateral coordination characterized by strategic interaction.[124] The definition of a contract therefore extends far beyond a contract in the legal sense and includes any institutional arrangement – in the form of private contracts, corporate governance, or political norms – influencing and coordinating strategic interactions between the individual decision makers.[125] A contract is a reliable promise by the contracting parties specifying their obligations in all possible contingencies as well as the payment mechanisms for their effort compensation.[126]

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[118] As a relatively young discipline, contract theory does not appear under a consistent name in the literature but is also referred to as incentive theory. See Schmidt (1995), p. 7, and Brousseau and Glachant (2002), pp. 3–6.

[119] For a detailed review of the literature on contract theory and financial contract theory, see Brousseau and Glachant (2002), Hart (1995), Hart and Holmström (1987), Harris and Raviv (1992), and Schweizer (1999).

[120] See Jensen and Meckling (1976), pp. 308–309, 311.

[121] See Salanié (1997), p. 2.

[122] See Schweizer (1999), p. 3.

[123] Jensen and Meckling (1976), p. 310.

[124] See Brousseau and Glachant (2002), p. 5, and Schweizer (1999), p. 1.

[125] See Schweizer (1999), p. 5.

[126] See Macho-Stadler and Pérez-Castrillo (2001), p. 5.

Contract theory attempts to identify the optimal contract or institutional setting. In the context of this thesis, it is applied to identify the contract resolving the following type of agency problem: A group of individuals can cooperate and thereby generate a surplus, which is split between them. The amount of the surplus stochastically depends on the actions undertaken by the individual group members. However, if not properly incentivized by the contract, they all have an incentive to behave opportunistically implying that each individual chooses the action maximizing his private utility. This action, however, does not necessarily correspond to the action that would have been best for the entire group of individuals.[127]

In the context of venture capital, contract-theoretical models analyze both the contractual relationship between the entrepreneur and the venture capital investor and that between the venture capitalist and his fund provider, within their institutional environment in the form of company law, public promotional programs, taxes, and others.[128] Throughout this thesis, the focus lies on the relationship between the entrepreneur and the venture capitalist.[129]

4.2.2 Agency Theory

According to Hart and Holmström (1987), *agency theory* is "a representative paradigm for the organization-theoretical aspects of contracting."[130] Jensen and Meckling (1976) define agency relationships as delegation contracts under which an agent (or informed party) acts on behalf of a principal (or uninformed party) because of a comparative advantage resulting from specialization. The signed contracts are *comprehensive contracts* specifying the parties' obligations across all future states of the world in as much detail as possible. As a result, there is no need for ex-post renegotiation of the contract.[131] Asymmetric information between principal and agent in the form of private information or

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[127] See Schmidt (1995), p. 7.
[128] See Barry (1994), p. 12.
[129] For papers on the relationship between the venture capitalist and his fund providers, see, for example, Gompers and Lerner (1996) and Schmidt and Wahrenburg (2003).
[130] Hart and Holmström (1987), p. 73.
[131] See Hart (1995), pp. 21–23.

informational expertise leads to heterogeneous interests within the relationship. To limit these divergences in objectives, the principal creates appropriate incentive schemes for the agent and at the same time incurs *agency costs* in the form of monitoring or bonding costs or a reduction in welfare.[132] The principal's incentive schemes can be established to either induce the agent to disclose pre-contractual information (*adverse selection problem*) or to induce the agent to internalize the principal's objectives and adopt a compatible behavior (*moral hazard problem*).

In an *adverse selection* problem, the agent has private information on her characteristics or the quality of her project before the contract is signed. The principal knows that the agent or project can be any of several different characters or qualities but he cannot distinguish between them. To solve the problem, either the principal or the agent can take the initiative while the cost of information transfer is always borne by the agent: Under *screening*, the principal offers the agent a menu of contracts that will induce self-revelation by the agent of her private information through the choice of the contract maximizing her utility. The principal can then observe the agent's contract choice, which allows him to infer her private information. Under *signaling*, the agent sends out a signal observable by the principal before he offers the contract. The signal takes the form of a decision which the agent takes deliberately.[133]

A venture capital-specific adverse selection model is presented by Amit et al. (1990), who analyze the venture capitalists' screening problem in choosing the portfolio companies as well as the entrepreneurs' signaling behavior vis-à-vis the venture capitalists. They find that, in a pool of good and bad projects, only the entrepreneurs of bad projects agree to involve outside investors and that, under certain circumstances, entrepreneurs engage in a costly effort to convey their ability to the venture capital investors before the signing of the contract.[134]

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[132] See Jensen and Meckling (1976), p. 308.

[133] See Macho-Stadler and Pérez-Castrillo (2001), p. 11–12. An example for a signaling decision is a situation where the borrower can decide to finance part of the investment himself. This is shown in the financial contracting model by Leland and Pyle (1977), p. 371.

[134] See Amit et al. (1990), pp. 1232–1234. Further venture capital adverse selection models are, for example, Chan et al. (1990), and Hellmann (2002b).

In a *moral hazard* problem, principal and agent have symmetric information at the time of contracting. After the contract has been signed, however, the agent takes an action which is costly and affects the principal's welfare. In the *hidden action* case her action is unobservable by the principal. In the *hidden information* case her action is observable but the underlying information is private.[135] To incentivize the agent not to behave opportunistically, for example by shirking, perk consumption, cheating, excessive risky taking, over-investing, or under-investing,[136] the principal can either monitor the agent or define an optimal remuneration mechanism. A risk-neutral agent prefers a remuneration mechanism that pays her a wage linear in her observed productivity. A risk-averse agent prefers a fixed wage. Yet this does not motivate her to take the optimal action. A combination of fixed wage and variable bonus solves this trade-off between optimal incentive and complete insurance.[137]

In the literature, the moral hazard problem is extended to contracting with several agents, information asymmetry with respect to more than one variable, repeated interactions, and double moral hazard.[138] Under *double moral hazard*, the principal also participates in the production process, that is, his action also contributes to the social welfare and is costly and unobservable by the agent. Incentive problems therefore also emanate from the venture capitalist.[139]

A venture capital-specific moral hazard model on the overinvestment problem is presented by Admati and Pfleiderer (1994). They analyze the problem of optimal continuation and investment decisions in a multistage contracting problem. They show that the entrepreneur will not disclose her private information but will over-invest if she chooses to continue and the project is financed by an uninformed outside investor instead of a venture capital

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[135] Hart and Holmström (1987) point out that the hidden action case can formally be shown to include the hidden information case. See Hart and Holmström (1987), p. 76.

[136] Myers (1977) argues that shareholders in a firm will under-invest in situations where risky holders of debt benefit. At the same time, the shareholder in a firm will over-invest in situations where he does not provide the financing but benefits. See Myers (1977), p. 149.

[137] See Macho-Stadler and Pérez-Castrillo (2001), p. 9, and Holmström (1979), p. 89.

[138] See Brousseau and Glachant (2002), p. 10.

[139] See Kim and Wang (1998), p. 342.

investor.[140] Schmidt (2003) presents a double moral hazard model where the efforts by the venture capitalist and the entrepreneur both contribute substantially to the success of the project but are both unobservable. Convertible securities are shown to endogenously solve this double moral hazard problem.[141]

Under heterogeneous preferences, the first-best solution is attained if the principal can observe the agent's action at no cost and order her to choose the efficient action. Under heterogeneous interests and asymmetric information, however, only the second-best solution is realized. Asymmetric information encourages opportunistic behavior, which causes agency costs in the form of non-efficient actions.[142] For double moral hazard situations, first-best and second-best solutions are commonly defined to achieve the maximum aggregate utility attainable.

4.2.3 Theory of Incomplete Contracts

Incomplete contract theory is a recent branch of contract theory originating from the work by Grossman and Hart (1986). They challenge the assumption that contracts are complete, accounting for all contingencies that might affect the contractual relationship. Writing *complete contracts* is, on the one hand, almost impossible due to the parties' bounded rationality and, on the other hand, very costly in terms of time and legal fees. Furthermore, complete contracting is impossible in a highly complex world, in which a court of law cannot verify the action or any other contracted variable ex post and thus cannot settle disputes on the issue. The same caveat applies in situations where the parties' actions or

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[140] See Admati and Pfleiderer (1994), p. 372. Further venture capital moral hazard models are, for example, Cornelli and Yosha (2002) and Trester (1998) on the overinvestment problem and Bergemann and Hege (1998) on the underinvestment problem. See Pytlik (2003), p. 69.

[141] See Schmidt (2003), p. 1140. Further venture capital double moral hazard models are, for example, Casamatta (2003) and Repullo and Suarez (2004); combined double adverse selection and double moral hazard models are presented in, for example, Houben (2002) and Hirsch (2005).

[142] See Salanié (1997), pp. 108–109. Under heterogeneous interests and asymmetric information, the first-best solution can be reached in the special case where the agent is risk-neutral and has limited liability. This does not hold if the agent is risk-averse. See Laffont and Martimort (2002), pp. 154–156.

other contracted variables are unobservable and to situations where the optimal actions depend on the realization of a state of the world, on which only one party is privately informed.[143] While uncertainty therefore arises from non-verifiability of contracted variables, the parties are assumed to be symmetrically informed, other than in agency models.

Grossman and Hart (1986) focus on relationship-specific investments by the contracting parties, especially on investments in human capital. Assets resulting from these investments are also relationship-specific and are not valuable outside the relationship. The investments are thus sunk and the parties locked in. During the relationship, some unforeseen contingencies may arise which affect the relationship to such an extent that the parties will want to renegotiate the contract. While renegotiation results in an efficiency loss under complete contracting, it may be socially useful under incomplete contracting.[144] However, if the agents anticipate ex-post renegotiation, they will no longer have an incentive to efficiently invest ex ante. Therefore, the scope of ex-post negotiations needs to be constrained. Instead, ex-ante binding governance mechanisms or structures based on ownership rights need to be defined. In this situation, it is optimal for one party to purchase the residual ownership rights, while the interests of the other party are protected by default option.[145]

Nevertheless, the first-best solution is not attainable. Under heterogeneous interests and non-verifiability, only the second-best solution is realized. The principal can only observe a variable correlated with the agent's action. This induces the agent to choose a sufficient action at the lowest cost. This action is generally not optimal.[146]

In the context of relationship-specific investments, the *hold-up* problem may arise. After the non-verifiable relationship-specific investments have been undertaken, both parties fear an unfair division of their joint project's surplus

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[143] See Schmidt (1995), p. 8.
[144] See Salanié (1997), pp. 175–176.
[145] See Grossman and Hart (1986), p. 692, and Schweizer (1999), pp. 6–7.
[146] See Salanié (1997), pp. 108–109.

and are therefore tempted to improve their situation. They choose to under-invest by renegotiating or behaving opportunistically. This, however, reduces their total welfare.[147]

A venture capital-specific model on the hold-up problem is presented by Neher (1999). In the model, staged financing is endogenously explained as the solution to the following hold-up problem. After the venture capitalist has sunk his investment, substantial bargaining power accrues to the entrepreneur. She can then make use of her bargaining power in renegotiations and thereby improve her position. If the venture capitalist anticipates this behavior, he will not agree to invest ex ante if his outcome from renegotiation does not cover his claims. Neher (1999) shows that, by agreeing to a staging of the venture capitalist's commitments, the entrepreneur can credibly signal that she will not enter into renegotiations.[148]

4.2.4 Game Theory

Game theory is the methodological foundation of contract theory. Similar to contract theory, it analyzes the strategic interaction of a small group of decision-makers. For this purpose, it uses mathematics to formally express its ideas.[149] However, while contract theory adopts the analytical tools provided by game theory, it differs significantly: In game theory, the form of the game is exogenous; in contract theory, the form of the game or contract is endogenous and chosen by the contracting parties to solve incentive problems. Nevertheless, game-theoretical and contract-theoretical models are set up similarly. This is demonstrated by the following overview of the essential elements of a game.[150]

- *Players* are the decision-makers in the game. They take their decisions such as to maximize their utility.

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147 See Schweizer (1999), p. 186.
148 See Neher (1999), pp. 255–274. For another model on hold-up in a venture capital context, see Bigus (2002).
149 See Holler and Illing (2000), p. 1, and Osborne and Rubinstein (2001), pp. 1–2.
150 See Rasmusen (2001), pp. 22–27, 33.

- *Nature* is not a player in the game. Nevertheless, it influences the game with its random actions that take place with specified probabilities at specified dates in the game.
- *Actions* or moves are the choices the players can make.
- *Information sets* reflect the players' knowledge of certain variables, which they acquire at specified dates in the game.
- *Strategies* are rules for the players specifying which actions they choose based on their information sets.
- *Payoffs* stand for the (expected) utility a player receives.
- *Equilibria* are combinations of strategies, at which each player follows his best strategy. An example is the Nash equilibrium, at which no player has an incentive to deviate from his strategy as long as the other players do not deviate.

Besides these essential elements of games, it is important to also introduce the concepts of (weakly) dominant strategies and Pareto-efficiency. These concepts are used later in the model.[151]

A *dominant strategy* is a strategy representing a player's best response, no matter which strategies the other player chooses. In a *strictly dominant* strategy, the player always receives his highest payoff; in a *weakly dominant* strategy, the player's payoff is no smaller than with any other strategy combination but higher with at least one strategy combination.[152] This concept is later adapted to the context of venture capital contracting.

Pareto-efficiency of a strategy combination implies that no other strategy combination increases the payoff of one player without decreasing that of another player. A strategy combination is therefore said to *Pareto-dominate* another strategy combination if it is preferred by all players.[153] This concept is also later adapted to the context of venture capital contracting.

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[151] See Rasmusen (2001), pp. 28, 31, 34–35.
[152] See Rasmusen (2001), pp. 28, 31.
[153] See Rasmusen (2001), pp. 34–35.

4.3 The Model

4.3.1 Setup

The model's setup introduces the necessary definitions on the project, the states of nature, the agents, and the timing and information structure. The definitions are supported by real-world phenomena presented in the form of stylized facts and additional standard assumptions. Finally, incentive properties of venture capital contracts are identified based on which augmented contracting patterns are be compared.

4.3.1.1 Project and States of the World

A venture capitalist A and an entrepreneur B contractually agree to realize a potentially profitable project. This project requires a fixed initial venture capital investment $I > 0$ at the start-up stage.[154] At the end of the contracted investment period, it generates a return $P(a,b,\lambda,\theta)$ which depends on the effort provided by the venture capitalist $a \in \mathbb{R}_0^+$, the effort provided by the entrepreneur $b \in \mathbb{R}_0^+$, the relative productivity of the venture capitalist $\lambda \in]0,1[$, and the profitability of the project $\theta \in \mathbb{R}_0^+$. Similar to Repullo and Suarez (2004), the final return is defined as the product of the project's profitability θ and probability of success $p(a,b,\lambda)$.[155]

$$P(a,b,\lambda,\theta) = \theta\, p(a,b,\lambda) \tag{4.1}$$

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[154] The entrepreneur requires external financing because she is wealth-constrained before the venture capitalist commits to the project. While banks are reluctant to lend money to entrepreneurial projects, venture capitalists usually have specific expertise in financing innovative projects. For this reason, the project is most likely to obtain venture capital financing. However, once the initial investment has been made and the project started, the entrepreneur participates in project returns. As a result, her initial wealth constraint is resolved. See Casamatta and Haritchabalet (2003), p. 4.

[155] See Repullo and Suarez (2004), p. 79.

The probability of success $p(a,b,\lambda)$ is defined as a linearly homogeneous Cobb-Douglas production function[156] where the sum of the two exponents, the relative productivity of the venture capitalist λ and that of the entrepreneur $(1-\lambda)$, is equal to one.

$$p(a,b,\lambda) = a^{\lambda} b^{1-\lambda} \tag{4.2}$$

Under this specification, returns to a single input a or b are decreasing because the exponents are limited to $\lambda \in]0,1[$ and returns to scale are constant: If both inputs a and b are increased by a factor n, the probability of success also increases by a factor n. While this specification is therefore realistic in this setting, it is furthermore mathematically tractable.

The profitability of the project θ represents the quality of the project, that is, the underlying business opportunity in the form of a product, a design, or a patent, and market conditions.[157]

Stylized Fact 1: *(States of the World).* There exist two cut-off values for $\theta \in \mathbb{R}_0^+$, $\underline{\theta}$ and $\overline{\theta}$ with $\underline{\theta} < \overline{\theta}$, which determine three states of the world such that

(i) if $\theta \leq \underline{\theta}$, the project is in the low state of the world Θ_L,

(ii) if $\underline{\theta} < \theta \leq \overline{\theta}$, the project is in the medium state of the world Θ_M,

(iii) if $\theta \geq \overline{\theta}$, the project is in the high state of the world Θ_H.

These three states of the world, similarly defined in Schmidt (2003), rely on empirical findings by Sahlman (1990) and Ruhnka et al. (1992).[158] Both analyses distinguish between three differently performing types of investments. In a sample of 383 investments by 13 US venture capital companies from 1969 to 1985, Sahlman (1990) finds that 15.7% of investments realized a return of

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[156] Chemla et al. (2003), instead, specify the return of the project as a Leontief production function. See Chemla et al. (2003), p. 5.

[157] See Schmidt (2003), p. 1143, and Repullo and Suarez (2004), p. 79.

[158] See Schmidt (2003), p. 1149, Sahlman (1990), p. 484, and Ruhnka et al. (1992), p. 143.

five to ten times the initial capital invested, 49.8% realized a return of up to five times the initial capital invested, and 34.5% of investments were partial or total losses. Ruhnka et al. (1992) present a survey conducted among 80 US venture capital companies with a total of 3,418 investments in 1988. When asked to classify their portfolio companies into "winners", "living dead", and "losers" with respect to unspecified rates of return, investment managers classified 55.2% of their investments as winners, 20.6% as "living dead", and 20.6% as "losers". The model by Schmidt (2003) summarizes these findings by grouping venture capital companies as "high flyers", "living dead", and "write-offs", directly relating these states of performance to a high, a medium, and a low state of the world. This approach is adopted in Stylized Fact 1 and the subsequent definitions.

The first cut-off value $\bar{\theta}$ is the value of the profitability of the project θ where the venture capitalist is indifferent between a "high flyer" and a "living dead" investment. It is realistic to assume that the venture capitalist wishes to participate in the project's upward potential in the high state of the world Θ_H and to protect his downside in the medium state of the world Θ_M. Therefore, the venture capitalist at this point is indifferent between a straight equity contract and a straight debt contract. To determine $\bar{\theta}$, the venture capitalist's payoffs under both contracts are equated. The payoffs are explained in detail in the subsequent sections, specifically in equations (4.21), (4.29), and (4.53). e_A and e_B represent the parties' cost parameters and are introduced in the next section.

$$\frac{1}{2}\theta^2\alpha(2-\lambda)\left((1-\alpha)(1-\lambda)e_B\right)^{1-\lambda}\left(\lambda\alpha e_A\right)^{\lambda} - I = rI - I \tag{4.3}$$

Solving for θ, the cut-off value is then given by the following expression

$$\bar{\theta} = \sqrt{\frac{2R}{\alpha(2-\lambda)\left((1-\lambda)(1-\alpha)e_B\right)^{1-\lambda}\left(\alpha\lambda e_A\right)^{\lambda}}} > 0, \tag{4.4}$$

with $R \equiv rI$. R represents the redemption payment the venture capitalist receives upon execution of his redemption option, and r represents the cumulated interest or the cumulated dividend on the initial investment I paid to the venture capitalist as debtholder or holder of preferred equity. The variables e_A and e_B relate to the contracting parties' cost functions and will be introduced in the next section.

The second cut-off value $\underline{\theta}$ is the value of the probability of the project θ in the low state Θ_L, where $\theta \leq \underline{\theta}$. It is defined by the lower boundary for $\theta \in \mathbb{R}_0^+$

$$\underline{\theta} \equiv 0, \tag{4.5}$$

which narrows the definition of the low state Θ_L in Stylized Fact 1 down to $\theta = \underline{\theta}$. The profitability of the project θ is equal to zero for projects characterized as "write-offs". In this state, the initial investment therefore always exceeds the level of profitability, that is $I > \underline{\theta}$.

Based on Stylized Fact 1, it is furthermore assumed for the cumulated interest or dividend payments rI and the redemption payment R that in the high state Θ_H and in the medium state Θ_M where the project is continued profitably or as a "living dead" investment

$$R \geq I \Rightarrow r \geq 1, \tag{4.6}$$

and in the low state Θ_L where the project is liquidated and written-off partially or totally

$$R < I \Rightarrow r < 1, \tag{4.7}$$

whereby the venture capitalist realizes a maximum loss amounting to his initial investment I.

4.3.1.2 Agents

The Cobb-Douglas specification of the probability of success $p(a,b,\lambda)$ captures the complementarity between the effort provided by the venture capitalist *a* and the effort provided by the entrepreneur *b*, which follows from Stylized Fact 2.

Stylized Fact 2: *(Venture Capitalist Support).*The effort of the venture capitalist a is vital for the joint realization of the project. For this reason, the probability of success is defined such that $p(a,b,\lambda)=0$ for $a=0$ and/or for $b=0$.

When starting up a company, the effort of the entrepreneur is a basic requirement. Empirical evidence shows that active support by the venture capital company is equally important. Besides the provision of capital, the venture capital company supports the entrepreneur with financial, strategic, management, administrative, and marketing expertise, industry-specific knowledge, and a network of contacts. [159] Occasionally, its investment managers are even involved in the day-to-day business of the venture. [160] Kaplan and Strömberg (2003) find that venture capital contracts are written in such a way that the investor obtains full control if the company performs poorly but that these rights are relinquished as performance improves.[161] Hellmann and Puri (2000) analyze the relationship between venture capital financing and a product's time to market and show that venture capital-backed companies bring their products to market faster than non-venture capital-backed companies.[162] Similarly, Kortum and Lerner (2000) examine the relationship between venture capital financing and innovation and identify a positive and significant effect of venture capital activity on industry patenting rates.[163] This is

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[159] Cumming et al. (2005) empirically analyze the effect of different value-added activities by venture capital companies on their fundraising performance. They find that venture capital companies providing mainly strategic/management and financial advice raised relatively more capital than venture capital companies providing mainly administrative and marketing advice. See Cumming et al. (2005), pp. 327–328.

[160] See Sahlman (1990), p. 508, and Schmidt (2003), p. 1148.

[161] See Kaplan and Strömberg (2003), p. 282.

[162] See Hellmann and Puri (2000), p. 962.

[163] See Kortum and Lerner (2000), p. 691.

an indication that venture capital companies play an active and supportive role for their portfolio companies.

In this model, Stylized Fact 2 is extended beyond the necessity of the venture capitalist's support for the success of the project to also capture the necessity of both parties' simultaneous efforts in the continuation of the project. Therefore, if both parties choose to invest zero effort, that is, $a = b = 0$, the project is bound to fail any time after execution of the contract. As a result, it is discontinued in the long run. Discontinuation of the project, however, conflicts with the entrepreneur's super-ordinate goal of project continuation:

Stylized Fact 3: *(Project Continuation)*. The entrepreneur's super-ordinate goal is to ensure project continuation in the high and medium states of the world Θ_H and Θ_M. For the project to be continued, it has to hold for $\theta > \underline{\theta}$ that

$$a \neq 0 \vee b \neq 0 .$$

The venture capitalist's goal is to exit the company profitably after a holding period of approximately five to ten years or to end the investment as soon as it arrives at the "living dead" and liquidation cases. The entrepreneur in his striving for economic independence aims at continuing the portfolio company in the long-term. This conflict of interest between the contracting parties has been named the "horizon" problem by Brettel et al. (2001).[164] It becomes especially apparent in the "living dead" state, where the portfolio company maintains a positive cash flow and meets its debt contracts but is not profitable enough to fulfil the venture capitalist's return expectations or its equity contracts.[165] The venture capitalist therefore wishes to exit or end the investment in order to reduce his (potential) losses. The entrepreneur invests in increasingly risky projects; her behaviour is known as "gambling for resurrection".[166] These observations emphasize the entrepreneur's super-ordinate goal to continue the project in the long-term, as expressed in Stylized Fact 3.

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[164] See Brettel et al. (2001), pp. 10–11.
[165] See Ruhnka et al. (1992), p. 145.
[166] See Gebhardt and Schmidt (2002), p. 243.

The agents' objective functions are defined as follows. The venture capitalist chooses his effort *a* such that he maximizes his final wealth in the form of a share $\alpha \in]0,1[$ of the final return $P(a,b,\lambda,\theta)$ or any fixed transfer payment in the form of a cumulated interest or dividend payment – depending on the contract components and the state of the world – net his disutility of effort $C_A(a)$, where e_A is a cost parameter with $e_A > 0$.

$$C_A(a) = \frac{a^2}{2e_A} \tag{4.8}$$

If covenants are included in the contract, the venture capitalist can influence his and the entrepreneur's payoff by choosing to exercise his redemption or liquidation option. He then obtains a fixed redemption payment or liquidation preference net his disutility of effort $C_A(a)$.[167]

The entrepreneur chooses his effort *b* as to maximize his final wealth in the form of a share $(1-\alpha) \in]0,1[$ of the final return $P(a,b,\lambda,\theta)$ and/or private benefits of control $CB(b,\lambda,\theta)$ net fixed transfer payments resulting from the venture capitalist's redemption or liquidation option exercise and his disutility of effort $C_B(b)$, where e_B is a cost parameter with $e_B > 0$.

$$C_B(b) = \frac{b^2}{2e_B} \tag{4.9}$$

Both agents' shares of return, α and $(1-\alpha)$, are defined in such a way that neither party receives the entire return while both parties are actively involved in the project, as stipulated by Stylized Fact 2. Furthermore, the parties are restricted from holding equal shares in the project so that one party is in control of the project. Taken together, this implies that $\alpha \in]0,\frac{1}{2}[\cup]\frac{1}{2},1[$.

[167] Conversion provisions are automatically included in the definition of convertible securities.

The entrepreneur's private benefits of control $CB(b,\lambda,\theta)$ are defined to closely resemble the Cobb-Douglas specification of the project's return excluding the effort of the venture capitalist *a* because this specification no longer needs to capture the complementarity of the parties' efforts.

Stylized Fact 4: *(Private Benefits of Control).* Private benefits of control accrue to the entrepreneur if she is the sole owner of the company. They are determined by the profitability of the project θ as well as the effort *b* and relative productivity λ of the entrepreneur and given by

$$CB(b,\lambda,\theta) = \theta b^{1-\lambda}.$$

This definition relies on findings from the existing literature. Private benefits of control have been defined as a non-monetary non-transferable element in the controlling party's payoff, which is neither observable nor verifiable by third parties.[168] They accrue to the person in control proportionally to the total revenues or final return of his project and depend on his ability.[169] Jensen and Meckling (1976) describe private benefits of control as "the utility generated by various non-pecuniary aspects of [the owner-manager's] entrepreneurial activities such as the physical appointments of the office, the attractiveness of the secretarial staff, the level of employee discipline, the kind and amount of charitable contributions, personal relations [...] with employees, a larger than optimal computer to play with, purchase of production inputs from friends, etc."[170] According to Black and Gilson (1998), private benefits of control are a standard feature in models on incentive properties of capital structure (Grossman and Hart (1988), Harris and Raviv (1988)) and in venture capital models (Berglöf (1994), Marx (1998)).[171]

In this model, the above definition of private benefits of control is – for reasons of simplification – reduced to the special case where the entrepreneur is the

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[168] See Marx (1998), p. 374, and Dyck and Zingales (2001), pp. 2–6.
[169] See Aghion and Bolton (1992), p. 481, Stein (2002), p. 1896, and Harris and Raviv (1991), p. 320.
[170] Jensen and Meckling (1976), p. 312.
[171] See Black and Gilson (1998), p. 258.

sole owner of the project instead of the controlling party. The underlying assumption is that the entrepreneur's control benefits are disproportionately higher where she is the sole owner because this resembles her aspired state of economic independence, as mentioned in the explanation of Stylized Fact 3. Finally, despite the fact that this model focuses exclusively on cash flow rights, control benefits are included for the following reason brought forward by Baker and Gompers (1999): Cash flow and control rights can be allocated separately but, in practice, managerial incentives derive from equity ownership.[172]

4.3.1.3 Timing and Information Structure

The relationship between the venture capitalist and the entrepreneur is modeled similar to Schmidt (2003).[173]

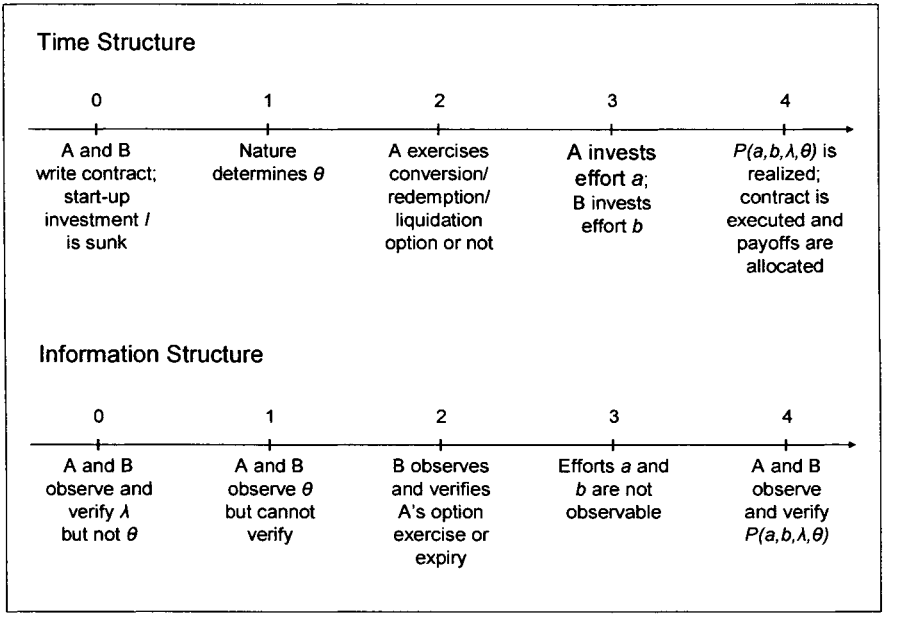


Figure 4-1: Time and Information Structure of the Model

[172] See Baker and Gompers (1999), p. 1.
[173] See Schmidt (2003), p. 1143–1144. For an illustration of the time structure of the model, see Figure 4-1.

At date 0, the venture capitalist and the entrepreneur negotiate and sign an incomplete contract governing their relationship. Due to ex-post informational asymmetries arising from the problem of double moral hazard with hidden action, this contract is not conditioned on the actions of the involved parties but on the consequences of their actions.[174] The contract therefore determines the sharing rules for the potential final return of the project rather than their required efforts a and b. The fixed relative productivities of both parties, λ and $(1-\lambda)$, are observable and verifiable. Verifiable information can be presented before a court of law. The court can then verify if a breach of contract has taken place and demand that the contract is fulfilled.[175] The parties' relative productivities are thus contractible. The state of the world θ, however, is unknown to both parties at this state, and thus not contractible. After the signing of the contract, the venture capitalist's relationship-specific initial investment I is sunk. At date 1, the state of the world Θ_i with $i \in \{H,M,L\}$ is determined by nature and can now be observed but not verified by both parties. As a result, at date 2, the venture capitalist decides whether to exercise the contractual option(s) included in the contract, that is, the conversion, redemption, and/or liquidation option(s). His action is immediately observable and verifiable by the entrepreneur. At date 3, the venture capitalist invests his relationship-specific effort a associated with costs $C_A(a)$. Simultaneously, the entrepreneur invests her relationship-specific effort b associated with costs $C_B(b)$. At date 4, the final return of the project, which is observable and verifiable, is realized and split between both parties according to the sharing rules specified in the contract. Finally, any date after date 4, the project is either continued or discontinued depending on the parties' effort choices at date 3.

[174] See Neff (2003), pp. 47–49, and Schmidt (1995), p. 8.
[175] See Brousseau and Glachant (2002), p. 9.

4.3.1.4 Assumptions

The following additional standard assumptions complete the setup of the model.[176]

Assumption 1: *(Risk-Neutrality).* The venture capitalist and the entrepreneur are both risk-neutral.

Risk-neutrality can be assumed for the venture capitalist because he holds a diversified portfolio of investments as well as for the entrepreneur because she is protected by limited liability.[177]

Assumption 2: *(Limited liability).* The venture capitalist and the entrepreneur are both protected by limited liability. They do not offer any collateral and thus their liability is limited to their undertaken efforts and investments as well as their final wealth, with that of the entrepreneur includes the initially received investment from the venture capitalist.

While limited liability usually requires payments to be non-negative as long as the return is zero,[178] it is extended for both parties to payments that amount to the initial investment by the venture capitalist I. The entrepreneur is given this investment to start up and develop the project and can therefore be made liable for this amount.

Assumption 3: *(No discounting).* The opportunity cost of funds – or the rate at which future cash flows are discounted – is normalized to zero.

This assumption is made purely for convenience and without loss of generality.[179]

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[176] Together with an assumption on the entrepreneur's wealth constraint, Schmidt (2003) includes the same assumptions in his model. See Schmidt (2003), pp. 1142–1144. For information on the wealth constraint assumption in this model, see Footnote 154.

[177] See Hirsch (2005), p. 29.

[178] See Repullo and Suarez (2004), p. 8.

[179] See Admati and Pfleiderer (1994) ,p. 380.

4.3.1.5 Contract Properties

In the simultaneous double moral hazard model, contracts cannot be analyzed as to whether they incentivize the contracting parties to invest first-best efficient efforts. Therefore, in the second-best world, three incentive properties of contracts are introduced based on which augmented contracting patterns are compared.

Contract Property 1: *(Utility Magnitude).* The parties derive their utility from the payoffs they are allocated by contract. A contract is defined to *(weakly)* dominate another contract if and only if the level of utility of the venture capitalist and *(or)* the entrepreneur in all states of the world *(at least one state of the world)* is higher than under the other contract *(while it remains the same in all other states).*

Comparing the parties' levels of utility incorporates the efforts invested by the contracting parties. The cost of effort provision is deducted from their share of the final return or fixed transfer payments they receive.

Contract Property 2: *(Long-Term Project Continuation).* Not liquidation but continuation of the project in the long run, that is, after the end of the venture capitalist's investment horizon, is the super-ordinate goal of the entrepreneur. The entrepreneur is thereby considered as a strategic rather than a financial initiator of and investor in the project.

As explained by Stylized Fact 3, it is the entrepreneur's super-ordinate goal that the project is continued after the end of venture capitalist's investment period.

Contract Property 3: *(Pareto-Efficiency of Option Exercise).* A contract after option exercise through the venture capitalist is defined to be Pareto-efficient if, by exercising his option, the venture capitalist increases his payoff without at the same time decreasing that of the entrepreneur. This property is an important incentive for the entrepreneur because, under a Pareto-efficient option contract, the entrepreneur will always agree with and thus back the venture capitalist's decision to exercise his option.

Options included in venture capital contracts constitute the most important determinants of the parties' payoffs. These are redefined after option exercise. Therefore, in augmented contracting analysis, the incentive effects, especially on the party not owning the option, need to be considered.

4.3.2 Contract Analyses

Based on the setup, this section first presents the socially first-best solution as reference case. It then analyzes and compares the incentive properties of standard straight equity, straight debt/preferred equity, and convertible securities contracts. In a next step, the underlying research question is addressed by focusing on straight equity contracts in combination with a redemption option for the venture capitalist.

4.3.2.1 Social First-Best Solution

4.3.2.1.1 Contract Setup

A first necessary step in evaluating contract design is to define a reference case. The reference point is determined by the first-best solution of the double moral hazard problem.

Starting point is the total social welfare $V_{A+B}(a,b,\lambda,\theta)$ created by the project and given by

$$V_{A+B}(a,b,\lambda,\theta) = U_A(\alpha,a,b,\lambda,\theta) + U_B(\alpha,a,b,\lambda,\theta) \\ = P(a,b,\lambda,\theta) - C_A(a) - C_B(b) - I \quad , \tag{4.10}$$

which increases linearly in the profitability of the project θ. The first-best efficient effort levels for the three states of the world are calculated below.

4.3.2.1.2 Contract Analysis

If efforts are observable, the first-best solution in a double moral hazard setting with risk-neutral agents is calculated as follows, with the subscript FB denoting the first-best solution:

$$\{a_{FB}, b_{FB}\} = \underset{\{a,b\}}{\operatorname{argmax}} V_{A+B}(a,b,\lambda,\theta) \tag{4.11}$$

where the venture capitalist maximizes

$$\underset{a}{\operatorname{argmax}} V_{A+B}(a,b,\lambda,\theta) \tag{4.12}$$

and the entrepreneur maximizes

$$\underset{b}{\operatorname{argmax}} V_{A+B}(a,b,\lambda,\theta) . \tag{4.13}$$

In the high and medium states Θ_H and Θ_M, the first-order conditions are

$$a = \left(b^{1-\lambda}\theta\lambda e_A\right)^{\frac{1}{2-\lambda}} \tag{4.14}$$

and

$$b = \left(a^{\lambda}\theta(1-\lambda)e_B\right)^{\frac{1}{1+\lambda}} . \tag{4.15}$$

Both reaction functions increase and are convex in the respective other party's effort and in the profitability of the project θ.

Solving the reaction functions for the values of *a* and *b* yields the equilibrium first-best efforts

$$a_{FB} = \theta\left((1-\lambda)e_B\right)^{\frac{1-\lambda}{2}}\left(\lambda e_A\right)^{\frac{1+\lambda}{2}} \tag{4.16}$$

and

$$b_{FB} = \theta\left((1-\lambda)e_B\right)^{1-\frac{\lambda}{2}}\left(\lambda e_A\right)^{\frac{\lambda}{2}}, \tag{4.17}$$

which are independent of the respective other party's effort as well as any sharing rule α and increase linearly in θ.

The following second-order conditions hold:

$$\begin{aligned}\frac{\partial^2 V_{A+B}(a,b,\lambda,\theta)}{\partial a^2} &= a^{\lambda-2}b^{1-\lambda}\theta(\lambda-1)\lambda - \frac{1}{e_A} \\ &= \frac{-2+\lambda}{e_A} < 0\end{aligned} \tag{4.18}$$

and

$$\begin{aligned}\frac{\partial^2 V_{A+B}(a,b,\lambda,\theta)}{\partial b^2} &= a^{\lambda}b^{-1-\lambda}\theta(\lambda-1)\lambda - \frac{1}{e_B} \\ &= -\frac{1+\lambda}{e_B} < 0\end{aligned}. \tag{4.19}$$

As shown by equations (4.14)–(4.19), the first-best solution $\left(a_{FB}, b_{FB}\right)$ is a unique and socially efficient effort combination.

The total social welfare of the project increases concavely in θ and is given by

$$V_{A+B}\left(a_{FB}, b_{FB}, \lambda, \theta\right) = \frac{1}{2}\theta^2\left((1-\lambda)e_B\right)^{1-\lambda}\left(\lambda e_A\right)^{\lambda} - I. \tag{4.20}$$

Despite the fact that the same equations for the efforts, objective functions, and total social welfare apply in the medium state as in the high state, their values are lower due to a lower θ with $\bar{\theta} \geq \theta > \underline{\theta} = 0$.

In the low state of the world Θ_L where $\theta = \underline{\theta} = 0$ and thus $P(a,b,\lambda,\theta) = 0$, the parties' efforts are zero $a_{FB} = b_{FB} = 0$ and the total social welfare is negative with $V_{A+B}(a_{FB}, b_{FB}, \lambda, \theta) = -I$.

4.3.2.1.3 Summary

In the first-best equilibrium, the venture capitalist and the entrepreneur choose their equilibrium efforts, which maximize the sum of their utilities or total social welfare of their project independent of the contractually defined sharing rule. The equations determining the total social welfare and their equilibrium efforts are the same across the high and medium states of the world. With lower values for the profitability of the project in the medium state, however, the efforts and utilities in this state are smaller because they decrease with diminishing profitability of the project. In the low state, both parties do not invest any effort, and the total social welfare of the project is negative.

In the discrete models by Schmidt (2003) and Hirsch (2005), the investments by the entrepreneur and the venture capitalist are defined to be undertaken sequentially. Because of the sequential nature of investments, the authors can show that a convertible securities contract can implement first-best investment incentives. In this model, however, the simultaneous nature of investments does not allow for any contract to reach first-best investment levels.[180]

[180] See Schmidt (2003), pp. 1144, 1158, Hirsch (2005), p. 8, and Laffont and Martimort (2002), pp. 153–158.

Proposition 1: *(Second-Best Efficiency of Efforts).* If efforts are unobservable, that is, at the second-best equilibrium, none of the contracts analyzed below induce both parties to invest first-best efficient efforts.

Proof of Proposition 1: *The proof follows from the subsequent contract discussions in Sections 4.3.2.2–4.3.2.4.*

Setting up this model in the second-best world, as Schmidt (2003) also suggests, makes it possible to analyze in a more realistic simultaneous investment setting which contracts at least weakly outperform other contracts in terms of all three contract properties: utility magnitude, long-term project continuation, and Pareto-efficiency of option exercise.[181]

4.3.2.2 Straight Equity Contract

4.3.2.2.1 Contract Setup

Under a straight equity contract, the objective functions for the venture capitalist and for the entrepreneur are defined such that both parties receive a fixed share α and $(1-\alpha)$ in the final return upon execution of the contract. They are defined as follows, with the superscript SE denoting the straight equity contract and the subscript SB denoting the second-best solution:

$$U_A^{SE}(\alpha,a,b,\lambda,\theta) = \alpha P(a,b,\lambda,\theta) - C_A(a) - I \tag{4.21}$$

and

$$U_B^{SE}(\alpha,a,b,\lambda,\theta) = (1-\alpha)P(a,b,\lambda,\theta) - C_B(b). \tag{4.22}$$

As a result of this specification, the objective functions increase linearly in the profitability of the project θ. Furthermore, they increase and are convex in the respective other party's effort.

[181] See Schmidt (2003), p. 1158.

As in the social first-best setup, the total social welfare generated by the project is given by

$$\begin{aligned} V_{A+B}^{SE}(a,b,\lambda,\theta) &= U_A^{SE}(\alpha,a,b,\lambda,\theta)+U_B^{SE}(\alpha,a,b,\lambda,\theta) \\ &= P(a,b,\lambda,\theta)-C_A(a)-C_B(b)-I \end{aligned} \tag{4.23}$$

and also increases linearly in θ.

4.3.2.2.2 Contract Analyses

4.3.2.2.2.1 Analysis of Θ_H

In the high state of the world Θ_H, the objective function of the venture capitalist is given by $U_A^{SE}(\alpha,a,b,\lambda,\theta) \geq R-I \geq 0$, which results from the above definition of $\overline{\theta}$ in equation (4.4) and the fact that it holds that $R-I \geq 0$ in this state.

If efforts are not observable, the second-best solution in a double moral hazard setting with risk-neutral agents is calculated as follows:

$$\alpha_{SB}^{SE} = \underset{\alpha}{\operatorname{argmax}} V_{A+B}^{SE}(\alpha,a,b,\lambda,\theta) \tag{4.24}$$

subject to

$$a_{SB}^{SE} = \underset{a}{\operatorname{argmax}} U_A^{SE}(\alpha,a,b,\lambda,\theta) \tag{4.25}$$

and

$$b_{SB}^{SE} = \underset{b}{\operatorname{argmax}} U_B^{SE}(\alpha,a,b,\lambda,\theta). \tag{4.26}$$

The first-order conditions define the reaction functions

$$a = \left(b^{1-\lambda}\alpha\theta\lambda e_A\right)^{\frac{1}{2-\lambda}} \tag{4.27}$$

and

$$b = \left(a^{\lambda}(\alpha-1)\theta(\lambda-1)e_B\right)^{\frac{1}{1+\lambda}}. \tag{4.28}$$

Both reaction functions are increasing and convex in the respective other party's effort and in θ. Furthermore, the effort of the venture capitalist a is increasing and convex in his share of the final return α, whereas the effort of the entrepreneur b is decreasing and convex in α.

Solving the reaction functions for the values of a and b yields the equilibrium second-best efforts

$$a_{SB}^{SE} = \theta\left((1-\alpha)(1-\lambda)e_B\right)^{\frac{1-\lambda}{2}}(\alpha\lambda e_A)^{\frac{1+\lambda}{2}} \tag{4.29}$$

and

$$b_{SB}^{SE} = \theta\left((1-\alpha)(1-\lambda)e_B\right)^{1-\frac{\lambda}{2}}(\alpha\lambda e_A)^{\frac{\lambda}{2}}, \tag{4.30}$$

which are smaller than the efforts in the first-best equilibrium and increase linearly in θ. Furthermore, a_{SB}^{SE} is maximized at $\alpha = \frac{1+\lambda}{2} \Rightarrow \alpha > \frac{1}{2}$ where the venture capitalist holds a majority share in the project, and b_{SB}^{SE} is maximized at $\alpha = \frac{\lambda}{2} \Rightarrow \alpha < \frac{1}{2}$ where the entrepreneur holds a majority share in the project. The same applies for their objective functions.

The following second-order conditions hold:

$$\begin{aligned}\frac{\partial^2 U_A^{SE}(\alpha,a,b,\lambda,\theta)}{\partial a^2} &= a^{\lambda-2}b^{1-\lambda}\alpha\theta(\lambda-1)\lambda - \frac{1}{e_A} \\ &= -\frac{2+\lambda}{e_A} < 0\end{aligned} \tag{4.31}$$

and

$$\begin{aligned}\frac{\partial^2 U_B^{SE}(\alpha,a,b,\lambda,\theta)}{\partial b^2} &= -a^{\lambda}b^{-1-\lambda}(1-\alpha)\theta(1-\lambda)\lambda - \frac{1}{e_B} \\ &= \frac{-1-\lambda}{e_B} < 0\end{aligned} \tag{4.32}$$

If the parties invest first-best efforts, the objective functions and the total social welfare are increasing and concave in θ and defined by

$$U_A^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) = \frac{1}{2}\theta^2\alpha(2-\lambda)\left((1-\alpha)(1-\lambda)e_B\right)^{1-\lambda}\left(\lambda\alpha e_A\right)^{\lambda} - I \tag{4.33}$$

and

$$U_B^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) = \frac{1}{2}\theta^2(1-\alpha)(1+\lambda)\left((1-\alpha)(1-\lambda)e_B\right)^{1-\lambda}\left(\lambda\alpha e_A\right)^{\lambda} \tag{4.34}$$

and

$$V_{A+B}^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) = -\frac{1}{2}\theta^2\underbrace{\left(\alpha(2\lambda-1)-\lambda-1\right)}_{<0}\left((1-\alpha)(1-\lambda)e_B\right)^{1-\lambda}\left(\lambda\alpha e_A\right)^{\lambda} - I. \tag{4.35}$$

To finally solve the optimization problem, this total social welfare at the second-best equilibrium has to be maximized with regard to the sharing rule. It is determined only by the venture capitalist's share of the final return α, his relative productivity λ, and the profitability of the project θ, of which α is the only contractible variable. This implies that the optimization problem is reduced to

$$\alpha^{SE} = \arg\max_{\alpha} V_{A+B}^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right). \tag{4.36}$$

The first-order condition leads to

$$\alpha = \frac{\lambda + \lambda^2 - \sqrt{2\lambda - \lambda^2 - 2\lambda^3 + \lambda^4}}{2(2\lambda - 1)}. \tag{4.37}$$

Since α is indeterminate for $\lambda = \frac{1}{2}$, the case of equal productivities is excluded from the analysis.

The second-order condition

$$\frac{\partial^2 V_{A+B}^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right)}{\partial \alpha^2} < 0 \tag{4.38}$$

holds for

$$\alpha^3\left(4\lambda - 2\right) + \left(\alpha\lambda - 2\alpha^2\right)\left(2\lambda^2 + \lambda - 1\right) > 0\,, \tag{4.39}$$

which is fulfilled if

$$\underbrace{\frac{1+\lambda}{2} - \frac{\sqrt{1-\lambda^2}}{2}}_{\text{lower boundary for } \alpha} < \alpha < \underbrace{\frac{1+\lambda}{2} + \frac{\sqrt{1-\lambda^2}}{2}}_{\text{upper boundary for } \alpha} \quad \text{if } 0 < \lambda < \frac{1}{2} \tag{4.40}$$

and

$$0 < \alpha < \underbrace{\frac{1+\lambda}{2} - \frac{\sqrt{1-\lambda^2}}{2}}_{\text{lower boundary for } \alpha} \quad \text{and} \quad \alpha > \underbrace{\frac{1+\lambda}{2} + \frac{\sqrt{1-\lambda^2}}{2}}_{\text{upper boundary for } \alpha} \quad \text{if } \frac{1}{2} < \lambda < 1. \tag{4.41}$$

The reaction function and the sufficient conditions for a maximum of the total social welfare are shown in the graph below. The hatched areas show for which values of α the second-order condition holds, that is, the total social welfare is maximized. It thereby illustrates that the optimal contract allocates a minority share $0 < \alpha < \frac{1}{2}$ in the project's final return to the venture capitalist, who is allocated a share which is larger than his contributed productivity with $\alpha > \lambda$, especially for low values of λ.[182]

The economic reasoning behind his over-compensation lies in the fact that the venture capitalist not only contributes his support at the contracted productivity but also adds his capital to the project through the initial investment I. The additional profit share exceeding the situation where $\alpha = \lambda$ may therefore be interpreted as additional compensation for his direct financial commitment.

[182] For an illustration of the reaction function for α and the sufficient conditions, see Figure 4-2.

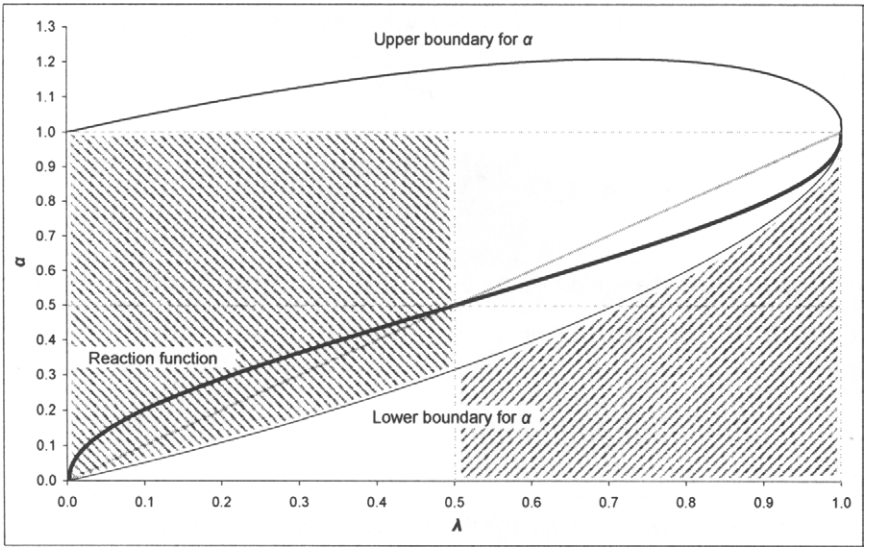


Figure 4-2: Reaction Function and Sufficient Conditions for the Optimal Equity Stake

Proposition 2: *(Optimal Straight Equity Sharing Rule).* If the project is not in the low state of the world, and if efforts are not observable, the optimal straight equity contract allocates a majority share of the final return to the entrepreneur and a minority share to the venture capitalist such that the venture capitalist is over-compensated and the entrepreneur under-compensated for their relative productivities.

Proof of Proposition 2: *The proof follows directly from the above argumentation.*

4.3.2.2.2.2 Analysis of Θ_M

In the medium state of the world Θ_M, the objective function of the venture capitalist is given as $U_A^{SE}(\alpha, a, b, \lambda, \theta) \leq R - I \geq 0$, which results from substituting the above definition of $\bar{\theta}$ in equation (4.4) and is not necessarily positive. Regarding the efforts, objective functions, and total social welfare, the same

equations as in the high state of the world Θ_H apply, but their values are lower due to a lower θ with $\overline{\theta} \geq \theta > \underline{\theta} = 0$.

4.3.2.2.2.3 Analysis of Θ_L

In the low state of the world Θ_L, the definition of $\underline{\theta}$ in equation (4.5), implies that $\theta = \underline{\theta} = 0$. From this follows that

$$P(a,b,\lambda,\theta) = P(a,b,\lambda,\underline{\theta}) = P(a,b,\lambda,0) = 0. \tag{4.42}$$

The parties' objective functions and the total social welfare reduce to

$$U_A^{SE}(a) = -C_A(a) - I \tag{4.43}$$

and

$$U_B^{SE}(b) = -C_B(b) \tag{4.44}$$

and

$$V_{A+B}^{SE}(a,b) = -C_A(a) - C_B(b) - I. \tag{4.45}$$

The first-order conditions define the reaction functions and equilibrium efforts

$$a = 0 \Rightarrow a_{SB}^{SE} = 0 \tag{4.46}$$

and

$$b = 0 \Rightarrow b_{SB}^{SE} = 0. \tag{4.47}$$

The equilibrium efforts are zero and thus smaller than in the other states of the world. This is in line with the above explanation of the low state of the world, in which the project is liquidated.

The following second-order conditions hold:

$$\frac{\partial^2 U_A^{SE}(a)}{\partial a^2} = -\frac{1}{e_A} < 0 \tag{4.48}$$

and

$$\frac{\partial^2 U_B^{SE}(b)}{\partial b^2} = -\frac{1}{e_B} < 0 . \tag{4.49}$$

The parties' objective functions and the total social welfare are therefore as follows:

$$U_A^{SE}\left(a_{SB}^{SE}\right) = -I \tag{4.50}$$

and

$$U_B^{SE}(b_{SB}^{SE}) = 0 \tag{4.51}$$

and

$$V_{A+B}^{SE}\left(a_{SB}^{SE}, b_{SB}^{SE}\right) = -I . \tag{4.52}$$

The objective functions are smaller than in the high and medium states of the world and demonstrate the limitation of both parties' liability to the initial investement I.

4.3.2.2.3 Summary

Under a straight equity contract, in the second-best equilibrium, the venture capitalist and the entrepreneur choose the equilibrium efforts which maximize their own utility functions. The optimal contract determines a sharing rule maximizing the total social welfare given the equilibrium efforts.

The equations determining the parties' utilities and equilibrium efforts are the same across the high and medium states of the world, but the values of the efforts and utilities are smaller in the medium state due to a lower profitability of the project. The utility of the venture capitalist is positive in the high state and

smaller but ambiguous in the medium state; that of the entrepreneur is positive in both states. The equilibrium efforts are smaller than those at the first-best equilibrium. The optimal sharing rule allocates a minority share to the venture capitalist.

In the low state of the world, the parties' objective functions are independent of the project's final return and decrease in the parties' efforts. For this reason, both parties choose not to invest any effort. This results in a loss amounting to his initial investment for the venture capitalist and a profit of zero for the entrepreneur. The parties' efforts and utilities are therefore smaller than in the high and medium states.

4.3.2.3 Straight Debt or Preferred Equity Contract

4.3.2.3.1 Contract Setup

Under a straight debt/preferred equity contract, the objective functions for the venture capitalist and for the entrepreneur are defined so that the venture capitalist is paid a fixed interest/dividend rI by the entrepreneur, who receives the entire final return. The maturity of the straight debt contract is the execution of the contract (date 4), not the conversion date (date 2). This accounts for the fact that the venture capitalist cannot exit his preferred shareholding unless he is granted an additional exit option. This assumption is relaxed later in Section 4.3.3.1, where the contract is extended to prior debt contract maturity. The objective functions are defined as follows, with the superscript SD denoting the straight debt/preferred equity contract:

$$U_A^{SD}(a) = rI - C_A(a) - I \tag{4.53}$$

$$U_B^{SD}(a,b,\lambda,\theta) = P(a,b,\lambda,\theta) - C_B(b) - rI \tag{4.54}$$

As a result of this specification, the objective function of the venture capitalist is independent of the profitability of the project θ and the effort of the

entrepreneur b. However, the objective function of the entrepreneur increases linearly in θ and convexly in the effort of the venture capitalist a.

The total social welfare generated by the project is then

$$\begin{aligned} V_{A+B}^{SD}(a,b,\lambda,\theta) &= U_A^{SD}(a) + U_B^{SD}(a,b,\lambda,\theta) \\ &= P(a,b,\lambda,\theta) - C_A(a) - C_B(b) - I \end{aligned} \tag{4.55}$$

and equals the function determining the total social welfare in the straight equity case $V_{A+B}^{SE}(a,b,\lambda,\theta)$, which increases linearly in θ.

4.3.2.3.2 Contract Analyses

4.3.2.3.2.1 Analysis of Θ_H and Θ_M

The objective function of the venture capitalist in the case of straight debt or preferred equity financing is independent of θ. For this reason, the contract achieves the same results across the high and medium states of the world Θ_H and Θ_M, where $U_A^{SD}(a) = (r-1)I \geq 0$ because $r \geq 1$ by definition.

If efforts are not observable, the second-best solution in a double moral hazard setting with risk-neutral agents is calculated as follows:

$$a_{SB}^{SD} = \underset{a}{\operatorname{argmax}} U_A^{SD}(a) \tag{4.56}$$

and

$$b_{SB}^{SD} = \underset{b}{\operatorname{argmax}} U_B^{SD}(a,b,\lambda,\theta). \tag{4.57}$$

The first-order conditions define the reaction functions

$$a = 0 \tag{4.58}$$

and

$$b = \left(a^{\lambda}\theta(1-\lambda)e_B\right)^{\frac{1}{1+\lambda}}. \tag{4.59}$$

The entrepreneur's reaction function is increasing and convex in the profitability of the project θ and the effort of the venture capitalist a.

Solving the reaction functions for the values of a and b yields the equilibrium second-best efforts

$$a_{SB}^{SD} = 0 \tag{4.60}$$

and

$$b_{SB}^{SD} = 0, \tag{4.61}$$

which are both equal to zero. This demonstrates the complementarity of both parties' efforts, where the entrepreneur does not invest any effort if the venture capitalist does not invest any effort. The project will therefore be discontinued after execution of the contract, as shown in Stylized Fact 3.

The following sufficient second-order conditions hold:

$$\frac{\partial^2 U_A^{SD}(a)}{\partial a^2} = -\frac{1}{e_A} < 0 \tag{4.62}$$

and

$$\begin{aligned}\frac{\partial^2 U_B^{SD}(a,b,\lambda,\theta)}{\partial b^2} &= a^{\lambda} b^{-1-\lambda}\theta(\lambda-1)\lambda - \frac{1}{e_B} \\ &= -\frac{1}{e_B} < 0\end{aligned}. \tag{4.63}$$

The parties' objective functions and the total social welfare at equilibrium are as follows:

$$U_A^{SD}\left(a_{SB}^{SD}\right) = (r-1)I \geq 0 \tag{4.64}$$

and

$$U_B^{SD}(a_{SB}^{SD}, b_{SB}^{SD}, \lambda, \theta) = -rI \tag{4.65}$$

and

$$V_{A+B}^{SD}\left(a_{SB}^{SD}, b_{SB}^{SD}, \lambda, \theta\right) = -I\,. \tag{4.66}$$

In both states of the world, the utility of the venture capitalist is nonnegative as $r \geq 1$, while that of the entrepreneur is negative. Due to the entrepreneur's limited liability introduced in Assumption 3, he can at a maximum repay the initially invested amount I. Therefore, the above only holds for $r = 1$. In this case, venture capitalist exits the project without a loss.

4.3.2.3.2.2 Analysis of Θ_L

In the low state of the world Θ_L, the definition of $\underline{\theta}$ in equation (4.5), implies that $\theta = \underline{\theta} = 0$. From this follows that

$$P(a,b,\lambda,\theta) = P(a,b,\lambda,\underline{\theta}) = P(a,b,\lambda,0) = 0\,. \tag{4.67}$$

While the objective function of the venture capitalist is independent of the project's final return and thus of its profitability θ with

$$U_A^{SD}(a) = rI - C_A(a) - I\,, \tag{4.68}$$

the objective function of the entrepreneur and the total social welfare reduce to

$$U_B^{SD}(b) = -C_B(b) - rI \tag{4.69}$$

and

$$V_{A+B}^{SD}(a,b) = -C_A(a) - C_B(b) - I\,, \tag{4.70}$$

which are also independent of θ. The total social welfare of the project equals that under a straight equity contract in the low state of the world.

The first-order conditions define the reaction and equilibrium efforts, which equal those under a straight equity contract in the low state of the world:

$$a = 0 \Rightarrow a_{SB}^{SD} = 0 \tag{4.71}$$

and

$$b = 0 \Rightarrow b_{SB}^{SD} = 0, \tag{4.72}$$

where the following second-order conditions hold:

$$\frac{\partial^2 U_A^{SD}(a)}{\partial a^2} = -\frac{1}{e_A} < 0 \tag{4.73}$$

and

$$\frac{\partial^2 U_B^{SD}(b)}{\partial b^2} = -\frac{1}{e_B} < 0. \tag{4.74}$$

The parties' objective functions and the total social welfare are therefore as follows:

$$U_A^{SD}\left(a_{SB}^{SD}\right) = (r-1)I < 0 \tag{4.75}$$

and

$$U_B^{SD}(b_{SB}^{SD}) = -rI > -I \tag{4.76}$$

and

$$V_{A+B}^{SD}\left(a_{SB}^{SD}, b_{SB}^{SD}\right) = -I. \tag{4.77}$$

Since in the low state of the world Θ_L it holds that $r < 1$, all three functions are negative.

The utilities of both parties are smaller than under a straight debt/preferred equity contract in the high and medium states of the world. The total social welfare remains negative and unchanged.

4.3.2.3.3 Summary and Comparison with the Straight Equity Contract

At the second-best equilibrium, the venture capitalist and the entrepreneur choose their equilibrium efforts maximizing their own utility functions. The venture capitalist's utility equals the fixed interest/dividend payment net his initial investment across all states of the world.

In the high state, the utility of the venture capitalist is positive and smaller than or equal to that under a straight equity contract. In the medium state, it is positive but higher than or equal to that under a straight equity contract. The utility of the entrepreneur equals the fixed interest/dividend payment to the venture capitalist. It is negative and smaller than that under straight equity financing. The equilibrium efforts are zero and smaller than those under a straight equity contract. As a result, the project is discontinued after the execution of the contract.

In the low state of the world, the utility of the venture capitalist is negative but higher than that under a straight equity contract. The utility of the entrepreneur is negative and smaller than that under straight equity financing. The equilibrium efforts are zero and thus the same for both contracts. A summary of the comparison between straight equity and straight debt/preferred equity contracts is displayed below:[183]

[183] For a comparison of a straight equity and a straight debt/preferred equity contract, see Table 4-1.

Contract Comparison			
Θ	Straight Equity Contract		Straight Debt/Preferred Equity Contract
Θ_H	$U_A^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) \geq R - I \geq 0$	$\geq$	$U_A^{SD}\left(a_{SB}^{SD}\right) = (r-1)I \geq 0$
Θ_M	$U_A^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) \leq R - I \geq 0$	$\leq$	$U_A^{SD}\left(a_{SB}^{SD}\right) = (r-1)I \geq 0$
Θ_H / Θ_M	$\left(a_{SB}^{SE}, b_{SB}^{SE}\right) \gg 0$	$>$	$\left(a_{SB}^{SD}, b_{SB}^{SD}\right) = (0,0)$
Θ_H / Θ_M	$U_B^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) > 0$	$>$	$U_B^{SD}\left(a_{SB}^{SD}, b_{SB}^{SD}, \lambda, \theta\right) = -rI < 0$
Θ_H / Θ_M	$V_{A+B}^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right)$	$>$	$V_{A+B}^{SD}\left(a_{SB}^{SD}, b_{SB}^{SD}, \lambda, \theta\right) = -I < 0$
Θ_L	$U_A^{SE}\left(a_{SB}^{SE}\right) = -I < 0$	$<$	$U_A^{SD}\left(a_{SB}^{SD}\right) = (r-1)I < 0$
Θ_L	$\left(a_{SB}^{SE}, b_{SB}^{SE}\right) = (0,0)$	$=$	$\left(a_{SB}^{SD}, b_{SB}^{SD}\right) = (0,0)$
Θ_L	$U_B^{SE}\left(b_{FB}^{SE}\right) = 0$	$>$	$U_B^{SD}\left(b_{SB}^{SD}\right) = -rI$
Θ_L	$V_{A+B}^{SE}\left(a_{SB}^{SE}, b_{SB}^{SE}\right) = -I < 0$	$=$	$V_{A+B}^{SD}\left(a_{SB}^{SD}, b_{SB}^{SD}\right) = -I < 0$

Table 4-1: Comparison of a Straight Equity and a Straight Debt/Preferred Equity Contract

The above findings can be summarized as follows. The venture capitalist prefers a straight equity contract in the high state, and a straight debt/preferred equity contract in the medium and low states. If he had the option to switch from one contract to the other, he would thus choose to participate in the project's upward potential, if he expected it to continue profitably, and to protect his downside in the "living dead" and liquidation cases. The entrepreneur prefers a straight equity contract to a straight debt/preferred equity contract across all states of the world. Since both parties favor a straight equity contract in the high state of the world, it can be said to strictly *dominate* a straight debt/preferred equity contract in terms of the venture capitalist's and the entrepreneur's utilities. This does not apply to the medium and low states, where the parties' contract preferences diverge. Finally, under a straight debt/preferred equity contract neither party invests any effort. In the long run or any time after execution of the contract, this will lead to the failure and *discontinuation* of the project in the high and medium states, as stipulated by Stylized Fact 2.

Proposition 3: *(Properties of Straight Equity Contracts and Straight Debt/Preferred Equity Contracts).* A straight equity contract strictly *dominates* a straight debt/preferred equity contract only in the high state of the world in terms of the venture capitalist's and the entrepreneur's utilities. Under a straight debt/preferred equity contract, the project will be *discontinued* after execution of the contract in the high and medium states of the world, but not under a straight equity contract.

Proof of Proposition 3: *The proof follows directly from the above argumentation and Table 4-1.*

4.3.2.3.4 Note on Combinations of Straight Equity and Straight Debt

A contract comprised of a combination of straight debt and straight equity pays the venture capitalist a share α in the final return of the project and a fixed cumulated interest dI with $r \geq d > 0$. By definition, similar to r, $d \geq 1$ in the high and medium states of the world, and $d < 1$ in the low state of the world. The superscript CED is used in the following to denote the combination of straight equity and straight debt.

Under a combination of straight equity and straight debt the equilibrium efforts of both parties equal those under a straight equity contract $\left(a_{SB}^{SE}, b_{SB}^{SE}\right)$. So does the total social welfare, but it is split differently between the contracting parties: The utility of the venture capitalist is higher than that under a straight equity contract across all states of the world because he receives a fixed payment from the entrepreneur on top of the straight equity contract. Due to this transfer payment, the entrepreneur's utility in return is smaller than that under a straight equity contract across all states of the world.

The venture capitalist's utility under a combination of straight equity and straight debt is higher than under a straight debt/preferred equity contract in the high and medium states if $d = r$ and otherwise ambiguous, and identical if $d = r$ and

otherwise smaller in the low state. At the same time, the utility of the entrepreneur is identical if $d = r$ and otherwise higher than that under a straight debt/preferred equity contract across all states of the world.

These findings can be summarized as follows. The venture capitalist prefers a combination of straight equity and straight debt to a straight equity contract and a straight debt/preferred equity contract only in the special case where the fixed cumulated interest/dividend payments are the same as in the straight debt/preferred equity contract $d = r$. The entrepreneur, however, prefers a straight equity contract to a combination of straight equity and straight debt, which he again prefers to a straight debt/preferred equity contract. Therefore, a combination of straight equity and straight debt can be said to weakly *dominate* a straight debt contract in terms of the venture capitalist's and the entrepreneur's utilities across all states of the world only in the special case where $d = r$. However, if $d \neq r$, the parties' contract preferences diverge at least in the low state. Finally, under a combination of straight equity and straight debt both parties choose to invest positive efforts in the high and medium states. This will ensure *continuation* of the project after execution of the contract.[184]

With respect to convertible securities contracts and straight equity contracts with redemption option, the analyses in the subsequent Sections 4.3.2.4 and 4.3.2.5 reveal the following results:[185] For $d \neq r$ and if the redemption payment is not given by equation (4.106), the comparison of the parties' utilities between combinations of straight equity and straight debt with convertible securities and straight equity contracts with redemption option exercise is ambiguous in the high and medium states. In the special case where $d = r$ and R is chosen to reflect equation (4.106), combinations of straight equity and straight debt *weakly dominate* the convertible securities and the straight equity contracts with redemption option in the medium and low states. The parties' contract preferences diverge in the high state. The findings on the redemption contract

[184] For a comparison of a combination of straight equity and straight debt with a straight equity contract and a straight debt/preferred equity contract, see Table 4-2.

[185] For a comparison of a combination of straight equity and straight debt with a convertible securities contract and a contract after redemption option exercise, see Table 4-3.

represent a highly exceptional case and are therefore excluded from the following proposition.

Proposition 4: *(Properties of Combinations of Straight Equity and Straight Debt).* In the special case where the cumulated interest is defined identically to that under a straight debt contract ($d = r$), a combination of straight equity and straight debt *weakly dominates* a straight debt/preferred equity contract *(convertible securities contract)* across all states of the world *(in the medium and low states of the world)* in terms of the venture capitalist's and the entrepreneur's utilities. The project will be *continued* after execution of the contract in the high and medium states of the world.

Proof of Proposition 4: *The proof follows directly from the above argumentation and* Table 4-2.

Contract Comparison						
Θ	Straight Equity Contract		Combination of Straight Equity and Straight Debt		Straight Debt/Preferred Equity Contract
Θ_H	$U_A^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) \geq R - I \geq 0$	$<$	$\left\{ U_A^{CED}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) = \right.$	?[a]	$U_A^{SD}\left(a_{SB}^{SD}\right) = (r-1)I \geq 0$
Θ_M	$U_A^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) \leq R - I \geq 0$	$<$	$\left. U_A^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) + dI \right\}$		
Θ_H / Θ_M	$\left(a_{SB}^{SE}, b_{SB}^{SE}\right) \gg 0$	$=$	$\left(a_{SB}^{SE}, b_{SB}^{SE}\right) \gg 0$	$>$	$\left(a_{SB}^{SD}, b_{SB}^{SD}\right) = (0,0)$
Θ_H / Θ_M	$U_B^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) > 0$	$>$	$U_B^{CED}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) > -dI$	$\geq$	$U_B^{SD}\left(a_{SB}^{SD}, b_{SB}^{SD}, \lambda, \theta\right) = -rI < 0$
Θ_H / Θ_M	$V_{A+B}^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right)$	$=$	$V_{A+B}^{CED}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right)$	$>$	$V_{A+B}^{SD}\left(a_{SB}^{SD}, b_{SB}^{SD}, \lambda, \theta\right) = -I < 0$
Θ_L	$U_A^{SE}\left(a_{SB}^{SE}\right) = -I < 0$	$<$	$U_A^{CED}\left(a_{SB}^{SE}\right) = (d-1)I < 0$	$\leq$	$U_A^{SD}\left(a_{SB}^{SD}\right) = (r-1)I < 0$
Θ_L	$\left(a_{SB}^{SE}, b_{SB}^{SE}\right) = (0,0)$	$=$	$\left(a_{SB}^{SE}, b_{SB}^{SE}\right) = (0,0)$	$=$	$\left(a_{SB}^{SD}, b_{SB}^{SD}\right) = (0,0)$
Θ_L	$U_B^{SE}\left(b_{FB}^{SE}\right) = 0$	$>$	$U_B^{CED}\left(b_{FB}^{SE}\right) = -dI$	$\geq$	$U_B^{SD}\left(b_{SB}^{SD}\right) = -rI$
Θ_L	$V_{A+B}^{SE}\left(a_{SB}^{SE}, b_{SB}^{SE}\right) = -I < 0$	$=$	$V_{A+B}^{CED}\left(a_{SB}^{SE}, b_{SB}^{SE}\right) = -I < 0$	$=$	$V_{A+B}^{SD}\left(a_{SB}^{SD}, b_{SB}^{SD}\right) = -I < 0$

[a] Ambiguous but for $d = r$ it holds that $U_A^{CED}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) > U_A^{SD}\left(a_{SB}^{SD}\right)$.

Table 4-2: Comparison of a Combination of Straight Equity and Straight Debt with a Straight Equity Contract and a Straight Debt Contract

Table 4-3: Comparison of a Combination of Straight Equity and Straight Debt with a Convertible Securities Contract and a Redemption Contract

	Contract Comparison				
Θ	Convertible Securities Contract [a]		Combination of Straight Equity and Straight Debt		Contract with Exercised Redemption Option [b]
Θ_H	$U_A^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) \geq R - I \geq 0$	$<$	$\left\{ \begin{array}{l} U_A^{CED}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) = \\ U_A^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) + dI \end{array} \right\}$	$>$	$U_A^{SE}\left(a_{SB}^{RC}\right) = R - I \geq 0$
Θ_M	$U_A^{SD}\left(a_{SB}^{SD}\right) = (r-1)I \geq 0$	$?^c$			$U_A^{SE}\left(a_{SB}^{RC}\right) = R - I \geq 0$
Θ_H	$\left(a_{SB}^{SE}, b_{SB}^{SE}\right) \gg 0$	$=$	$\left\{ \left(a_{SB}^{SE}, b_{SB}^{SE}\right) \gg 0 \right\}$	$(>, ?^c)$	$\left(a_{SB}^{RC}, b_{SB}^{RC}\right) = \left(0, b_{SB}^{RC}\right)$
Θ_M	$\left(a_{SB}^{SD}, b_{SB}^{SD}\right) = (0,0)$	$<$			
Θ_H	$U_B^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) > 0$	$>$	$\left\{ U_B^{CED}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) > -dI \right\}$	$\geq$	$U_B^{RC}\left(a_{SB}^{RC}, b_{SB}^{RC}, \lambda, \theta\right) > -R$
Θ_M	$U_B^{SD}\left(a_{SB}^{SD}, b_{SB}^{SD}, \lambda, \theta\right) = -rI < 0$	$\leq$			
Θ_H	$V_{A+B}^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right)$	$=$	$\left\{ V_{A+B}^{CED}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) \right\}$	$>$	$\left\{ V_{A+B}^{RC}\left(\alpha, a_{SB}^{RC}, b_{SB}^{RC}, \lambda, \theta\right) \right.$
Θ_M	$V_{A+B}^{SD}\left(a_{SB}^{SD}, b_{SB}^{SD}, \lambda, \theta\right) = -I < 0$	$<$			
Θ_L	$U_A^{SD}\left(a_{SB}^{SD}\right) = (r-1)I < 0$	$\geq$	$U_A^{CED}\left(a_{SB}^{SE}\right) = (d-1)I < 0$	$\leq$	$U_A^{SE}\left(a_{SB}^{RC}\right) = R - I \leq 0$
Θ_L	$\left(a_{SB}^{SD}, b_{SB}^{SD}\right) = (0,0)$	$=$	$\left(a_{SB}^{SE}, b_{SB}^{SE}\right) = (0,0)$	$=$	$\left(a_{SB}^{RC}, b_{SB}^{RC}\right) = (0,0)$
Θ_L	$U_B^{SD}\left(b_{SB}^{SD}\right) = -rI$	$\leq$	$U_B^{CED}\left(b_{FB}^{SE}\right) = -dI$	$\geq$	$U_B^{RC}\left(b_{FB}^{RC}\right) = -R$
Θ_L	$V_{A+B}^{SD}\left(a_{SB}^{SD}, b_{SB}^{SD}\right) = -I < 0$	$=$	$V_{A+B}^{CED}\left(a_{SB}^{SE}, b_{SB}^{SE}\right) = -I < 0$	$=$	$V_{A+B}^{RC}\left(a_{SB}^{RC}, b_{SB}^{RC}\right) = -I < 0$

[a] For the contract description and the calculation of these efforts, utilities, and total social welfares, see Section 4.3.2.4.

[b] For the contract description and the calculation of these efforts, utilities, and total social welfares, see Section 4.3.2.5. These results show that the venture capitalist redeems his contract only in the medium and low states. Therefore, the above findings only apply in these states, while the findings on a straight equity contract apply in the high state.

[c] Ambiguous but for $d = r$ it holds that $U_A^{CED}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) > U_A^{SD}\left(a_{SB}^{SD}\right)$. If R is defined as in equation (4.106), then $U_B^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) > U_B^{RC}\left(a_{SB}^{RC}, b_{SB}^{RC}, \lambda, \theta\right)$ in Θ_H and Θ_M. It then also holds that $b_{SB}^{SE} < b_{SB}^{RC}$ in Θ_H and $b_{SB}^{SE} > b_{SB}^{RC}$ in Θ_M.

4.3.2.4 Convertible Securities Contract

4.3.2.4.1 Contract Setup

Under a convertible securities contract, the objective functions for the venture capitalist and for the entrepreneur are defined such that the contract remains a straight debt/preferred equity contract if the venture capitalist does not exercise his conversion option, which is referred to as $E=0$, but changes into a straight equity contract if the venture capitalist exercises his option to convert his debt claim or preferred equity holding into a straight equity holding in the project, which is referred to as $E=1$. As above, the maturity of the straight debt contract is the execution of the contract (date 4), not the conversion date (date 2). This accounts for the fact that the venture capitalist cannot exit his preferred shareholding unless he is granted an additional exit option. This assumption is relaxed later in Section 4.3.3.1, where the contract is extended to prior debt contract maturity. The objective functions are as follows, with the superscript CS denoting the convertible securities contract:

$$U_A^{CS}(\alpha,a,b,\lambda,\theta)= \max\left\{\underbrace{\alpha P(a,b,\lambda,\theta)-C_A(a)-I}_{E=1},\underbrace{rI-C_A(a)-I}_{E=0}\right\} \tag{4.78}$$

and

$$U_B^{CS}(\alpha,a,b,\lambda,\theta)= \begin{cases}(1-\alpha)P(a,b,\lambda,\theta)-C_B(b) & \text{if } E=1.\\ P(a,b,\lambda,\theta)-C_B(b)-rI & \text{if } E=0\end{cases} \tag{4.79}$$

These payoffs reflect that, depending on the option decision of the venture capitalist with $E\in\{0,1\}$, the contract takes the form of a straight equity contract or of a straight debt/preferred equity contract.

However, independent of whether the venture capitalist chooses to exercise his conversion option or not, the total social welfare of the project $V_{A+B}^{CS}(a,b,\lambda,\theta)$ is

$$V_{A+B}^{CS}(a,b,\lambda,\theta) = U_A^{CS}(\alpha,a,b,\lambda,\theta) + U_B^{CS}(\alpha,a,b,\lambda,\theta) \\ = P(a,b,\lambda,\theta) - C_A(a) - C_B(b) - I \tag{4.80}$$

and thereby the equation equals that of the total social welfare in the straight equity and straight debt cases $V_{A+B}^{SE}(a,b,\lambda,\theta)$ and $V_{A+B}^{SD}(a,b,\lambda,\theta)$.

4.3.2.4.2 Contract Analyses

4.3.2.4.2.1 Analysis of Θ_H

The convertible securities contract grants the venture capitalist flexibility with respect to the choice of the financing instrument, which he has to make only after the state of the world is revealed to both contracting parties. By exercising or letting expire his conversion option, the venture capitalist then chooses the contract providing him with the highest utility in the respective state of the world.

In the high state of the world Θ_H, the venture capitalist obtains a utility after conversion – or from a straight equity contract – which is higher than or equal to the utility without conversion – or from a straight debt/preferred equity contract. He therefore decides to convert his straight debt or preferred equity shareholding into a straight equity share α in the project and to invest a positive second-best effort a_{SB}^{SE}. In this case, the entrepreneur also obtains a positive and thus higher utility from a straight equity contract than from a straight debt/preferred equity contract and invests a positive second-best effort b_{SB}^{SE}. The total social welfare of the project equals that under a straight equity contract and is thus higher than that under a straight debt contract, where neither party invests any effort.

4.3.2.4.2.2 Analysis of Θ_M

In the medium state of the world Θ_M, the venture capitalist obtains a utility after conversion which is smaller than or equal to the utility without conversion. He therefore decides not to exercise his conversion option and not to invest any effort. Due to effort complementarity, the entrepreneur also does not invest any effort despite the fact that she is full residual claimant on the margin. The project will therefore fail and be discontinued in the long run or any time after execution of the contract. The entrepreneur obtains a negative utility amounting to the cumulated interest/dividend payments to the venture capitalist. Her utility and the total social welfare of the project are lower than under a straight equity contract.

4.3.2.4.2.3 Analysis of Θ_L

In the low state of the world Θ_L, the profitability of the project θ is defined to be zero, and the project is consequently liquidated. Due to the fixed interest/dividend payment to the venture capitalist rI, the utility of the venture capitalist obtained with zero effort is negative but higher under a straight debt/preferred equity contract than that also obtained with zero effort under a straight equity contract. The utility of the entrepreneur under straight debt/preferred equity financing is negative and thus lower than that under straight equity financing. The negative total social welfare equals the sunk costs for the initial investment and is the same across both contracts.

4.3.2.4.3 Summary

A convertible securities contract allows the venture capitalist to adapt the contract's payoff structure to his utility after the revelation of the state of the world. He exercises his conversion option in the high state and remains with his straight debt/preferred equity contract in the medium and low states. In this way, the conversion feature allows him to participate in the project's upward potential

if the project is profitable, and to protect his downside in the "living dead" and liquidation cases. The entrepreneur's payoff is highest under a straight equity contract and she therefore prefers conversion by the venture capitalist across all states of the world.

Since both parties favor conversion into a straight equity contract in the high state, a convertible securities contract can be said to strictly *dominate* a straight debt/preferred equity contract in terms of the venture capitalist's and the entrepreneur's utilities. This does not apply to the medium and low states where the parties' contract preferences diverge. It follows from these findings that the venture capitalist improves not only his but also the entrepreneur's utility when exercising his conversion option in the high state. Therefore, the contract before conversion is not Pareto-efficient but *Pareto-dominated* by the contract after conversion in the high state of the world. Finally, the project will be *discontinued* any time after execution of the contract in the medium state where both parties choose not to invest any effort.

Proposition 5: *(Properties of Convertible Securities Contracts).* A convertible securities contract strictly *dominates* a straight debt/preferred equity contract in the high state of the world in terms of the venture capitalist's and the entrepreneur's utilities. In this state, the venture capitalist chooses to exercise his conversion option. The contract after conversion *Pareto-dominates* the contract before conversion. In the medium state, the project will be *discontinued* after execution of the contract.

Proof of Proposition 5: *The proof follows directly from the above argumentation and* Table 4-4.

4.3.2.5 Straight Equity Contract with Redemption Option

This section introduces the augmented contracting approach and analyzes the incentive structure created by a straight equity contract in combination with a redemption covenant. The findings are compared to a convertible securities

contract. They are furthermore extended to the inclusion of liquidation provisions in the subsequent section. Together, these analyses serve to answer the initial research question whether the incentive-compatible allocation of cash flow rights obtained with convertible securities is replicable using straight equity financing in combination with at least one cash flow-related covenant.

4.3.2.5.1 Contract Setup

Under a straight equity contract with redemption option, the objective functions for the venture capitalist and for the entrepreneur are defined such that the venture capitalist holds a straight equity contract which he can redeem by exercising his redemption option. Redemption by the venture capitalist is referred to as $E=1$, with $E \in \{0,1\}$. Otherwise he does not exercise his redemption option, which is referred to as $E=0$, and continues to hold a straight equity contract. Option exercise allows the venture capitalist to claim back a contractually defined redemption value from the entrepreneur exceeding his initial investment by an interest of $(r-1)$. The venture capitalist thereby exits the investment, and the entrepreneur remains the sole owner of the project. In this situation, the entrepreneur draws significant private benefits of control $\mathrm{CB}(\mathrm{b},\lambda,\theta)$ from managing the project alone, as determined by Stylized Fact 4. The parties' objective functions are defined as follows, with the superscript RC denoting the straight equity contract with redemption option (redemption contract):

$$U_A^{RC}(\alpha,a,b,\lambda,\theta) = \max\left\{\underbrace{R-C_A(a)-I}_{E=1}, \underbrace{\alpha P(a,b,\lambda,\theta)-C_A(a)-I}_{E=0}\right\} \tag{4.81}$$

and

$$U_B^{RC}(\alpha,a,b,\lambda,\theta) = \begin{cases} P(a,b,\lambda,\theta)-C_B(b)-R+CB(b,\lambda,\theta) & \text{if } E=1. \\ (1-\alpha)P(a,b,\lambda,\theta)-C_B(b) & \text{if } E=0 \end{cases} \tag{4.82}$$

Furthermore, the total social welfare of the project $V_{A+B}^{RC}(a,b,\lambda,\theta)$ is then

$$V_{A+B}^{RC}(a,b,\lambda,\theta) = U_A^{RC}(\alpha,a,b,\lambda,\theta) + U_B^{RC}(\alpha,a,b,\lambda,\theta) = \begin{cases} P(a,b,\lambda,\theta) - C_A(a) - C_B(b) - I + C(b,\lambda,\theta) & \text{if } E = 1. \\ P(a,b,\lambda,\theta) - C_A(a) - C_B(b) - I & \text{if } E = 0 \end{cases} \quad (4.83)$$

If the venture capitalist does not exercise his redemption option, the contract remains a straight equity contract. In the following, the equilibrium efforts, utilities, and total social welfare are calculated for the case where the venture capitalist exercises his redemption option and compared to the respective outcomes under a straight equity contract.

4.3.2.5.2 Contract Analyses

4.3.2.5.2.1 Analysis of Θ_H

If efforts are not observable, the second-best solution in a double moral hazard setting with risk-neutral agents is calculated as follows:

$$a_{SB}^{RC} = \underset{a}{\operatorname{argmax}} U_A^{RC}(a) \quad (4.84)$$

and

$$b_{SB}^{RC} = \underset{b}{\operatorname{argmax}} U_B^{RC}(a,b,\lambda,\theta). \quad (4.85)$$

The first-order conditions define the reaction functions

$$a = 0 \quad (4.86)$$

and

$$b = \left(\left(1 + a^{\lambda}\right)\theta(1-\lambda)e_B\right)^{\frac{1}{1+\lambda}}. \quad (4.87)$$

The entrepreneur's reaction function is increasing and convex in the profitability of the project θ and the effort of the venture capitalist a.

Solving the reaction functions for the values of a and b yields the equilibrium second-best efforts

$$a_{SB}^{RC} = 0 \tag{4.88}$$

and

$$b_{SB}^{RC} = \left(\theta(1-\lambda)e_B\right)^{\frac{1}{1+\lambda}}. \tag{4.89}$$

The entrepreneur's effort is positive, and thus different from that of the venture capitalist, and breaks up the complementarity of efforts as the result of her private benefits of control. It increases linearly in the profitability of the project θ.

The following second-order conditions hold:

$$\frac{\partial^2 U_A^{RC}(a)}{\partial a^2} = -\frac{1}{e_A} < 0 \tag{4.90}$$

and

$$\frac{\partial^2 U_B^{RC}(a,b,\lambda,\theta)}{\partial b^2} = \left(1+a^{\lambda}\right)b^{-1-\lambda}\theta\underbrace{(\lambda-1)}_{<0}\lambda - \frac{1}{e_B} < 0. \tag{4.91}$$

At equilibrium, the venture capitalist's objective function is independent of θ. The entrepreneur's objective function and the total social welfare are increasing and concave in θ. They are given by

$$U_A^{RC}\left(a_{SB}^{RC}\right) = R - I \tag{4.92}$$

and

$$U_B^{RC}(a_{SB}^{RC}, b_{SB}^{RC}, \lambda, \theta) = \frac{1}{2}\left(\theta(1-\lambda)e_B\right)^{\frac{2}{1+\lambda}}\frac{(1+\lambda)}{(1-\lambda)e_B} - R \tag{4.93}$$

and

$$V_{A+B}^{RC}\left(a_{SB}^{RC}, b_{SB}^{RC}, \lambda, \theta\right) = \frac{1}{2}\left(\theta(1-\lambda)e_B\right)^{\frac{2}{1+\lambda}}\frac{(1+\lambda)}{(1-\lambda)e_B} - I. \tag{4.94}$$

The utility of the venture capitalist after exercising his redemption option is nonnegative as $R-I \geq 0$; that of the entrepreneur and the total social welfare are ambiguous.

Compared to his utility under a straight equity contract $U_A^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) \geq R-I$, the utility of the venture capitalist after exercising his redemption option is the same or less. For this reason, the venture capitalist chooses not to exercise his redemption option and to invest a positive and higher effort a_{SB}^{SE} than the zero effort he would invest otherwise. The relation between the entrepreneur's efforts and utilities as well as the total social welfare under both contracts are ambiguous.

4.3.2.5.2.2 Analysis of Θ_M

In the medium state of the world Θ_M, the objective function of the venture capitalist after exercising the redemption option is independent of θ. For this reason, the contract achieves the same results across the high and medium states of the world Θ_H and Θ_M, where $U_A^{RC}(a)=R-I \geq 0$. In this state, the utility of the venture capitalist is consequently higher than under a straight equity contract $U_A^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) \leq R-I \geq 0$, and he chooses to exercise his redemption option. He obtains a higher utility than under a straight equity contract by investing no effort instead of a positive effort. The entrepreneur, however, chooses to invest a positive effort. The comparison of her effort and utility as well as the total social welfare under both contracts is ambiguous.

4.3.2.5.2.3 Analysis of Θ_L

In the low state of the world Θ_L, the definition of $\underline{\theta}=0$ eliminates any final return of the project as well as any private benefits of control.

$$P(a,b,\lambda,\theta) = P(a,b,\lambda,\underline{\theta}) = P(a,b,\lambda,0) = 0 \tag{4.95}$$

The parties' objective functions and the total social welfare in the redemption case reduce to

$$U_A^{RC}(a) = R - C_A(a) - I \tag{4.96}$$

and

$$U_B^{RC}(b) = -C_B(b) - R, \tag{4.97}$$

and

$$V_{A+B}^{RC}(a,b) = -C_A(a) - C_B(b) - I. \tag{4.98}$$

Consequently, the first-order conditions define the reaction functions and equilibrium efforts

$$a = 0 \Rightarrow a_{SB}^{RC} = 0 \tag{4.99}$$

and

$$b = 0 \Rightarrow b_{SB}^{RC} = 0. \tag{4.100}$$

The equilibrium efforts are zero and thus the entrepreneur's effort is smaller than in the other states of the world, while that of the venture capitalist is smaller than that in the high state and equal to that in the medium state.

The following second-order conditions hold:

$$\frac{\partial^2 U_A^{RC}(a)}{\partial a^2} = -\frac{1}{e_A} < 0 \tag{4.101}$$

and

$$\frac{\partial^2 U_B^{RC}(b)}{\partial b^2} = -\frac{1}{e_b} < 0. \tag{4.102}$$

In equilibrium, the objective functions and the total social welfare are therefore negative and given by

$$U_A^{RC}(a) = R - I \leq 0 \tag{4.103}$$

and

$$U_B^{RC}(b) = -R \tag{4.104}$$

and

$$V_{A+B}^{RC}(a,b) = -I. \tag{4.105}$$

The equilibrium investment levels and payoffs are equal to those under straight debt/preferred equity financing because $R = rI$ by definition. As a result of the transfer payment R, the venture capitalist obtains a higher utility in the redemption case than under straight equity financing where $U_A^{SE}\left(a_{SB}^{SE}\right) = -I$, and the entrepreneur obtains a lower utility than under straight equity financing where $U_B^{SE}\left(b_{FB}^{SE}\right) = 0$. The total social welfare remains unchanged.

4.3.2.5.3 Summary and Comparison with the Convertible Securities Contract

In the high state of the world, the utility of the venture capitalist after exercising his redemption option is positive and equal to or smaller than that before exercising his redemption option, that is, under a straight equity contract. In the medium state, it is also positive but higher than or equal to that under straight equity financing and at the same time equal to that under a straight debt/preferred equity contract. The venture capitalist does not invest any effort in the high and medium states. His effort is smaller than that under a straight equity contract and equal to that under a straight debt/preferred equity contract.

The utility and effort of the entrepreneur are ambiguous across both states. If the redemption payment is defined in such a way that it increases concavely in

the venture capitalist's share in the project α and is furthermore a function of his relative productivity λ and his effort parameter e_A and given by

$$R = \frac{(2-\lambda)(1-\alpha)^{\frac{\lambda}{2}}}{2\lambda e_A}, \tag{4.106}$$

the utility of the entrepreneur in the redemption case is smaller than that under straight equity financing and higher than that under a straight debt/preferred equity contract. Additionally, her positive equilibrium effort is smaller than that under a straight equity contract in the high state and higher in the medium state. It is furthermore higher than under straight debt/preferred equity financing in both states.

In the low state of the world, the parties' efforts and utilities in the redemption case are identical to those under a straight debt/preferred equity contract because $R = rI$ by definition. Compared to a straight equity contract, the utility of the venture capitalist in the redemption case is negative but nevertheless higher. The utility of the entrepreneur amounts to her redemption outpayment to the venture capitalist. It is negative and smaller than that under straight equity financing. The equilibrium efforts are zero and thus the same for both contracts. A summary of the comparison between a straight equity contract with redemption option and a pure straight equity contract as well as a straight debt contract is displayed below.[186]

The above findings can be summarized as follows. Similar to a convertible securities contract, a straight equity contract with redemption option allows the venture capitalist to choose either a straight equity contract or a debt-like contract after the revelation of the state of the world, depending on which contract generates his highest utility. The venture capitalist prefers a straight equity contract in the high state and a debt-like downward protection in the form of an exercised redemption option in the medium and low states. Other than a

[186] For a comparison of straight equity contracts with redemption option with straight equity and straight debt/preferred equity contracts, see Table 4-4.

convertible securities contract, however, the exercising of his option prevents the venture capitalist from keeping a "living dead" investment in his portfolio until its liquidation and the entrepreneur from *discontinuing* the project after contract execution. If the redemption payment is defined as in equation (4.106), the entrepreneur prefers a straight equity contract across all states. Therefore, both parties favor a straight equity contract or no redemption in the high state of the world. In the medium and low states, however, the parties' contract preferences diverge. It follows from these findings that, in contrast to convertible securities financing, the venture capitalist improves his utility but worsens the entrepreneur's utility when exercising his redemption option in the medium state. Consequently, the contract after redemption is not Pareto-efficient but *Pareto-dominated* by the contract before redemption in the medium state. Furthermore, a straight equity contract with redemption option *weakly dominates* a straight debt contract/preferred equity contract and a convertible securities contract across all states of the world in terms of the venture capitalist's and the entrepreneur's utilities.

Proposition 6: *(Properties of Straight Equity Contracts with Redemption Option).* A straight equity contract with redemption option *weakly dominates* a straight debt/preferred equity contract and a convertible securities contract across all states of the world in terms of the venture capitalist's and the entrepreneur's utilities. In the medium state, the venture capitalist chooses to exercise his redemption option. However, the contract before redemption *Pareto-dominates* the contract after redemption if the redemption payment is defined by

$$R = \frac{(2-\lambda)(1-\alpha)^{-\frac{\lambda}{2}}}{2\lambda e_A}.$$

In the high and medium states, the project will be *continued* after execution of the contract.

Proof of Proposition 6: *The proof follows directly from the above argumentation and* Table 4-4.

Contract Comparison						
Θ	Straight Equity Contract		Contract with Exercised Redemption Option		Straight Debt/Preferred Equity Contract
Θ_H	$U_A^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) \geq R - I \geq 0$	$\geq$	$U_A^{RC}\left(a_{SB}^{RC}\right) = R - I \geq 0$	$=$	$U_A^{SD}\left(a_{SB}^{SD}\right) = (r-1)I \geq 0$
Θ_M	$U_A^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) \leq R - I \geq 0$	$\leq$	$U_A^{RC}\left(a_{SB}^{RC}\right) = R - I \geq 0$	$=$	$U_A^{SD}\left(a_{SB}^{SD}\right) = (r-1)I \geq 0$
Θ_H / Θ_M	$\left(a_{SB}^{SE}, b_{SB}^{SE}\right) \gg 0$	$(>, ?^a)$	$\left(a_{SB}^{RC}, b_{SB}^{RC}\right) = \left(0, b_{SB}^{RC}\right)$	$(=, >)$	$\left(a_{SB}^{SD}, b_{SB}^{SD}\right) = (0,0)$
Θ_H / Θ_M	$U_B^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) > 0$	$?^a$	$U_B^{RC}\left(a_{SB}^{RC}, b_{SB}^{RC}, \lambda, \theta\right) > -R$	$>$	$U_B^{SD}\left(a_{SB}^{SD}, b_{SB}^{SD}, \lambda, \theta\right) = -rI < 0$
Θ_H	$V_{A+B}^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right)$	$>$	$V_{A+B}^{RC}\left(\alpha, a_{SB}^{RC}, b_{SB}^{RC}, \lambda, \theta\right)$	$>$	$V_{A+B}^{SD}\left(a_{SB}^{SD}, b_{SB}^{SD}, \lambda, \theta\right) = -I < 0$
Θ_M	$V_{A+B}^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right)$	$?$			
Θ_L	$U_A^{SE}\left(a_{SB}^{SE}\right) = -I < 0$	$<$	$U_A^{RC}\left(a_{SB}^{RC}\right) = R - I < 0$	$=$	$U_A^{SD}\left(a_{SB}^{SD}\right) = (r-1)I < 0$
Θ_L	$\left(a_{SB}^{SE}, b_{SB}^{SE}\right) = (0,0)$	$=$	$\left(a_{SB}^{RC}, b_{SB}^{RC}\right) = (0,0)$	$=$	$\left(a_{SB}^{SD}, b_{SB}^{SD}\right) = (0,0)$
Θ_L	$U_B^{SE}\left(b_{FB}^{SE}\right) = 0$	$>$	$U_B^{RC}\left(b_{FB}^{RC}\right) = -R$	$=$	$U_B^{SD}\left(b_{SB}^{SD}\right) = -rI$
Θ_L	$V_{A+B}^{SE}\left(a_{SB}^{SE}, b_{SB}^{SE}\right) = -I < 0$	$=$	$V_{A+B}^{RC}\left(a_{SB}^{RC}, b_{SB}^{RC}\right) = -I < 0$	$=$	$V_{A+B}^{SD}\left(a_{SB}^{SD}, b_{SB}^{SD}\right) = -I < 0$

[a] If R is defined as in equation (4.106), then $U_B^{SE}\left(\alpha, a_{SB}^{SE}, b_{SB}^{SE}, \lambda, \theta\right) > U_B^{RC}\left(a_{SB}^{RC}, b_{SB}^{RC}, \lambda, \theta\right)$ in Θ_H and Θ_M. It then also holds that $b_{SB}^{SE} < b_{SB}^{RC}$ in Θ_H and $b_{SB}^{SE} > b_{SB}^{RC}$ in Θ_M.

Table 4-4: Comparison of a Straight Equity Contract with Redemption Option with a Straight Equity Contract and a Straight Debt Contract

4.3.3 Extensions

This section extends the augmented contracting analysis of straight equity contracts with redemption option in two respects. Firstly, a redemption covenant is added to all remaining financial instruments previously analyzed. If applicable, also an earlier straight debt contract maturity than that at contract execution is considered. The augmented contracts' incentive properties are then compared. While an included option provides the venture capitalist with greater flexibility, his option exercise is not necessarily of advantage to the entrepreneur. The contract properties *long-term project continuation* and *Pareto-efficiency of option exercise*, which focus on incentives for the entrepreneur, are therefore paid special attention in the subsequent analyses. The table below illustrates the course of analysis with respect to these two exit channels.[187] Secondly, it adds liquidation provisions as a second cash flow-related covenant to the analysis of augmented contracting.

Model Extensions	Straight Equity Contract	Preferred Equity Contract	Straight Debt Contract	Combinations of Straight Equity and Straight Debt	Convertible Securities Contract	Straight Equity Contract with Redemption Option [a]
Prior Straight Debt Contract Maturity	–	–	(1)	(2)	(3)	–
Redemption Option Inclusion	[a]	(4)	(4)	(5)	(6)	[a]

[a] For the analysis of a straight equity contract with redemption option, see Section 4.3.2.5.

Table 4-5: Course of Analysis with Respect to Model Extensions

[187] For an illustration of the course of analysis throughout the subsequent sections, see Table 4-5.

4.3.3.1 Prior Straight Debt Contract Maturity

To account for the fact that the venture capitalist cannot exit his preferred equity shareholdings, straight debt/preferred equity contracts in this model have so far been analyzed under the assumption that the maturity of a straight debt contract is the execution of the contract (date 4) and not an earlier date, that is, the date where the venture capitalist decides whether to exercise his conversion or redemption option or not (date 2). Relaxing this assumption so that the maturity of a straight debt contract is at date 2, the venture capitalist at maturity has to perform a mandatory exit or, if available, exercise a conversion option available to him. In the following, the contracts considered in the previous section are analyzed for the case of prior straight debt contract maturity.

(1) *Straight debt contract with prior maturity:* Since $R = rI$ by definition, the parties' utilities under a straight debt contract with prior maturity equal those in the redemption case. After all, the notion underlying the definition $R = rI$ for $r \geq 1$ is that the redemption payment includes a compensation for the venture capitalist's value-added to the project. This is comparable to a debt repayment compensating the venture capitalist for his opportunity cost of capital. A straight debt contract with prior maturity thus *weakly dominates* a straight debt contract across all states of the world in terms of the venture capitalist's and the entrepreneur's utilities. Due to the fact that the venture capitalist receives the same fixed payments under both contracts, he is indifferent. However, as explained in Stylized Fact 3, the venture capitalist in his role as debtholder prefers to continue his involvement with a potentially profitable project but to exit the project in the "living dead" and liquidation cases. It can be concluded that the venture capitalist favors a straight debt contract to a straight debt contract with prior maturity in the high state and conversely in the medium and low states. Therefore, in the high state, the parties' contract preferences diverge. Finally, under a straight debt contract with prior maturity, the project is *not discontinued* after execution of the contract in the high and medium states.

(2) *Combinations of straight equity and straight debt with prior maturity:* For $d \neq r$, the comparison of the parties' utilities between combinations of straight equity and straight debt with and without prior maturity is ambiguous in the high and medium states. In the special case where $d = r$ and the entrepreneur's debt repayment is defined equal to the redemption payment in equation (4.106), the parties' utilities under a combination of straight equity and straight debt with prior maturity equal those in the redemption case. A combination of straight equity and straight debt therefore *weakly dominates* a combination of straight equity and straight debt with prior maturity across all states of the world. Finally, under debt-equity financing with prior maturity, the project is not *discontinued* after execution of the contract as is the case under debt-equity mixes.

(3) *Convertible securities contract with prior maturity:* A convertible debt contract with prior maturity grants the venture capitalist the flexibility to choose between exiting his debt contract and converting his debt claim into a straight equity share in the project. Since the venture capitalist is indifferent in terms of payoff between a straight debt contract and a straight debt contract with prior maturity, he makes the same contract payoff choices as in the above convertible securities contract: He exercises his conversion option in the high state of the world and exits his straight debt contract in the medium and low states. The entrepreneur also favors conversion into a straight equity contract in the high state. This does not apply for the medium and low states, where the parties' contract preferences diverge. It follows from these findings that – as for the above convertible securities contract – the entrepreneur's utility improves and at the same time the venture capitalist's utility is not diminished when he exercises his conversion option in the high state. Therefore, in this state, the contract before conversion is not Pareto-efficient but *Pareto-dominated* by the contract after conversion. This convertible debt contract with prior maturity *weakly dominates* a convertible securities contract because the entrepreneur obtains a higher utility than under a straight debt/preferred equity contract across all

states of the world. The convertible securities contract with prior maturity further equals a straight equity contract with redemption option in terms of the parties' utilities. Finally, other than under the above convertible securities contract, the project will not be *discontinued* after execution of the contract in the high and medium states because the entrepreneur chooses to invest a positive effort after the venture capitalist's decision to exit in the medium state.

Overall, advancing a straight debt contract's maturity from date 4 to date 2 and thus including a mandatory exit for the venture capitalist in the above contracts improves a straight debt and a convertible debt contract so that they weakly dominate the respective contracts without prior maturity. Under both contracts, the project is continued after contract execution of the contract in the high and medium states. No definite statement can be made on combinations of straight equity and straight debt.

Proposition 7: *(Prior Straight Debt Contract Maturity).* Prior maturity in straight debt and convertible debt contracts, implying a mandatory exit of the venture capitalist, *weakly dominates* maturity at contract execution. A convertible securities contract with prior maturity equals a straight equity contract with redemption option, both in terms of the venture capitalist's and the entrepreneur's utilities across all states of the world. Prior maturity furthermore ensures project *continuation* in the high and medium states.

Proof of Proposition 7: *The proof follows directly from the above argumentation.*

4.3.3.2 Redemption Option Inclusion

This section analyzes the contracts considered in the previous section after a redemption option has been added. As mentioned above, a straight debt contract with maturity at date 2 equals the situation in which the venture capitalist has exercised his redemption option. Differences may, however, arise

because a redemption exit is optional, whereas a prior maturity exit is mandatory.

(4) *Straight debt/preferred equity contract with redemption option:* As a redemption option grants the venture capitalist the flexibility to exit the project according to his utilities and preferences, he will remain invested in the project in the high state and exit the project in the medium and low states, despite the fact that his utility remains the same under a straight debt/preferred equity contract and in the redemption case across all states of the world. The entrepreneur prefers the venture capitalist to exit the project in the high and medium states. Therefore, the parties' contract preferences diverge in the high state but not in the medium and low states. It follows from these findings that the entrepreneur's utility is improved and at the same time the venture capitalist's utility is not diminished when he exercises his redemption option in the medium state. For this reason – other than under a straight equity contract with redemption option – the contract before redemption is not Pareto-efficient but *Pareto-dominated* by the contract after redemption in the medium state. Furthermore, as shown above, a straight debt/preferred equity contract with redemption option *weakly dominates* a straight debt/preferred equity contract in terms of the venture capitalist's and the entrepreneur's utilities. Finally, the project is not *discontinued* in the high and medium states. It has to be added that preferred equity contracts do not end at a certain maturity, and that only a redemption option thus allows for the venture capitalist to exit the project.

(5) *Combinations of straight equity and straight debt with redemption option:* For $d \neq r$, the comparison of the parties' utilities between combinations of straight equity and straight debt with and without redemption option are ambiguous in the high and medium states. In the special case where $d = r$ and the entrepreneur's redemption payment is defined as in equation (4.106), the findings equal those for a combination of straight equity and straight debt with prior maturity. A combination of straight equity and straight debt therefore *weakly dominates* a combination of

straight equity and straight debt with redemption option across all states of the world. Therefore, as under a straight equity contract with redemption option, the contract after redemption is not Pareto-efficient but *Pareto-dominated* by the contract before redemption in the medium state. The venture capitalist will not exercise his redemption option in the high and medium states. Finally, the project will be *continued* after the execution of the contract in the high and medium states.

(6) *Convertible securities contract with redemption option:* Due to the fact that $R = rI$ by definition, the parties' utilities under a straight debt contract with prior maturity equal those in the redemption case. For this reason, the findings on convertible securities contracts with redemption option equal the findings on convertible securities contracts with prior maturity. This implies that a convertible securities contract with redemption option *weakly dominates* a convertible securities contract in the medium state of the world. The contract before conversion is not Pareto-efficient but *Pareto-dominated* by the contract after conversion in the high state. It further equals a straight equity contract with redemption option in terms of the parties' utilities but not in terms of the Pareto-criterion of the redemption option. Finally, the project will be *continued* after execution of the contract in the high and medium states. As the result of the optional character of the venture capitalist's exit by redemption as opposed to his mandatory exit from prior maturity, the following findings from straight debt/preferred equity contracts with redemption option also apply: The entrepreneur's utility is improved and at the same time the venture capitalist's utility is not diminished when he exercises his redemption option in the medium state. For this reason, the contract before redemption is not Pareto-efficient but *Pareto-dominated* by the contract after redemption. To summarize, a convertible securities contract with redemption option includes two options, that is, the conversion option and the redemption option, and exercising both options *Pareto-dominates* exercising neither option in the high and medium states.

Overall, including a redemption option and thus an optional exit for the venture capitalist in the medium or "living dead" state improves a straight debt/preferred equity contract and a convertible securities contract so that they weakly dominate the respective contracts without redemption option, and the project is continued after contract execution in the high and medium states. Additionally, other than under a straight equity contract with redemption option, redemption under these contracts Pareto-dominates redemption in terms of the venture capitalist's and the entrepreneur's utilities. No definite statement can be made on combinations of straight equity and straight debt.

Proposition 8: *(Redemption Option Inclusion).* Including a redemption option in straight debt/preferred equity and convertible securities contracts *weakly dominates* not including a redemption option and a convertible securities contract with redemption option, both in terms of the venture capitalist's and the entrepreneur's utilities across all states of the world. The contracts after redemption *Pareto-dominate* the contracts before redemption. Including a redemption option furthermore avoids the *discontinuation* of the project in the high and medium states.

Proof of Proposition 8: *The proof follows directly from the above argumentation.*

4.3.3.3 Liquidation Provisions

The model has so far mainly neglected the low state of the world by assuming that the venture capitalist's options apply at liquidation of the project as they do in the profitable and "living dead" states. In reality, however, the parties usually include liquidation provisions in the contract which define the parties' payoffs at project dissolution, as defined by Stylized Fact 5. The superscript LP denotes the liquidation provision payoffs.

Stylized Fact 5: (*Liquidation Provisions*). With help of a liquidation provision, it is determined by contract that the venture capitalist holds a liquidation preference over the entrepreneur at liquidation of the project. His liquidation value or liquidation preference amounts to a multiple $x \geq 1$ of his initial investment plus a return on the capital invested net his initial investment. The venture capitalist's utility then equals

$$U_A^{LP}\left(a_{SB}^{LP}, b_{SB}^{LP}\right) = (x + r - 1)\, I\,,$$

where $r < 1$ and $R = rI$. The entrepreneur is full residual claimant on the final return.

In their detailed analyses of liquidation provisions in German and US venture capital contracts, Hoffmann and Hölzle (2003a) and Hoffmann and Hölzle (2003b) summarize the main characteristics of liquidation provision clauses:

- Liquidation provisions grant the venture capitalist a preference over the final return from liquidation ("dissolution") or from a sale of the portfolio company ("deemed liquidation").[188]
- The amount of the venture capitalist's liquidation preference is geared to his capital invested in the portfolio company and often represents a multiple of circa one in German contracts and a multiple of between two and five in US contracts of his investment or a preferred dividend plus a return on the initial investment. The return in practice depends on the venture capitalist's specific interest rate for refinancing (circa 8–10%) or on his expected annual rate of return (circa 30%).[189]
- After the liquidation preference of the venture capitalist has been satisfied, the entrepreneur is usually granted a subordinated liquidation preference, the amount of which depends on the capital and intellectual investments contributed to the portfolio company by the entrepreneur. US venture capital contracts, however, usually do not include this subordinated liquidation preference for the entrepreneur.[190]

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[188] See Hoffmann and Hölzle (2003a), p. 113, and Hoffmann and Hölzle (2003b), p. 265.
[189] See Hoffmann and Hölzle (2003a), pp. 113–114, and Hoffmann and Hölzle (2003b), p. 266.
[190] See Hoffmann and Hölzle (2003a), pp. 114–115.

- The remaining return is then split pro rata between the venture capitalist and the entrepreneur. Under US law, such liquidation provisions are called "participating preferred".[191]
- German law allows to define that liquidation preferences are reduced or do not apply if the proceeds from a sale of the portfolio company exceed a certain amount.[192]

Without a loss of generality, these findings are summarized in Stylized Fact 5 with the exception of the pro rata allotment of cash flows. Underlying reason is the fact that the venture capitalist's payoff already exceeds the total social welfare by $(x+r)I$ as a result of the entrepreneur's transfer payment.

The analysis of the liquidation provisions as defined by Stylized Fact 5 across all previously analyzed contracts yields the following interesting result. Since in the low state it holds that $\theta = 0$, the total social welfare is always negative and amounts to the venture capitalist's sunk initial investment. Depending on the contract design, it is split between the parties such that the venture capitalist's payoff either equals his sunk initial investment $-I$ or a cumulated interest/redemption payment from the entrepreneur minus the sunk initial investment $(r-1)I = R - I < 0$. However, assuming that the contract does not allow the venture capitalist to exercise his redemption option in the low state, his payoff equals $(r-1)I$ only under a straight debt/preferred equity contract with or without prior maturity, where his claim is senior to that of the entrepreneur. Adapting the liquidation preference to German contracting practice, it is assumed that $x = 1$. At dissolution of the project in the low state, the venture capitalist then obtains a payoff $R - I < 0$, which is the same as under a straight debt contract and after redemption option exercise. Thus, the definition of liquidation provisions allows the venture capitalist to obtain the same payoff, even in the case where redemption is not possible in the low state. It is therefore optimal for the venture capitalist to include both a redemption

[191] See Hoffmann and Hölzle (2003b), p. 263.
[192] See Hoffmann and Hölzle (2003a), p. 114, and Hoffmann and Hölzle (2003b), p. 263.

option and a liquidation provision in the financing contract. The entrepreneur as full residual claimant on the negative final return has to pay out $U_B^{LP}\left(a_{SB}^{LP}, b_{SB}^{LP}\right) = -R$ because she can be made liable for the value of the initially received investment $-I$, and in the low state it is defined that $R < I$.

Proposition 9: (*Liquidation Provision Inclusion*). The venture capitalist's and the entrepreneur's utilities under a liquidation provision equal those after the exercise of a redemption option in the low state. These clauses are thus substitutes in the liquidation case.

Proof of Proposition 9: *The proof follows directly from the above argumentation.*

4.3.4 Robustness

In order to check the obtained results for robustness, this section shows that the model yields the same results under asymmetric information, additional uncertainty, and different timing of investments.

4.3.4.1 Asymmetric Information on Project Profitability

The revelation of information on the profitability of the project at date 1 has so far been modelled in such a way that the profitability can be observed but not verified by both parties. This accounts for the fact that the entrepreneur has deeper project-specific information while the venture capitalist is better informed of the market conditions. The underlying business opportunity and the market conditions both represent the quality of the project, which is predicted in the form of its profitability θ.

It can be argued, however, that the venture capitalist has gathered investment experience from previous investments and therefore chooses to invest only in projects with successful business opportunities. The profitability of the project

then mainly depends on the market conditions. As a result, it is sufficient that the information on project profitability is revealed asymmetrically to the venture capitalist, but not to the entrepreneur, and is not verifiable by the venture capitalist.

It is realistic to assume that this is the case. It can then be shown that with the help of cash flow-related covenants the same results are obtained as above, with only one financial instrument as exception: After nature has revealed θ to the venture capitalist, he decides whether to exercise his conversion and/or redemption option or not. The entrepreneur can then observe the venture capitalist's option decisions or the liquidation announcement. From the signed contract, the entrepreneur furthermore knows the venture capitalist's payoffs in each state of the world and under each contract and can adapt her effort level. Unless the project is financed with a combination of straight equity and straight debt, she can therefore identify that the project is in the *high state* of the world if the venture capitalist exercises his conversion option (or does not exercise his redemption option) because the above analyses show the venture capitalist to exercise his conversion option under a convertible securities contract only in the high state. She can furthermore identify that the project is in the *medium state* of the world if the venture capitalist exercises his redemption option (or does not exercise his conversion option) because the above analyses show the venture capitalist to exercise his redemption option under straight equity, straight debt, and convertible securities financing in the medium state. She can finally identify that the project is in the *low state* of the world if the venture capitalist calls for his liquidation preference or the project is written-off. The existence of at least a conversion or a redemption option for the venture capitalist therefore constitutes an information revelation mechanism to the entrepreneur. Under a straight debt/preferred equity contract, the entrepreneur always chooses to invest the same effort levels in the high and medium states of the world. Under a straight equity contract, however, the entrepreneur may over-invest or under-invest in the absence of a redemption covenant in the high and medium states because his effort choice depends on θ. Under contracts including combinations of straight equity and straight debt, in the special case where $d = r$, redemption option inclusion does not reveal the state of the world because the venture

capitalist prefers not to redeem his investment. If $d \neq r$, no definite statement can be made on debt-equity combinations.

4.3.4.2 Additional Project Uncertainty

As in Schmidt (2003), the model can be extended to include another uncertainty besides the realization of the project's profitability θ. If the uncertainty resolves after both parties have invested their efforts but before the contract is executed, the final return $P(a,b,\lambda,\theta)$ can be interpreted as an expected value. By assumption, both parties are risk-neutral. Therefore, their utilities from the final return of the project equal the expected value thereof.[193] The additional uncertainty appearing between dates 3 and 4 does therefore not change the model's outcome.

If the risk-neutrality assumption is relaxed and it is assumed that the entrepreneur's risk preferences shift over time in such way that he becomes more risk-averse with increasing project return, his utility under additional project uncertainty is lower than under risk-neutrality. The difference between the outcomes depends on the degree of risk-aversion and the certainty equivalent.

4.3.4.3 Timing of Investments

Simultaneous investments as in this model reflect reality better than sequential investments because the parties' effort investments are not taken at a single point in time but rather over a certain period. The venture capitalist's support in the form of financial, strategic, management, administrative, and marketing support takes place at several points in time or over several sub-periods, while the entrepreneur continuously manages the project throughout the period. Therefore, during this period – which is captured by date 3 of the model's timeline – the parties' investments can overlap partly or totally.

[193] See Schmidt (2003), p. 1157.

These simultaneous effort investments can, however, also take place sequentially within this time period and thus capture the reasoning by Schmidt (2003) whereby the entrepreneur's effort is more important in the beginning of the project and the active support of the venture capitalist at the expansion stage. However, modelling simultaneous investments is not as restrictive as modelling sequential investments. In Schmidt's (2003) model on sequential investments, the venture capitalist's effort must not be invested after the entrepreneur has invested all her effort, and this has been observed by the venture capitalist, for the first-best results to hold.[194]

4.4 Summary of Results

This section summarizes the main findings of the model, sorted by financial instruments in the same order as in the preceding analyses, and derives a new pecking order of venture capital contracting. Furthermore, it critically compares them to findings presented in the related empirical literature on US and German venture capital contracting.

Proposition 2 states that an optimal *straight equity contract* and an exercised conversion option (as component of a convertible securities contract) allocate the majority of equity shares in the project's final return to the entrepreneur. The venture capitalist receives a minority share and is, in return, over-compensated for her relative productivity. While the entrepreneur's large equity ownership increases his incentive to invest effort in the project, it does not allow the venture capitalist to exert control over the project.[195] However, as shown by Kaplan and Strömberg (2003), the venture capitalist can be reallocated control rights separately from the cash flow rights.[196] The contracting parties would then decide on a separate allocation of control rights to activities, from which agency conflicts might potentially arise. Furthermore, according to *Propositions 3 and 5*, a straight equity contract or convertible securities contract dominates a straight

[194] See Schmidt (2003), p. 1157.
[195] See Gompers (1997), p. 5.
[196] See Kaplan and Strömberg (2003), pp. 286, 294.

debt/preferred equity contract in the high state of the world in terms of the venture capitalist's and the entrepreneur's utilities. This implies that the venture capitalist prefers to participate in the upside only if the project is profitable but to protect his downside in the "living dead" and liquidation cases. Kaplan and Strömberg (2003) empirically identify similar state-contingencies built into the allocation of cash flow rights in US venture capital contracts. They find that differences in the venture capitalist's cash flow rights, that is, the state contingencies, are contractually defined to be lower for well performing portfolio companies as well as late-stage and second-round investments, and higher for bad performing as well as early-stage and first-round investments.[197] Contrary to the findings in this paper, however, the contractual state contingencies in the empirical paper by Kaplan and Strömberg (2003) on US venture capital contracts have been found to allocate an average cash flow stake between 24.3% and 31.1% to the entrepreneur, and an average cash flow stake between 46.7% and 55.5% to the venture capitalist. The entrepreneur thus never holds a majority stake, and the venture capitalist does not necessarily hold a minority stake if the project is profitable.[198] While these empirical results on the US venture capital market are not supportive of this model's findings, it is common knowledge in the German venture capital market that in particular the international venture capital private equity company 3i has started to commit only to minority investments recently.

Propositions 3, 5 and 6 show that *straight debt/preferred equity contracts* are weakly and strongly dominated by straight equity contracts and convertible securities contracts in the high state of the world and straight equity contracts with redemption option across all states of the world, both in terms of the venture capitalist's and the entrepreneur's utilities. The underlying reason is the fact that they neither allow the debtholder or preferred shareholder to participate in the final return of the profitable project nor prevent the project from being discontinued in the "living dead" and liquidation cases, whereas it is continued under straight equity financing. However, *Propositions 7 and 8* point out that straight debt/preferred equity contracts in combination with prior maturity or a

[197] See Kaplan and Strömberg (2003), p. 287.
[198] See Kaplan and Strömberg (2003), p. 288.

redemption option dominate straight debt/preferred equity contracts and do not invoke project discontinuation. While the exit at prior maturity is mandatory and the contracting parties cannot necessarily be expected to define maturity correctly upon the signing of the contract (date 0), the combination of straight debt/preferred equity with a Pareto-optimal redemption option allows for a flexible optional exit. Furthermore, preferred equity does not end at maturity and can therefore only be exited by the venture capitalist through a redemption option. These results therefore strongly suggest that straight debt/preferred equity should only be employed together with a redemption option. According to empirical findings by Kaplan and Strömberg (2003), straight debt is not employed at all in US venture capital contracts.[199] Similarly, Hommel et al. (2003) report straight debt to be the financing instrument least frequently employed by mainly non-public German venture capital companies.[200] However, Schäfer et al. (2004) find straight debt to be included in 45% of the considered 228 German sample contracts. Their sample consists of portfolio companies supported by public promotional programs and can therefore not be considered a good benchmark.[201] Since neither paper provides information on covenants included in these contracts, no conclusion can be drawn on the optimality of German venture capital contracting with straight debt/preferred equity.

Proposition 4 does not provide universally valid information on *combinations of straight equity and straight debt*. However, in the special case where the debt component is as high as in a regular straight debt contract $(d = r)$, the inclusion of a redemption option does not improve both parties' utilities over those under a plain combination of straight equity and straight debt. The debt component grants the venture capitalist the same payoff as a redemption option and, resulting from the equity component, the venture capitalist additionally earns his share in the final return of the project. Bascha and Walz (2002) present empirical results whereby debt-equity mixes are contracted upon by 14% of firms in their sample including 60 German venture capital companies, more

[199] See Kaplan and Strömberg (2003), p. 284.
[200] See Hommel et al. (2003), p. 328.
[201] See Schäfer et al. (2004), pp. 14, 18.

frequently than straight debt used only by 6% of investors.[202] Similar to the above discussion on straight debt/preferred equity contracts, no information is included on covenants frequently combined with combinations of straight equity and straight debt.

Propositions 5 and 6 find that a *convertible securities contract* is weakly dominated by a *straight equity contract with redemption option* across all states of the world in terms of the venture capitalist's and the entrepreneur's utilities. Additionally, a straight equity contract with redemption option facilitates long-term project continuation, and a convertible securities contract causes project discontinuation after execution of the contract in the medium state. While a convertible securities contract guarantees the venture capitalist a higher utility than a straight equity contract in the "living dead" state, it is even better for the venture capitalist to exit the project via a redemption option and to thereby enable the entrepreneur to generate her own private benefits of control. However, the entrepreneur obtains better incentives under a convertible securities contract than under a straight equity contract with redemption option because the venture capitalist's exercise of the conversion option is Pareto-optimal but that of the redemption option is Pareto-dominated. As a result, a straight equity contract with redemption option outperforms a convertible securities contract in the two contract properties *long-term project continuation* and *Pareto-efficiency of option exercise*. Furthermore, according to *Proposition 8*, a straight equity contract with redemption option equals a convertible securities contract with prior maturity or with redemption option in terms of the venture capitalist's and the entrepreneur's utilities. A redemption option allows for a flexible optional exit by the venture capitalist as opposed to a mandatory prior maturity exit. Both contracts encourage project continuation after execution of the contract and only convertible securities with redemption option lead to a Pareto-optimal exercise of the included conversion and redemption options. Therefore, a convertible securities contract with redemption option outperforms a straight equity contract with redemption option in the contract property *Pareto-efficiency of option exercise*. These results suggest

[202] See Bascha and Walz (2002), p. 13.

that a straight equity contract with redemption option (1) can easily be designed to replicate or outperform a convertible securities contract with or without prior maturity or redemption option in terms of the parties' utility *magnitude*, (2) can fulfil the entrepreneur's super-ordinate goal of *long-term project continuation* after execution of the contract, but (3) cannot implement *Pareto-efficiency of option exercise* by the venture capitalist and therefore fails to provide the entrepreneur with additional effort incentives. Regarding empirical evidence, Kaplan and Strömberg (2003) find that redemption rights are included in 78.7% of their US sample contracts, of which 96.7% use any form of convertible securities.[203] It can be concluded that redemption options are almost always included in convertible securities contracts in the US venture capital market. Brettel et al. (2004a) find redemption rights to be included only in 22% of in their 114 German sample contracts, with 46% of contracts financed using straight equity.[204] While this is evidence that redemption options are contained in less than one quarter of German venture capital contracts, these findings do not allow drawing conclusions on the frequency of redemption option inclusion in straight equity contracts.

Proposition 9 shows that *liquidation provisions* define the same payoffs to the contracting parties as an exercised redemption option. They reduce the venture capitalist's loss by increasing that of the entrepreneur in line with her limited liability in the low state of the world. Hence, liquidation provisions should always be included in a venture capital contract to protect the venture capitalist's downside, as long as liquidation preferences are not automatically defined by the straight debt or preferred equity contract. These findings correspond to empirical evidence by Kaplan and Strömberg (2003), whereby liquidation rights are included in 100% of the 213 US sample contracts and 71.2% of liquidation rights are defined to exceed the venture capitalist's cumulative investments.[205] Conversely, Brettel et al. (2004a) report a frequency of inclusion of 42.1% in their German sample contracts but does not include information on liquidation

[203] See Kaplan and Strömberg (2003), pp. 286, 291.
[204] See Brettel et al. (2004a), p. 645.
[205] See Kaplan and Strömberg (2003), p. 288.

values.[206] This may be evidence of malpractice on the part of German venture capitalists.

These results can be summarized in the form of a *new pecking order of venture capital contracting*. As Neff (2003) points out, the well-known pecking order hypothesis by Myers (1984) and Myers and Majluf (1984) ranks the financing alternatives for companies that have attained a certain size and position in the market and have possibly publicly issued stock. These companies have arrived at a later stage of the financial growth cycle and therefore – if they decide not to use internal funds – prefer external debt over external equity to finance a new investment opportunity. Since young, small, and high-growth companies bear high risks of failure and asymmetric information, they are not necessarily given access to external debt and external equity. This suggests that venture capital finance is of particular importance for start-up firms, and the original pecking order hypothesis is not applicable.[207] This is underlined by Garmaise (2001), who demonstrates the existence of a pecking order of securities applying for young firms which is in direct contrast to the pecking order suggested by Myers (1984). He shows that entrepreneurs prefer to grant an investor the request for junior equity over debt.[208] Similarly, the new pecking order of venture capital contracting derived from the above analyses provides venture capitalists with a ranking of certain contract designs, which constitute incentive-compatible self-enforcing contracts despite large informational asymmetries between the contracting parties. These contracts are ranked on the basis of the underlying three contract properties used for contract comparisons: *utility magnitude*, long-term *project continuation*, and *Pareto-efficiency of option exercise*, where the latter is extended to consider the inclusion of an option – no matter whether Pareto-optimal or Pareto-dominated – better than no option. Liquidation provisions are assumed to be automatically included in straight debt and preferred equity contracts and are therefore not mentioned explicitly with convertible securities contracts. Furthermore, instead of including a redemption option, the venture capitalist can define a less flexible but comparable prior

[206] See Brettel et al. (2004a), p. 645.
[207] See Neff (2003), pp. 109–110.
[208] See Garmaise (2001), p. 2.

straight debt contract maturity in convertible debt contracts.[209] The new pecking order ranks the analyzed augmented contracts as follows: The venture capitalist and the entrepreneur should first sign a financing *contract including convertible securities with redemption option*, second a *straight equity contract with redemption option and liquidation provisions*, third a *straight debt contract with prior contract maturity*, and fourth a *straight debt/preferred equity contract*. The reasoning behind this pecking order is the following: Convertible securities contracts with redemption option outperform straight equity contracts with redemption option and liquidation provisions with respect to the option Pareto-criterion while the other contract properties are equal. Straight equity contracts with redemption option and liquidation provisions outperform straight debt contracts with prior maturity with respect to the magnitude of utilities and the option Pareto-criterion while the other contract property is equal. Straight debt contracts with prior maturity outperform straight debt/preferred equity contracts with respect to all contract properties. Straight debt/preferred equity contracts with redemption option also strictly outperform straight debt/preferred equity contracts across all three contract properties but Pareto-dominate straight equity contracts with redemption option and liquidation provisions. For this reason, they are not included in the pecking order.

[209] For an illustration of the new pecking order of venture capital contracting, see Figure 4-3.

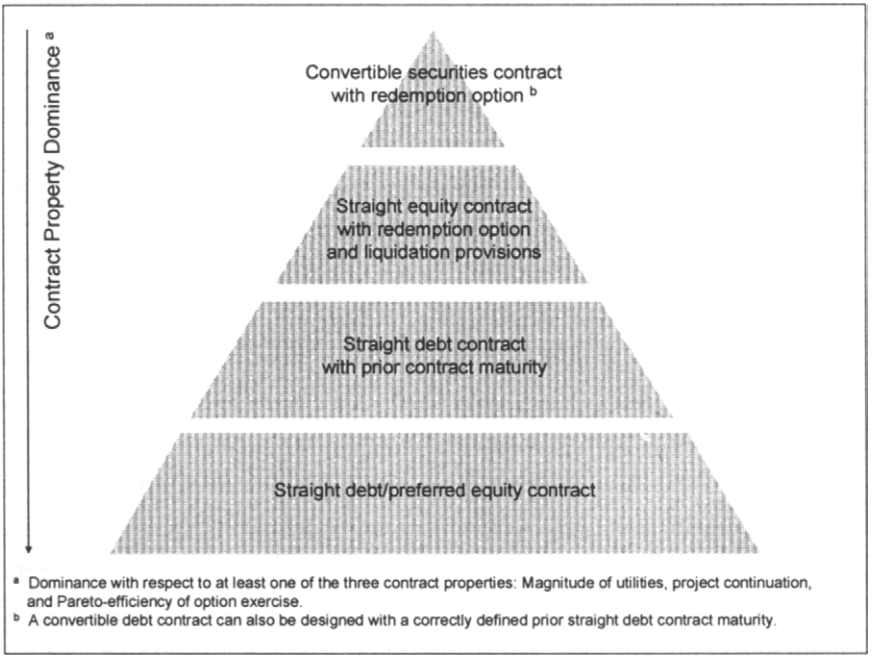


Figure 4-3: Pecking Order of Venture Capital Contracting

With respect to the initial research question it can be summarized that the pecking order indicates that a straight equity contract with redemption option can create a better incentive structure than that created by a convertible securities contract. However, in markets where convertible securities contracts are always combined with a redemption option, straight equity contracts with redemption option cannot replicate these incentives. The question therefore arises whether German venture capital contracts on the basis of convertible securities and straight equity financings frequently include redemption options.

For this reason and because the above comparisons of the model's results with existing empirical evidence has made clear that the model's findings can mainly not be assessed using existing findings on venture capital contracting in the German market, a detailed empirical analysis of augmented contract design using financing instruments and cash flow-related covenants by German venture capital companies is necessary for assessing the incentive-compatibility of their current contracting practice and for providing them with instructions on

how to design incentive-compatible contracts similar to convertible securities contracts.

4.5 Conclusions

This model extends the existing theoretical literature on venture capital contracting to a detailed analysis of the interaction of covenants and financial instruments in the allocation of cash flow rights and the resulting incentive mechanisms to the involved parties. The setup represents a synthesis of the models by Schmidt (2003) and Repullo and Suarez (2004) as well as stylized facts on venture capital finance. It thereby reflects venture capital reality better than previous models. Its findings are robust to a variety of changes in the setup.

The model presents as main finding that straight equity contracts in combination with a redemption option and possibly liquidation provisions can at least replicate the payoff structure of convertible securities contracts with and without redemption option as well as ensure project continuation for the entrepreneur. Only stand-alone convertible securities contracts cause project discontinuation. However, straight equity contracts with redemption option do not fulfill the Pareto-criterion of redemption option exercise, while convertible securities contracts fulfill the Pareto-criterion of conversion and redemption option exercise. As a result, straight equity contracts with redemption option outperform convertible securities in terms of their incentive structure but are outperformed by convertible securities with redemption option. This hierarchy of contract designs is extended to a new pecking order of venture capital contracting, which provides the venture capitalists with guidelines to incentive-compatible contracting with entrepreneurs.

The implications of the model are consistent with the empirical findings on the US venture capital market: US market participants include convertible securities and redemption options in almost total contracts. However, there so far exists no empirical evidence on German augmented contracting practices. This will be presented in Chapter 5.

5 Empirical Evidence on Contractual Architecture

5.1 Introduction

This chapter offers new insights into the real-world practices of contract negotiations and design between venture capital companies and their portfolio companies in the German venture capital market. Similar to the theoretical model in Chapter 4, its focus lies on the contractually defined allocation of cash flow rights to the contracting parties. It therefore adopts an *augmented contracting* approach in order to consider not only the cash flows resulting from financial instruments but also those determined by cash flow-related covenants. It additionally analyzes determinants of contract design, which relate to characteristics of the venture capital company. The separate allocation of control rights is also reported, despite the fact that control rights are not at the center of the analysis.

The study builds on the research question of the theoretical analysis in Chapter 4, which proposes that the incentive structure created by straight equity financing in combination with specific covenants is suited to effectively replicate the optimal allocation of cash flow rights obtained with convertible securities. This view has also been expressed by this survey's participants.[210] Since straight equity defines linear payoff functions for the contracting parties while convertible securities define non-linear payoff functions,[211] it can be argued that straight equity has to be combined with at least one cash flow-related covenant if it is to replicate the convertible securities' kinked payoff function. In order to isolate the frequently employed combinations of straight equity and cash flow-related covenants, five contracting patterns on the basis of different financial instruments are identified. Subsequently, determinants of the choice of contracting patterns by the venture capital companies are searched for within

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[210] 13.95% of survey participants report that they do not finance all investments with convertible securities because they are highly complex financial instruments. See Table 5-24.

[211] See Bascha and Walz (2000), p. 412.

their characteristics. On the one hand, venture capital company characteristics are the least analyzed determinants in empirical literature. On the other, the data collected by means of a self-report survey among venture capital companies does not permit the inclusion of further determinants such as legal, tax, and institutional environments or portfolio company characteristics and related agency problems. [212] Altogether, the empirical study therefore researches the following questions:

- Is straight equity the main financial instrument in German venture capital contracts, as existing empirical evidence suggests?
- How are German venture capital contracts structured? Can consistent patterns in combinations of financial instruments *(esp. straight equity)* and cash flow-related covenants be identified?
- What are the determinants of contractual architecture? Taking into account the limitations of the survey data on venture capital portfolios, which variables describing the venture capital companies' characteristics determine contract design?

These questions are summarized by the expectations[213] and hypotheses, which have been developed in Chapter 3.[214]

Expectation 1	Straight equity is the main financial instrument in the German venture capital market.
Expectation 2	Straight equity is used in combination with at least one non-ubiquitous cash flow-related covenant.
Hypothesis 1	Sophisticated venture capital companies use convertible securities as dominant financial instrument in their contracts.
Hypothesis 2	The investor types of venture capital companies determine the implemented contractual architecture.
Hypothesis 3	The ownership categories of venture capital companies determine the implemented contractual architecture.

Table 5-1: Expectations and Hypotheses

[212] For an overview of empirical literature on determinants of venture capital contract design, see Table 3-3.
[213] For an explanation of expectations, see Section 3.1.
[214] For an overview of the formulated expectations and hypotheses, see Table 5-1.

These expectations and hypotheses are tested and confirmed with help of data from a survey among 43 German venture capital companies with a total of 1063 portfolio companies. Firstly, descriptive statistics on the frequency of use of common financial instruments and covenants as well as contract negotiations are presented. Secondly, with a combination of cluster, factor, and discriminant analyses, a novel methodological approach to the context of venture capital contracting is introduced in order to identify consistent patterns in augmented contracting as well as their determinants.

The novelty of the approach originates from the fact that it significantly extends methodologies applied in the most closely related empirical work on patterns in venture capital contracting and their determinants. *Kaplan and Strömberg (2003)* present a detailed study of US venture capital contracts, of which 94.9% include convertible preferred equity. Therefore, their *descriptive statistics* on covenant inclusion directly relate to convertible securities.[215] *Cumming (2002b)* summarizes his *logit regression* results on European venture capital contracts as observed combinations of a financial instrument (straight equity or convertible preferred equity) with control rights, contingencies, a certain exit channel, and the venture capital companies' stage focus. He thereby not only vaguely forms contracting patterns but also distinguishes between them with the help of a characteristic of the venture capital companies.[216] *Kaplan et al. (2003)* apply *multivariate regression* analyses to a dataset on contracts from 23 non-US countries and show that convertible preferred equity contracts are written by sophisticated investors with respect to venture capital company characteristics such as size, age, and investment experience.[217] On the determinants of contract structure, *Isaksson et al. (2004)* combine *factor and discriminant analyses* to categorize covenants used by Swedish venture capital companies and identify determinants of covenant factor usage such as the venture capitalists' investor type and ownership category.[218] These analyses fail to identify actual contracting patterns which do justice to a broader scope of

[215] See Kaplan and Strömberg (2003), pp. 284, 288–289.
[216] See Cumming (2003), p. 19.
[217] See Kaplan et al. (2003), p. 21.
[218] See Isaksson et al. (2004), pp. 59–62.

employed financial instruments. This, however, is particularly relevant in European and especially in German venture capital contracts. Furthermore, they do not include more than three venture capital company characteristics and analyze them as to their influence on the choice of contracting patterns. In this chapter, applying cluster analysis for the first time to venture capital contracting enables the identification of several standard contracts in the German market. In addition, factor and discriminant analyses categorize the venture capital companies' characteristics into factors and identify those factors distinguishing most between the clusters. Not only have these three analyses so far not been combined in research on venture capital contracting but they also allow for unique contract interpretations. Consequently, the chosen methodological approach contributes substantially to the literature by providing unprecedented insights into contract design.

The analysis determines four main combinations of a financial instrument (convertible securities, preferred equity, straight equity, and combinations of debt and equity) with cash flow-related covenants. It confirms existing evidence that straight equity is the main financial instrument in the German market and shows that straight equity contracts so not include any additional cash flow-related covenants in their contracts that are not also included in all other identified contractual patterns. A judgment on the cash flow incentives created by these contracts, however, cannot be pronounced unless these results are compared to related contract-theoretical findings from Chapter 4. The findings on contract determinants are summarized in the form of a contract ranking in the order of venture capital investor sophistication: German convertible securities investors are most sophisticated in terms of size and domestic as well as international investment experience, followed by straight equity investors with only domestic investment experience. Legal restrictions are proven not to play a predominant role in the choice of contract designs.

The rest of the chapter is organized as follows. Section 5.2 describes the data and the applied research methodology. Section 5.3 presents empirical results: Section 5.3.1 displays descriptive statistics on contract negotiations and components, Section 5.3.2 identifies patterns in contract design, and

Section 5.3.3 discusses determinants of contract architecture. Section 5.4 summarizes the findings, and Section 5.5 concludes.

5.2 Sampling and Methodology

5.2.1 Data Collection and Sample

This study is the first empirical analysis to comprehensively analyze contract negotiations and design in the German venture capital market. No public data is available on the issue. Therefore, on the basis of earlier venture capital survey research,[219] a questionnaire[220] was developed and, with support of the German Private Equity and Venture Capital Association (BVK), sent to the top management of 169 German venture capital companies in November 2003. These companies had been selected or identified according to the criteria (1) membership in the BVK and/or (2) participation in the previous surveys. Since the BVK directory does not distinguish between venture capital and private equity companies, the questionnaire was sent to all identified companies. The survey sample does, however, not include any company with pure buy-out focus. The survey attained a response rate of 30.18% – slightly below that of the abovementioned preceding surveys –, thereby covering approximately one third of the market defined relevant. Of the returned 51 questionnaires, eight were excluded from the analysis due to extensive incompleteness and outlier deletion in the cluster analysis. The study thus relies on a sample of 43 venture capital companies (or 25.44%).[221] This sample size is comparable to research on related issues by Bascha and Walz (2002), where $n_{min} = 47$, and Isaksson et al. (2004), where $n = 27$. The survey questions were asked at the level of the venture capital companies' portfolio of investments and thus cover the aggregate investment and contracting behavior of participating venture capital companies, thereby incorporating a total of 1063 venture capital investments.[222] Data on single venture capital investments and related contracts was not raised.

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[219] Feinendegen et al. (2001); Hommel et al. (2003).
[220] For a copy of the questionnaire, see Appendix D.
[221] For an overview of sample selection and composition, see Table 5-2.
[222] This volume of data is consistent to that reported by other empirical papers. For an overview of sample sizes in the related empirical literature, see Appendix A.

Sample	Total	BVK Members	No BVK Members	Anonymous Participants
Contacted Venture Capital Companies	169	158	11	
Returned Questionnaires	51	44	1	6
Response Rate: 30.18%				
Excluded Questionnaires				
Incomplete Questionnaires	5	4	0	1
Cluster Analysis: Outlier	3	3	0	0
Total	43	37	1	5

Table 5-2: Sample Selection and Response

5.2.2 Sample Firm Descriptives

This section presents descriptive analyses of variables[223] on the sample firms. Firstly, the participating venture capital companies are characterized by means of their investor type, ownership category, operating years and number of employees.[224] Secondly, their investment activity is summarized.[225]

[223] The variables in this study are operationalized in the form of nominal, ordinal (Likert) or interval scaling and are non-normally distributed. Kolmogorov-Smirnov tests (with Lilliefors significance correction) and Shapiro-Wilk tests for the composite hypothesis of normality show significant values for all variables (with one constant exception), stating that the given distributions deviate from normal distribution. Nevertheless, for the majority of variables, skewness and kurtosis values are within tolerable ranges from their values under normal distribution. For this reason, mean values are reported for interval-scaled variables throughout this chapter. For detailed information on the operationalization of variables and on their skewness and kurtosis, see Appendix B.

[224] For descriptive statistics on sample firm characteristics, see Table 5-3.

[225] For descriptive statistics on the sample firms' investment activity, see Table 5-4.

Sample Firm Characteristics	Mean	Median	Grouped Median	Minimum	Maximum	Std. Deviation	Number	Percent of Total
Investor Type								
Early-Stage Inv.							18	41.86%
Late-Stage Inv.							12	27.91%
Generalist							13	30.23%
Other							0	0.00%
Ownership Category								
Captive Inv.							12	27.91%
Affiliated Inv.							3	6.98%
Independent Inv.							23	53.49%
Public Sector Inv.							3	6.98%
Other							2	4.65%
Operating Years	9.02	*6.00*	*5.80*	1	30	7.79		
Employees	13.60	*8.00*	*8.50*	1	100	17.01		

Table 5-3: Descriptive Statistics on Sample Firm Characteristics

5.2.2.1 Descriptive Statistics on Sample Firm Characteristics

The investor type refers to the investment preferences of a venture capital company with regard to the development stage of its portfolio companies. The following investor types can be distinguished:[226]

- *Early-stage investor:* Venture capital company focusing on investments in the seed and start-up stages.
- *Late-stage investor:* Venture capital company focusing on investments in the expansion, bridge, turnaround, secondary placement, and possibly buy-out stages.
- *Generalist:* Venture capital company investing actively across all investment stages without distinct stage focus.

In the sample, 41.86% of venture capital companies are early-stage investors, 27.91% are late-stage investors, and 30.23% are generalists. The three investor

[226] See BVK (2004c), pp. 4, 6–7, and EVCA (2002), pp. 8, 10, 12.

types are therefore almost equally represented. No other investor type is reported.

The ownership category of a venture capital company refers to its ownership structure and the resulting controlling and/or dominating shareholders. Four main categories are reported:[227]

- *Captive investor:* Venture capital company which is a subsidiary company of a financial institution or corporate entity: One shareholder holds more than 50% of the venture capital company's shares.[228]
- *Affiliated investor:* Venture capital company which is an associated company of a financial institution or corporate entity: At least one shareholder holds 20% or between 20% and 50% of the venture capital company's shares.[229]
- *Independent investor:* Venture capital company which is not controlled by another company, neither a parent company nor an influence-exerting affiliated company: No shareholder holds 20% or more of the venture capital company's shares.
- *Public sector investor:* Venture capital company which is "affiliated to government, local authorities, or other state enterprises having a mission to promote particular policies, such as innovation, regional development, [or] employment".[230]

Independent investors are best represented in the sample with 53.49%, followed by captive investors with 27.91%, and affiliated and public sector investors with only 6.98% each. Two participants report having an ownership structure other than the above: One company is publicly listed, the other is a financial institution itself.

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[227] See BVK (2004c), pp. 3, 7, EVCA (2002), pp. 3, 11, and Christofidis and Debande (2001), p. 9.
[228] See § 271.2 HGB in conjunction with § 290.2.1 HGB.
[229] See § 271.1.3 HGB in conjunction with § 311.1.1 HGB.
[230] Christofidis and Debande (2001), p. 9.

Both investor type and ownership category are characteristics of venture capital companies which may change over time. Despite the fact that this does not necessarily apply universally, they are therefore considered as developing rather than static characteristics throughout this chapter:[231] Venture capital companies may shift their investment focus from early-stage investments to late-stage investments and a generalist investment approach as result of a growth in funds available and greater investment experience. Similarly, venture capital companies may change their ownership category from a captive to an affiliated and an independent status as result of their growth and investment experience in a certain industry, technology, or niche market. Their corporate or other shareholders subsequently reduce their stake in the venture capital companies because these no longer uniquely cover the investors' investment criteria and needs. Both developments may also be facilitated by merger or acquisition activities among venture capital companies, possibly with international investors thereby entering the German market.[232]

These developments are exemplified by the examples of German venture capital companies illustrated below.[233] In addition, data on the venture capital market confirms these developments: Since market consolidation began in 2002, the relative importance of late-stage investments as opposed to early-stage investments in the German venture capital market has increased from 58.8% in 2002 to 67.3% in 2004.[234] The relative importance of independent investors as opposed to affiliated and captive investors in the German venture capital and private equity markets has increased from 58.3% in 2002 to 63.9%

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231 In the following, the variables "Investor Type" and "Ownership Category" are considered as ordinal instead of categorical variables. See Appendix B.

232 Public venture capital investors have shown to continuously remain in public ownership in the German market. See Leopold et al. (2003), pp. 73–80. They therefore represent an exception from the above assumed development of the venture capital companies' ownership status. However, due to their small representation in the sample, public venture capital investors do not form the dominant ownership category in any contractual pattern or cluster identified in Section 5.2.3.1. For this reason, a metric scaling for the variable "Ownership Category" in the subsequent factor and discriminant analyses in Sections 5.2.3.2 and 5.2.3.3 can be assumed.

233 For selected examples on the investor type and ownership category development of German venture capital companies, see Figure 5-1.

234 The relative importance of late-stage investments is calculated on the basis of the respective annual new investment volumes in 2002 and 2004. See BVK (2005a), p. 20, or Figure 2-3.

in 2004, whereby the relative importance of affiliated investors decreased only from 5.42% to 4.18% but that of captive investors decreased from 36.3% to 31.9%.[235] These observations support the choice of ordinal scaling of the variables "Investor Type" and "Ownership Category" throughout the rest of this chapter.

[235] The relative importance of independent, affiliated, and captive investors is calculated on the basis of the respective annual new investment volumes in the venture capital and private equity markets in 2002 and 2004. Public and other venture capital and private equity companies are excluded. Separate data for the venture capital market only is not available. See BVK (2005a), p. 14, and BVK (2003), p. 13.

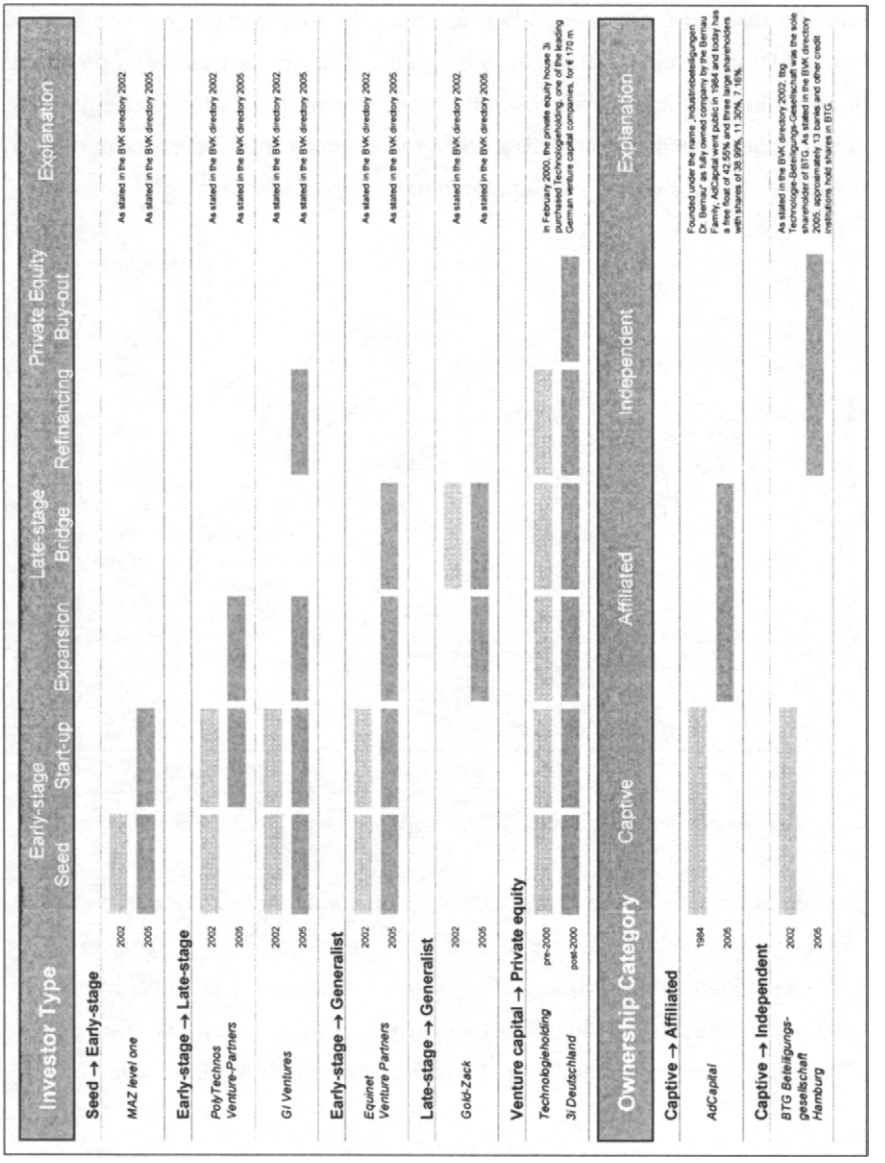


Figure 5-1: Development of Investor Type and Ownership Category of Selected German Venture Capital Companies Over Time

The number of operating years in the German venture capital market reports the age of a German-based venture capital company. The average number of operating years (year established) across the sample is 9.02 (1995), with a range of 1.23 years (2003) to 16.81 years (1987) defined by the sample

standard deviation, and a reported maximum of 30 years (1974). The sample thus contains a majority of rather young but also a non-negligible proportion of older venture capital companies. This becomes obvious when looking at the distribution of the 43 participating companies across the five major periods in the rather short history of the German venture capital market:[236]

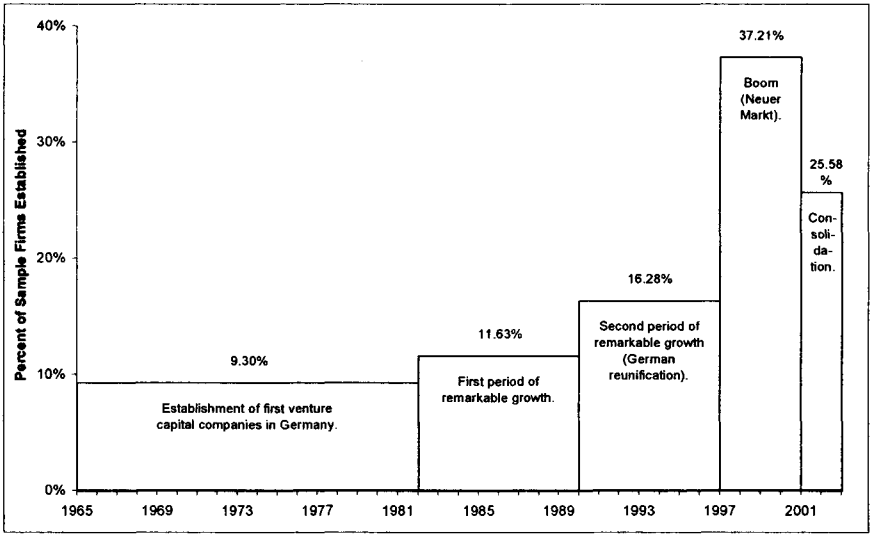


Figure 5-2: Sample Firm Establishment across German Venture Capital Market History

The number of employees is reported at a sample average of 13.60 employees. The sample standard deviation defines a range of 1 employee to 30.61 employees. Hence, the majority of participating companies is small to medium-sized with respect to the number of employees. However, a reported maximum of 100 employees shows that large firms are also included in the sample.

5.2.2.2 Descriptive Statistics on Investment Activity

On average, sample firms have invested 57.78% of their raised funds in portfolio companies. In their portfolio, they manage 24.72 investments, of which

[236] See Leopold et al. (2003), pp. 42–78. For a distribution of sample firm age or operating years in the German venture capital market, see Figure 5-2.

2.10 (1.64) are new investments undertaken in 2003 (2002). Investment size ranges from an average minimum investment of EUR 1.6 m to an average maximum investment of EUR 29.98 m. 25.81% of investments do not exceed the size of EUR 1 m, 69.44% range between EUR 1 m and EUR 10 m, and the remaining 4.75% between EUR 10 m and EUR 50 m.

Concerning international investing, "investment activity" in this context refers to investing in at least one foreign country without physically locating in that country. "Physical presence" is the physical location of the company and a team in at least one foreign country, that is, setting up a branch office in another country, acquiring a foreign venture capital company or engaging in an international joint venture/alliance. Across the sample, 30.23% of venture capital companies invest internationally by means of mere investment activity in at least one foreign country and 9.30% by means of investment activity and physical presence in at least one foreign country each.[237]

[237] In this survey, physical presence is always combined with investment activity in at least one other country.

Investment Activity	Mean	Median	Grouped Median	Minimum	Maximum	Std. Deviation	Number	Percent of Total (Scaled Mean)
Funds Invested	57.78%	*50.00%*	*53.85%*	10.00%	100%	0.24		
(as % of Funds Raised)								
Investments under Management	24.72	*11.00*	*10.83*	2	220	35.46		
New Investments								
2003	2.10	*2.00*	*1.74*	0	6	1.85		
2002	1.64	*1.00*	*1.32*	0	7	1.74		
Investment Size Preferences								
Minimum (in EUR m)	1.60	*0.70*	*0.70*	0.00	10.00	2.01		
Maximum (in EUR m)	29.98	*5.00*	*5.60*	0.15	500.00	99.05		
Distribution of Investment Size								
< EUR 1m	25.84%	*10.00%*	*10.00%*	0.00%	100%	0.33		25.81%
EUR 1m–10m	69.52%	*81.00%*	*81.33%*	0.00%	100%	0.32		69.44%
EUR 10m–20m	3.92%	*0.00%*	*0.62%*	0.00%	70.00%	0.12		3.91%
EUR 20m–50m	0.24%	*0.00%*	*0.24%*	0.00%	5.00%	0.01		0.24%
< EUR 50m	0.60%	*0.00%*	*0.24%*	0.00%	20.00%	0.03		0.60%
International Investing								
Investment Activity							13	30.23%
Physical Presence							4	9.30%

Table 5-4: Descriptive Statistics on Investment Activity

5.2.3 Research Methodology

The sample size of 43 venture capital companies does not limit the analysis to descriptive statistics but allows the use of carefully executed structure-discovering and structure-testing methods:[238] As a first step, a cluster analysis is conducted to identify consistent patterns of contract design. As a second step, variables describing the venture capital companies' characteristics are grouped with help of a factor analysis. And finally, a discriminant analysis is applied to

[238] See Bascha and Walz (2002), pp. 17–24, and Isaksson et al. (2004), pp. 55–56.

identify those factors discriminating between clusters. The following sections discuss the applied techniques as well as strengths and weaknesses of the analysis.

5.2.3.1 Cluster Analysis

The term "cluster analysis" encompasses different explorative, taxonomic methods classifying data into mutually exclusive a priori unknown clusters on the basis of all underlying variables. In this specific case, the analysis targets the identification and explanation of groups of venture capital companies within which contract design is relatively homogeneous and amongst which it is relatively heterogeneous. The necessary steps of analysis undertaken are explained in the following.

5.2.3.1.1 Variables

An important characteristic of cluster analysis is the fact that all variables enter the analysis at equal weight.[239] Since the above reasoning suggests a similar importance of financial instruments and covenants on cash flow allocation, this is realized by including 6 variables each in the analysis.[240] For each venture capital company, these variables are operationalized with interval scaling such that they indicate the percentage of contracts with current portfolio companies which include the financial instrument or cash flow-related covenant used as name for the respective variable. The variable "Other (Financial Instruments)" is excluded due to its low relative frequency of 0.62%[241].

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[239] See Backhaus et al. (2003), p. 480.

[240] For the included cluster analysis variables, see Table 5-5. Variable descriptives follow in Section 5.3.1. For detailed variable information, see Appendix B.

[241] Scaled mean as displayed in Table 5-22.

Cluster Analysis Variables		
	Financial Instruments	Covenants: Cash Flow Allocation
1	Straight Equity	Conversion Provisions
2	Preferred Equity	Co-Sale Agreements
3	Debt	Dividend Provisions
4	Combinations of Debt and Equity	Liquidation Rights
5	Convertible Securities	Redemption Rights
6	Silent Partnerships	Staged Financing

Table 5-5: Cluster Analysis Variables

5.2.3.1.2 Outliers

Cluster analysis is easily distorted by cases which clearly differ from the rest. "[These o]utliers can represent either (1) truly "aberrant" observations that are not representative of the general population, or (2) an undersampling of actual group(s) in the population that causes an underrepresentation of the group(s) in the sample."[242] To avoid distortions of cluster structure in this study, three cases (24, 32, 49) are detected by means of single-linkage procedure[243], classified as "aberrant observations" and excluded from the analysis.

5.2.3.1.3 Distance Measure

Inter-object dissimilarity is quantified mainly with help of distance measures. They calculate proximity or (absolute) distance between objects across all variables. In this analysis, squared Euclidean distance is applied which calculates the squared geometric or straight-line distance in multidimensional space:[244]

[242] Hair et al. (1998), pp. 482–483.
[243] For an explanation of the single-linkage method, see Section 5.2.3.1.4.
[244] See Bortz (1999), pp. 550–551.

$$d(e_i, e_j) = \sum_{l=1}^{P} (x_{li} - x_{lj})^2 \quad (5.1)$$

with $d(e_i, e_j)$ squared Euclidean distance measure between objects,

e_i (e_j) object,

x_{li} (x_{lj}) observation of objects e_i (e_j) at variable l,

P number of variables.

It is selected because it places greater weight on objects that are further apart than, for example, the city-block metric. Squared Euclidean distance is also the recommended distance measure for the chosen Ward clustering algorithm.[245]

5.2.3.1.4 Clustering Algorithm

On the basis of a distance matrix calculated with the squared Euclidean procedure, a clustering algorithm merges objects into clusters. In this study, polythetic algorithms apply which, as opposed to monothetic algorithms, use more than one variable for clustering. Ward's method is used as clustering algorithm because it creates the best partition and finds clusters with a comparable number of objects.[246] Like single-linkage, it is a hierarchical or step-wise and agglomerative method starting with each object as a cluster and step by step fusing similar clusters until only one cluster with all objects remains. The methods differ, however, in the definition of cluster similarity. Ward's (minimum variance) method defines similarity of clusters as the minimum increase in variance upon aggregation of two clusters:[247]

[245] See Hair et al. (1998), p. 486, and Bühl and Zöfel (2002), p. 502.
[246] See Backhaus et al. (2003), pp. 516–517.
[247] See Bortz (1999), p. 558.

$$D(C_i, C_j) = \frac{n_i \cdot n_j}{n_i + n_j} \sum_{l=1}^{p} (\bar{x}_{li} - \bar{x}_{lj})^2 \qquad (5.2)$$

with $D(C_i, C_j)$ distance or dissimilarity measure between Clusters C_i (C_j),
n_i (n_j) number of objects in cluster C_i (C_j),
$\bar{x}_{li}$ $(\bar{x}_{lj})$ average observation of variable l across the n_i (n_j) elements of cluster C_i (C_j).

The single linkage method, used to identify outliers, defines similarity of clusters as the minimum distance between any object in one cluster and any object in another given by

$$D(C_i, C_j) = \min_{e_i \in C_i, e_j \in C_j} \left\{ d(e_i, e_j) \right\}. \qquad (5.3)$$

5.2.3.1.5 Number of Clusters

The number of clusters is determined by the researcher. Despite the fact that he can thus freely decide between manageability (few clusters) and homogeneity (many clusters), the final number of clusters should above all be determined by the following statistical criterion: The cluster solution is defined as a number of clusters where the next stage of agglomeration causes the cluster similarity (here: Ward) measure to make a first relatively large jump. [248] In the agglomeration schedule, this is the case in stage 38.[249] This five-cluster solution is also graphically represented as a first large jump before the next agglomeration step in the dendrogram. This is a tree graph visualizing objects (horizontal axis) and steps (vertical axis) of the agglomerative hierarchical clustering procedure.[250]

[248] See Backhaus et al. (2003), p. 522.
[249] For an illustration of the agglomeration schedule, see Table 5-6.
[250] For an illustration of the dendrogram, see Figure 5-3.

Ward's Method (Squared Euclidean) Agglomeration Schedule

Stage	Clusters Combined Cluster 1	Cluster 2	Coefficients (Ward Similarity Measure)	Number of Clusters
1	31	32	0.763	1
2	28	43	1.869	2
3	14	41	3.095	3
4	2	24	4.619	4
5	8	37	6.188	5
6	35	39	7.761	6
7	17	21	9.411	7
8	10	29	11.101	8
9	19	33	13.181	9
10	30	34	15.367	10
11	6	15	18.171	11
12	17	27	21.057	11
13	5	31	24.149	11
14	2	23	27.281	11
15	25	26	31.114	12
16	13	40	34.961	13
17	7	20	39.015	14
18	10	14	43.257	13
19	4	19	47.631	13
20	35	38	52.078	13
21	8	18	56.812	13
22	11	28	61.674	13
23	3	11	67.797	13
24	8	42	73.956	13
25	12	35	80.135	13
26	2	22	86.914	13
27	6	9	94.084	13
28	7	8	102.076	12
29	4	16	110.267	12
30	10	30	118.976	11
31	3	25	128.737	10
32	10	17	139.231	9
33	1	13	150.412	9
34	3	36	163.357	9
35	4	5	178.190	8
36	3	6	200.564	7
37	1	2	229.665	6
38	4	7	259.113	5
39	3	10	300.401	4
40	4	12	348.061	3
41	1	4	416.415	2
42	1	3	504.000	1

Table 5-6: Agglomeration Schedule

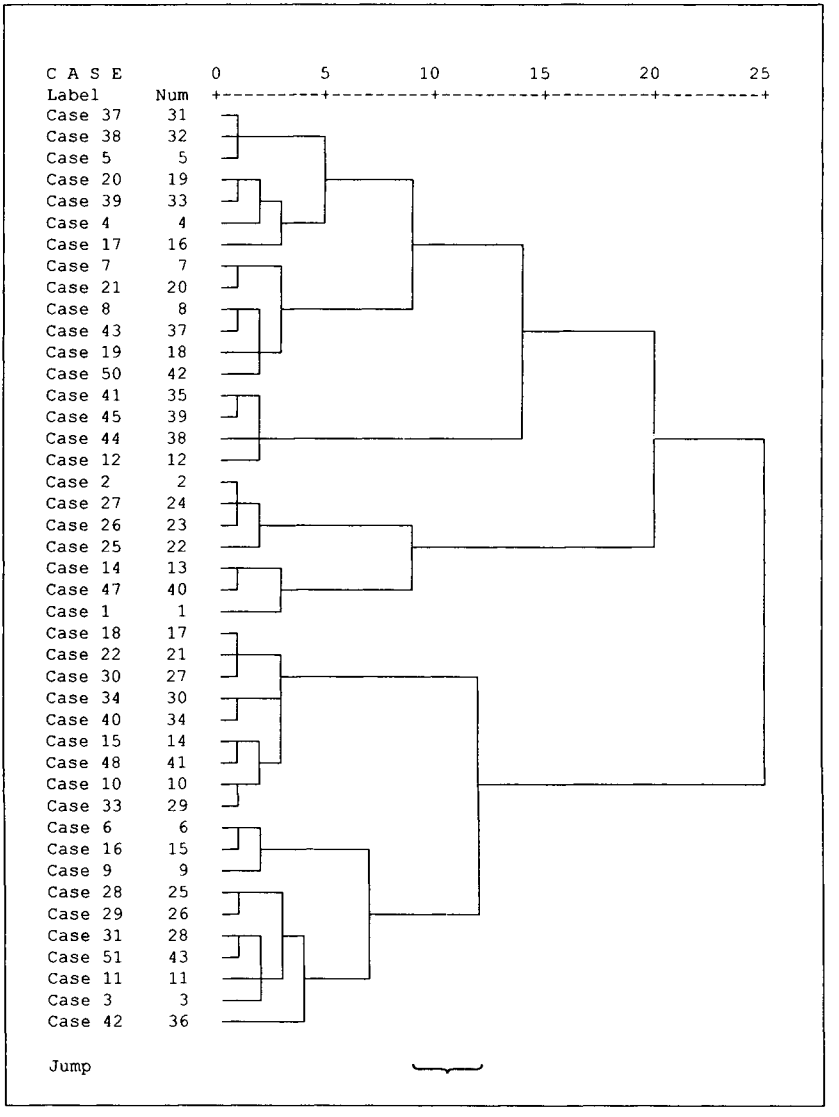


Figure 5-3: Dendrogram

5.2.3.1.6 Kruskal-Wallis Test

The Kruskal-Wallis test for k (k > 2) independent samples is a generalization of the Wilcoxon-Mann-Whitney test for two independent samples. It is a non-parametric, distribution-free test which compares sample medians to analyze

whether the samples stem from different populations. Thus, the null hypothesis states that the samples come from identical populations. It is employed because, unlike analysis of variance tests, it does not make the assumption that the underlying data is normally distributed. In this analysis, the null hypotheses states that the frequencies of use of financing instruments and contractual covenants are identical across the five clusters and can be rejected in 20 out of 24 cases.[251] This verifies that the five-cluster solution separates the entire sample into heterogeneous clusters. The heterogeneity also extends to covenants other than cash flow-related covenants.

Variables	Chi-Square	df	Asymp. Sig.
Straight Equity	31.978	4	0.000***
Preferred Equity	31.150	4	0.000***
Debt	16.657	4	0.002***
Debt-Equity Combinations	20.243	4	0.000***
Convertible Securities	28.318	4	0.000***
Silent Partnerships	8.490	4	0.075*
(Other)	*3.778*	*4*	*0.437*
Conversion Provisions	20.664	4	0.000***
Co-Sale Agreements	26.537	4	0.000***
Dividend Provisions	9.841	4	0.043**
Liquidation Rights	19.906	4	0.001***
Redemption Rights	9.587	4	0.048**
Staged Financing	7.446	4	0.114
Information Rights	2.835	4	0.586
Board Representation	13.668	4	0.008***
Board Supermajority Rights	15.057	4	0.005***
Board Veto Rights	6.477	4	0.166
Protective Provisions	15.406	4	0.004***
Voting Rights	14.088	4	0.007***
Anti-Dilution Provisions	13.327	4	0.010**
Registration Provisions	17.522	4	0.002***
Rights of First Refusal	15.772	4	0.003***
Non-Compete Clauses	8.828	4	0.066*
Vesting Provisions	13.773	4	0.008***

*** significant at $p \leq 0.01$; ** significant at $p \leq 0.05$; * significant at $p \leq 0.10$

Table 5-7: Kruskal Wallis Test with Grouping Variable "Cluster Membership"

[251] Of the remaining four variables, the variable "Other (Financial Instruments)" is a constant. For the results of the Kruskal Wallis Test, see Table 5-7.

Finally, the profiling and interpretation of the identified clusters involves examining the average cluster profiles. These are presented and discussed in Section 5.3.2.

5.2.3.2 Factor Analysis

Factor analysis is an explorative, taxonomic, data reducing method which groups variables into independent factors explaining the correlations within a set of variables. In this case, it is used to identify and profile factors containing variables which describe certain characteristics of the venture capital companies. The entire factor analysis procedure chosen for this purpose is described in the following.

5.2.3.2.1 Variables

Variable selection for factor analysis is based on hypotheses on underlying factors developed in advance. In this study, it is hypothesized on the influence of the characteristics (in a broader sense) of venture capital companies on contract design. The general rule for factor analysis, stating that the minimum sample size is to be about five times as large as the number of variables, is fulfilled if nine variables are included in the analysis.[252] Thus, nine factor analysis variables describing sample firm characteristics, investment activity, and contracting process are chosen.[253] The variables "Investor Type" and "Ownership Category" describe the venture capital companies' current investment stage focus and ownership status and are ordinal-scaled;[254] the variables "Operating Years", "Employees", and "Investments under Management" indicate age, headcount and portfolio size for each venture capital company and have interval scaling; the variables "International Investment Activity" and "International Physical Presence" are operationalized

[252] See Hair et al. (1998), pp. 98–99.

[253] For the included factor analysis variables, see Table 5-8. Variable descriptives are presented in Sections 5.2.2 and 5.3.1. For detailed variable information, see Appendix B.

[254] For a detailed explanation of the ordinal operationalization chosen for the variables "Investor Type" and "Ownership Category", see Section 5.2.2.1.

as binary variables and indicate whether the venture capital companies invest internationally from their German offices and whether they invest internationally from their German as well as at least one foreign office; and the variables "Contracting: Financial Structure" and "Contracting: Contractual Covenants" are operationalized with interval scaling indicating the percentage of total contracting time venture capital companies spend on the definition of financial instruments and covenants respectively. These variables' binary[255], ordinal and interval operationalization makes z-standardization necessary for comparability of the variables. Hereby, each variable is converted to standard or Z scores as shown below:[256]

$$z_i = \frac{x_i - \bar{x}}{s} \tag{5.4}$$

with x_i observation,

$\bar{x}$ mean,

s standard deviation.

Factor Analysis Variables		
Sample Firm Characteristics	Investment Activity	Contracting Process
Investor Type	Investments under Management	Contracting: Financial Structure
Ownership Category		
Operating Years	International Investment Activity	Contracting: Contractual Covenants
Employees		
	International Physical Presence	

Table 5-8: Factor Analysis Variables

5.2.3.2.2 Tests of Appropriateness

The appropriateness of factor analysis depends on the correlations between variables. Factors exist only if partial correlations among variables, that is, the correlations between variables when the effects of other variables are taken into

[255] The inclusion of binary variables in factor analysis does not notably affect the output. See Moosbrugger and Hartig (2002), pp. 139–141.

[256] See Backhaus et al. (2003), pp. 538–539.

account, are small. [257] Measures examining the intercorrelations among variables are the Bartlett's test of sphericity and the Kaiser-Meyer-Olkin measure of sampling adequacy (MSA). In this study, both measures are used to test the appropriateness of factor analysis:

Measures of Appropriateness		
Bartlett's Test of Sphericity	Approx. Chi-Square	139.209
	df	36
	Sig.	0.000***
Kaiser-Meyer-Olkin Measure of Sampling Adequacy (MSA)		0.556

*** significant at $p \leq 0.01$; ** significant at $p \leq 0.05$; * significant at $p \leq 0.10$

Table 5-9: Measures of Appropriateness

Firstly, the Bartlett's test of sphericity examines the null hypothesis that the sample is drawn from a basic population in which the variables are uncorrelated. With a statistical significance of 0.000 in this analysis, the null hypothesis can be rejected and the factor analysis conducted. [258] Secondly, the MSA is calculated on the basis of the anti-image correlation matrix.[259] It tests partial correlations and as a result quantifies variable prediction on a 0 to 1 basis. The MSA value for the *totality of variables* included in the factor analysis tests the appropriateness of factor analysis; the MSA values for *individual variables* test the appropriateness of their inclusion in the factor analysis.[260] The following guidelines for interpretation apply:[261]

KMO Measure of Sampling Adequacy Interpretation Guidelines			
MSA ≥ 0.9	Marvelous	MSA ≥ 0.6	Mediocre
MSA ≥ 0.8	Meritorious	MSA ≥ 0.5	Miserable
MSA ≥ 0.7	Middling	MSA < 0.5	Unacceptable

Table 5-10: KMO Interpretation Guidelines

[257] Hair et al. (1998), p. 99, suggest that a partial correlation $c < 0.3$ is small. The negative partial correlations are reported in the anti-image correlation matrix in Table 5-11. Absolute values $c \geq 0.3$ are underlined.

[258] For the results of the Bartlett's Test of Sphericity, see Table 5-9.

[259] For the anti-image correlation matrix with individual MSA values, see Table 5-11.

[260] For the overall MSA value, see Table 5-9. For the individual MSA values, see Table 5-11.

[261] See Backhaus et al. (2003), p. 276.

In this analysis, an MSA value of 0.556 is to be interpreted as "miserable" but indicates that factor analysis is nevertheless feasible. As the MSA increases not only with average correlation but also with sample size and number of variables,[262] this indicates that, with more than 43 cases and nine variables, the MSA value would have been even higher. The MSA for individual variables are displayed on the diagonal of the anti-image correlation matrix. They range from miserable to unacceptable for two binary variables. These are, however, not excluded from the analysis because their communalities do not necessarily suggest their exclusion.[263]

Anti-Image Correlation	Investor Type	Ownership Category	Operating Years	Employees	Investments under Management	Contracting: Financial Structure	Contracting: Contractual Covenants	International Investment Activity	International Physical Presence
Investor Type	0.681								
Ownership Categories	-0.003	0.566							
Operating Years	-0.232	0.174	0.728						
Employees	0.011	-0.047	0.060	0.535					
Investments under Management	-0.057	-0.001	-0.223	-0.909	0.555				
Contracting: Financial Structure	0.002	0.001	-0.181	-0.102	0.168	0.547			
Contracting: Contractual Covenants	0.154	0.169	-0.082	-0.042	0.146	0.512	0.575		
International Investment Activity	-0.034	-0.009	0.131	-0.327	0.162	0.098	-0.220	0.459	
International Physical Presence	0.199	0.127	-0.119	-0.381	0.230	0.085	-0.047	0.371	0.451

Table 5-11: Anti-Image Correlation and Individual MSA

[262] See Hair et al. (1998), pp. 99-100.

[263] It is suggested that variables with low communalities distort results and are thus to be excluded from the analysis if they also do not fulfil MSA requirements. See Backhaus et al. (2003), p. 317. According to Table 5-12, the variable "Operating Years" displays the by far lowest communality, not the two binary variables "International Investment Activity" and "International Physical Presence" with unacceptable individual MSA values. Furthermore, the Kruskal-Wallis test in Table 5-19 states that, of all variables, the clusters differ significantly only with respect to the variable "International Investment Activity" (at the 0.05 significance level). This also supports the inclusion of this variable in the analysis.

5.2.3.2.3 Extraction Method

Principal component analysis and principal axis factoring are the two main methods of factor extraction. While the computation of both iterative methods is almost identical, they differ significantly in the interpretation of factors: Principal component analysis addresses the question of how the variables loading on a factor can be summarized by a *collective term* or component. It is a variable summarizing and thus data reducing method. Principal axis factoring searches for the *cause* of high factor loadings of variables on a factor. It thereby attempts to explain the variance through hypothetical factors.[264] The choice of extraction method therefore relies solely on objective textual considerations. Since the above defined goal of this factor analysis is to reduce and summarize data, principal component analysis is applied.

5.2.3.2.4 Communalities

A basic assumption of factor analysis is that every observation of a (standardized) variable can be described as a linear combination of a number of (hypothetical) factors:[265]

$$x_{mi} = f_{m1} \cdot a_{i1} + f_{m2} \cdot a_{i2} + \ldots + f_{mQ} \cdot a_{iQ} = \sum_{j=1}^{Q} f_{mj} \cdot a_{ij} \qquad (5.5)$$

with x_{mi} observation of case m at variable I,
a_{iq} loading of factor j for variable I,
f_{mj} value of factor j at case m,
i index for the P variables,
j index for the Q factors,
m index for the N cases.

Factor loadings represent the correlation between variables and factors. When squared, they equal the coefficient of determination (R^2) in a regression analysis and quantify the percentage of the variance in a variable which is explained by

[264] See Backhaus et al. (2003), pp. 292–293.
[265] See Bortz (1999), pp. 500–501.

a factor. The sum of squared factor loadings for a variable across all factors is called communality:[266]

$$0 \leq h_i^2 = \sum_{j=1}^{Q} a_{ij}^2 \leq 1. \tag{5.6}$$

Communalities after factor extraction are smaller than 1 since the totality of factors does usually not explain total variance. In the analysis, communalities indicate medium to very high correlations.[267] The variable "Operating Years" with the by far lowest communality is not excluded from the analysis because of its "middling" and thus acceptable MSA value.

Communalities	Initial	Extraction
Investor Type	*1.000*	0.859
Ownership Category	*1.000*	0.926
Operating Years	*1.000*	0.669
Employees	*1.000*	0.941
Investments under Management	*1.000*	0.911
Contracting: Financial Structure	*1.000*	0.826
Contracting: Contractual Covenants	*1.000*	0.775
International Investment Activity	*1.000*	0.850
International Physical Presence	*1.000*	0.779

Table 5-12: Communalities

5.2.3.2.5 Number of Factors

To determine the number of factors to be extracted, the researcher can subjectively choose between two main procedures based on factor eigenvalues. These are defined as the sum of squared factor loadings for a factor across all variables and represent the amount of total variance accounted for by that factor:[268]

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[266] See Bortz (1999), p. 504.

[267] For a list communalities related to the factor analysis variables, see Table 5-12. In principal component analysis, it is assumed that no specific or error variance exists and factors are based on common variance only. The initial value for communality is therefore set to 1. See Moosbrugger and Hartig (2002), pp. 142–143.

[268] See Bortz (1999), p. 504.

$$\gamma_j = \sum_{i=1}^{P} a_{ij}^2 . \tag{5.7}$$

According to the Kaiser-Guttman (latent root) criterion, only factors with eigenvalues greater than 1 are considered significant and all other factors disregarded. The scree test criterion determines the optimal number of factors graphically, and therefore not always explicitly, and usually includes at least one more factor in the analysis than the Kaiser-Guttman criterion.[269] The number of factors after which the eigenvalue-line straightens out is the elbow after which eigenvalues are useless or "scree" for variance explanation. In this analysis, the Kaiser-Guttman criterion suggests a four-factor solution,[270] and the scree plot inexactly a four- or a five-factor solution.[271] Due to the fact that five factors considerably increase interpretability and explained variance, factor extraction in this analysis follows this scree plot criterion.

Eigenvalues and Total Variance Explained

	Initial Eigenvalues			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.526	28.07	28.07	2.361	26.24	26.24
2	1.845	20.50	48.57	1.621	18.01	44.24
3	1.386	15.40	63.97	1.257	13.97	58.21
4	1.044	11.60	75.57	1.204	13.38	71.59
5	0.734	8.16	83.73	1.092	12.14	83.73
6	0.568	6.31	90.04			
7	0.487	5.41	95.46			
8	0.355	3.95	99.41			
9	0.053	0.59	100.00			

Table 5-13: Eigenvalues

[269] See Hair et al. (1998), p. 104.
[270] For factor analysis eigenvalues, see Table 5-13.
[271] For an illustration of the scree plot, see Figure 5-4.

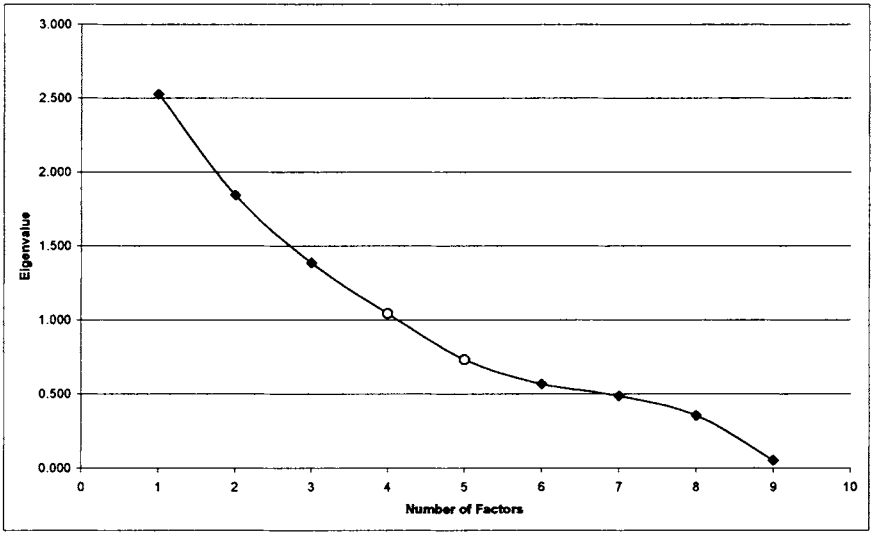


Figure 5-4: Screeplot

5.2.3.2.6 Factor Rotation

Analytic factor rotation is a tool which facilitates factor interpretation without changing the explanatory power of principal component analysis. It rotates the coordinate plane around the origin with the axes remaining orthogonal. Varimax rotation, which is most frequently used, is also applied here. It maximizes the variances of the squared factor loadings for each factor across all variables.[272] In other words, it minimizes the number of variables with high factor loadings on each factor and thereby simplifies factor interpretation.

5.2.3.2.7 Factor Identification

Factors are identified with help of the rotated factor matrix of loadings.[273] Variables load up to the factor at which they show the highest factor loading. If a variable shows several moderate-size loadings, there is no simple structure

[272] See Bortz (1999), p. 532.
[273] For the rotated factor matrix of loadings, see Table 5-14.

solution and interpretation is complicated. In the analysis, this is the case with the variable "Operating Years", which shows factor loadings around 0.50 for Factors 1 and 4. As far as factor loading significance is concerned, it is a general rule that, with a sample size of 50 cases, a factor loading of 0.75 or above is significant on a 0.05 significance level.[274] This critical value is easily exceeded by all variables except the variables "Operating Years" and "International Physical Presence". The reasoning above, however, explains their retention.

Rotated Factor Matrix of Loadings

	Factor				
	1	2	3	4	5
Investor Type	0.094	0.100	0.094	0.909	0.063
Ownership Category	0.037	0.095	0.039	0.015	0.956
Operating Years	0.459	0.132	-0.297	0.499	-0.322
Employees	0.966	0.011	0.051	0.061	0.031
Investments under Management	0.939	0.046	0.036	0.156	0.039
Contracting: Financial Structure	-0.060	0.902	-0.041	0.032	-0.073
Contracting: Contractual Covenants	-0.130	-0.827	0.101	-0.141	-0.208
International Investment Activity	0.302	-0.256	0.827	-0.095	-0.021
International Physical Presence	0.462	-0.134	-0.677	-0.265	-0.139

Table 5-14: Rotated Factor Matrix of Loadings

5.2.3.2.8 Factor Scores

Based on the factor loadings and the observations of variables within the factors, new variables are created representing the variables in the factors. These can then be used as factors in subsequent analyses. The observations of these new variables are factor scores which are "composite measures of each factor computed for each [case]".[275] For this analysis, factor scores are created with the regression method. Despite the fact that factor scores are estimated differently in the Bartlett and the Anderson-Rubin methods, all three procedures deliver the exact same results under principal component analysis.

[274] See Hair et al. (1998), p. 112.
[275] Hair et al. (1998), p. 119.

Finally, the interpretation of the factors involves finding a variable-summarizing collective term describing each factor. This follows in Section 5.3.3.

5.2.3.3 Discriminant Analysis

Discriminant analysis is a multivariate dependence technique for the analysis of group differences, where the dependent variable is nominally scaled. It explains and predicts group membership with help of a set of metric independent variables. In this study, it is employed to analyze (1) whether the previously identified clusters differ significantly with respect to factors summarizing various venture capital companies' characteristics and (2) which of these factors discriminate between clusters. Methodological details of the undertaken discriminant analysis are described below.

5.2.3.3.1 Variables

When specifying variables for the discriminant analysis, it is essential that the number of categories of the dependent variable does not exceed the number of independent variables. In this analysis, cluster membership is the nominal dependent variable, with five clusters as mutually exclusive and exhaustive groups. Five factors (in the form of factor score estimates) are chosen as independent variables. Thus, the numbers of categories and independent variables are equal. Since the dependent variable has more than two categories, multiple discriminant analysis (MDA) applies. The sample size of 43 venture capital companies is sufficient according to a general rule whereby five objects for each independent variable is the minimum recommended sample size for discriminant analysis.[276]

[276] See Hair et al. (1998), p. 258.

5.2.3.3.2 Discriminant Functions

Discriminant functions are canonical functions or linear combinations which best discriminate between categories and determine the discriminatory potential of the independent variables. In an MDA with c categories, the number of (orthogonal) discriminant functions equals $c-1$.[277] They take the following basic form:[278]

$$Y_{ij} = a_0 + a_1 x_{1j} + a_2 x_{2j} + \ldots + a_n x_{nj} \tag{5.8}$$

with Y_{ij} (standardized) discriminant score defined by discriminant function i for object j,

a_0 intercept,

a_k discriminant coefficient or weight for independent variable k,

x_{kj} observation of independent variable k for object j.

The discriminant coefficients are estimated based on the variance structure of the independent variables such that the discriminant criterion, which is the quotient of between-groups variance (SS_b) over within-groups variance (SS_w), is maximized:[279]

[277] See Backhaus et al. (2003), p. 177.

[278] See Hair et al. (1998), p. 241.

[279] Between-groups variance is measured by the squared deviations of group centroids from the overall mean, multiplied by group size to account for different group sizes. Within-groups variance is measured by the squared differences of group elements from the respective group centroid. See Backhaus et al. (2003), pp. 164–166, 176.

$$\gamma = \max\{\Gamma\} \tag{5.9}$$

and

$$\Gamma = \frac{SS_b}{SS_w} = \frac{\sum_{g=1}^{G} J_g(\bar{Y}_g - \bar{Y})^2}{\sum_{g=1}^{G}\sum_{j=1}^{J_g}(Y_{gj} - \bar{Y}_g)^2} \tag{5.10}$$

with γ eigenvalue (or maximum of the discriminant criterion),

Γ discriminant criterion,

J_g size of group g,

$\bar{Y}_g$ centroid (or mean value of discriminant scores) of group g,

$\bar{Y}$ overall mean,

Y_{gj} discriminant score of observation j in group g.

Discriminant functions can be computed with the simultaneous or the stepwise estimation method. The simultaneous method calculates the discriminant weights of all variables in a single step, and is, as in this study, used when all independent variables are to be included in the analysis. The stepwise method includes independent variables successively, beginning with those variables with the highest discriminatory power, and is employed mainly to reduce large numbers of independent variables.[280] The discriminatory potential of the discriminant functions can be judged by testing the discriminant criterion, the independent variables, and the classification, as is shown below.

5.2.3.3.3 Testing the Discriminant Criterion

The discriminant criterion can be evaluated by means of Wilks' lambda and the canonical correlation coefficient. Wilks' lambda tests whether the mean values

[280] See Hair et al. (1998), p. 260.

of the discriminant functions for the groups or clusters differ significantly. It is an inverse quality measure and is calculated by the following formula:[281]

$$\Lambda = \frac{1}{1+\gamma} \tag{5.11}$$

A transformation of Wilks' lambda delivers a probabilistic variable which is approximately Chi-square (χ^2) distributed. This makes a significance test of the discriminant functions possible. The null hypothesis states that the mean values for the groups do not differ. In this analysis, the null hypothesis can be rejected for the first discriminant function at the 0.05 significance level, but not for the other three functions.[282] These are nevertheless retained because they do not distort results.[283]

Wilks' Lambda				
Test of Function(s)	Wilks' Lambda	Chi-square	Df	Sig.
1 through 4	0.377	36.116	20	0.015 **
2 through 4	0.798	8.349	12	0.757
3 through 4	0.954	1.738	6	0.942
4	0.986	0.538	2	0.764

*** significant at p ≤ 0.01; ** significant at p ≤ 0.05; * significant at p ≤ 0.10

Table 5-15: Wilks' Lambda for Discriminant Functions

The statistical significance of a discriminant function states that the groups differ significantly with regard to this function. To examine whether the discriminant function has discriminatory power, however, the canonical correlation coefficient needs to be calculated. The canonical correlation coefficient resembles the coefficient of determination (R^2) in a regression analysis. It is calculated as follows:[284]

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[281] See Backhaus et al. (2003), pp. 182. In MDA, the multivariate Wilks' lambda is calculated by $\Lambda_k = \prod_{k=1}^{K} \frac{1}{1+\gamma_k}$, with γ_k as the eigenvalue of the discriminant function k. See Backhaus et al. (2003), p. 184.

[282] For Wilk's lambda for the discriminant functions, see Table 5-15.

[283] This can be seen when comparing standardized and average canonical discriminant function coefficients in Table 5-18.

[284] See Backhaus et al. (2003), p. 182.

$$c = \sqrt{\frac{\gamma}{1+\gamma}}. \tag{5.12}$$

In this analysis, the canonical correlation coefficients range from very high for the first discriminant function to very low for the third and forth discriminant functions.[285] While the first function explains 82.13% of the variance, the second function only adds 14.37%, and the third and fourth functions only 2.42% and 1.08% respectively.[286] In line with results obtained from testing Wilks' lambda, this indicates that only discriminant function 1 has high discriminatory power.

Eigenvalues				
Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation Coefficients
1	1.118	82.13%	82.13%	0.727
2	0.196	14.37%	96.50%	0.405
3	0.033	2.42%	98.92%	0.179
4	0.015	1.08%	100.00%	0.120

Table 5-16: Eigenvalues and Canonical Correlation Coefficients

5.2.3.3.4 Testing the Independent Variables

Before the discriminatory power of the independent variables is tested, Wilks' lambda tests for the equality of group means. In the analysis, group means differ significantly at the 0.05 significance level for Factor 2, and at the 0.10 significance level for Factor 4.[287] For the other three factors, group means do

[285] This interpretation follows the interpretation guidelines in Bühl and Zöfel (2002), p. 318:

Correlation Coefficient (c)	Interpretation
$c < 0.2$	Very low correlation
$0.2 \leq c < 0.5$	Low correlation
$0.5 \leq c < 0.7$	Medium correlation
$0.7 \leq c < 0.9$	High correlation
$0.9 < c$	Very high correlation

[286] For an overview of eigenvalues and canonical correlation coefficients of the discriminant functions, see Table 5-16.

[287] For Wilk's Lambda of individual factors, see Table 5-17.

not differ significantly. This suggests that Factors 1, 3, and 5 do not have discriminatory power.

Wilks'Lambda					
Factor Scores	Wilks' Lambda	F	df1	df2	Sig.
Factor 1	0.976	0.232	4	38	0.918
Factor 2	0.740	3.344	4	38	0.019**
Factor 3	0.877	1.337	4	38	0.274
Factor 4	0.767	2.886	4	38	0.035*
Factor 5	0.903	1.023	4	38	0.408

*** significant at $p \leq 0.01$; ** significant at $p \leq 0.05$; * significant at $p \leq 0.10$

Table 5-17: Wilks' Lambda for Independent Variables

The discriminatory power of the independent variables can be analyzed with help of the standardized canonical discriminant function coefficients[288]. They represent the discriminant coefficients of each factor in each discriminant function. An assessment of the discriminatory power for each factor across all discriminant functions, however, can only be made on the basis of the average discriminant coefficients. These are determined by multiplying the standardized canonical discriminant function coefficients with the relative eigenvalue ("% of variance") of the discriminant functions.[289] In this analysis, the average discriminant coefficients (and the discriminant function coefficients for the first function) are high for Factors 2 and 4, medium for Factor 3 and very low for Factors 1 and 5. Results comply with the outcome of Wilks' lambda except for the fact that Factor 3 also has a reasonable discriminatory power.

[288] For the standardized and average canonical discriminant function coefficients, see Table 5-18.

[289] See Backhaus et al. (2003), pp. 187, 206.

Standardized Canonical Discriminant Function Coefficients					
	Function				Average Discriminant
Factor Scores	1	2	3	4	Coefficients
Factor 1	-0.127	*0.351*	*0.252*	*-0.181*	0.163
Factor 2	0.815	*-0.377*	*0.441*	*-0.348*	0.738
Factor 3	-0.576	*-0.235*	*0.701*	*0.445*	0.528
Factor 4	0.794	*0.346*	*0.030*	*0.609*	0.709
Factor 5	-0.060	*0.771*	*0.360*	*-0.313*	0.172

Table 5-18: Standardized and Average Canonical Discriminant Function Coefficients

5.2.3.3.5 Kruskal-Wallis Test

The Kruskal-Wallis test verifies this outcome with only a minor change: It shows that clusters differ significantly with respect to Factor 4 at a 0.01 significance level, and with respect to Factors 2 and 3 at a 0.05 significance level. Moreover, the test supports the inclusion of the variable "International Investment Activity" in the factor analysis.

Variables	Chi-Square	df	Asymp. Sig.
Investor Type	7.186	4	0.126
Ownership Category	6.132	4	0.189
Operating Years	8.585	4	0.072
Employees	2.953	4	0.566
Investments under Management	1.757	4	0.780
Contracting: Financial Structure	7.742	4	0.101
Contracting: Contractual Covenants	6.136	4	0.189
International Investment Activity	12.783	4	0.012**
International Physical Presence	2.195	4	0.700
Factor 1 (Factor Score)	3.853	4	0.426
Factor 2 (Factor Score)	8.130	4	0.087*
Factor 3 (Factor Score)	8.106	4	0.088*
Factor 4 (Factor Score)	9.651	4	0.047**
Factor 5 (Factor Score)	4.904	4	0.297

*** significant at $p \leq 0.01$; ** significant at $p \leq 0.05$; * significant at $p \leq 0.10$

Table 5-19: Kruskal Wallis Test with Grouping Variable "Cluster Membership"

5.2.3.3.6 Testing the Classification

The classification of elements into groups is summarized in the classification results.[290] In this analysis, prediction of cluster membership is correct in 75.00% of cases for Cluster 5, in 57.14% and 55.56% for Clusters 1 and 4, and in 46.15% and 40.00% for Clusters 3 and 2. Overall, 51.16% of the grouped cases were classified correctly. Compared to the prior 20.00% probability of correct classification at random allocation, this means a more than doubled success ratio.

Classification Results [a]

		Predicted Group Membership					Prior Probabilities
	Cluster	1	2	3	4	5	
Count	1	4	0	3	0	0	
	2	1	4	1	3	1	
	3	1	3	6	0	3	
	4	0	2	1	5	1	
	5	0	0	1	0	3	
%	1	57.14%	0.00%	42.86%	0.00%	0.00%	20.00%
	2	10.00%	40.00%	10.00%	30.00%	10.00%	20.00%
	3	7.69%	23.08%	46.15%	0.00%	23.08%	20.00%
	4	0.00%	22.22%	11.11%	55.56%	11.11%	20.00%
	5	0.00%	0.00%	25.00%	0.00%	75.00%	20.00%

[a] 51.16% of original grouped cases correctly classified.

Table 5-20: Classification Results

Finally, the interpretation of the factors' discriminatory power and their specifications across clusters are presented in Section 5.3.3.

5.2.4 Methodological Strengths and Weaknesses

As in any empirical study, the application of multivariate analysis techniques presented in Section 5.2.3 involves certain methodological strengths and weaknesses. These have already been addressed individually above and are summarized in the following.

[290] For a summary of classification results, see Table 5-20.

- By statistically evaluating a sample of 43 German venture capital companies (or 25.44%), the study covers approximately one quarter of the German non-public venture capital market defined relevant for the purpose of the study. Results are therefore believed to be applicable to the whole of the existing non-public venture capital population in Germany.
- The applied empirical methods and their combination represent a novel methodological approach in the analysis of venture capital contracts. Obtained results emphasize the benefits of structure-discovering methods, which aim at discovering interrelations between variables and/or objects and thereby focus on the interpretation of results.
- Overall, the results are highly significant and allow the drawing of specific conclusions. They provide new insights into the field of venture capital research, as is shown in Section 5.3.
- The sample size of 43 firms is small. Nevertheless, it is comparable to similar research on related issues. Furthermore, the applicability of cluster, factor, and discriminant analysis on the dataset is carefully tested.
- The study's country focus on Germany excludes results from being applied universally due to the high probability that the influence of culturally and legally specific phenomena is strong.
- Finally, the study suffers from all the weaknesses associated with a self-report survey with questions asked at portfolio level since the data was not extracted directly from written contracts.

5.3 Empirical Findings

The empirical results are based on the data introduced in Sections 5.2.2 and 5.3.1 and the methodology introduced in Section 5.2.3. A detailed description of contract negotiations and components is followed by an interpretation of patterns in contract design with regard to financial instruments and cash flow-related covenants. Finally, venture capital companies' characteristics are analyzed as determinants of contractual architecture.

5.3.1 Contract Negotiations and Components

This section presents the first descriptive analyses of variables on initial contract negotiations of German venture capital companies with their current portfolio companies.[291] Furthermore, it exhibits sample statistics on financial instruments and an extended list of contractual covenants.[292]

5.3.1.1 Descriptive Statistics on the Contracting Process

While existing literature on the German venture capital market provides rudimentary checklists preparing portfolio companies for initial contract negotiations with venture capital companies,[293] quantifiable details on the negotiation process as such have so far not been investigated.[294] This survey carried out among sample firms (at portfolio level) therefore contained questions pertaining to legal assistance in contracting as well as contracting time and costs.

On average, when it comes to contracting, sample firms seek the assistance of lawyers in 76.19% of their investments under management (not of all deals negotiated). This may suggest a relatively high deal-specificity of the contract design. Contracting time, defined as the time span between starting contract negotiations (not establishing a first contact) and signing the contract, ranges between an average minimum of 2.06 months and an average maximum of 7.17 months. The reported longest average contracting time of 1¼ years underlines the importance of the contract as the core of a successful relationship between the venture capital company and its portfolio company. 39.84% of contracting time is spent designing contractual covenants, 31.70% devising the financial structure (or specifying financial instruments) of the

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[291] For descriptive statistics on the contracting process, see Table 5-21.
[292] For descriptive statistics on financial instruments and covenants, see Table 5-22 and Table 5-25.
[293] See Leopold et al. (2003), pp. 147–149, and Weitnauer (2000), pp. 196–197.
[294] The only comparable work by Landström et al. (1998) presents a clinical study on the focus of contract negotiations (relational versus transactional components) as well as the openness of the negotiation process.

investment, and 28.46% defining milestones and triggers[295]. This distribution of contracting time emphasizes the high importance ascribed to contractual covenants by venture capital companies. Internal and external contracting costs together amount to an average of 3.08% of total investment size and do not exceed 10.00%.

Contracting Process	Mean	Median	Grouped Median	Minimum	Maximum	Std. Deviation	Number	Percent of Total (Scaled Mean)
Lawyer Assistance *(in % of Investments)*	76.19%	*100%*	*87.59%*	0%	100%	0.35		
Contracting Time *(in Months)*								
Minimum	2.08	*2.00*	*1.82*	0.25	6.00	1.34		
Maximum	7.17	*6.00*	*6.63*	1.50	15.00	3.71		
Distribution of Contracting Time								
Financial Structure	30.47%	*30.00%*	*28.33%*	0.00%	75.00%	0.16		31.70%
Milestones/ Triggers	*27.35%*	*25.00%*	*26.79%*	*0.00%*	*60.00%*	*0.14*		*28.46%*
Contractual Covenants	38.28%	*33.00%*	*33.67%*	10.00%	100%	0.18		39.84%
Contracting Costs *(as % of Investment Size)*	3.08%	*2.00%*	*2.41%*	0.00%	10.00%	0.02		

Table 5-21: Descriptive Statistics on the Contracting Process

5.3.1.2 Descriptive Statistics on Financial Instruments

In this study, the term "financial instruments" is used to refer to those securities commonly employed by German venture capital companies and includes straight equity, preferred equity, debt, combinations of debt and equity,

[295] Milestones and triggers are clearly defined targets which have to be attained for certain covenants to apply or be applied. Since they thus do not directly affect contractual architecture, they are excluded from factor analysis despite their unchallenged importance for the contracting parties.

convertible securities, and silent partnerships.[296] The survey aimed at questioning sample firms regarding their use of these financial instruments and their minimum and maximum equity stake. Due to the outstanding importance attached to convertible securities by the existing literature, separate data on the use of convertible preferred equity and convertible debt was also collected.

Overall, Expectation 1 holds because straight equity is the most frequently used financial instrument with a scaled mean of 27.66% of investments *(and a percentage of sample firms reporting a more than 50% frequency on this financial instrument of 31.58%)*. It is followed by preferred equity with 21.57% *(23.68%)*. Therefore, equity is the predominant financial instrument, employed by the sample firms with a frequency of 49.23% *(55.26%)*. Combinations of debt and equity are used in 13.84% *(15.79%)* of investments, convertible securities in 11.69% *(13.16%)*, and silent partnerships in 11.25% *(5.26%)*. Mezzanine instruments thus finance more than one third of venture capital deals. Finally, debt is used in 1.68% *(0%)* of investments; the reported maximum frequency of 30.00% further emphasizes its insignificant role in the venture capital investments analyzed. The use of other financial instruments, which remained unspecified by survey participants, is reported at only 0.62% *(0%)*. Finally, the equity stake held by German venture capital companies under straight equity or convertible securities financing ranges between a minimum equity stake of 6.26% and a maximum equity stake of 53.60%, and 32.56% of investors reported a maximum equity stake of above 50%.[297]

[296] See Bascha and Walz (2002), p. 13, and Hommel et al. (2003), p. 328. For definitions of these financial instruments, see Section 2.2.2.1.

[297] For information on the minimum and maximum equity stakes held by the sample firms, see Table 5-22.

Financial Instruments	Mean	Median	Grouped Median	Minimum	Maximum	Std. Deviation	Number/Percent w/Instrument>50%	Percent of Total (Scaled Mean)
Straight Equity*	31.33%	*20.00%*	*17.00%*	0.00%	100%	0.35	12/ 31.58%	27.66%
Preferred Equity	24.42%	*0.00%*	*3.80%*	0.00%	100%	0.35	9/ 23.68%	21.57%
Debt	1.91%	*0.00%*	*0.64%*	0.00%	30.00%	0.06	0/ 0.00%	1.68%
Combinations of Debt and Equity	15.67%	*0.00%*	*4.67%*	0.00%	100%	0.30	6/ 15.79%	13.84%
Convertible Securities	13.23%	*0.00%*	*4.69%*	0.00%	100%	0.27	5/ 13.16%	11.69%
Convertible Preferred Equity	9.79%	*0.00%*	*2.33%*	0.00%	100%	0.24	4/ 10.53%	8.65%
Convertible Debt	3.44%	*0.00%*	*2.16%*	0.00%	30.00%	0.08	0/ 0.00%	3.04%
Silent Partnerships	12.74%	*0.00%*	*10.29%*	0.00%	80.00%	0.20	2/ 5.26%	11.25%
Other	0.70%	*0.00%*	*0.70%*	0.00%	30.00%	0.05	0/ 0.00%	0.62%
Minimum Equity Stake*	6.26%	*5.00%*	*5.25%*	0.00%	25.00%	0.05	Min. Stake≥50% 0.00%	
Maximum Equity Stake*	53.60%	*49.00%*	*49.09%*	5.00%	100%	0.25	Max. Stake>50% 32.56%	
							Max. Stake=50% 9.30%	

Table 5-22: Descriptive Statistics on Financial Instruments and Equity Stake

These results are largely comparable to results of existing surveys on the use of financial instruments in the German venture capital market.[298] BVK (2004a) and Hommel et al. (2003) report equity to be the most important method of financing, with Hommel et al. (2003) witnessing straight equity to be employed more often than preferred equity. Surprisingly, according to Bascha and Walz (2002), silent partnerships are the predominant instrument, followed closely by equity financing. Differences in variable choice, measurement and labeling complicate comparisons of results on the use of mezzanine instruments. Results by Bascha and Walz (2002) and BVK (2004a) suggest, however, that convertible securities are the least common type of mezzanine capital, in the case of BVK (2004a) even less common than debt. In line with this study's results, however,

[298] For an overview of existing empirical evidence on financial instruments in the German venture capital market, see Table 5-23 and for more detail Appendix A.

Hommel et al. (2003) report convertible securities to be employed more often than debt.[299] Despite the fact that no German data is available on the equity stake held by the venture capital company, it can be compared to US data raised by Kaplan and Strömberg (2003). They report that US venture capital companies are allocated an average of between 46.7% and 55.5% of the portfolio company's cash flow stake, depending on the definition of contractual contingencies.[300] This suggests that US venture capital companies on average hold a slightly higher maximum majority stake in the portfolio company than German venture capital companies.

Frequency of Use of Financial Instruments	Straight Equity	Preferred Equity	Debt	Combinations of Debt and Equity	Silent Partnerships	Convertible Securities	Other	
BVK (2004a) Annual German "BVK Statistik 2003" data reported at portfolio level as volume in Mio. Euro. n = 198 31st December 2003	78% *Equity*		6% *Share-holder's Loan* [a]	12% *Quasi-Equity/ Silent Partnerships*		3% *Mezza-nine*	-	-
Bascha and Walz (2002) German survey data reported at portfolio level. n_{min} = 47 Spring 2000	27% *Equity Only*		-	14%	33%	11%	6% *Silent Partner-ships + Debt*	11% *Other*
Hommel et al. (2003) German survey data reported at portfolio level on a 5 (almost always) to 1 (almost never) Likert scale. n = 68 Spring 2001	4.6	3.9	1.8	-	-	2.2/2.0 Conv. Preferred Equity/ Conv. Debt	-	-

[a] A loan granted from a shareholder is subordinated to all other debt claims. See Schäfer et al. (2004), p. 14.

Source: BVK (2004a), p. 14; Bascha and Walz (2002), p. 13; Hommel et al. (2003), p. 283.

Table 5-23: Existing Empirical Evidence on Financial Instruments in the German Market

Regarding convertible securities in the German venture capital market, this survey is the first not only to investigate their design but also to quantify reasons against their use. Convertible preferred equity is the most frequent convertible security contracted upon with a scaled mean of 8.65% *(and a percentage of*

[299] See BVK (2004a), p. 14, Bascha and Walz (2002), p. 13, and Hommel et al. (2003), p. 283.
[300] See Kaplan and Strömberg (2003), p. 288.

sample firms reporting a more than 50% frequency on this financial instrument of 10.53%). Convertible debt attains an average frequency of 3.04% *(0%)*, and a reported maximum of only 30%. In the US venture capital market, for comparison, convertible preferred equity is found in 95% of venture capital contracts, convertible debt in 3%.[301]

The following main reasons, why German venture capital companies do not finance (almost) all their investments with convertible securities like their US counterparts, have been identified:[302] 39.53% of survey participants state that convertible securities are simply not as widespread and popular in Germany as they are in the United States. 20.93% believe that the incentive structure created by convertible securities for the portfolio companies can easily be replicated using other financial instruments in combination with covenants.[303] Interestingly, only 13.95% of sample firms refrain from convertible securities due to their high complexity and 11.63% due to unfavorable legal regulations[304] in the German venture capital market. This clearly indicates that legal regulations play a subordinated role in the venture capital companies' choice of a financial instrument. Least important reasons against the use of convertible securities are the standstill of the German IPO market and a lack of venture capitalist seniority in Germany. Finally, unsuitability of convertible securities for public sector venture capital investments or for MBO investments is reported among other reasons. These results are consistent with the above descriptive statistics on the use of financial instruments and provide support for the validity of the research question of the theoretical paper. Nevertheless, results may be distorted by the underlying self-reporting bias.

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[301] See Kaplan and Strömberg (2003), p. 50, and Appendix A. See also Kaplan et al. (2003), p. 28, and Kaplan et al. (2002), p. 12.

[302] On the importance of certain reasons against the ubiquitous use of convertible securities, see Table 5-24.

[303] For self-reporting reasons, we asked venture capital companies only on the incentives for their portfolio companies.

[304] For information on German legal restrictions to venture capital contracting, see Section 2.1.4.

If your company does not finance all investments with convertible securities, what are the reasons?	Percent of Total (n=43)
Not the most common financing instrument in the German market.	39.53%
Same incentive structure for the portfolio company can be achieved using other forms of financing in combination with covenants.	20.93%
Other.	18.60%
Highly complex financing instrument.	13.95%
Unfavorable legal regulations.	11.63%
Currently no exit via IPO possible.	6.98%
Used mainly by senior and experienced venture capitalists.	2.33%

Table 5-24: Reasons against the Ubiquitous Use of Convertible Securities (Questionnaire Excerpt)

5.3.1.3 Descriptive Statistics on Contractual Covenants

This study follows the initial classification of contractual covenants into five groups according to their intention of allocating cash flow, information, or control rights, safeguarding the venture capitalist's position, and penalizing the entrepreneur's "bad" behavior.[305]

The frequency of covenant inclusion in contracts is reported on a 5 (almost always) to 1 (almost never) Likert scale. Of all covenants, information rights (Likert score/grouped median: 4.76) are most frequently contracted upon in venture capital contracts. This is evidence that they are *conditio sine qua non* for the contractual relationship. Other highly significant covenants are co-sale agreements (4.65) and liquidation rights (4.49) – protecting the venture capital company's cash flow in the case of a sale and liquidation of the portfolio company –, and voting rights (4.62) and board representation (4.49) – ensuring the venture capital company's control and influence on company decisions. These results show that information and control rights are vital for participative management by the venture capital company, while the protection of its cash flow rights is equally important. And it has been well-documented by the literature that, besides the entrepreneur's effort, the venture capitalist's active management involvement plays a major role in the success of portfolio

[305] For the complete list of considered covenants and their definitions, see Section 2.2.2.2.

companies.[306] Finally, when asked which of a selection of contractual rights are exercised most frequently in practice,[307] sample firms report making use mostly of voting rights and board veto rights. This again underlines the importance of the venture capital company's supporting and monitoring role in the development of its portfolio companies.

Existing empirical evidence on the use of covenants in German venture capital contracts is presented by Hommel et al. (2003) and Brettel et al. (2004a). Hommel et al. (2003) find that board veto rights, anti-dilution provisions, and non-compete clauses (each with a score of 4.4 on a 5 (almost always) to 1 (almost never) Likert scale) are most frequently contracted upon. Brettel et al. (2004a) identify board veto rights (89%), information rights (88%), and non-compete clauses (83%) to be the most frequently employed covenants. While this supports the above identified importance of the venture capital company's involvement in portfolio company decision-making, it also emphasizes the primary significance of covenants specifying the venture capitalist's safeguards and entrepreneur's penalties.[308]

[306] See, for example, Sahlman (1990), p. 508-509, and Lerner (1995), pp. 301–302.
[307] Sample firms were questioned only on those covenants marked by * in Table 5-25.
[308] See Hommel et al. (2003), p. 328, and Brettel et al. (2004a), p. 443. Hommel et al. (2003) question German venture capital companies on the use of the following six covenants: Board supermajority rights, board veto rights, redemption rights, vesting provisions, non-compete, clauses, and anti-dilution provisions. For details on the survey, the sample size, and the operationalization of variables, see Appendix B.

Covenants	Mean	Median	Grouped Median (Rank)	Minimum	Maximum	Std. Deviation	Number of Cases Where Frequently Exercised (*)	Percent Frequently Exercised (a)
Information Rights [a]	*4.72*	*5.00*	4.76 (1)	3	5	0.55	21	48.84%
Control Rights								
Board Representation	*4.42*	*5.00*	4.49 (4)	2	5	0.73		
Board Supermajority Rights [a]	*3.02*	*3.00*	*2.95 (16)*	1	5	1.32	6	13.95%
Board Veto Rights [a]	*3.79*	*4.00*	4.00 (9)	1	5	1.23	10	23.26%
Protective Provisions	*4.12*	*5.00*	4.34 (7)	1	5	1.16		
Voting Rights [a]	*4.53*	*5.00*	4.62 (3)	3	5	0.74	18	41.86%
Venture Capitalist's Safeguards								
Anti-Dilution Provisions	*4.33*	*5.00*	4.42 (6)	3	5	0.84		
Registration Provisions	*3.12*	*3.00*	*3.10 (13)*	1	5	1.33		
Rights of First Refusal [a]	*4.30*	*5.00*	4.45 (5)	2	5	0.94	6	13.95%
Entrepreneur's Penalties								
Non-Compete Clauses	*3.81*	*4.00*	4.12 (8)	1	5	1.38		
Vesting Provisions	*3.44*	*3.00*	*3.36 (12)*	1	5	1.20		
Cash Flow Allocation								
Conversion Provisions	*3.21*	*3.00*	*3.06 (14)*	1	5	1.21		
Co-Sale Agreements	*4.49*	*5.00*	4.65 (2)	2	5	0.88		
Dividend Provisions	*3.05*	*3.00*	*3.00 (15)*	1	5	1.25		
Liquidation Rights	*4.35*	*5.00*	4.49 (4)	2	5	0.90		
Redemption Rights [a]	*3.53*	*4.00*	3.63 (10)	1	5	1.30	2	4.65%
Staged Financing	*3.42*	*3.00*	*3.48 (11)*	1	5	1.22		

[a] Sample firms were asked whether they frequently exercised these rights.

Table 5-25: Descriptive Statistics on Contractual Covenants

5.3.2 Patterns in Contract Design

The isolated examination of contract components does not provide information on standard contracts employed in the German venture capital market. Empirical evidence on the US market suggests high contract standardization – with convertible securities included in 95% of contracts[309] – and makes it easy to identify contractual architecture. The scope of financial instruments used by their German counterparts, however, is relatively wide. Hence, an identification of contractual patterns is a prerequisite to further contract analysis and comparison with theoretical findings.

5.3.2.1 Introduction to Cluster Interpretation

As shown in Section 5.2.3.1, cluster analysis is applied to identify German contract prototypes. It classifies venture capital companies in the sample in clusters such that contract design is relatively homogeneous within and heterogeneous among them. This is a novel methodological approach in the field of venture capital contracting, where the majority of empirical papers uses logit regression models.[310] For the clustering of sample firms, six financial instruments and six cash flow-related covenants are used to account for their equal importance in allocating cash flow rights. Below, clusters are described with the help of their average cluster profiles which present the average use of financial instruments (mean) and cash flow-related covenants (grouped median) for the sample firms within each cluster.[311] For the sake of completeness, cluster profiles are extended to other than cash flow-related covenants (hereafter referred to as other covenants; grouped median).[312] Cluster names correspond to the predominant (> 50.00%) financial instrument employed by cluster firms (with the exception of Cluster 2). Cluster size ranges between 4 and 13 sample firms, whereby the predominant financial instruments' frequency

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[309] See Kaplan and Strömberg (2003), p. 284.

[310] For information on the methodology applied in related empirical literature, see Appendix A.

[311] For cluster descriptives on financial instruments and cash flow-related covenants, see Table 5-27 and Appendix C.

[312] For cluster descriptives on other than cash flow-related covenants, see Table 5-28 and Appendix C.

of use increases and the related standard deviation decreases for all clusters the smaller the cluster size (with the exception of Cluster 2).[313] Financial instruments used with a frequency below 5.00% are neglected in the profiling of clusters. To identify the main covenants, which are frequently combined with the dominant financial instruments in the clusters,[314] covenants with a reported frequency below the survey participants' indifference threshold of 3 on the five-point Likert scale[315] are neglected, as are covenants rated at or above 3 but below 4, which can be interpreted as covenants used only "sometimes" or "often". As indicated in Section 5.3.1.3, co-sale agreements and liquidation rights are "very often", "extremely often", or "almost always" included across all clusters (with the exception of Cluster 2). They do therefore not serve as distinctive features between clusters and are hereafter referred to as non-distinctive covenants. The same applies for several other covenants: Information rights, board representation, protective provisions, voting rights, anti-dilution provisions, and non-compete clauses. This implies that all contracts include important cash flow-related covenants securing the venture capitalist's cash flow in the case of sale and liquidation of the portfolio company as well as fundamental information, voting, venture capitalist's safeguards, and entrepreneur's penalties covenants as basic building blocks. These are therefore not the focus of the cluster interpretations. Besides cluster profiles, the interpretation of clusters also resorts to the bivariate rank correlation coefficients by Spearman calculated across the entire sample for all variables included in the cluster profiles.[316] In the following, cluster sizes and profiles with respect to financial instruments, cash flow-related and other covenants are presented and

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313 For cluster sizes and their justification, see Table 5-26, Figure 5-5, and Appendix C.

314 It has to be noted that the higher the frequency of use of the dominant financial instrument in one cluster, the more accurate is the classification of at least "very often" included covenants to these financial instruments.

315 For the interpretation guidelines of the employed Likert scale, see Figure 5-6.

316 For the related Spearman's and Kendall's rank correlation coefficients, see Appendix C. Spearman's and Kendall's rank correlation coefficients are nonparametric (distribution-free) rank statistics or measures of monotone association used in the case that at least one variable has ordinal scaling or is non-normally distributed. Despite the fact that, in this analysis, factor and discriminant analysis are executed on variables with binary, ordinal, and interval scaling, under the assumption underlying both methods that all included variables are interval-scaled, correlations in Appendix C are intentionally not reported as Pearson's correlation coefficients but as Spearman's and Kendall's rank correlation coefficients to account for those variables that are not interval-scaled. Rank correlation coefficients inserted in the text are Spearman's rank correlation coefficients.

interpreted against the background of existing theoretical and empirical literature. Clusters are sorted by their average frequency of covenant inclusion. This is introduced as comparative measure of frequency of covenant use per cluster and calculated as the mean value of the reported grouped medians across cash flow-related and other covenants as well as the totality of covenants.

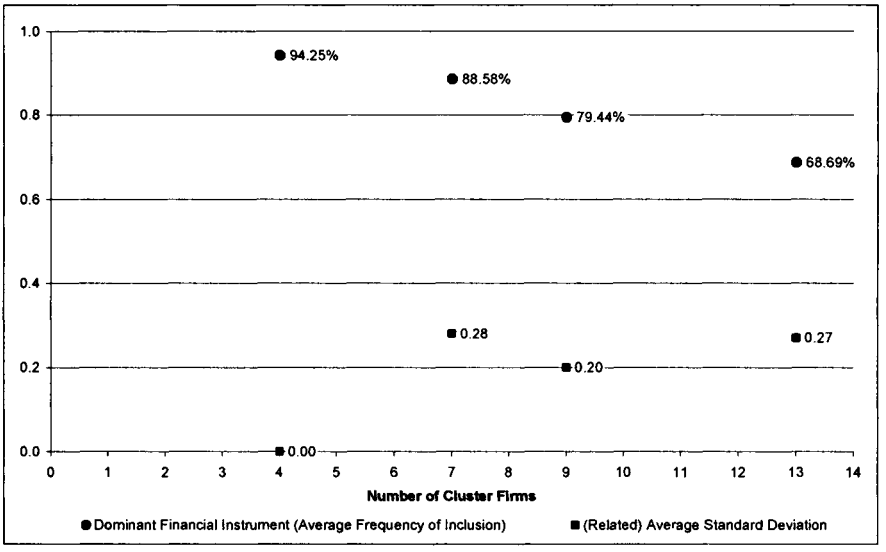


Figure 5-5: Cluster Size Justification

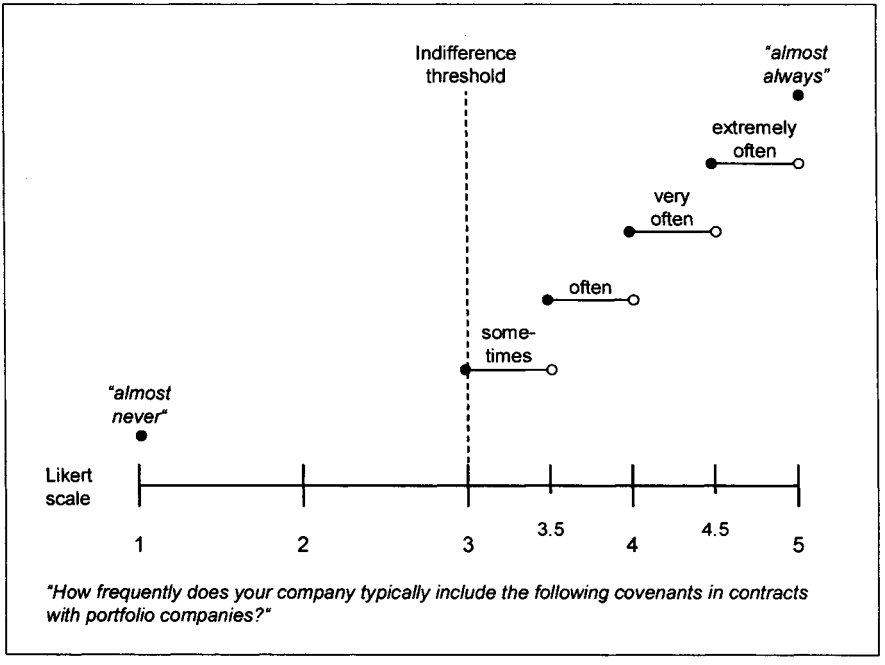


Figure 5-6: Likert Scale Interpretation (Questionnaire Excerpt)

Cluster Size	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
Venture Capital Companies (n)	7	10	13	9	4
As Percent of Total	16.28%	23.26%	30.23%	20.93%	9.30%

Table 5-26: Absolute and Relative Cluster Size

Cluster	Straight Equity	Preferred Equity	Debt	Debt-Equity Combinations	Convertible Securities	Silent Partnerships	Conversion Provisions	*Co-Sale Agreements*	Dividend Provisions	*Liquidation Rights*	Redemption Rights	Staged Financing
1	8.86%	15.29%	9.00%	*0.00%*	64.29%	*2.57%*	5.00	5.00	4.40	4.86	4.40	*3.33*
2	47.80%	*3.00%*	*1.90%*	19.20%	*0.00%*	28.10%	*2.70*	*3.25*	*3.25*	*3.14*	*2.86*	*2.83*
3	7.08%	68.69%	*0.00%*	*3.08%*	8.38%	12.77%	*3.36*	4.73	*2.25*	4.58	4.25	4.20
4	79.44%	*2.22%*	*0.00%*	7.22%	*1.11%*	6.67%	*2.67*	5.00	*3.20*	4.67	*3.00*	*3.00*
5	*0.00%*	*0.00%*	*0.00%*	94.25%	*0.00%*	5.75%	*2.00*	5.00	*2.50*	5.00	4.33	4.00
Total	31.33%	24.42%	1.91%	15.67%	13.23%	12.74%	*3.06*	4.65	*3.00*	4.49	*3.63*	*3.48*
	Mean						Grouped Median					

Table 5-27: Cluster Descriptives (Summary) – Financial Instruments and Cash Flow-Related Covenants

Cluster	*Information Rights*	*Board Representation*	Board Supermajority Rights	Board Veto Rights	*Protective Provisions*	*Voting Rights*	*Anti-Dilution Provisions*	Registration Provisions	Rights of First Refusal	*Non-Compete Clauses*	Vesting Provisions
1	4.86	4.86	4.71	4.71	5.00	5.00	4.67	4.86	4.86	4.71	4.43
2	4.56	*3.88*	*2.83*	*3.60*	*3.00*	*3.88*	*3.44*	*2.50*	*3.38*	*3.00*	*2.67*
3	4.77	4.45	*3.00*	4.11	4.73	4.83	4.67	*3.43*	4.75	4.25	4.00
4	4.89	4.56	*2.38*	*3.00*	4.00	4.57	4.75	*2.50*	4.63	4.33	*2.67*
5	4.50	5.00	*2.33*	*3.25*	4.33	4.75	4.33	*2.50*	*3.67*	4.00	*3.50*
Total	4.76	4.49	*2.95*	4.00	4.34	4.62	4.42	*3.10*	4.45	4.12	*3.36*
							Grouped Median				

Table 5-28: Cluster Descriptives (Summary) – Other Covenants

5.3.2.2 Cluster Descriptives on Contract Design

5.3.2.2.1 Cluster 1: Convertible Securities

As cluster size approximately reflects the overall frequency distribution of financing instruments in the entire sample, this cluster with dominant convertible security financing is also the second smallest cluster including seven venture capital companies.

Convertible securities are the main financial instrument employed in 64.29% of investments. *Preferred equity* and *debt*, which both turn into convertible securities if combined with an "almost always" included conversion clause (see below), are used in 15.29% and 9.00%. Convertible securities and identical combinations are thus included in 88.58% of investments by cluster firms. *Straight equity* is used in another 8.86%, despite the fact that, across the entire sample, straight equity is significantly negatively correlated (−0.393***)[317] with convertible securities. This emphasizes the observation that straight equity is also used by venture capital companies which most frequently employ convertible securities in their contracts but does not necessarily imply that straight equity and convertible securities are used simultaneously in one contract.

In line with empirical findings by Kaplan and Strömberg (2003),[318] convertible securities are "almost always" combined with *conversion provisions (5.00)* and "very often" with *redemption rights (4.40)* in contracts by cluster firms. The ubiquity of conversion provisions indicates clearly that preferred equity and debt, though not reported as convertible securities, are offered jointly with a conversion clause. As shown by Houben (2002), redemption rights represent exit options. When combined with correctly defined redemption rights, convertible preferred equity thus offers the venture capital company comparable

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[317] Rank correlation coefficients referred to in the text are Spearman's rank correlation coefficients as displayed in Appendix C. Correlation significance levels: *** significant at $p \leq 0.01$; ** significant at $p \leq 0.05$; * significant at $p \leq 0.10$. For correlation coefficient interpretation guidelines, see Footnote 285.

[318] See Kaplan and Strömberg (2003), pp. 284, 288–289.

cash flow rights as convertible debt expiring at maturity, which is shown to be "optimal" by the majority of theoretical papers. The fact that *dividend provisions (4.40)* are contracted upon "very often" can be ascribed to the use of preferred equity, for which dividend provisions need to be defined. The rank correlation coefficients for dividend provisions show a low significant negative correlation (−0.273*) with preferred equity but a low insignificant positive correlation (0.244) with convertible securities. This supports the above interpretation that specific dividend provisions, possibly in the participating form, are formulated primarily for convertible as opposed to pure preferred equity investments.[319] The low frequency of *staged financing (3.33)* complies with existing literature by Kaplan et al. (2003), Bottazzi et al. (2004), and Hommel et al. (2003), who report its infrequent use for non-US contracts and on the basis of mainly straight but also convertible preferred equity financings.

Besides the non-distinctive other covenants, cluster firms add mainly venture capitalist's safeguard covenants in the form of *registration provisions (4.86)* and *rights of first refusal (4.86)* to their contracts. These findings on registration provisions, which allow the venture capital company to include its shares in the portfolio company's IPO registration, are at odds with findings by Cumming (2002b), that European convertible security contracts are normally exited by acquisition and straight equity contracts by IPO.[320] They are, however, in accordance with theoretical findings by Bascha and Walz (2001) that convertible securities resolve the problem of how to select efficiently between an IPO or acquisition exit.[321] With regard to control rights, venture capital companies ascribe great importance to board influence by means of *board supermajority rights (4.71)* and *board veto rights (4.71)*. *Voting rights (5.0)*, although frequently included across all contracts (with the exception of Cluster 2), are highlighted at this point because their widespread use in convertible security contracts most likely originates from the fact that they are

[319] Data on dividend provisions was not raised separately for cumulative, non-cumulative, and participating preferred equity. Future empirical research on German venture capital contracting should account for the differences between these three forms of dividend provisions. This would then provide evidence on whether participating convertible securities are employed as frequently as in the US venture capital market, as implied by the data.

[320] See Cumming (2002b), pp. 19–20.

[321] See Bascha and Walz (2002), pp. 286, 304.

not automatically included in convertible or pure preferred equity and debt contracts. Finally, *vesting provisions (4.43)* are included to augment the entrepreneur's penalties.

Overall, Cluster 1 has an average frequency of covenant inclusion of 4.69 (cash flow-related covenants: 4.50; other covenants: 4.79), and thereby ranks highest of all clusters: Convertible securities are "extremely often" combined with all but one rather equity-specific cash flow-related covenant.

5.3.2.2.2 Cluster 3: Preferred Equity

Despite the fact that preferred equity is not the dominant financial instrument used by all sample firms, this cluster is the largest including 13 venture capital companies. This is due to the significant additional equity-like claims contracted upon by cluster firms.

Preferred equity is the dominant financial instrument employed in 68.69% of investments. *Silent partnerships* are used in 12.77%, although they are overall slightly negatively correlated (−0.101) with preferred equity. It can be argued that silent partnerships can be designed to resemble preferred equity financings, and are thus in some cases employed instead by cluster firms.[322] Furthermore, *convertible securities* are used in 8.38%, and *straight equity* in 7.08%. Possibly, straight and preferred equity are combined in these contracts. Evidence on this is reported by Cumming (2002b), where a non-negligible number of European contracts use combinations of straight and preferred equity.[323]

Contrary to the observations on Cluster 1, preferred equity is combined neither with *conversion provisions (3.36)* nor with specific *dividend provisions (2.25)* by sample firms in this cluster. These covenants are reported to be included "sometimes" and less frequently, which corresponds to the frequency of use of

[322] Data on the use of silent partnerships was not raised separately for typical and atypical silent partnerships. Future empirical research on German venture capital contracting should account for the differences between these two forms of silent partnerships.

[323] See Cumming (2002b), p. 31.

convertible security financings by cluster firms.[324] This may imply that venture capital companies abandon their right to define specific dividend rights throughout the early lifecycle stages of the portfolio company in order not to reduce its cash flow.[325] Exit options for the venture capital company are included "very often" in the form of *redemption rights (4.25)* and *staged financing (4.20)*. While staged financing is significantly positively correlated (0.450***) with preferred equity across the entire sample, it is almost equally significantly negatively correlated (−0.382**) with straight equity. This observation contradicts existing empirical findings by Kaplan et al. (2003), Bottazzi et al. (2004), and Hommel et al. (2003).

Regarding the other covenants, cluster firms "very often" and "extremely often" make use of *rights of first refusal (4.63)* and *board veto rights (4.11)*, which emphasize their wish to maintain and exert influence on their portfolio companies. In this context it is interesting to note that *voting rights (4.83)*, as non-distinctive covenant, are not used as frequently with preferred equity as with convertible securities in Cluster 1, although both financial instruments do not automatically include voting rights. Finally, *vesting provisions (4.00)* increase entrepreneur commitment.

Overall, Cluster 3 has an average frequency of covenant inclusion of 4.14 (cash flow-related covenants: 3.90; other covenants: 4.27), and thereby ranks second of all clusters: Preferred equity is "very often" combined with covenants, especially with cash flow-related clauses on venture capitalist exit and control rights.

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[324] Conversion provisions and dividend provisions are reported in combination with convertible security financing for Cluster 1. Kaplan and Strömberg (2003) offer comparable evidence on conversion provisions. See Kaplan and Strömberg (2003), p. 289.

[325] This interpretation relies on the understanding that venture capital companies in the sample reported the definition of dividend rights separately from preferred equity financings although dividend provisions are an integral part thereof. This is confirmed by the reported data on Cluster 1 in Section 5.3.2.2.1.

5.3.2.2.3 Cluster 5: Combinations of Debt and Equity

This cluster with predominant debt-equity combinations is the smallest cluster including only four venture capital companies but it exhibits the highest consistency in financial instruments and the smallest standard deviation.

Debt-equity combinations are employed in 94.25% of investments. *Silent partnerships* finance the remaining 5.75%. Similar to Cluster 3, it can be argued that silent partnerships can be specified to resemble the individual design of debt-equity combinations.

With *redemption rights (4.33)* and *staged financing (4.00)*, cluster firms "very often" carry options to exit their portfolio companies, as do the firms in Cluster 3. These covenants are, however, the only distinctive cash flow-related covenants frequently employed on top of the non-distinctive covenants. Although debt-equity combinations, under exclusion of covenants, have been shown to achieve the same theoretical incentive allocations as convertible securities (Bergemann and Hege (1998); Green (1983); Marx (1998); Repullo and Suarez (2004)), this is an indication that their contracts differ enormously from convertible security contracts in the underlying German sample and for this reason cannot achieve the identical cash flow allocation. This result is underlined by the mainly significant negative *(positive)* correlations of debt-equity combinations *(convertible securities)* with all covenants included in the analysis.

Board representation (5.0), although frequently used across all contracts (with the exception of Cluster 2), is mentioned at this point because its ubiquity in debt-equity contracts certainly originates from the fact that venture capital companies are not necessarily given board seats for the debt or preferred equity fraction of their investment. Furthermore, *information rights (4.50)* are least frequently used of all clusters and are significantly negatively correlated (−0.286*) with debt-equity combinations. This supports the idea that an outside investor, that is, the debt-equity investor in his role as creditor, is not as involved

in supporting and monitoring the portfolio companies as is an inside investor and therefore requests fewer information rights.

Overall, Cluster 5 has an average frequency of covenant inclusion of 3.82 (cash flow-related covenants: 3.81; other covenants: 3.83), and thereby ranks third of all clusters: Debt-equity combinations are "often" combined with covenants, mainly with cash flow-related exit clauses.

5.3.2.2.4 Cluster 4: Straight Equity

This cluster with dominant straight equity financing is the third largest cluster including nine venture capital companies. Underlying reasons are the significant equity proportions in Clusters 1, 2, and 3 indicating that equity may well be the most common instrument in the German venture capital market – as implied by Expectation 1 and verified by sample data in Section 5.3.1 – but used in different contractual contexts.

Straight equity is the dominant financial instrument employed in 79.44% of investments by cluster firms. *Debt-equity combinations*, which include an equity component, are used in 7.22%, *silent partnerships* in 6.67%. The fact that Schäfer et al. (2004), in their empirical work, subsume straight equity and silent partnerships (and shareholder loans) under the term "equity" can also be interpreted in favor of their similarity and their use by the same venture capital companies.[326] Their simultaneous use in one contract, however, seems rather improbable with a view to the exceptional legal construct of a silent partnership. Bascha and Walz (2002) instead report the use of combinations of silent partnerships and debt.[327] On the whole, cluster firms have a tendency to include equity or equity-like claims in their contracts.

Rights of first refusal (4.63) are "extremely often" employed to maintain the venture capital company's influence vis-à-vis other venture capital investors. No

[326] See Schäfer et al. (2004), p. 14.
[327] See Bascha and Walz (2002), p. 13.

additional covenant is used, besides all non-distinctive cash flow-related and other covenants. Similar to Cluster 3, this is reflected by mainly significant and predominantly negative correlations of straight equity with all covenants included in the analysis. This clearly suggests that Expectation 2 does not hold: Straight equity is not used in combination with a number of non-ubiquitous cash flow-related covenants but only with *co-sale agreements (5.0)* and *liquidation rights (4.67)*, which are frequently included across all clusters (with the exception of Cluster 2).

Overall, Cluster 4 has an average frequency of covenant inclusion of 3.75 (cash flow-related covenants: 3.59; other covenants: 3.84), and thereby ranks fourth of all clusters: Straight equity is only "often" combined with all non-distinctive cash flow-related and other covenants.

5.3.2.2.5 Cluster 2: Straight Equity and Equity-Related Claims

As pointed out above, this cluster differs in several respects from the previous clusters, mainly in that it is dominated by straight equity and equity-related claims instead of one single financial instrument. Its equity focus, however, makes it the second largest cluster including ten venture capital companies.

The combination of financial instruments in this cluster equals that in Cluster 4 but with a different and less focused weighting: *Straight equity* is the most common financial instrument included in 47.80% of investments. It is, however, not a dominating financial instrument defined above as a financial instrument included with a frequency of more than 50.00% in the respective cluster. *Silent partnerships* are used in 28.10%, and *debt-equity combinations* in 19.20%. Following the reasoning for Cluster 4, straight equity and silent partnerships are most likely not simultaneously contracted upon with a portfolio company. With a view to the use of covenants by sample firms in this cluster, this can be extended to debt-equity combinations.

Information rights (4.56), as fundamental element of the basic contractual building block, are combined "extremely often" with straight equity and equity-related claims. Contrary to all other clusters using at least all non-distinctive covenants more frequently than "often", information rights represent the only covenant used with a frequency of 4 or above for this cluster of venture capital companies. This is the result of the rather balanced mix of financial instruments, which are all three (in part) significantly negatively correlated with the majority of cash flow-related and other covenants.

Overall, Cluster 2 has an average frequency of covenant inclusion of 3.22 (cash flow-related covenants: 3.01; other covenants: 3.34), and thereby ranks fifth of all clusters: No standard venture capital contract can therefore be identified. Consequently, Cluster 2 is excluded from subsequent contract comparisons.

5.3.2.3 Summary

Given the above cluster interpretations, the following conclusions can be drawn. The applied methodological approach of identifying clusters of venture capital companies with homogeneous contract design has refined the understanding of venture capital contracts, particularly of German venture capital companies. The analysis demonstrates that, in the absence of high market conformity, correlations or regressions across the entire sample do not provide a detailed insight into the contractual architectures composed by homogeneous sub-samples. Nevertheless, it shows that a combination of both methodologies draws a comprehensive picture of contract patterns. In the study, cluster size is comparable to the frequency of use of financial instruments and mirrors Expectation 1 with an apparent dominance in size of those clusters employing mainly straight equity. The dominant financial instruments in the clusters account for between 68.69% and 94.5% of investments by cluster firms and related standard deviations of between 0.28 and 0.00 (with the exception of Cluster 2), which enables an unequivocal allocation of covenants to these financial instruments. The following contractual patterns of financial instruments

and cash flow-related covenants deserve to be highlighted and compared to the findings of the existing empirical literature:

- *Convertible securities* (Cluster 1) *(esp. convertible preferred equity)* are combined with conversion provisions, dividend provisions, and redemption rights, in addition to co-sale agreements and liquidation rights. On average, these cash flow-related covenants are included "extremely often" in convertible security contracts (average frequency of covenant inclusion: 4.50).
- *Preferred equity* (Cluster 3) is used in combination with redemption rights and staged financing, in addition to co-sale agreements and liquidation rights. On average, cash flow-related covenants are employed "often" in preferred equity contracts (3.90).
- *Debt-equity combinations* (Cluster 5) are contracted upon with redemption rights and staged financing, in addition to co-sale agreements and liquidation rights. On average, cash flow-related covenants are included "often" in debt-equity contracts (3.81).
- *Straight equity* (Cluster 4) is combined with no more than co-sale agreements and liquidation rights. On average, cash flow-related covenants are used "often" in straight equity contracts (3.59).

While existing literature focuses on convertible preferred and straight equity contracts,[328] the cluster analysis carried out in this paper identifies two additional standard contracts on the basis of preferred equity financing and debt-equity combinations. It thereby accounts for the observed broad scope of financial instruments employed in the German venture capital market. Furthermore, the analysis directly links financial instruments to cash flow-related covenants. This is not possible when summarizing existing empirical evidence as can be seen in the literature review in Chapter 3. The findings on financial instruments are grouped into convertible preferred and straight equity whereas findings on covenants can only be grouped geographically by US and non-US

[328] For example, Kaplan and Strömberg (2003), Cumming (2004), Bascha and Walz (2002).

samples.[329] This prohibits drawing conclusions on combinations of financial instruments and cash flow-related covenants across all existing empirical evidence. Nevertheless, it can be argued that results from existing literature and from this analysis are largely comparable with the exception of findings on the use of staged financing. This is shown to be combined with mainly straight but also convertible preferred equity by empirical literature, although it is combined with preferred equity in this sample. The most important conclusion from the above cluster interpretation is the fact that straight equity is not used in combination with at least one non-ubiquitous cash flow-related covenant and therefore Expectation 2 is not fulfilled. This has important implications for the results of the theoretical model in Chapter 4. Certainly the fact that straight equity is not combined with as many cash flow-related covenants as convertible securities raises the suspicion that US venture capital contracts are indeed optimal and thus US venture capitalists more sophisticated than their German counterparts.[330] Therefore, the relationships between the contractual patterns and venture capitalist characteristics – including sophistication – are analyzed in the following.

5.3.3 Determinants of Contract Architecture

Venture capital company characteristics are the least-analyzed determinant of contractual architecture in the empirical literature. Kaplan et al. (2003) and Isaksson et al. (2004) present partly-conflicting insights into the influence of venture capital characteristics on contracts in 23 non-US countries and Sweden. This paper extends their analyses to the German venture capital market and includes significant additional characteristics.

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[329] The underlying reason is that Kaplan et al. (2003) find the use of convertible preferred equity by 23 non-US countries to be combined with covenants otherwise employed with straight equity, and with the same frequency. For an overview of the related empirical literature, see Table 3-3.

[330] US venture capital contracts presented by Kaplan and Strömberg (2003) closely resemble the convertible preferred equity contracts in Cluster 1.

5.3.3.1 Factor Interpretation

Factor analysis is a data reducing method without loss of information, which groups variables into independent factors. After the selection of nine variables on the venture capital companies' characteristics, investment and contracting activities, these variables are summarized to five collective terms by means of factor analysis. While these five factors are thus only slightly and non-significantly correlated, their variables are significantly and highly correlated with the factor they belong to. Below, the factors are named, interpreted, and compared to existing literature.

5.3.3.1.1 Factor 1: Size and Experience

This factor combines the variables *"Operating Years"*, *"Employees"*, and *"Investments under Management"*. The variable "Operating Years" has similar factor loadings on Factors 1 and 4 but is allocated to this factor because it is significantly positively correlated with Factor 1 (0.603***)[331] and its variables "Employees" (0.523***) and "Investments under Management" (0.675***), while both significance level and correlation coefficient are lower for Factor 4 (0.379**). The number of employees and of managed investments are an indicator of the size of the venture capital company, while the number of investments under management and the years of operating in the German venture capital market reflect its experience. Factor 1 thereby combines and redefines characteristics from existing literature. Isaksson et al. (2004) categorizes the 50% of venture capital companies with the highest number of investments as experienced.[332] Kaplan et al. (2003) use the funds under management as size indicator, and the sample median of age to distinguish between younger and older firms. Together with US experience or "familiarity with the United States", Kaplan et al. (2003) combine them to the construct of

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[331] Rank correlation coefficients referred to in the text are Spearman's rank correlation coefficients as displayed in Appendix C. Correlation significance levels: *** significant at $p \leq 0.01$; ** significant at $p \leq 0.05$; * significant at $p \leq 0.10$. For correlation coefficient interpretation guidelines, see Footnote 285.

[332] See Isaksson et al. (2004), p. 55.

venture capitalist sophistication.[333] In this study, however, size and experience in the home market are separated from international experience (Factor 3), and only sample firms with highest scores for both factors are interpreted as being most sophisticated. This relation between Factors 1 and 3 is underlined by significant positive correlations (0.416***; 0.465***) of both variables in Factor 3 with Factor 1, despite a very low correlation (0.064) between both factors.

5.3.3.1.2 Factor 2: Contracting Focus

This factor summarizes the variables *"Contracting: Financial Structure"* and *"Contracting: Contractual Covenants"*, which quantify the percentages of overall contracting time spent devising the financial structure of the investment and designing the covenants. The variables do not add to 100% because the variable "Contracting: Contingencies/Milestones" is not included in the factor analysis.[334] Since this variable ranges between 27.15% and 33.75% across clusters, the other two variables are almost perfectly inversely related and therefore also significantly negatively correlated (−0.478***).[335] They indicate whether the venture capital companies set their main focus on financial instruments or covenants[336] when designing their contracts. Variables like these on the contracting process have so far not been included in analyses on contract determinants. However, the venture capital companies' attitude towards contracting, which is captured hereby, severely influences their contracting practice.

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[333] See Kaplan et al. (2003), p. 16.

[334] For an explanation of the exclusion of the variable "Contracting: Contingencies/Milestones" from factor analysis, see Footnote 295.

[335] For the cluster profiles across factor variables, see Table 5-29.

[336] Data on the time spent defining covenants was not raised separately for cash flow-related and other covenants. Future empirical research on German venture capital contracting should account for differences between these two types of covenants.

5.3.3.1.3 Factor 3: International Experience

This factor comprises the variables *"International Investment Activity"* and *"International Physical Presence"*, which – other than in the descriptive statistics in Section 5.2.2.2 – are reported as binary variables indicating whether a venture capitalist has investment activity in at least one foreign country and whether a venture capitalist has investment activity and physical presence in at least one foreign country each. This operationalization is in line with literature on the incremental internationalization by Johanson and Wiedersheim-Paul (1975), Johanson and Vahlne (1977), and Dixit and Jayaraman (2001), where firms successively commit to foreign operations as they gradually gain resources as well as knowledge about foreign markets.[337] This also explains the variables' negative correlation (−0.211). International experience in this context relies on a narrower definition than in Kaplan et al. (2003), where a non-US venture capital company has US experience if it has syndicated or co-invested deals with a US venture capital company or with a non-US venture capital company that had previously syndicated or co-invested with a US venture capital company.[338]

5.3.3.1.4 Factor 4: Investor Type

This factor only includes the variable *"Investor Type"* revealing the investment preferences of a venture capital company with regard to the development stage of its portfolio companies and distinguishing between early-stage and late-stage investors as well as generalists. It is significantly positively correlated (0.379***) with the age of the venture capital company. But, as reasoned above, the variable "Operating Years" with equivocal factor loadings is allocated to Factor 1 rather than to this factor. Isaksson et al. (2004) also includes the investor type in

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[337] See Johanson and Wiedersheim-Paul (1975), pp. 23–30, Johanson and Vahlne (1977), pp. 306–308, and Dixit and Jayaraman (2001), pp. 43-45.

[338] See Kaplan et al. (2003), p. 16. International investment experience in this study can be interpreted as being equivalent to US experience: According to Table 5-29, it is only reported in the form of international investment activity for firms in Cluster 1, who have international investment activity mainly in the United States.

a discriminant analysis, and finds that it best discriminates between different combinations of covenants.[339] Furthermore, Cumming (2002b) *(Cumming (2004))* demonstrates that agency problems related to early or late-stage portfolio firms influence contract design *(security choice)*.[340]

5.3.3.1.5 Factor 5: Ownership Category

This is a single-variable factor on the *"Ownership Category"* of the venture capital company, which indicates its legal status of captivity, affiliation, independence, or public ownership. It thereby extends the similar concept of firm structure by Isaksson et al. (2004) which distinguishes only between public and non-public investors.[341]

5.3.3.2 Implications of Discriminant Analysis Results

On the basis of these factors on venture capital company characteristics, a discriminant analysis is applied as multivariate dependence technique for the analysis of cluster differences. As shown in Section 5.2.3.3, classification results show a correct prediction of cluster membership in 51.16% of sample firms. With random allocation of sample firms to clusters attaining a 20.00% probability of correct classification, the success ratio has more than doubled. This is an indication that – besides tax, legal, and institutional aspects (Cumming (2004); Cumming (2002c); Lerner and Schoar (2004)) and portfolio company characteristics and related agency problems (Barney et al. (1994); Bascha and Walz (2002); Cumming (2004); Cumming (2002b); Schäfer et al. (2004)) – characteristics of the venture capital company (Isaksson et al. (2004); Kaplan et al. (2003)) have a great influence on contractual architecture. The medium canonical discriminant coefficients as well as the Kruskal-Wallis test show that Factors 2 ("Contracting Focus"), 3 ("International Experience"), and 4 ("Investor Type") discriminate most and significantly between clusters. Hence,

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[339] See Isaksson et al. (2004), p. 60.
[340] See Cumming (2004), p. 581, and Cumming (2002b), p. 23.
[341] See Isaksson et al. (2004), p. 55.

investor type determines contractual architecture implying that Hypothesis 2 holds. Furthermore, in line with Isaksson et al. (2004), Factor 4 clearly dominates Factor 3. At the same time, Hypothesis 3 has to be rejected on the grounds of the low and insignificant influence of ownership category on the structure of contracts. Most important is the narrower redefinition of venture capitalist sophistication on the basis of the definition by Kaplan et al. (2003),[342] which serves to test Hypothesis 1 with help of the average cluster profiles with respect to the factor variables. These are presented and interpreted below.[343]

Factor	1			2		3		4		5
Cluster	*Operating Years*	*Employees*	*Investments under Management*	Contracting: Financial Structure	Contracting: Contractual Covenants	International Investment Activity	International Physical Presence	Investor Type[a]	Operating Years	Ownership Category[b]
1	8.14	15.14	21.00	15.71%	57.14%	1.00	0.00	1.00	*8.14*	3.00
2	10.30	16.00	40.70	35.90%	34.00%	0.00	0.00	2.00	*10.30*	3.00
3	4.92	13.23	20.31	29.31%	37.77%	0.00	0.00	1.00	*4.92*	3.00
4	15.00	12.78	20.67	37.22%	30.56%	0.00	0.00	2.00	*15.00*	3.00
5	7.25	8.00	14.75	31.25%	35.00%	0.00	0.00	2.00	*7.25*	1.00
Total	9.02	13.60	24.72	30.47%	38.28%	0.00	0.00	2.00	*9.02*	3.00
	Mean					Median			*Mean*	Median

[a] (1) early-stage investor, (2) late-stage investor, (3) generalist

[b] (1) captive investor, (2) affiliated investor, (3) independent investor

Table 5-29: Cluster Descriptives (Summary) – Factor Analysis Variables

5.3.3.3 Cluster Descriptives on Factor Variables

5.3.3.3.1 Cluster 1: Convertible Securities

Venture capital companies in this cluster are the second oldest with 8.14 operating years, which is slightly below the sample average of 9.02 operating years. They are also the second largest with 15.14 employees and 21.00

[342] See Kaplan et al. (2003), p. 16.

[343] For cluster descriptives on factor analysis variables grouped by factors, see Table 5-29.

investments behind firms in Cluster 2 with an average of 16.00 employees and 40.70 investments under management. Their contracting focus lies with 57.14% (out of 72.85%) of contracting time strongest among all clusters on the design of contractual covenants. This cluster is the only one, for which the cluster median indicates international investment activities by its venture capital companies (71.43% of companies report having at least one foreign investment activity). In addition, the correlation of convertible securities with the variable "International Investment Activity" is highly significantly correlated (0.401***)[344] across the entire sample. International investment activity from the home office is conducted mainly in the United States (4 firms), Great Britain, France, the Low Countries, Switzerland (3 firms each), Austria (2 firms), as well as the Nordic region (with Finland, Sweden, and Denmark; 1 firm). This reflects their investment focus on the Anglo-Saxon as well as neighboring markets, that is, on culturally and geographically proximate markets.[345]

According to the cluster medians, cluster firms are early-stage and independent investors. Empirical work by Cumming (2002b) similarly finds that portfolio companies in the seed, start-up, and expansion stages are most likely to be financed with convertible preferred equity.[346] Following Cumming's (2004) reasoning, whereby security choice depends on portfolio company-specific expected agency problems,[347] venture capital companies in this cluster can be interpreted to invest in young, high-risk portfolio companies and to therefore protect themselves from related agency problems with a financial instrument providing them with a strong claim on cash flows under poor and a participating claim under good performance, in combination with a great number of meticulously defined cash flow-related and other covenants.

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[344] Rank correlation coefficients referred to in the text are Spearman's rank correlation coefficients as displayed in Appendix C. Correlation significance levels: *** significant at $p \leq 0.01$; ** significant at $p \leq 0.05$; * significant at $p \leq 0.10$. For correlation coefficient interpretation guidelines, see Footnote 285.

[345] See Johanson and Vahlne (1977), pp.26–27.

[346] See Cumming (2002b), p. 13.

[347] See Cumming (2004), p. 561.

5.3.3.3.2 Cluster 3: Preferred Equity

Venture capital companies in this cluster are the youngest and have only 4.92 years of operating experience. With 13.23 employees, they are almost as large as the average sample firm, and with 20.67 investments, they have approximately the same number of investments under management as the firms in Cluster 1. Cluster firms spend 37.77% (out of 67.08%) of their contracting time on designing contractual covenants and thereby set not quite such a strong focus on covenants as firms in Cluster 1. This becomes apparent when comparing their contractual architectures: Preferred equity is combined with slightly fewer covenants than convertible preferred equity. Together with firms in Cluster 1, firms in this cluster are the only early-stage investors. This is supported by the empirical work on the Canadian venture capital market by Cumming (2004), where seed stage portfolio companies are most likely to be financed by preferred equity and high-tech firms by convertible securities.[348] The ownership category of cluster firms is that of an independent venture capital company. Overall, the cluster profile of Cluster 3 highly resembles that of Cluster 1 with the difference that venture capital companies financing deals with preferred equity are younger and less internationally experienced (46.15% of companies report to have at least one foreign investment activity), that is, less sophisticated according to the underlying definition. Nevertheless it has to be noted that preferred equity is the only other financial instrument that is significantly positively correlated (0.330**) with the variable "International Investment Activity" across the entire sample.

5.3.3.3.3 Cluster 5: Combinations of Debt and Equity

Venture capital companies in this cluster are 7.25 years old and thus the second youngest across all clusters. They are also the smallest with only 8.00 employees and 14.75 investments under management. Their contracting time is spent almost equally-balanced on financial instruments and contractual

[348] See Cumming (2004), p. 578.

covenants, with only a slight focus on the financial structure (35.00% out of 66.25%). Cluster firms invest mainly in late-stage portfolio companies. Unlike all other clusters, this cluster is reported to include mainly captive investors. This suggests that captive investors have no contracting focus and, through debt-equity financing, wish to reduce their involvement in portfolio companies to the equity fraction of their investments.

5.3.3.3.4 Cluster 4: Straight Equity

Venture capital companies in this cluster are 15.00 years old and thus have the greatest operating experience. They rank third with 20.67 investments under management and fourth with 12.78 employees. Their contracting focus lies strongest among all clusters with the financial structure, on which they spend 37.22% (out of 67.78%) of their contracting effort. Cluster firms are independent and late-stage investors. This corresponds with findings by Cumming (2002b) that late-stage firms are financed mainly with straight equity.[349] In line with the above reasoning on agency problems and security choice for Cluster 1, it can be argued that late-stage portfolio companies are less risky. Thus, invested venture capital companies mainly protect themselves against the case of liquidation and employ only few additional covenants in their contracts.

5.3.3.3.5 Cluster 2: Straight Equity and Equity-Related Claims

Venture capital companies in this cluster with 10.30 years of operating experience are somewhat older than the sample average of 9.02 years. They are the largest firms with respect to size, employing 16.00 employees and managing 40.70 investments. They thereby have almost twice as many portfolio companies as firms in Clusters 1, 3, and 4. Contracting time is almost evenly devoted to financial instruments and contractual covenants. Cluster firms are late-stage and independent investors. Distinguishing characteristic of venture

[349] See Cumming (2002b), p. 14.

capital companies in this cluster is their focus on forms of equity financings and late-stage investments, which they have in common with firms in Cluster 4.

5.3.3.4 Summary

The main findings from the above cluster interpretation are summarized in the following. They are mainly in line with findings by Cumming (2004) and Cumming (2002b). The clusters are ranked according to their level of sophistication. Since only firms in Cluster 1 invest internationally, the ranking is mainly determined by their relative "Size and Experience", which is calculated as their average ranking across the variables included in Factor 1.

- *Convertible securities* (Cluster 1) are employed by middle-aged, relatively large, independent venture capital companies – which rank first in terms of size and experience (under exclusion of Cluster 2) – and focus on *early-stage* investments. These are the only firms with *international* investing in the form of *investment activity*, mainly in the United States. For this reason, they are the most sophisticated venture capital companies in the German market.
- *Straight equity* (Cluster 4) is used by the oldest, average-sized, independent venture capital companies – which rank second in terms of size and experience (under exclusion of Cluster 2) – and focus on *late-stage* portfolio companies, as do firms in the equity-related Cluster 2.
- *Preferred equity* (Cluster 3) is included by the youngest, average-sized, independent venture capital companies – which rank third in terms of size and experience (under exclusion of Cluster 2) – and invest mainly in *early-stage* portfolio companies.
- *Debt-equity combinations* (Cluster 5) are contracted upon by relatively young and the smallest venture capital companies – which rank fourth in terms of size and experience (under exclusion of Cluster 2) – and fund mainly *late-stage* portfolio companies. These venture capital companies are mainly captive investors and are thus subsidiaries of a company or financial institution.

The main finding is that the most sophisticated investors with highest scores (under exclusion of Cluster 2) for the factors on "Size and Experience" in the home market and "International Experience" employ mainly convertible securities in combination with numerous covenants. Hypothesis 1 therefore holds, implying that not only US venture capital companies but also non-US or German firms with international or US investment experience are sophisticated and use convertible securities in their contracts, despite differing tax, legal, and institutional environments. This is largely concordant with the fact that only 11.63% of sample firms report unfavorable legal regulations in Germany to prevent them from using convertible securities.[350] As a consequence, the largest fraction of German venture capital companies, which are shown to use mainly straight equity (see Expectation 1), are less sophisticated.[351]

5.4 Summary of Results

This section summarizes the main findings of the empirical analyses and derives a contract ranking or ladder of venture capital investor sophistication.

The *descriptive statistics on the contracting process* indicate that venture capital companies ascribe great importance to initial contract negotiations and design and consider them as fundamental to profitable venture capital investing. Venture capital companies therefore invest considerable amounts of time and money into contracting, and frequently seek lawyer assistance. On the contract components, it is interesting to note that venture capital companies attach almost equal importance to the definition of both financial instruments and covenants.

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[350] For a list of reasons against the ubiquitous use of convertible securities by German venture capital companies, see Table 5-24.

[351] Conclusions drawn on the sophistication of German venture capital companies are not based on information about the financial success of sample firms in the form of, for example, rates of return. Only 12 venture capital companies participating in the survey provided information on their average realized rate of return; unfortunately this variable, therefore, had to be excluded from the analyses. So far, only Brettel et al. (2004a) and Cumming (2002b) analyze the influence of contract design on portfolio company success, that is the internal rate of return, but not venture capital company success.

The *descriptive statistics on the financial instruments* are largely comparable to results of existing evidence on the German venture capital market: The main financial instrument is straight equity, where the investor holds a minority stake or a narrow majority stake, followed by preferred equity, combinations of debt and equity, and convertible securities *(esp. convertible preferred equity).*

The *descriptive statistics on the contractual covenants* suggest that the inclusion of cash flow-related covenants protecting the venture capital company's cash flow is equally important as the inclusion of information and control rights ensuring participative management by the venture capital investor.

Based on these findings, *augmented contracting patterns* are identified, representing consistent combinations of equally weighted financial instruments and cash flow-related covenants. While convertible securities, preferred equity, and combinations of debt and equity are shown to be frequently combined with at least redemption rights – besides the ubiquitously included liquidation provisions and co-sale agreements –, straight equity is only combined with the latter ubiquitous covenants. This is inconsistent with the proposition that straight equity in combination with at least one cash flow-related covenant can imitate the incentive-compatible cash flow allocation created by convertible securities.

The choice of contracting pattern is *determined* by certain factors related to the characteristics of the venture capital companies. While convertible securities and preferred equity are contracted upon by early-stage investors with contracting focus on the definition of covenants, straight equity is contracted upon by late-stage investors with contracting focus on the definition of financial instruments.[352] Convertible securities investors are the only venture capital companies with international investment activity, mainly in culturally and geographically proximate countries. Since they are also ranked highest in terms of their average rank across size ("Employees" and "Investments under Management") and experience ("Operating Years") in the domestic market (under exclusion of Cluster 2), they are defined as the most sophisticated

[352] Combinations of debt and equity are also contracted upon by late-stage investors but these investors have a contracting focus on the definition of covenants.

venture capital investors in the German market, followed by straight equity, preferred equity, and debt-equity investors. These results are summarized below in the form of a *contracting ladder of venture capital investor sophistication*.[353]

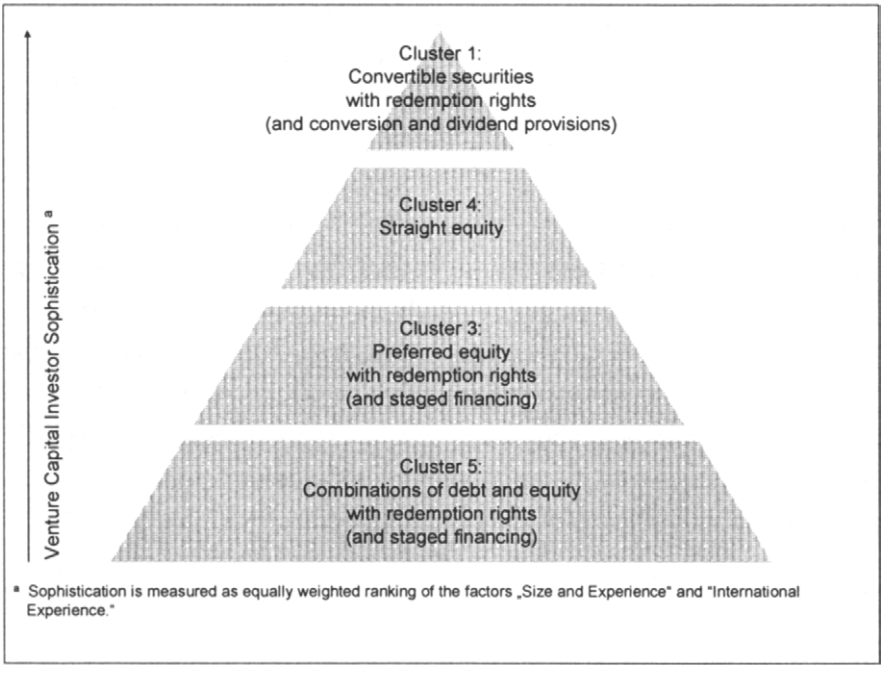


Figure 5-7: Contracting Ladder of Venture Capital Investor Sophistication

Altogether, the data supports one expectation and two hypotheses,[354] from which the following can be concluded: Although straight equity is the main financial instrument in the German market, venture capital companies financing portfolio companies with straight equity are not the most sophisticated investors. This, however, is to a large extent not attributable to unfavorable German legal regulations.

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[353] For an illustration of the new contracting ladder of venture capital investor sophistication, see Figure 5-7.

[354] For a summary of empirical results on the expectations and hypotheses, see Table 5-30.

Expectation 1	Straight equity is the main financial instrument in the German venture capital market.	Supported
Expectation 2	Straight equity is used in combination with at least one non-ubiquitous cash flow-related covenant.	Not supported
Hypothesis 1	Sophisticated venture capital companies use convertible securities as dominant financial instrument in their contracts.	Supported
Hypothesis 2	The investor types of venture capital companies determine the implemented contractual architecture.	Supported
Hypothesis 3	The ownership categories of venture capital companies determine the implemented contractual architecture.	Not supported

Table 5-30: Summary of Results on Expectations and Hypotheses

Finally, when asked to indicate reasons against the use of convertible securities, venture capital companies frequently reported that the incentive structure for portfolio companies created by convertible securities could also be achieved using other forms of financing in combination with covenants. This suggests that possibly the above identified contract patterns implement similar incentive structures. However, only a detailed comparison with the theoretical analysis of cash flow incentive mechanisms in Chapter 4 can shed light on this issue.

5.5 Conclusions

This chapter presents the first detailed empirical analysis of German venture capital contract negotiations and design, especially of the use of cash flow-related covenants and their interaction with financial instruments, also called "augmented contracting". Through cluster analysis in combination with factor and discriminant analyses, it furthermore introduces a novel methodological approach to research on venture capital contracting.

Unlike existing evidence, it accounts for the wide scope of financial instruments used in the German market and identifies four main contractual patterns on the basis of convertible security, preferred equity, debt-equity, and straight equity financing. It provides a detailed analysis of determinants of these contractual architectures relating to the characteristics of venture capital companies and finds that, in line with common belief, not only sophisticated US but also

sophisticated German venture capital companies use convertible securities. In order to draw conclusions on German contract design, however, these results have to be contrasted with the findings from the theoretical model in Chapter 4. This synthesis follows in Chapter 6.

6 Synthesis

This chapter presents a synthesis of the above theoretical and empirical analyses on cash flow allocations in German augmented venture capital contracts in Chapters 4 and 5. It compares real-world practices with incentive considerations and derives implications for an improved venture capital contract design in the German market.

The comparison of findings is subject to the following limitations. The theoretical analysis is restricted to four out of six cash flow-related covenants, excluding co-sale agreements and staged financing. However, empirical evidence shows that German venture capital contracts always include co-sale agreements, and that German convertible securities contracts and straight equity contracts do not contain staged financing agreements. This implies that the findings on convertible securities and straight equity contracts are not distorted. In addition, the theoretical analysis includes neither contracting time and costs nor possible rejections of complex or unknown financial instruments by portfolio companies. Yet these might differ between the empirically identified contracting patterns and thus define entry barriers to complex contracting.

The first comparison relates to the *optimal equity stake* allocated to the venture capital investor under straight equity financing, that is, also after conversion option exercise.

- The theoretical analysis derives that the optimal contract allocates a *minority share* in the project's return to the venture capitalist and a majority share to the entrepreneur.
- The empirical analysis finds that approximately one third of German venture capital companies report their maximum equity share across their contracts to be a *majority share*.

As a result, the maximum equity share allocated to the venture capital investor should be reduced to below 50% under straight equity financing as well as after conversion option exercise in order to provide optimal incentives to the portfolio company. From this results Implication 1.

Implication 1: *(Optimal Equity Share).* Under straight equity financing, the venture capital company should optimally be allocated a minority share in the portfolio company.

The second comparison refers to the *optimality of augmented contracts.* It contrasts the new pecking order of venture capital contracting with the four main contractual patterns identified in the German market.[355]

First, the pecking order recommends the use of *convertible securities* contracts.

- The theoretical analysis confirms findings in the existing literature on the optimality of convertible securities and extends this proposition by the finding that *convertible securities* with *redemption option* outperform all possible combinations of financial instruments and cash flow-related covenants in terms of their cash flow incentive-compatibility.
- The empirical analysis is an indication that German venture capital companies use *convertible securities* and combine them with *redemption options.*

These findings concur in contracting with convertible securities. They approve that the most sophisticated German venture capital investors choose the most incentive-compatible cash flow allocations. This is summarized in Implication 2.

[355] For a juxtaposition of the pecking order of venture capital contracting and the contracting ladder of venture capital investor sophistication, see Figure 5-7.

Implication 2: *(Optimal Convertible Securities Contracts).* If they are uninhibited in their choice of contract design, German venture capital companies should employ convertible securities with redemption option.

Second, the pecking order recommends the use of *straight equity* contracts.

- The theoretical analysis proves that *straight equity* is best combined *with redemption options* and *liquidation provisions.*
- The empirical analysis reveals that German venture capital companies do not add any other than common or ubiquitous cash flow-related covenants (including *liquidation preferences*) to *straight equity* contracts.

Thus, not including redemption options implies less incentive-compatible contracting by the second most sophisticated German venture capital investors. From this results Implication 3.

Implication 3: *(Improved Straight Equity Contracts).* Under straight equity financing, the venture capital company should include redemption options.

Straight equity is nevertheless most frequently employed in German venture capital contracts. Two possible explanations exist for this phenomenon: First, US investors almost exclusively contract upon convertible securities and German convertible securities investors are shown by the above empirical analysis to be the only German investors with a significant international investment activity and to carry out this activity mainly in the US venture capital market. This may be an indication that German straight equity investors are lack *international investment experience.* Second, *unfavorable legal regulations* in Germany may restrict the use of convertible securities as financial instrument for certain legal forms of portfolio companies. If German venture capital investors consequently resort to straight equity financing for these portfolio companies, it is the legal environment that inhibits a better allocation of cash flow incentives, and thus needs to be reconsidered. However, only 11.63% of survey participants reported legal constraints to be the underlying reasons for the fact that they do not always employ convertible securities in their contracts.

Third, the pecking order recommends the use of *preferred equity contracts*.

- The theoretical analysis of augmented contracting shows that a *straight debt* contract produces the best cash flow incentives if a *prior maturity* is defined. It further shows that the same cash flow allocation is achieved using a *straight debt/preferred equity* contract with *redemption option*. This contract does, however, not appear in the pecking order because it Pareto-dominates a straight equity contract with redemption option, while only a straight equity contract ensures project continuation.
- The empirical analysis finds that *preferred equity* contracts are combined with *redemption options*.

These findings concur in contracting with preferred equity. They indicate that the third most sophisticated German venture capital investors choose an augmented contract similar to that ranked third by the pecking order. In terms of sophistication, preferred equity investors not only lack international investment experience but they are also the youngest domestic market participants.

Fourth, the pecking order recommends the use of *straight debt/preferred equity* contracts and the contracting ladder that of *combinations of straight equity and straight debt*.

- The theoretical analysis does not provide consistent findings on combinations of straight equity and straight debt, and thus does not include them in the pecking order.
- The empirical analysis finds that *combinations of straight equity and straight debt* are added on redemption rights. Debt-equity investors distinguish themselves from investors employing other contracting patterns in that they are not independent but captive investors. This may imply that captive investors are obliged to follow certain investment guidelines set up by their majority shareholder and restricting the use of specific financial instruments.

Regarding *liquidation provisions*, the theoretical analysis recommends their inclusion in all contracts and assumes that they always form part of straight debt/preferred equity contracts. Empirical evidence shows that German venture capital contracts always include liquidation provisions. Therefore, the findings also concur in liquidation provisions.

Overall, the contracts chosen by the top three sophisticated venture capital investors almost perfectly match the top three incentive contracts of the pecking order. Thus, the incentive potential of augmented contracts seems to be directly linked to the sophistication of venture capital investors. Unless entry barriers to contracting exist,[356] this implies that a transfer of knowledge from highly to less sophisticated investors can, to some extent, improve the incentive-compatibility of the contract design chosen by less sophisticated investors. The empirical analysis shows that convertible securities investors are more domestically and internationally experienced than preferred equity investors and more internationally experienced than straight equity investors. A transfer of this knowledge is facilitated by syndication.

In syndication, a group of venture capital companies jointly invest in a portfolio company. The syndicate leader coordinates their investment and management supporting activities. He is usually the venture capital investor with the largest share in the portfolio company.[357] The close cooperation of the syndicate participants potentially fosters knowledge transfer on hard facts such as contracting as well as soft facts such as active investor involvement.[358] It thereby helps establish optimal incentives and support for the portfolio company. However, existing empirical evidence on the German venture capital market reports that 37.8% of investments by domestic venture capital companies are syndicated, of which 47.2% are undertaken with national partners, 15.3% with European partners, and 37.5% with non-European partners.[359] Altogether, only one fifth of venture capital investments in the German market are syndicated

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[356] Convertible securities are considered as highly complex financial instrument by 13.95% of survey participants, as shown Table 5-24.
[357] See BVK (2004c), p. 9.
[358] See Manigart et al. (2004), pp. 15–18, and Dixit and Jayaraman (2001), p. 44.
[359] See BVK (2004a), p. 7.

with foreign venture capital companies. This suggests that an increase in German deal syndication may have the potential to initiate a transfer of contracting knowledge. Therefore, preferred and straight equity investors are recommended to engage in deal syndication with

- domestically and at the same time internationally experienced German venture capital companies,
- foreign venture capital companies investing in the German market, or
- foreign venture capital companies investing in their foreign domestic market.

These findings are summarized in Implication 4.

Implication 4: *(Sophistication Improvements through Syndication).* Less sophisticated venture capital companies should syndicate investments with domestically and internationally more experienced partners in order to benefit from a transfer of knowledge on incentive-compatible contracting.

Overall, this synthesis develops implications for an improved German contract design. These implications are formulated in the form of instructions directed towards less sophisticated independent investors and explicitly point out their improvement potential in contracting. Thus, this thesis contributes substantially to the education of German venture capital investors on the issue of incentive driven contracting in the prevailing legal environment.

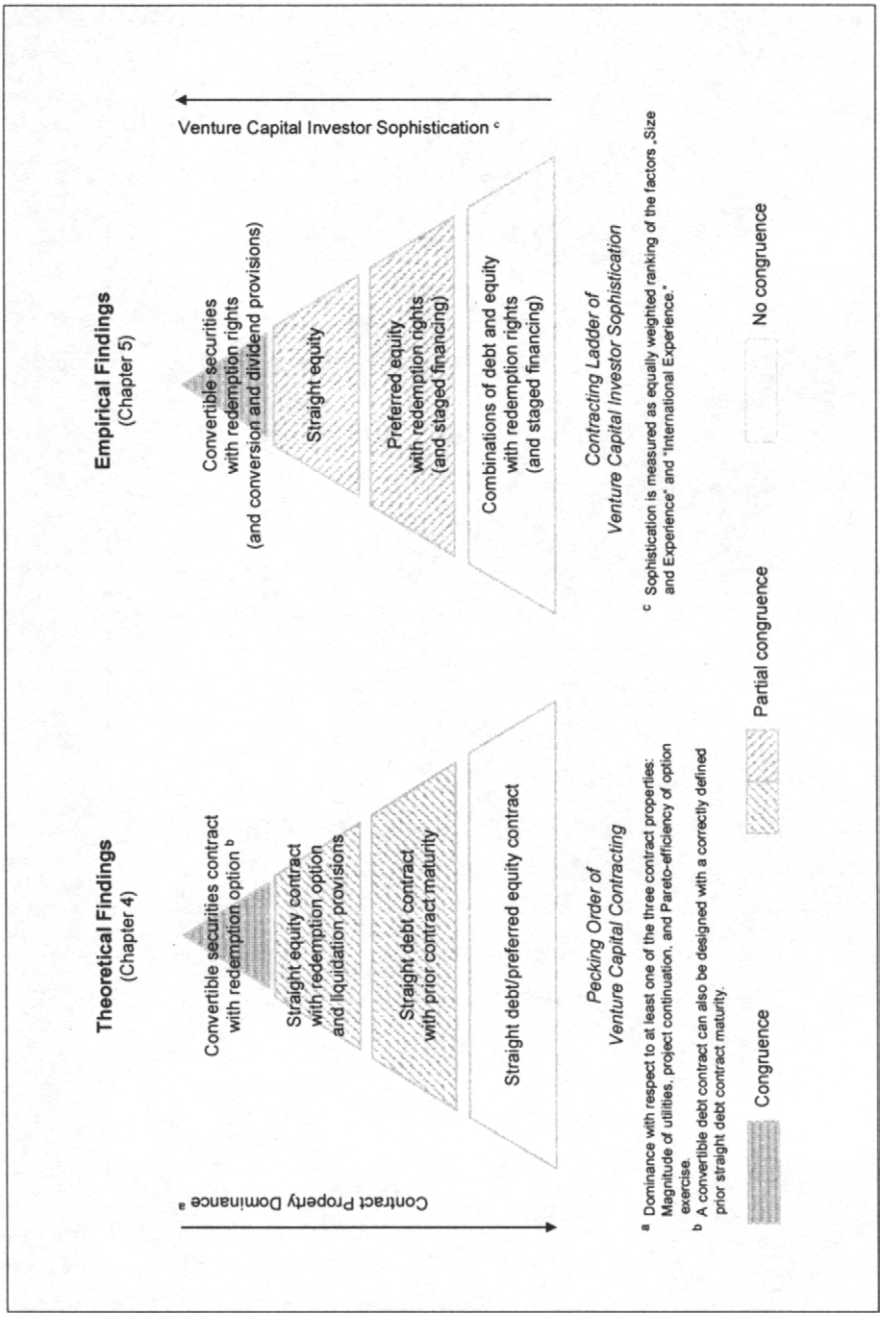


Figure 6-1: Comparison of Theoretical and Empirical Findings

7 Conclusion

Venture capital relationships between venture capital companies and their portfolio companies are governed by contracts defining the financing terms as well as the contracting parties' rights and duties throughout the investment period. The contracts' coordinating function and their incentive-compatibility are particularly relevant in the venture capital setting where both parties are actively involved in the management of the portfolio company. Contracts and the design of their formal components, *financial instruments* and *contractual covenants,* therefore play a central role in making the investment a success.

Starting point of this thesis is a comprehensive *literature review* reflecting the current status of research on venture capital contracting. The *theoretical literature* strongly supports the use of convertible securities, rather than that of straight equity, as incentive-compatible financial instrument. It mainly ignores covenants despite the fact that they, too, can be employed to create incentives for the contracting parties. Neglecting the interaction between both contractual components in the creation of incentives, the analyses disregard a central aspect of contracting reality. The *empirical literature* presents evidence that straight equity is the main financial instrument in German contracts but is combined less frequently with covenants creating cash flow incentives than are convertible securities, which are the predominant financial instrument in US contracts. However, the analyses fail to identify common German contract designs consisting of both contractual components, which are required to fully assess the incentive-compatibility of German contracting practices. Summarizing these insights, an important *research gap* lies in the analysis of the combined use of financial instruments and covenants in the creation of incentive mechanisms for the contracting parties in the German venture capital market.

This thesis therefore lays its explicit focus on the interaction of both contractual components, which is introduced as an *"augmented contracting"* approach to

incentive-compatible contract design. Applying augmented contracting to venture capital, this thesis aims at comparing German real-world contracts with related theoretical incentive considerations and at deriving implications for an improved contract design.

The *theoretical analysis* in this thesis aims at investigating whether the incentive-compatible allocation of cash flow rights obtained with convertible securities can effectively be replicated by straight equity in combination with covenants allocating cash flow rights. It extends existing literature mainly by its augmented contracting approach. In a simultaneous double moral hazard model, which integrates several real-world phenomena, common financial instruments – among them straight equity and convertible securities – are combined with covenants and compared on the basis of three contract properties describing their incentive-compatibility. These properties include the level of the parties' utilities but also incentive mechanisms directed specifically towards the entrepreneur. The findings of this augmented contracting analysis are presented in a hierarchy of contract designs: Convertible securities contracts with redemption option are the most incentive-compatible contracts, followed by straight equity contracts with redemption option and liquidation provisions. Nevertheless, the latter creates the same utility levels as the former. Under both contracts, allocating a minority equity share to the venture capitalist is shown to be incentive-compatible. The hierarchy of contracts is formulated in the form of a new *pecking order of venture capital finance*, which significantly refines existing findings on the financing of young companies but contradicts the pecking order for mature firms established by Myers (1984).

The *empirical analysis* in this thesis aims at identifying common contract patterns consisting of financial instruments and covenants in the German venture capital market and at analyzing which characteristics of venture capital companies determine the choice of these patterns. It extends existing literature mainly by its augmented contracting approach. As the first paper applying cluster analysis to the context of venture capital contracting, it shows that German venture capital investors combine convertible securities with a redemption option and numerous other covenants. It further shows that they

combine straight equity, which is the main financial instrument in the German market, only with covenants included also in convertible securities contracts and all remaining contract patterns. These are based on straight debt and combinations of financial instruments. In a factor and a discriminant analysis, a variety of characteristics of the surveyed venture capital companies is grouped into five factors. The factors describing the investors' "Size and Experience" in the domestic market and their "International Experience" are summarized in the construct of "venture capitalist sophistication". The analysis shows that venture capital companies employing convertible securities contracts are the most sophisticated investors, followed by those employing straight equity contracts. This suggests that the most sophisticated German venture capital companies are able to enforce US-style contracts. Interestingly, only a small proportion of survey participants reported unfavorable legal regulations to restrict them from the use of convertible securities. The findings of the empirical analysis are summarized in the form of a *ranking of contracts with respect to the level of sophistication of the venture capital investors.*

In a *synthesis of the theoretical and empirical analyses*, the thesis finally compares German real-world contracts with related theoretical incentive considerations. It shows that German venture capital investors mainly employ the contracts included in the new pecking order and choose them in the order of their level of sophistication. From observed deviations of German contract patterns from the pecking order, the following recommendations for an improved contract design are extracted. These *recommendations* are directed towards German venture capital investors and contribute substantially to their education in incentive-compatible contract design. They propose the following improvements to German contracting:

- Venture capital companies should write the contract such that they hold a *minority share* under straight equity financing and after conversion option exercise.
- Venture capital companies should always invest by means of *convertible securities* in combination with a *redemption option.*

- If convertible securities investments cannot be implemented, venture capital companies should combine *straight equity* financing with a *redemption option*.
- Venture capital companies should *syndicate* investments with in particular *internationally experienced partners* and learn from their contract design.

The final recommendation clearly aims at fostering communication and cooperation among market participants, in the understanding that they are likely to increase the level of sophistication of German venture capital companies and thereby possibly impact the overall performance of the venture capital industry. An improved investment performance may lead to a greater interest in and acceptance of this asset class among a broader scope of institutional and, even more so, private investors. Additional funds could then be invested to support innovation and growth, thus contributing to the ongoing structural change in the German economy.

Taking these analyses as a starting point, there are ample opportunities for *future theoretical and empirical research*. A valuable theoretical extension includes an augmented contracting analysis of governance mechanisms in venture capital. The analysis of the contingent allocation of control rights defined by financial instruments and control covenants can complement this thesis' analysis of incentive mechanisms to decision-making in the context of certain events. Valuable empirical extensions could be facilitated by a dataset on individual venture capital contracts in Germany and possibly across several other European countries. The analysis of detailed contract and portfolio company data could be used to identify deal-specific information on augmented contracting with a focus on incentive and even governance mechanisms across different countries. The dataset could furthermore form the basis for a comprehensive analysis of the determinants of contract design, including not only venture capital company characteristics but also portfolio company characteristics. Moreover, differing tax, legal, and institutional environments across different European countries could be accounted for. Since related worldwide and European benchmarking analyses have shown Germany to

provide a rather unfavorable tax and legal environment for its venture capital investors, these findings might make it possible to identify how German legal authorities could improve upon local parameters.

Appendices

Empirical Papers (I)	Country Focus	Sample-Size	Data-Source	Period	Method	Financial Instruments	Cash Flow-Related Covenants
Kaplan and Strömberg (2003)	United States	200 venture capital investments, 118 portfolio companies, 14 venture capital companies	Viewed documents: Stock purchase and security purchase agreements, term sheets, business plan, internal analyses	1987-1999	Logit regression	Convertible preferred equity: 95% (of which 36% are participating); convertible debt: 3%; straight and preferred equity: 3%	Liquidation rights: 99%; automatic conversion provisions: 94%; redemption rights: 84%
Cumming (2002b)	Europe (Austria, Belgium, Czech Republic, Denmark, France, Germany, Italy, Poland, Switzerland, Netherlands)	179 venture capital investments, 132 portfolio companies, 17 venture capital funds	Hand-collected dataset	2001-2002	Binomial and multinomial logit regression	Straight equity: 44%; debt-equity mixes: 21%; convertible preferred equity: 18%; straight and preferred equity: 17%	Co-sale agreements: 61%; redemption rights: 36%; automatic conversion provisions (IPO): 8%
Cumming et al. (2004)	39 countries (from North and South America, Asia and Europe; mainly US, France, UK, and Germany	3848 portfolio companies, 193 venture capital funds, 66 venture capital companies	Detailed information on a number of transaction-specific variables	1971-2003	Logit regression	Periodic cash flows and/or upside potential	
Cumming (2002c)	United States: US-investments by Canadian venture capitalists	208 venture capital investments	Macdonald and Associates, Ltd - database (http://www.canadavc.com)	1991-2000	Multinomial logit regression	Straight equity: 35%; convertible preferred equity: 21%; preferred equity: 15%; debt: 12%; convertible debt: 12%; debt-equity mixes: 5%	

Empirical Papers (II)	Country Focus	Sample-Size	Data-Source	Period	Method	Financial Instruments	Cash Flow-Related Covenants
Lerner and Schoar (2004)	25 developing countries (according to the definition of developing countries by the World Bank)	210 venture capital investments	Viewed documents: Investment and private placement memoranda, stock purchase agreements, other documents	1987-2003	Re-gression analysis	Straight equity: 55%; convertible preferred equity: 21%; convertible debt: 13%; preferred equity: 9%	Automatic conversion provisions: 26%; redemption rights: 31%
Bascha and Walz (2002)	Germany	47 venture capital companies (minimum sample)	Survey (among BVK members)	January 2000	Tobit models	Silent partnerships: 33%; "equity only": 27%; debt-equity mix: 14%; convertible securities: 11%; silent partnerships + debt: 6%; other: 11%	
Schäfer et al. (2004)	Germany	228 portfolio companies	KfW database (including balance sheets, project information from KfW questionnaire on financing- and project-related	1999-2003	Logit regression	Equity (straight equity + silent partnerships + shareholder loan): 55%; debt: 45%	
Cumming (2004)	Canada	3083 venture capital investments	Macdonald and Associates, Ltd - database (http://www.canadavc.com)	1991-2000	Multi-nomial logit regression	Straight equity: 36%; debt: 15%; convertible debt: 12%; convertible preferred equity: 11%; mixes of straight equity and debt: 11%; other: 8%; preferred equity: 7%	

Empirical Papers (III)	Country Focus	Sample-Size	Data-Source	Period	Method	Financial Instruments	Cash Flow-Related Covenants
Kaplan et al. (2003)	23 non-US countries (comparison to US dataset used in Kaplan and Strömberg (2003)	107 portfolio companies, 70 venture capitalists (lead ~)	Viewed documents: Stock purchase and security purchase, agreements, term sheets, business plan, internal analyses	1992-2001	Multi-variate regression analyses	Convertible preferred equity: 54%; straight equity: 28%; preferred equity: 15%; convertible debt: 2%; other: 2%	Liquidation rights: 89%; staged financing: 39%; redemption rights: 35%
Bottazzi et al. (2004)	Europe (15 EU countries)	1300 portfolio companies, 150 venture capital funds, 118 venture capital companies	Survey data augmented with commercially available databases	1998-2001	Descrip-tive statistics	Straight equity: > 50%; preferred equity: > 25%; straight debt: ~ 5%, convertible securities: > 5%, other > 5%	Co-sale agreements: 54%; "rights to profits": 43%; liquidation rights: 33%; staged financing: 26%
Hommel et al. (2003)	Germany	63 venture capital companies	Survey (among mainly BVK members)	Spring 2002	Significance tests	Data reported on 5-point Likert scale: Straight equity: 4.6 ; preferred equity: 3.9; convertible preferred equity: 2.0; convertible debt: 2.2; debt: 1.8	Redemption rights: 3.5; staged financing: 3.2
Brettel et al. (2004a)	Germany	114 portfolio companies, 49 venture capital companies	Survey data on venture capital companies and max. 3 portfolio companies each	July 2001	Analysis of variance	Straight equity: 46%; debt: 30%; mezzanine instruments: 24%	Co-sale agreements: 61%; staged financing: 42%; liquidation rights: 42%; redemption rights: 22%

Empirical Papers (IV)	Country Focus	Sample-Size	Data-Source	Period	Method	Financial Instruments	Cash Flow-Related Covenants
Barney et al. (1994)	USA	151 venture capital companies	Survey	1987-1989	Factor analysis and OLS		Liquidation rights
Isaksson et al. (2004)	Sweden	27 venture capital companies	Survey	Autumn 1998	Factor and discrimi-nant analyses		(79 clauses including:) Co-sale agreements, dividend agreements, redemption rights, staged financing

Sample Firm Characteristics (I)	Label	Description	Operationalization	Skew-ness	Kurto-sis	N
Investor Type	a_1_2	Investor type which best describes the company:	Nominal scaling: (1) Early-Stage Inv.; (2) Late-Stage Inv.; (3) Generalist; (4) Other. Ordinal scaling for (1), (2), and (3) throughout factor and discriminant analyses.	0.230	-1.595	43
Early-Stage Investor	a_1_2a	Investor with focus on early-stage (seed and start-up) investments.	Binary variable: (1) Early-Stage Inv.; (0) Other than ~.	0.342	-1.977	43
Late-Stage Investor	a_1_2b	Investor with focus on later-stage (expansion, bridge, turnaround, buy-out) investments.	Binary variable: (1) Late-Stage Inv.; (0) Other than ~.	1.021	-1.006	43
Generalist	a_1_2c	Investor without (distinct) investment-stage focus.	Binary variable: (1) Generalist; (0) Other than ~.	0.892	-1.265	43
Other	a_1_2d	Investor type other than the above.	Binary variable: (1) Other; (0) Any of the above.	Constant		43
Ownership Category	a_1_1	Ownership category which best describes the company:	Nominal scaling: (1) Captive Inv.; (2) Affiliated Inv.; (3) Independent Inv.; (4) Public Sector Inv.; (5) Other.Ordinal scaling for (1), (2), and (3) throughout factor and discriminant analyses.	-0.038	-0.512	43
Captive Investor	a_1_1a	Subsidiary company of a financial institution or corporate entity.	Binary variable: (1) Captive Inv.; (0) Other than ~.	1.021	-1.006	43
Affiliated Investor	a_1_1b	Associated company of a financial institution or corporate entity.	Binary variable: (1) Affiliated Inv.; (0) Other than ~.	3.501	10.755	43
Independent Investor	a_1_1c	Investor which is not controlled by another company.	Binary variable: (1) Independent Inv.; (0) Other than ~.	-0.145	-2.078	43
Public Sector Investor	a_1_1d	Investor affiliated to public authority.	Binary variable: (1) Public Sector Inv.; (0) Other than ~.	3.501	10.755	43
Other	a_1_1e	Ownership category other than the above.	Binary variable: (1) Other; (0) Any of the above.	4.464	18.801	43

Sample Firm Characteristics (II)	Label	Description	Operationalization	Skew-ness	Kurto-sis	N
Operating Years	a_2_3b	Number of years the company has actively been operating in the German market.	Interval scaling.	1.369	1.026	43
Employees	a_3_ 12a1	Number of employees, including back-office staff, the company currently employs.	Interval scaling.	1.637	5.984	43

Investment Activity (I)	Label	Description	Operationalization	Skew-ness	Kurto-sis	N
Funds Invested *(as % of Funds Raised)*	a_2_3f	Proportion of funds raised which is currently invested.	Interval scaling within the [0;1] range.	-0.022	-0.374	40
Investments under Management	a_2_3	Number of investments the company currently has under management.	Interval scaling.	0.226	5.226	43
New Investments						
2003	a_2_3e 1	Number of new investments made in 2003, excluding follow-on investments.	Interval scaling.	0.807	-0.201	42
2002	a_2_3e 2	Number of new investments made in 2002, excluding follow-on investments.	Interval scaling.	1.581	2.777	42
Investment Size Preferences						
Minimum (in EUR m)	a_2_4a 1	Minimum investment preference of the company, in EUR million.	Interval scaling.	2.328	6.361	43
Maximum (in EUR m)	a_2_4a 2	Maximum investment preference of the company, in EUR million.	Interval scaling.	4.426	18.774	43
Distribution of Investment Size		Distribution of the number of investments over the following investment size categories (in %) categories:				
< EUR 1 m	a_2_5a	< EUR 1 m.	Interval scaling within the [0;1] range.	1.150	0.055	42
EUR 1 m - EUR 10 m	a_2_5b	EUR 1 m - EUR 10 m.	Interval scaling within the [0;1] range.	-0.929	-0.368	42
EUR 10 m - EUR 20 m	a_2_5c	EUR 10 m - EUR 20 m.	Interval scaling within the [0;1] range.	4.756	25.724	42
EUR 20 m - EUR 50 m	a_2_5d	EUR 20 m - EUR 50 m.	Interval scaling within the [0;1] range.	4.408	18.296	42
< EUR 50 m	a_2_5e	< EUR 50 m.	Interval scaling within the [0;1] range.	5.977	36.887	42

Investment Activity (II)	Label	Description	Operationalization	Skew-ness	Kurto-sis	N
International Investing						
Investment Activity	IntInv Act	Variable indicating whether the company has international investment activity(ies).	Binary variable: (1) Company has international investment activity in at least one foreign country; (0) Company does not.	0.892	-1.265	43
Physical Presence	IntPhy Pr	Variable indicating whether the company has international physical presence(s) in addition to international investment activity(-ies).	Binary variable: (1) Company has international investment activity and physical presence in at least one foreign country; (0) Company does not.	2.905	6.748	43

Contracting Process	Label	Description	Operationalization	Skew-ness	Kurto-sis	N
Lawyer Assistance *(in % of Investments)*	a_4_15a	Proportion of investments, in which the company is actively assisted by a lawyer throughout the contracting stage.	Interval scaling within the [0;1] range.	-1.267	0.142	43
Contracting Time		Time period between starting contract negotiations and contract signing:				
Minimum (in Months)	a_4_15	Minimum experienced contracting time.	Interval scaling.	1.363	1.862	43
Maximum (in Months)	a_4_15	Maximum experienced contracting time.	Interval scaling.	0.320	-1.082	43
Distribution of Contracting Time		Proportion of contracting time spent on:				
Financial Structure	a_4_15c1	Devising the financial structure of the investment.	Interval scaling within the [0;1] range.	0.568	0.226	43
Contingencies/ Milestones	a_4_15c2	Defining contingencies and their milestones.	Interval scaling within the [0;1] range.	0.167	-0.119	43
Covenants	a_4_15	Designing the contractual covenants.	Interval scaling within the [0;1] range.	1.512	3.266	43
Contracting Costs *(as % of Inv. Size)*	a_4_15d	Average contracting costs as proportion of total investment size.	Interval scaling within the [0;1] range.	1.417	1.749	41

Financial Instruments	Label	Description	Operationalization	Skew-ness	Kurto-sis	N
Straight Equity	a_4_ 16SE	Frequency of using straight equity as financing instrument; as percentage of total number of investments.	Interval scaling within the [0;1] range.	0.735	-0.939	43
Preferred Equity	a_4_ 16PE	"preferred equity "	"	1.132	-0.217	43
Debt	a_4_ 16D	"debt "	"	3.511	12.435	43
Combinations of Debt and Equity	a_4_ 16ED	"debt-equity combinations "	"	1.020	3.037	43
Convertible Securities	a_4_ 16CS	" convertible securities "	"	2.444	5.083	43
Convertible Preferred Equity	a_4_ 16CE	" convertible preferred equity "	"	2.682	6.444	43
Convertible Debt	a_4_ 16CD	" convertible debt "	"	2.108	3.300	43
Silent Partnerships	a_4_ 16SP	" silent partnerships "	"	1.668	2.340	43
Other	a_4_ 16O	" any other financing instrument "	"	6.557	43.000	43
Minimum Equity Stake	a_4_ 18A	"minimum equity stake"	"	1.573	3.780	43
Maximum Equity Stake	A_4_ 18B	"maximum equity stake"	"	0.513	-0.485	43

Covenants	Label	Description	Operationalization	Skew-ness	Kurto-sis	N
Information Rights	a_4_21g	Frequency of including information rights in contracts with portfolio companies.	Likert (ordinal) scaling from 5 (almost always) to 1 (almost never).	-1.884	2.799	43
Control Rights						
Board Representation	a_4_20i	" board representation "	"	-1.236	1.524	43
Board Supermajority Rights	a_4_21e	" board supermajority rights "	"	0.086	-1.043	43
Board Veto Rights	a_4_21f	" board veto rights "	"	-0.474	-1.098	43
Protective Provisions	a_4_20e	" protective provisions "	"	-1.103	0.432	43
Voting Rights	a_4_21d	" voting rights "	"	1-.257	0.094	43
VC Safeguards						
Anti-Dilution Provisions	a_4_20d	" anti-dilution provisions "	"	-0.691	-1.218	43
Registration Provisions	a_4_20f	" registration provisions "	"	-0.032	-1.036	43
Rights of First Refusal	a_4_21c	" rights of first refusal "	"	-1.018	-0.223	43
Entrepreneur's Penalties						
Non-Compete Clauses	a_4_20h	" non-compete clauses "	"	-0.835	-0.452	43
Vesting Provisions	a_4_20g	" vesting provisions "	"	0.014	-0.922	43
Cash Flow Allocation						
Conversion Provisions	a_4_20a	" conversion provisions "	"	0.259	-0.638	43
Co-Sale Agreements	a_4_20c	" co-sale agreements "	"	-1.378	0.384	43
Dividend Provisions	a_4_20b	" dividend provisions "	"	0.061	-0.904	43
Liquidation Rights	a_4_21b	" liquidation rights "	"	-1.183	0.401	43
Redemption Rights	a_4_21a	" redemption rights "	"	-0.355	-1.012	43
Staged Financing	a_4_19a	" staged financing "	"	-0.297	-0.803	43

Appendix C: Statistics from Cluster, Factor, and Discriminant Analyses

Cluster Descriptives across Financial Instruments and Cash Flow-Related Covenants for Clusters 1 and 2

Cluster		Straight Equity	Preferred Equity	Debt	Debt-Equity Combinations	Convertible Securities	Silent Partnerships	Conversion Provisions	Co-Sale Agreements	Dividend Provisions	Liquidation Rights	Redemption Rights	Staged Financing
1	Mean	8.86%	15.29%	9.00%	0.00%	64.29%	2.57%	*5.00*	*5.00*	*4.14*	*4.86*	*4.29*	3.29
	Median	*0.00%*	*0.00%*	*5.00%*	*0.00%*	*60.00%*	*0.00%*	*5.00*	*5.00*	*5.00*	*5.00*	*5.00*	*3.00*
	Grouped Median	*1.20%*	*6.00%*	*5.00%*	*0.00%*	*71.67%*	2.57%	5.00	5.00	4.40	4.86	4.40	3.33
	Minimum	0.00%	0.00%	0.00%	0.00%	10.00%	0.00%	5	5	2	4	3	1
	Maximum	40.00%	60.00%	30.00%	0.00%	100.00%	18.00%	5	5	5	5	5	5
	Std. Deviation	0.16	0.24	0.11	0.00	0.37	0.07	0.00	0.00	1.21	0.38	0.95	1.50
	N (Percent of Total)					7 (16.28%)							
2	Mean	47.80%	3.00%	1.90%	19.20%	0.00%	28.10%	2.70	3.30	3.30	3.20	2.90	*2.80*
	Median	*45.00%*	*0.00%*	*0.00%*	*9.50%*	*0.00%*	*24.00%*	*3.00*	*3.00*	*3.00*	*3.00*	*3.00*	*3.00*
	Grouped Median	*45.00%*	*1.11%*	*1.90%*	*15.83%*	*0.00%*	25.33%	2.70	3.25	3.25	3.14	2.86	2.83
	Minimum	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2	2	2	2	2	1
	Maximum	80.00%	25.00%	19.00%	60.00%	0.00%	80.00%	3	5	5	5	4	5
	Std. Deviation	0.24	0.08	0.06	0.24	0.00	0.26	0.48	0.82	0.82	0.92	0.88	1.23
	N (Percent of Total)					10 (23.26%)							

Cluster Descriptives across Financial Instruments and Cash Flow-Related Covenants for Clusters 3 and 4

Cluster		Straight Equity	Preferred Equity	Debt	Debt-Equity Combinations	Convertible Securities	Silent Partnerships	Conversion Provisions	Co-Sale Agreements	Dividend Provisions	Liquidation Rights	Redemption Rights	Staged Financing
3	Mean	7.08%	68.69%	0.00%	3.08%	8.38%	12.77%	*3.38*	*4.62*	*2.38*	*4.54*	*3.85*	*4.08*
	Median	*0.00%*	*80.00%*	*0.00%*	*0.00%*	*10.00%*	*0.00%*	*3.00*	*5.00*	*2.00*	*5.00*	*5.00*	*4.00*
	Grouped Median	*4.50%*	*75.00%*	*0.00%*	*1.67%*	*8.75%*	*8.00%*	3.36	4.73	2.25	4.58	4.25	4.20
	Minimum	0.00%	16.00%	0.00%	0.00%	0.00%	0.00%	1	3	1	3	1	2
	Maximum	40.00%	100.00%	0.00%	30.00%	20.00%	63.00%	5	5	5	5	5	5
	Std. Deviation	0.11	0.27	0.00	0.09	0.09	0.22	1.26	0.77	1.19	0.66	1.46	0.95
	N (Percent of Total)	13 (30.23%)											
4	Mean	79.44%	2.22%	0.00%	7.22%	1.11%	6.67%	*2.67*	*5.00*	*3.11*	*4.67*	*2.89*	*3.11*
	Median	*80.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*3.00*	*5.00*	*3.00*	*5.00*	*3.00*	*3.00*
	Grouped Median	*80.00%*	*2.22%*	*0.00%*	*7.50%*	*1.11%*	*6.67%*	2.67	5.00	3.20	4.67	3.00	3.00
	Minimum	40.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2	5	1	4	1	2
	Maximum	100.00%	20.00%	0.00%	25.00%	10.00%	20.00%	3	5	5	5	5	5
	Std. Deviation	0.20	0.07	0.00	0.11	0.03	0.10	0.50	0.00	1.27	0.50	1.36	1.05
	N (Percent of Total)	9 (20.93%)											

Cluster Descriptives across Financial Instruments and Cash Flow-Related Covenants for Cluster 5 and Total

Cluster		Straight Equity	Preferred Equity	Debt	Debt-Equity Combinations	Convertible Securities	Silent Partnerships	Conversion Provisions	Co-Sale Agreements	Dividend Provisions	Liquidation Rights	Redemption Rights	Staged Financing
5	Mean	0.00%	0.00%	0.00%	94.25%	0.00%	5.75%	*2.00*	*5.00*	*2.50*	*5.00*	*4.25*	*3.75*
	Median	*0.00%*	*0.00%*	*0.00%*	*100.00%*	*0.00%*	*0.00%*	*2.00*	*5.00*	*2.50*	*5.00*	*4.50*	*4.00*
	Grouped Median	*0.00%*	*0.00%*	*0.00%*	*94.25%*	*0.00%*	*5.75%*	2.00	5.00	2.50	5.00	4.33	4.00
	Minimum	0.00%	0.00%	0.00%	77.00%	0.00%	0.00%	1	5	1	5	3	2
	Maximum	0.00%	0.00%	0.00%	100.00%	0.00%	23.00%	3	5	4	5	5	5
	Std. Deviation	0.00	0.00	0.00	0.12	0.00	0.12	1.14	0.00	1.29	0.00	0.96	1.26
	N (Percent of Total)					4 (9.30%)							
Total	Mean	31.33%	24.42%	1.91%	15.67%	13.23%	12.74%	*3.21*	*4.49*	*3.05*	*4.35*	*3.53*	*3.42*
	Median	*20.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*3.00*	*5.00*	*3.00*	*5.00*	*4.00*	*3.00*
	Grouped Median	*17.00%*	*3.80%*	*0.64%*	*4.67%*	*4.69%*	*10.29%*	3.06	4.65	3.00	4.49	3.63	3.48
	Minimum	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1	2	1	2	1	1
	Maximum	100.00%	100.00%	30.00%	100.00%	100.00%	80.00%	5	5	5	5	5	5
	Std. Deviation	0.35	0.35	0.06	0.30	0.27	0.20	1.21	0.88	1.25	0.90	1.30	1.22
	N (Percent of Total)					43 (100.00%)							

Cluster Descriptives across Other Covenants for Clusters 1 and 2

Cluster		Information Rights	Board Representation	Board Supermajority Rights	Board Veto Rights	Protective Provisions	Voting Rights	Anti-Dilution rovisions	Registration Provisions	Rights of First Refusal	Non-Compete Clauses	Vesting Provisions
1	Mean	*4.86*	*4.86*	*4.71*	*4.71*	*5.00*	*5.00*	*4.57*	*4.86*	*4.86*	*4.71*	*4.43*
	Median	*5.00*	*5.00*	*5.00*	*5.00*	*5.00*	*5.00*	*5.00*	*5.00*	*5.00*	*5.00*	*5.00*
	Grouped Median	4.86	4.86	4.71	4.71	5.00	5.00	4.67	4.86	4.86	4.71	4.43
	Minimum	4	4	4	3	5	5	3	4	4	3	3
	Maximum	5	5	5	5	5	5	5	5	5	5	5
	Std. Deviation	0.38	0.38	0.49	0.76	0.00	0.00	0.79	0.38	0.38	0.76	0.98
	N (Percent of Total)						7 (16.28%)					
2	Mean	*4.50*	*3.80*	*2.80*	*3.60*	*3.00*	*3.90*	*3.50*	*2.40*	*3.40*	*2.90*	*2.60*
	Median	*5.00*	*4.00*	*3.00*	*3.50*	*3.00*	*4.00*	*3.00*	*3.00*	*3.00*	*3.00*	*3.00*
	Grouped Median	4.56	3.88	2.83	3.60	3.00	3.88	3.44	2.50	3.38	3.00	2.67
	Minimum	3	2	1	2	1	3	3	1	2	1	1
	Maximum	5	5	4	5	5	5	5	3	5	5	3
	Std. Deviation	0.71	0.79	1.03	1.17	1.33	0.74	0.71	0.84	0.84	1.29	0.70
	N (Percent of Total)						10 (23.26%)					

Cluster Descriptives across Other Covenants for Clusters 3 and 4

Cluster		Information Rights	Board Representation	Board Supermajority Rights	Board Veto Rights	Protective Provisions	Voting Rights	Anti-Dilution rovisions	Registration Provisions	Rights of First Refusal	Non-Compete Clauses	Vesting Provisions
3	Mean	*4.77*	*4.38*	*3.00*	*3.85*	*4.54*	*4.77*	*4.62*	*3.31*	*4.69*	*3.85*	*3.92*
	Median	*5.00*	*5.00*	*3.00*	*4.00*	*5.00*	*5.00*	*5.00*	*4.00*	*5.00*	*5.00*	*4.00*
	Grouped Median	4.77	4.45	3.00	4.11	4.73	4.83	4.67	3.34	4.75	4.25	4.00
	Minimum	4	3	1	1	2	3	3	1	3	1	2
	Maximum	5	5	5	5	5	5	5	5	5	5	5
	Std. Deviation	0.44	0.77	1.53	1.28	0.97	0.60	0.65	1.25	0.63	1.52	1.04
	N (Percent of Total)						13 (30.23%)					
4	Mean	*4.89*	*4.56*	*2.33*	*3.44*	*4.00*	*4.44*	*4.67*	*2.44*	*4.56*	*4.00*	*2.89*
	Median	*5.00*	*5.00*	*2.00*	*3.00*	*4.00*	*5.00*	*5.00*	*3.00*	*5.00*	*5.00*	*3.00*
	Grouped Median	4.50	5.00	2.33	3.25	4.33	4.75	4.33	2.50	3.67	4.00	3.50
	Minimum	3	5	1	3	3	4	3	1	2	3	3
	Maximum	5	5	3	4	5	5	5	5	5	5	5
	Std. Deviation	1.00	0.00	0.96	0.50	0.96	0.50	0.96	1.71	1.50	1.14	1.00
	N (Percent of Total)						9 (20.93%)					

Cluster Descriptives across Other Covenants for Cluster 5 and Total

Cluster		Information Rights	Board Representation	Board Supermajority Rights	Board Veto Rights	Protective Provisions	Voting Rights	Anti-Dilution rovisions	Registration Provisions	Rights of First Refusal	Non-Compete Clauses	Vesting Provisions
5	Mean	*4.50*	*5.00*	*2.25*	*3.25*	*4.25*	*4.75*	*4.25*	*2.75*	*3.75*	*4.00*	*3.50*
	Median	*5.00*	*5.00*	*2.50*	*3.00*	*4.50*	*5.00*	*4.50*	*2.50*	*4.00*	*4.00*	*3.00*
	Grouped Median	4.50	5.00	2.33	3.25	4.33	4.75	4.33	2.50	3.67	4.00	3.50
	Minimum	3	5	1	3	3	4	3	1	2	3	3
	Maximum	5	5	3	4	5	5	5	5	5	5	5
	Std. Deviation	1.00	0.00	0.96	0.50	0.96	0.50	0.96	1.71	1.50	1.15	1.00
	N (Percent of Total)						4 (9.30%)					
Total	Mean	*4.72*	*4.42*	*3.02*	*3.79*	*4.12*	*4.53*	*4.33*	*3.12*	*4.30*	*3.81*	*3.44*
	Median	*5.00*	*5.00*	*3.00*	*4.00*	*5.00*	*5.00*	*5.00*	*3.00*	*5.00*	*4.00*	*3.00*
	Grouped Median	4.76	4.49	2.95	4.00	4.34	4.62	4.42	3.10	4.45	4.12	3.36
	Minimum	3	2	1	1	1	3	3	1	2	1	1
	Maximum	5	5	5	5	5	5	5	5	5	5	5
	Std. Deviation	0.55	0.73	1.32	1.23	1.16	0.74	0.84	1.33	0.94	1.38	1.20
	N (Percent of Total)						43 (100.00%)					

Cluster Descriptives across Factor Analysis Variables for Clusters 1 and 2

Factor		1			2		3		4		5
Cluster		Operating Years	Employees	Investments under Management	Contracting: Financial Structure	Contracting: Contractual Covenants	International Investment Activity	International Physical Presence	Investor Type	Operating Years	Ownership Category
1	Mean	8.14	15.14	21.00	15.71%	57.14%	*0.71*	*0.14*	*1.29*	8.14	*3.00*
	Median	*6.00*	*8.00*	*9.00*	*15.00%*	*40.00%*	1.00	0.00	1.00	*6.00*	3.00
	Grouped Median	*6.33*	*8.50*	*9.33*	*15.00%*	*50.00%*	*0.71*	*0.14*	*1.29*	*6.33*	*3.00*
	Minimum	4	7	7	0.00%	30.00%	0	0		4	
	Maximum	20	47	69	30.00%	100.00%	1	1		20	
	Std. Deviation	5.61	14.65	23.36	0.12	0.29	0.49	0.38	0.49	5.61	0.00
	N (Percent of Total)	7 (16.28%)									
2	Mean	10.30	16.00	40.70	35.00%	34.00%	*0.10*	*0.00*	*2.30*	10.30	*2.80*
	Median	*8.00*	*5.50*	*12.50*	*30.00%*	*27.50%*	0.00	0.00	2.00	*8.00*	3.00
	Grouped Median	*8.00*	*5.67*	*12.50*	*30.00%*	*28.75%*	*0.10*	*0.00*	*2.33*	*8.00*	*3.00*
	Minimum	1	3	2	20.00%	15.00%	0	0		1	
	Maximum	30	100	220	75.00%	60.00%	1	0		30	
	Std. Deviation	8.59	29.73	65.31	0.17	0.15	0.32	0.00	0.67	8.59	1.14
	N (Percent of Total)	10 (23.26%)									

Cluster Descriptives across Factor Analysis Variables for Clusters 3 and 4

Factor		1			2		3		4		5
Cluster		Operating Years	Employees	Investments under Management	Contracting: Financial Structure	Contracting: Contractual Covenants	International Investment Activity	International Physical Presence	Investor Type	Operating Years	Ownership Category
3	Mean	4.92	13.23	20.31	29.31%	37.77%	*0.46*	*0.15*	*1.77*	4.92	*2.31*
	Median	*4.00*	*10.00*	*16.00*	*30.00%*	*40.00%*	0.00	0.00	1.00	*4.00*	3.00
	Grouped Median	*4.00*	*9.50*	*16.00*	*30.75%*	*37.20%*	*0.46*	*0.15*	*1.77*	*4.00*	*2.44*
	Minimum	1	1	4	10.00%	20.00%	0	0		1	
	Maximum	13	46	53	50.00%	50.00%	1	1		13	
	Std. Deviation	3.17	12.05	17.79	0.12	0.10	0.52	0.38	1.01	3.17	0.95
	N (Percent of Total)	13 (30.23%)									
4	Mean	15.00	12.78	20.67	37.22%	30.56%	*0.00*	*0.11*	*2.11*	15.00	*2.67*
	Median	*15.00*	*12.00*	*11.00*	*40.00%*	*30.00%*	0.00	0.00	2.00	*15.00*	3.00
	Grouped Median	*15.00*	*12.00*	*11.00*	*40.00%*	*28.75%*	*0.00*	*0.11*	*2.14*	*15.00*	*2.50*
	Minimum	3	3	5	10.00%	20.00%	0	0		3	
	Maximum	30	38	65	60.00%	50.00%	0	1		30	
	Std. Deviation	9.90	10.28	19.42	0.19	0.10	0.00	0.33	0.78	9.90	1.58
	N (Percent of Total)	9 (20.93%)									

Cluster Descriptives across Factor Analysis Variables for Cluster 5 and Total

Factor		1			2		3		4		5
Cluster		Operating Years	Employees	Investments under Management	Contracting: Financial Structure	Contracting: Contractual Covenants	International Investment Activity	International Physical Presence	Investor Type	Operating Years	Ownership Category
5	Mean	7.25	8.00	14.75	31.25%	35.00%	*0.25*	*0.00*	*1.75*	7.25	*1.50*
	Median	*3.50*	*7.50*	*7.50*	*27.50%*	*40.00%*	0.00	0.00	2.00	*3.50*	1.00
	Grouped Median	*3.50*	*7.50*	*8.67*	*27.50%*	*36.67%*	*0.25*	*0.00*	*1.67*	*3.50*	*1.50*
	Minimum	2	1	4	20.00%	10.00%	0	0		2	
	Maximum	20	16	40	50.00%	50.00%	1	0		20	
	Std. Deviation	8.54	6.27	17.15	0.13	0.19	0.50	0.00	0.96	8.54	1.00
	N (Percent of Total)	4 (9.30%)									
Total	Mean	9.02	13.60	24.72	30.47%	38.28%	*0.30*	*0.09*	*1.88*	9.02	*2.53*
	Median	*6.00*	*8.00*	*11.00*	*30.00%*	*33.00%*	0.00	0.00	2.00	*6.00*	3.00
	Grouped Median	*5.80*	*8.50*	*10.83*	*28.33%*	*33.67%*	*0.30*	*0.09*	*1.83*	*5.80*	*2.62*
	Minimum	1	1	2	0.00%	10.00%	0	0		1	
	Maximum	30	100	220	75.00%	100.00%	1	1		30	
	Std. Deviation	7.79	17.01	35.46	0.16	0.18	0.46	0.29	0.85	7.79	1.12
	N (Percent of Total)	43 (100.00%)									

Spearman's and Kendall's Rank Correlation Coefficients for Financial Instruments and Covenants

Spearman / Kendall		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Straight Equity	1 Corr. Coeff.	1.000	-0.437	-0.145	-0.013	-0.330	0.071	0.072	-0.261	-0.221	0.058	-0.326	-0.374	-0.295	-0.060	-0.194	-0.155	-0.103	-0.405	-0.358	-0.231	-0.314	-0.194	-0.163	-0.358
	Sig. (2-tailed)		***			***			***	**		***	***	***					***	***	*	***				***
Preferred Equity	2 Corr. Coeff.	-0.496	1.000	0.122	-0.272	0.131	-0.081	-0.118	0.204	0.093	-0.212	0.083	0.159	0.361	0.091	-0.003	0.073	0.031	0.307	0.153	0.297	0.142	0.242	0.099	0.260
	Sig. (2-tailed)	***			***	**			*		*			***					***		**		*		**
Debt	3 Corr. Coeff.	-0.172	0.132	1.000	-0.115	0.309	-0.015	-0.055	0.363	0.046	0.171	0.015	0.160	0.074	-0.114	0.074	0.286	0.162	0.143	0.103	0.033	0.313	0.079	0.086	0.112
	Sig. (2-tailed)					**			***								*					**			
Debt-Equity Combinations	4 Corr. Coeff.	-0.013	-0.313	-0.128	1.000	-0.347	-0.203	-0.098	-0.386	-0.278	-0.130	-0.204	-0.111	-0.047	-0.270	-0.244	-0.054	-0.388	-0.332	-0.303	-0.269	-0.215	-0.309	-0.239	-0.278
	Sig. (2-tailed)		**			***			***	**		*			*	*		***	**	**	**		**	*	**
Convertible Securities	5 Corr. Coeff.	-0.393	0.184	0.352	-0.399	1.000	-0.164	0.116	0.621	0.256	0.187	0.315	0.269	0.117	0.066	0.256	0.358	0.271	0.311	0.381	0.081	0.444	0.317	0.195	0.284
	Sig. (2-tailed)	***		**	***				***	*		**	**			*	***	**	**	***		***	**		**
Silent Partnerships	6 Corr. Coeff.	0.098	-0.101	-0.020	-0.235	-0.186	1.000	0.127	-0.009	-0.206	-0.027	-0.056	0.164	-0.116	-0.023	-0.102	-0.096	-0.050	-0.093	-0.142	-0.107	-0.071	-0.168	-0.096	-0.165
	Sig. (2-tailed)																								
Other	7 Corr. Coeff.	0.083	-0.130	-0.056	-0.105	0.124	0.136	1.000	-0.006	0.092	0.121	0.119	0.041	-0.173	0.083	0.134	-0.120	-0.204	-0.169	0.101	-0.218	-0.011	-0.205	-0.119	-0.202
	Sig. (2-tailed)																								
Conversion Provisions	8 Corr. Coeff.	-0.293	0.231	0.398	-0.424	0.699	-0.013	-0.007	1.000	0.232	0.289	0.279	0.427	0.148	0.015	0.185	0.560	0.425	0.333	0.136	0.135	0.643	0.234	0.249	0.370
	Sig. (2-tailed)	*		***	***	***				*	**	**	***				***	***	*			***			**
Co-Sale Agreements	9 Corr. Coeff.	-0.268	0.103	0.048	-0.301	0.281	-0.231	0.095	0.245	1.000	-0.042	0.571	0.340	0.208	0.380	0.581	0.111	0.252	0.582	0.499	0.635	0.369	0.518	0.536	0.445
	Sig. (2-tailed)	*			**	*			*			***	**		***	***		*	***	***	***	**	***	***	***
Dividend Provisions	10 Corr. Coeff.	0.079	-0.273	0.192	-0.149	0.244	-0.041	0.134	0.343	-0.042	1.000	0.082	0.063	-0.114	0.185	-0.022	0.342	0.332	0.089	0.047	0.050	0.140	0.031	0.108	0.059
	Sig. (2-tailed)		*						**								**	**							
Liquidation Rights	11 Corr. Coeff.	-0.384	0.094	0.016	-0.216	0.357	-0.074	0.126	0.308	0.598	0.108	1.000	0.379	0.241	0.371	0.467	0.085	0.134	0.506	0.651	0.501	0.388	0.635	0.633	0.450
	Sig. (2-tailed)	**				**			**	***			***	*	**	***			***	***	***	***	***	***	***
Redemption Rights	12 Corr. Coeff.	-0.463	0.192	0.183	-0.129	0.316	0.196	0.045	0.466	0.401	0.079	0.448	1.000	0.018	0.209	0.320	0.422	0.285	0.506	0.222	0.365	0.573	0.397	0.393	0.510
	Sig. (2-tailed)	***				**			***	***		***				*	***	*	***		**	***	***	***	***
Staged Financing	13 Corr. Coeff.	-0.382	0.450	0.083	-0.071	0.140	-0.140	-0.192	0.166	0.237	-0.137	0.271	0.029	1.000	0.142	0.076	0.090	0.064	0.338	0.081	0.368	0.284	0.272	0.058	0.314
	Sig. (2-tailed)	**	***							*		*							**		**	*	*		**
Information Rights	14 Corr. Coeff.	-0.067	0.100	-0.119	-0.286	0.073	-0.028	0.084	0.013	0.362	0.164	0.346	0.180	0.125	1.000	0.162	0.062	0.240	0.338	0.394	0.315	0.192	0.525	0.287	0.220
	Sig. (2-tailed)				*					**		**						*	**	***	**		***	**	
Board Representation	15 Corr. Coeff.	-0.251	-0.004	0.078	-0.257	0.287	-0.113	0.139	0.179	0.548	-0.010	0.430	0.279	0.064	0.172	1.000	0.008	0.327	0.269	0.511	0.280	0.160	0.207	0.310	0.342
	Sig. (2-tailed)	*			*	*			*	***		***	**		*			**	*	***	**		*	**	**
Board Supermajority Rights	16 Corr. Coeff.	-0.196	0.088	0.327	-0.061	0.451	-0.112	-0.134	0.479	0.096	0.282	0.062	0.360	0.075	0.066	0.008	1.000	0.317	0.307	0.000	0.152	0.474	0.151	0.151	0.347
	Sig. (2-tailed)			**		***			***		*		***					**	**			***			***
Board Veto Rights	17 Corr. Coeff.	-0.109	0.031	0.180	-0.454	0.321	-0.062	-0.222	0.370	0.223	0.273	0.113	0.249	0.051	0.264	0.362	0.360	1.000	0.374	0.261	0.135	0.188	0.332	0.291	0.382
	Sig. (2-tailed)				***	**			***		**		*		*	**	**			*			**	***	***
Protective Provisions	18 Corr. Coeff.	-0.514	0.359	0.155	-0.367	0.362	-0.102	-0.180	0.296	0.526	0.072	0.452	0.440	0.283	0.371	0.289	0.356	0.424	1.000	0.353	0.641	0.332	0.613	0.528	0.414
	Sig. (2-tailed)	***	**		**	**			**	***		***	***	**	***	*	**	**		**	***	**	***	***	***
Voting Rights	19 Corr. Coeff.	-0.407	0.175	0.110	-0.354	0.421	-0.162	0.105	0.116	0.463	0.037	0.597	0.187	0.074	0.411	0.556	0.003	0.304	0.394	1.000	0.273	0.235	0.526	0.440	0.332
	Sig. (2-tailed)	***			**	***				***		***			***	***		**	***		**	*	***	***	**
Anti-Dilution Provisions	20 Corr. Coeff.	-0.267	0.347	0.035	-0.304	0.091	-0.119	-0.229	0.120	0.581	0.040	0.456	0.309	0.324	0.334	0.300	0.178	0.154	0.694	0.302	1.000	0.248	0.557	0.533	0.404
	Sig. (2-tailed)	*	**		**					***		***	**	*	**	*			***			*	***	***	***
Registration Provisions	21 Corr. Coeff.	-0.406	0.181	0.352	-0.261	0.522	-0.075	-0.013	0.580	0.317	0.115	0.314	0.484	0.255	0.205	0.187	0.570	0.238	0.419	0.268	0.306	1.000	0.335	0.403	0.612
	Sig. (2-tailed)	***		**	*	***			***	*		**	***	*			***		***	*	**		**	***	***
Rights of First Refusal	22 Corr. Coeff.	-0.223	0.276	0.084	-0.343	0.361	-0.190	-0.217	0.208	0.490	0.022	0.605	0.340	0.232	0.555	0.231	0.183	0.392	0.710	0.576	0.630	0.398	1.000	0.577	0.386
	Sig. (2-tailed)		*		**	**				***		***	**	*	***			***	***	***	***			***	***
Non-Compete Clauses	23 Corr. Coeff.	-0.206	0.112	0.094	-0.275	0.220	-0.110	-0.127	0.229	0.483	0.115	0.535	0.340	0.048	0.309	0.340	0.172	0.327	0.587	0.498	0.600	0.456	0.673	1.000	0.422
	Sig. (2-tailed)				*				*	***		***	**		**	**		**	***	***	***	***	***		***
Vesting Provisions	24 Corr. Coeff.	-0.441	0.305	0.123	-0.331	0.326	-0.197	-0.218	0.339	0.397	0.050	0.392	0.429	0.270	0.244	0.372	0.409	0.424	0.494	0.368	0.462	0.690	0.457	0.481	1.000
	Sig. (2-tailed)	***	**		**	**			**	***		***	***	**		**	***	***	***	**	***	***	***	***	

*** significant at $p \leq 0.01$; ** significant at $p \leq 0.05$; * significant at $p \leq 0.10$

Spearman's and Kendall's Rank Correlation Coefficients for Factor Analysis Variables

Spearman / Kendall		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Investor Type	1 Corr. Coeff.	1.000	0.054	0.177	-0.047	0.124	0.091	-0.206	0.021	-0.146	-0.087	0.059	0.024	0.746	0.051
	Sig. (2-tailed)			*		***		***		***				***	
Ownership Category	2 Corr. Coeff.	0.053	1.000	-0.120	-0.079	-0.004	0.045	-0.308	0.046	-0.140	0.021	0.107	-0.071	0.026	0.794
	Sig. (2-tailed)			*				***		***		*			***
Operating Years	3 Corr. Coeff.	0.213	-0.145	1.000	0.365	0.517	0.031	-0.106	-0.040	0.228	0.423	0.030	-0.199	0.261	-0.249
	Sig. (2-tailed)	***	***		***	***		***		***	***		*	***	***
Employees	4 Corr. Coeff.	-0.048	-0.100	0.523	1.000	0.615	0.007	0.022	0.244	0.375	0.736	0.021	0.053	-0.064	-0.157
	Sig. (2-tailed)		*	***		***			***	***	***			*	***
Investments under Management	5 Corr. Coeff.	0.148	-0.011	0.675	0.768	1.000	0.040	-0.067	0.091	0.352	0.635	0.018	-0.088	0.099	-0.083
	Sig. (2-tailed)	***		***	***		*	***		***	***		***	**	**
Contracting: Financial Structure	6 Corr. Coeff.	0.112	0.069	0.034	0.028	0.068	1.000	-0.387	-0.169	-0.107	-0.006	0.782	0.127	-0.052	-0.113
	Sig. (2-tailed)	***	**			*		***	***	***		***	***	*	***
Contracting: Contractual Covenants	7 Corr. Coeff.	-0.260	-0.386	-0.141	0.029	-0.086	-0.478	1.000	0.109	0.099	-0.073	-0.599	0.009	-0.097	-0.231
	Sig. (2-tailed)	***	***	***		***	***		***	***	***	***		***	***
International Investment Activity	8 Corr. Coeff.	0.022	0.049	-0.047	0.290	0.106	-0.195	0.126	1.000	-0.211	0.344	-0.131	0.657	-0.091	-0.037
	Sig. (2-tailed)		**	*	***	***	***	***		***	***	***	***	***	*
International Physical Presence	9 Corr. Coeff.	-0.155	-0.149	0.269	0.446	0.420	-0.124	0.114	-0.211	1.000	0.384	-0.165	-0.416	-0.229	-0.112
	Sig. (2-tailed)	***	***	***	***	***	***	***	***		***	***	***	***	***
Factor 1 (Factor Score)	10 Corr. Coeff.	-0.099	0.022	0.603	0.895	0.811	0.006	-0.099	0.416	0.465	1.000	0.032	0.050	-0.099	-0.103
	Sig. (2-tailed)	***		***	***	***		***	***	***		***	***	***	***
Factor 2 (Factor Score)	11 Corr. Coeff.	0.072	0.154	0.041	0.023	0.045	0.909	-0.743	-0.159	-0.200	0.040	1.000	0.127	-0.056	-0.021
	Sig. (2-tailed)	***	***	***	**	***	***	***	***	***	***		***	***	**
Factor 3 (Factor Score)	12 Corr. Coeff.	0.027	-0.087	-0.291	0.066	-0.116	0.157	0.032	0.796	-0.503	0.064	0.178	1.000	-0.132	-0.136
	Sig. (2-tailed)		***	***	***	***	***	***	***	***	***	***		***	***
Factor 4 (Factor Score)	13 Corr. Coeff.	0.862	0.041	0.379	-0.091	0.147	-0.069	-0.138	-0.110	-0.277	-0.132	-0.088	-0.168	1.000	0.043
	Sig. (2-tailed)	***	**	***	***	***	***	***	***	***	***	***	***		**
Factor 5 (Factor Score)	14 Corr. Coeff.	0.072	0.904	-0.330	-0.217	-0.113	-0.151	-0.331	-0.045	-0.135	-0.134	-0.016	-0.145	0.047	1.000
	Sig. (2-tailed)	***	***	***	***	***	***	***	*	***	***		***	**	

*** significant at $p \leq 0.01$; ** significant at $p \leq 0.05$; * significant at $p \leq 0.10$

Spearman's and Kendall's Rank Correlation Coefficients for Cluster and Factor Analysis Variables [a]

Spear. \ Kend.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1 Straight Equity	1.000	-0.437 ***	-0.145	-0.013	-0.330 ***	0.071	0.072	-0.261 **	-0.221 *	0.058	-0.326 **	-0.374 ***	-0.295 **	0.261 **	0.135 *	0.326 ***	-0.042	0.129	0.146	-0.275 **	-0.348 ***	0.043	-0.002	0.172 *	-0.321 ***	0.244 **	0.065
2 Preferred Equity	-0.496 ***	1.000	0.122	-0.272 **	0.131	-0.081	-0.118	0.204 *	0.093	-0.212 *	0.083	0.159	0.361 ***	-0.106	0.007	-0.207 *	0.139	-0.004	-0.084	0.148	0.299 **	-0.013	0.127	-0.127	0.172 *	-0.156	0.031
3 Debt	-0.172	0.132	1.000	-0.115	0.309 **	-0.015	-0.055	0.383 ***	0.046	0.171	0.015	0.160	0.074	-0.187	0.065	0.165	0.204	0.160	-0.322 **	0.263 **	0.082	0.108	0.186	-0.325 ***	-0.104	-0.019	0.066
4 Debt-Equity Combinations	-0.013	-0.313 **	-0.128	1.000	-0.347 ***	-0.203	-0.088	-0.388 ***	-0.278 **	-0.130	-0.204	-0.111	-0.047	0.035	-0.130	-0.085	-0.209 *	-0.096	-0.122	-0.034	-0.151	-0.203	-0.226 *	-0.030	-0.009	0.120	-0.021
5 Convertible Securities	-0.393 ***	0.184	0.352 **	-0.399 ***	1.000	-0.164	0.116	0.621 ***	0.256 *	0.187	0.315 **	0.269 **	0.117	-0.226 *	0.022	-0.077	0.072	-0.091	-0.413 ***	0.281 **	0.373 ***	0.226	0.129	-0.402 ***	0.073	-0.220 *	0.053
6 Silent Partnerships	0.098	-0.101	-0.020	-0.235 *	-0.186	1.000	0.127	-0.009	-0.206	-0.027	-0.056	0.164	-0.116	0.209 *	-0.129	0.171	-0.012	0.150	0.244 **	-0.081	-0.363 **	-0.028	-0.052	0.144	-0.138	0.213 *	-0.106
7 Other	0.083	-0.130	-0.056	-0.105	0.124	0.136	1.000	-0.006	0.092	0.121	0.119	0.041	-0.173	0.031	-0.199	0.085	0.121	-0.157	0.114	-0.060	-0.102	-0.049	-0.051	0.123	0.051	0.000	-0.175
8 Conversion Provisions	-0.293 *	0.231	0.398 ***	-0.424 ***	0.699 ***	-0.013	-0.007	1.000	0.232 *	0.288 **	0.279 **	0.427 ***	0.146	-0.183	0.012	0.028	0.145	-0.014	-0.309 **	0.159	0.441 ***	0.108	0.215 *	-0.291 **	0.130	-0.149	-0.004
9 Co-Sale Agreements	-0.268 *	0.103	0.048	-0.301 **	0.281 *	-0.231	0.095	0.245	1.000	-0.042	0.571 ***	0.340 **	0.208	-0.185	-0.101	-0.029	0.126	-0.114	-0.031	0.121	0.166	0.066	0.091	-0.031	0.064	-0.150	-0.176
10 Dividend Provisions	0.079	-0.273 *	0.192	-0.149	0.244 *	-0.041	0.134	0.343 **	-0.042	1.000	0.082	0.063	-0.114	-0.212	0.068	0.022	-0.062	-0.091	-0.072	0.045	-0.002	-0.012	-0.038	-0.036	-0.031	-0.147	0.016
11 Liquidation Rights	-0.384 **	0.094	0.016	-0.216 *	0.357 **	-0.074	0.126	0.308 **	0.598 ***	0.108	1.000	0.379 ***	0.241 *	-0.189	-0.231 *	-0.224 *	-0.069	-0.317 ***	-0.126	0.152	0.135	-0.113	-0.146	-0.103	0.109	-0.140	-0.160
12 Redemption Rights	-0.463 ***	0.192	0.183	-0.129	0.316 **	0.196	0.045	0.466 ***	0.401 ***	0.079	0.448 ***	1.000	0.018	-0.083	-0.260 **	-0.065	0.051	-0.130	0.037	0.188	0.246 *	-0.160	-0.024	-0.024	0.269 **	-0.104	-0.234 **
13 Staged Financing	-0.362 **	0.450 ***	0.083	-0.071	0.140	-0.140	-0.182	0.166	0.237	-0.137	0.271 *	0.029	1.000	-0.138	0.095	-0.252 **	0.004	-0.077	-0.169	0.020	0.019	0.138	-0.026	-0.143	-0.036	-0.158	0.181
Investor Type 14	0.312 **	-0.122	-0.202	0.037	-0.256 *	0.234	0.033	-0.204	-0.202	-0.240	-0.197	-0.088	-0.197	1.000	0.054	0.177	-0.047	0.124	0.091	-0.206	0.021	-0.148	-0.087	0.059	0.024	0.746 ***	0.051
Ownership Category 15	0.164	0.009	0.073	-0.145	0.023	-0.147	-0.212	0.016	-0.113	0.071	-0.266 *	-0.307 **	0.109	0.063	1.000	-0.120	-0.079	-0.004	0.045	-0.308 **	0.046	-0.140	0.021	0.107	-0.071	0.026	0.794 ***
Operating Years 16	0.401 ***	-0.250 *	0.199	-0.097	-0.094	0.222	0.100	0.036	-0.037	0.028	-0.283 *	-0.071	-0.342 **	0.213 *	-0.145	1.000	0.365 ***	0.517 ***	0.031	-0.106	-0.040	0.228 *	0.423 ***	0.030	-0.199 *	0.261 **	-0.249 **
Employees 17	-0.044	0.177	0.247	-0.266 *	0.078	-0.030	0.143	0.188	0.162	-0.094	-0.074	0.078	0.008	-0.048	-0.100	0.523 ***	1.000	0.615 ***	0.007	0.022	0.244 *	0.375 ***	0.736 ***	0.021	0.053	-0.064	-0.157
Inv. under Mgmt. 18	0.185	0.006	0.200	-0.125	-0.130	0.176	-0.187	-0.021	-0.143	-0.122	-0.417 ***	-0.166	-0.102	0.148	-0.011	0.675 ***	0.769 ***	1.000	0.040	-0.067	0.091	0.352 ***	0.635 ***	0.018	-0.088	0.099	-0.083
Contr.: Fin. Structure 19	0.205 *	-0.106	-0.388 ***	-0.161	-0.497 ***	0.310 **	0.132	-0.388 ***	-0.035	-0.089	-0.154	0.043	-0.253	0.112	0.069	0.034	0.028	0.068	1.000	-0.387 ***	-0.169	-0.107	-0.006	0.782 ***	0.127	-0.052	-0.113
Contr.: Contr. Covenants 20	-0.357 **	0.202	0.310 **	-0.038	0.345 **	-0.099	-0.069	0.204	0.149	0.058	0.181	0.243	0.024	-0.260 *	-0.386 **	-0.141	0.029	-0.086	-0.478 ***	1.000	0.109	0.099	-0.073	-0.599 ***	0.009	-0.097	-0.231 **
Intern. Inv. Activity 21	-0.399 ***	0.330 **	0.084	-0.162	0.401 ***	-0.391 ***	-0.102	0.470 ***	0.171	-0.002	0.142	0.272 *	0.021	0.022	0.049	-0.047	0.290 *	0.108	-0.195	0.128	1.000	-0.211	0.344 ***	-0.131	0.657 ***	-0.091	-0.037
Intern. Phys. Presence 22	0.050	-0.014	0.110	-0.217 *	0.243 *	-0.030	-0.049	0.116	0.057	-0.013	-0.120	-0.177	0.153	-0.155	-0.149	0.269 *	0.446 ***	0.420 ***	-0.124	0.114	-0.211	1.000	0.384 ***	-0.165	-0.416 ***	-0.229 *	-0.112
Factor 1 (Factor Score) 23	0.005	0.172	0.234	-0.314 **	0.157	-0.074	-0.062	0.274 *	0.117	-0.057	-0.173	-0.032	-0.020	-0.099	0.022	0.603 ***	0.885 ***	0.811 ***	0.006	-0.099	0.416 ***	0.465 ***	1.000	0.032	0.050	-0.099	-0.103
Factor 2 (Factor Score) 24	0.245 *	-0.168	-0.400 ***	-0.050	-0.512 ***	0.203	0.149	-0.380 **	-0.033	-0.052	-0.126	-0.027	-0.202	0.072	0.154	0.041	0.023	0.045	0.909 ***	-0.743 ***	-0.159	-0.200	0.040	1.000	0.127	-0.056	-0.021
Factor 3 (Factor Score) 25	-0.421 ***	0.235 *	-0.129	-0.045	0.112	-0.182	0.062	0.185	0.065	-0.037	0.146	0.383 **	-0.056	0.027	-0.087	-0.291 *	0.066	-0.116	0.157	0.032	0.796 ***	-0.503 ***	0.064	0.178	1.000	-0.132	-0.136
Factor 4 (Factor Score) 26	0.346 **	-0.216 *	-0.019	0.162	-0.289 *	0.268 *	0.000	-0.208 *	-0.191	-0.189	-0.181	-0.135	-0.251	0.882 ***	0.041	0.379 **	-0.091	0.147	-0.069	-0.138	-0.110	-0.277 *	-0.132	-0.088	-0.168	1.000	0.043
Factor 5 (Factor Score) 27	0.072	0.051	0.087	-0.020	0.084	-0.136	-0.211	-0.005	-0.225	0.016	-0.212	-0.332 **	0.241	0.072	0.904 ***	-0.330 **	-0.217	-0.113	-0.151	-0.331 **	-0.045	-0.135	-0.134	-0.016	-0.145	0.047	1.000

*** significant at $p \leq 0.01$; ** significant at $p \leq 0.05$; * significant at $p \leq 0.10$

[a] The shaded areas show rank correlation coefficients that are not already included in the preceding tables on correlation coefficients.

Appendix D: Survey Questionnaire







3rd German Venture Capital Market Survey

Part A
Venture capital in difficult times – review and outlook

Part B
Venture capitalist internationalisation – drivers and strategy

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Confidentiality

The Center for Entrepreneurial and Small Business Finance and the Centre for Management Buy-Out Research guarantee strictly confidential treatment of all returned questionnaires. Only the final report containing anonymised and aggregated data will be passed out to the participating companies, the sponsor, and with substantial delay the general public.

Part A: Venture capital in difficult times – review and outlook

This part of the survey focuses on venture capital in difficult times, reviewing the **entire year 2003** and taking an outlook on 2004.

A special focus lies on the different aspects of **venture capital contracting**, that is contracts signed between venture capitalists and portfolio companies, as one indicator for **German venture capital sophistication.**

"Company" refers to either **German venture capital companies** or **German offices of foreign venture capital companies** and their **investment activity in the German venture capital market.**

Section 1: Institutional background

1. Which of the following ownership categories best describes your company?

Please tick whichever box applies or specify any other category.

a. Captive	☐	b. Affiliated	☐
c. Independent	☐	d. Public sector	☐
e. Other:	☐		

2. Which of the following investor types best describes your company?

Please tick whichever box applies or specify any other category.

a. Early-stage investor	☐	b. Late-stage investor	☐
c. Generalist	☐	d. Other:	☐

Section 2: Investment activity

3. As far as your company's investment activity in the German venture capital market is concerned...

a. In which country is your company's global head office located? (e.g. D, GB, USA) ☐

b. For how many years has your company been actively operating in the German market? ☐

c. How many investments does your company currently have under management? ☐

d. How many of your investments currently under management are syndicated? ☐

- In how many of them is your company the lead investor? ☐

e. How many *new* investments did your company make in Germany in 2003, excluding all follow-on investments? ☐

- How many new investments were initiated in 2002? ☐

f. What proportion of your company's funds raised are currently invested? ☐ %

g. What average IRR (internal rate of return) did your company realise across all investments in 2003? ☐ %

Part A: Venture capital in difficult times – review and outlook

4. As far as investment size is concerned...

a. What are the investment size preferences of your company?

- Minimum investment (in million EUR) ☐
- Maximum investment (in million EUR) ☐

b. What is the maximum investment size your company could underwrite? (in million EUR) ☐

5. What is the distribution of the number of investments over the following investment size categories?
Please indicate the approximate percentage for each category, irrespective of total investment size.

a. Less than EUR 1 million ☐ %
b. EUR 1 million – EUR 10 million ☐ %
c. EUR 10 million – EUR 20 million ☐ %
d. EUR 20 million – EUR 50 million ☐ %
e. More than EUR 50 million ☐ %

6. To what extent is your company's portfolio specialised in terms of...

	Highly specialised				*Not specialised*
	5	**4**	**3**	**2**	**1**
a. Financing stages	☐	☐	☐	☐	☐
b. Industry sectors	☐	☐	☐	☐	☐
c. Geographical regions	☐	☐	☐	☐	☐

7. For the different financing stages, please indicate...

	Approx. number of investments in 2003	Number of exits excl. liquidation in 2003
a. Seed	☐	☐
b. Start-up	☐	☐
c. Expansion	☐	☐
d. Buy-out (MBO, MBI, LBO)	☐	☐
e. Secondary placement	☐	☐
f. Turnaround	☐	☐

8. To what extent does your company use the following sources of deal flow?

	Very often 5	4	3	2	*Very rarely* 1
a. Proprietary deal flow	☐	☐	☐	☐	☐
b. Deal finders compensated with commission	☐	☐	☐	☐	☐
c. Deal finders compensated with co-investment rights	☐	☐	☐	☐	☐
d. Auctions by investment banks/consultancies	☐	☐	☐	☐	☐

9. To what extent does your company use the following types of due diligence?

	Very often 5	4	3	2	*Very rarely* 1
a. Internal due diligence	☐	☐	☐	☐	☐
b. External business/commercial due diligence	☐	☐	☐	☐	☐
c. External technical due diligence	☐	☐	☐	☐	☐
d. External financial due diligence	☐	☐	☐	☐	☐
e. External legal due diligence	☐	☐	☐	☐	☐
f. External tax due diligence	☐	☐	☐	☐	☐

10. What percentage of the respective investment size does your company on average spend on ...

a. Internal due diligence? ☐ %

b. Advisors for external due diligence? ☐ %

11. How many portfolio companies did your company exit through the following routes?

Please indicate the number of exits completed in each category in 2003.

a. IPO ☐

b. Trade sale ☐

c. Sale to other venture capitalist(s) ☐

d. Sale to financial institution(s) ☐

e. Repayment of preference shares/loans ☐

f. Sale to management (buy-back) ☐

g. Liquidation ☐

Section 3: Human resource management

12. As far as employment at your company is concerned...

a. How many people, including back-office staff, does your company currently employ? ☐

– How many were employed at the beginning of 2003? ☐

– How many does your company plan to employ by the end of 2004? ☐

b. How many investment executives, that is people in charge of investing in and managing (including monitoring) portfolio companies, does your company currently employ? ☐

Part A: Venture capital in difficult times – review and outlook

13. What qualifications and experience (prior to the current position) do your investment executives have?
Please indicate the approximate percentage for each category. Percentages may add to more than 100%.

a. Masters degree %
b. Doctoral degree %
c. Previous international work experience %
d. Experience in the venture capital/private equity industry %
e. Experience in mergers & acquisitions %
f. Experience in line management %
g. Experience/qualifications in high-technology-based industries %
h. Experience/qualifications in engineering %
i. Experience/qualifications in consulting/strategy %
j. Experience/qualifications in finance and accounting %
k. Experience/qualifications in law %

14. Which of the following long-term incentives for investment executives does your company provide?
Please tick whichever boxes apply and/or any other category.

a. Salary ☐ b. Bonus ☐
c. Carried interest ☐ d. Co-investment rights ☐
e. Executive share options ☐ f. Other: ☐

Section 4: Venture capital contracting

15. As far as contract negotiations with portfolio companies are concerned...

a. In what proportion of its investments is your company actively assisted by a lawyer throughout the contracting stage? %
b. How long does it take from starting contract negotiations to signing the contract?
- Minimum contracting time (in months)
- Maximum contracting time (in months)

c. What proportion of the time spent on contracting is spent on
- Devising the financial structure of the investment? %
- Defining contingencies and their triggers/milestones? %
- Designing contractual covenants (provisions and rights)? %

d. How high are the average contracting costs, as a proportion of the total investment size? %

16. How frequently does your company use the following financing instruments in new investments?

Please indicate the approximate percentage of deals and specify any other combination if applicable.

a. Straight equity	%
Straight debt	%
Combination of straight equity and straight debt	%
b. Preferred equity	%
Preferred debt	%
c. Convertible preferred equity	%
Convertible preferred debt	%
d. Silent partnerships	%
e. Other:	%

17. If your company does not finance all investments with convertible securities, what are the reasons?

Please tick whichever boxes apply and/or specify any other reason.

- a. Not the most common financing instrument in the German market ☐
- b. Used mainly by senior and experienced venture capitalists ☐
- c. Highly complex financing instrument ☐
- d. Unfavourable legal regulations ☐
- e. Only used when agency problems are considered severe ☐
- f. Currently no exit via IPO possible ☐
- g. Same incentive structure for the portfolio company can be achieved using other forms of financing in combination with contingencies and covenants ☐
- h. Other: ☐

18. As far as your company's equity stake in its portfolio companies is concerned...

a. What is the minimum equity stake your company usually holds?	%
b. What is the maximum equity stake your company usually holds?	%

19. What contingencies are normally built into your company's contracts with portfolio companies?

	Almost always 5	4	3	2	*Almost never* 1
a. Staged financing	☐	☐	☐	☐	☐
b. Contingencies related to financial performance	☐	☐	☐	☐	☐
c. Contingencies related to corporate strategy (e.g. entering new markets)	☐	☐	☐	☐	☐
d. Contingencies related to operative performance (e.g. business plan projections attained, new product released)	☐	☐	☐	☐	☐
e. Contingencies related to general business activities (e.g. expanding facilities, hiring new executives)	☐	☐	☐	☐	☐

Part A: Venture capital in difficult times – review and outlook

20. What provisions does your company typically include in contracts with portfolio companies?

	Almost always 5	4	3	2	*Almost never* 1
a. Conversion provisions	☐	☐	☐	☐	☐
b. Dividend provisions	☐	☐	☐	☐	☐
c. Co-sale agreements	☐	☐	☐	☐	☐
d. Anti-dilution provisions	☐	☐	☐	☐	☐
e. Protective provisions	☐	☐	☐	☐	☐
f. Registration provisions	☐	☐	☐	☐	☐
g. Vesting provisions	☐	☐	☐	☐	☐
h. Non-compete clauses	☐	☐	☐	☐	☐
i. Board representation	☐	☐	☐	☐	☐

21. What rights does your company typically include in contracts with portfolio companies?

Please also indicate which of the following rights your company exercises frequently.

	Frequently exercised	*Almost always included* 5	4	3	2	*Almost never included* 1
a. Redemption rights	☐	☐	☐	☐	☐	☐
b. Liquidation rights	☐	☐	☐	☐	☐	☐
c. Rights of first refusal	☐	☐	☐	☐	☐	☐
d. Voting rights	☐	☐	☐	☐	☐	☐
e. Board supermajority rights	☐	☐	☐	☐	☐	☐
f. Board veto rights	☐	☐	☐	☐	☐	☐
g. Information rights and voice	☐	☐	☐	☐	☐	☐

22. To what degree are your company's contracts with portfolio companies standardised?

	Standardised 5	4	3	2	*Deal-specific* 1
a. Entire contract	☐	☐	☐	☐	☐
b. Financing instrument(s)	☐	☐	☐	☐	☐
c. Contingencies	☐	☐	☐	☐	☐
d. Contractual covenants (provisions and rights)	☐	☐	☐	☐	☐

23. How does your company intend to adjust its current contracting practice to general market conditions?

Please indicate to what extent the following statements represent your company's adjustments.

	Highly relevant 5	4	3	2	*Not relevant* 1
a. More time spent on contracting	☐	☐	☐	☐	☐
b. More extensive use of external advisors, especially lawyers	☐	☐	☐	☐	☐
c. Use of more complex financing structures to manage incentives	☐	☐	☐	☐	☐
d. More extensive use of contingencies to manage incentives	☐	☐	☐	☐	☐
e. More extensive use of covenants to ensure control over portfolio companies' activities	☐	☐	☐	☐	☐
f. More use of flexible interpretation of the contract and/or hands-on monitoring	☐	☐	☐	☐	☐

Section 5: Outlook

This section asks for your company's view on the German venture capital market in 2004.

All questions refer to the **entire German venture capital market**, that is all venture capitalists participating in the German venture capital market.

The questions ask for your company's view on the development of the market volume of funds raised and invested, the market's venture capital portfolio, the market IRR (internal rate of return) and the market's phase and sector focus.

24. How will the German venture capital market develop in 2004?

If not stated differently, please indicate increases (+) or decreases (–) expected for 2004 as percentage change to the 2003 level.

a. Change in value of funds raised	%
– Value of funds invested, stated as percentage of funds raised	%
b. Change in value of new investments	%
– Value of first investment rounds, stated as percentage of new investments	%
– Value of follow-on investments, stated as percentage of new investments	%
c. Change in value of market portfolio	%
d. Change in value of (partial and total) exits	%
e. Change in market IRR (average internal rate of return across the market), stated in percent	%

25. Which financing stages and exit channels will the market focus on in 2004?

Please indicate the overall distribution of stages and exits for the following categories. Percentages should add to 100% each.

Financing stages		*Exit routes*	
a. Seed	%	g. IPO	%
b. Start-up	%	h. Trade sale	%
c. Expansion	%	i. Sale to other venture capitalist(s)	%
d. Buy-out (MBO, MBI, LBO)	%	j. Sale to financial institution(s)	%
e. Secondary placement	%	k. Repayment of preference shares/loan	%
f. Turnaround	%	l. Sale to management (buy-back)	%
		m. Liquidation	%

Part B: Venture capitalist internationalisation – drivers and strategy

This part of the survey focuses on the internationalisation of venture capital companies, its drivers and strategies employed.

Venture capital companies that **do not invest internationally** are also kindly asked to complete section 1 of this part.

Internationalisation refers to **making investments in foreign companies** either through a **physical presence** in a foreign country, that is locating your company and team abroad (example: office), or an **investment activity**, that is investing in a foreign country without physically locating there (example: holding company).

"Company" refers to either **German venture capital companies**, that is venture capital companies with head office in Germany, which have a physical presence or an investment activity in foreign venture capital markets, or **German offices of foreign venture capital companies**, that is German offices of venture capital companies with head office outside of Germany, which themselves have a physical presence or an investment activity in foreign venture capital markets.

Section 1: Internationalisation drivers

1. **In encouraging your company to internationalise, how important are the following factors concerning...**
   Please provide answers regardless of whether your company invests internationally.

   1.1. Resources

	Very important 7	6	5	4	3	2	*Not important* 1
a. Availability of financial resources (within your company)	☐	☐	☐	☐	☐	☐	☐
b. Availability of internationally experienced personnel	☐	☐	☐	☐	☐	☐	☐
c. Availability of networks of contacts in foreign markets	☐	☐	☐	☐	☐	☐	☐
d. Availability of information on foreign-market opportunities	☐	☐	☐	☐	☐	☐	☐

   1.2. Strategic objectives

	Very important 7	6	5	4	3	2	*Not important* 1
a. Exploitation of competitive advantages across different locations	☐	☐	☐	☐	☐	☐	☐
b. Long-term strategic objectives	☐	☐	☐	☐	☐	☐	☐
c. Objectives to enhance rates of return	☐	☐	☐	☐	☐	☐	☐
d. Portfolio diversification objectives	☐	☐	☐	☐	☐	☐	☐
e. Response to one-off investment opportunities	☐	☐	☐	☐	☐	☐	☐
f. Imitating strategies of main competitors	☐	☐	☐	☐	☐	☐	☐

   1.3. Institutional context

	Very important 7	6	5	4	3	2	*Not important* 1
a. Unfavourable regulatory infrastructure in domestic market	☐	☐	☐	☐	☐	☐	☐
b. Favourable regulatory infrastructure in domestic market	☐	☐	☐	☐	☐	☐	☐
c. Favourable financial infrastructure in foreign market	☐	☐	☐	☐	☐	☐	☐
d. Favourable regulatory infrastructure in foreign market	☐	☐	☐	☐	☐	☐	☐
e. Compliance with industry codes of conduct	☐	☐	☐	☐	☐	☐	☐
f. Opportunities in culturally similar markets	☐	☐	☐	☐	☐	☐	☐
g. Opportunities in geographically proximate markets	☐	☐	☐	☐	☐	☐	☐

Part B: Venture capitalist internationalisation – drivers and strategy

1.4. Competitive issues

	Very important 7	6	5	4	3	2	*Not important* 1
a. Limited opportunities in domestic market	☐	☐	☐	☐	☐	☐	☐
b. Increased competition in domestic market	☐	☐	☐	☐	☐	☐	☐
c. Attractiveness of opportunities in foreign market	☐	☐	☐	☐	☐	☐	☐
d. Political and economic stability of foreign market	☐	☐	☐	☐	☐	☐	☐

1.5. Other

	Very important 7	6	5	4	3	2	*Not important* 1
a. Internationalisation of domestic investees	☐	☐	☐	☐	☐	☐	☐
b. Pressure from funds providers for wider geographic exposure	☐	☐	☐	☐	☐	☐	☐

2. In discouraging your company to internationalise, how important are the following factors concerning...

Please provide answers regardless of whether your company invests internationally.

2.1. Company issues

	Very important 7	6	5	4	3	2	*Not important* 1
a. Lack of financial resources (within your company)	☐	☐	☐	☐	☐	☐	☐
b. Large size of initial investment	☐	☐	☐	☐	☐	☐	☐
c. Lack of suitably qualified/internationally experienced personnel	☐	☐	☐	☐	☐	☐	☐
d. Lack of management time	☐	☐	☐	☐	☐	☐	☐
e. Problems of re-aligning executives' rewards package	☐	☐	☐	☐	☐	☐	☐
f. Lack of networks of contacts in foreign markets	☐	☐	☐	☐	☐	☐	☐
g. Lack of information regarding foreign-market opportunities	☐	☐	☐	☐	☐	☐	☐
h. Domestic strategic issues	☐	☐	☐	☐	☐	☐	☐

2.2. External issues

	Very important 7	6	5	4	3	2	*Not important* 1
a. Long time-scale to returns	☐	☐	☐	☐	☐	☐	☐
b. Unattractiveness of opportunities in foreign markets	☐	☐	☐	☐	☐	☐	☐
c. Unfavourable legal/regulatory environment in foreign markets	☐	☐	☐	☐	☐	☐	☐
d. Lack of opportunities in culturally similar markets	☐	☐	☐	☐	☐	☐	☐
e. Inadequate financial infrastructure in foreign markets	☐	☐	☐	☐	☐	☐	☐

Part B: Venture capitalist internationalisation – drivers and strategy

Section 2: International business strategy

If your company does make investments in foreign companies, either through an investment activity or a physical presence, please **continue** to complete the questionnaire.

If your company does not make any investments in foreign companies, either through an investment activity or a physical presence, the questionnaire **ends** here. Thank you very much for your contribution. Please proceed to the final page to provide your contact details if you wish to receive the summary of results.

3. As far as your international investment activity is concerned...

a. For how many years has your company been investing internationally? ☐

b. What proportion of your company's total funds under management is invested in investments in foreign companies? ☐ %

4. In which of the following continents and countries does your company invest?

Please also indicate whether your company holds an investment activity or a physical presence.

	Investment activity	*Physical presence*
a. North America	☐	☐
b. South/Latin America	☐	☐
c. Asia	☐	☐
d. Africa	☐	☐
e. Australia	☐	☐
f. EU member countries		
– United Kingdom, Ireland	☐	☐
– France	☐	☐
– Belgium, Netherlands, Luxemburg	☐	☐
– Austria	☐	☐
– Spain, Portugal, Italy, Greece	☐	☐
– Finland, Sweden, Denmark	☐	☐
g. Switzerland	☐	☐
h. EU accession countries; please specify:	☐	☐

5. To what extent does your company pursue a standardised company-wide policy or adapt to local market conditions concerning the following stages of the investment process...

	Highly standardised						*Highly adaptive*
	7	**6**	**5**	**4**	**3**	**2**	**1**
a. Deal generation	☐	☐	☐	☐	☐	☐	☐
b. Deal screening and evaluation	☐	☐	☐	☐	☐	☐	☐
c. Investment approval process	☐	☐	☐	☐	☐	☐	☐
d. Valuation techniques	☐	☐	☐	☐	☐	☐	☐
e. Deal structuring	☐	☐	☐	☐	☐	☐	☐
f. Investment monitoring at strategic level	☐	☐	☐	☐	☐	☐	☐
g. Investment monitoring at operational level	☐	☐	☐	☐	☐	☐	☐
h. Investment monitoring at financial level	☐	☐	☐	☐	☐	☐	☐
i. Investment realisation and exit	☐	☐	☐	☐	☐	☐	☐

Part B: Venture capitalist internationalisation – drivers and strategy

Section 2: International business strategy

If your company does make investments in foreign companies, either through an investment activity or a physical presence, please **continue** to complete the questionnaire.

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3. As far as your international investment activity is concerned...

a. For how many years has your company been investing internationally? ☐

b. What proportion of your company's total funds under management is invested in investments in foreign companies? ☐ %

4. In which of the following continents and countries does your company invest?

Please also indicate whether your company holds an investment activity or a physical presence.

	Investment activity	*Physical presence*
a. North America	☐	☐
b. South/Latin America	☐	☐
c. Asia	☐	☐
d. Africa	☐	☐
e. Australia	☐	☐
f. EU member countries		
– United Kingdom, Ireland	☐	☐
– France	☐	☐
– Belgium, Netherlands, Luxemburg	☐	☐
– Austria	☐	☐
– Spain, Portugal, Italy, Greece	☐	☐
– Finland, Sweden, Denmark	☐	☐
g. Switzerland	☐	☐
h. EU accession countries; please specify:	☐	☐

5. To what extent does your company pursue a standardised company-wide policy or adapt to local market conditions concerning the following stages of the investment process...

	Highly standardised 7	6	5	4	3	2	*Highly adaptive* 1
a. Deal generation	☐	☐	☐	☐	☐	☐	☐
b. Deal screening and evaluation	☐	☐	☐	☐	☐	☐	☐
c. Investment approval process	☐	☐	☐	☐	☐	☐	☐
d. Valuation techniques	☐	☐	☐	☐	☐	☐	☐
e. Deal structuring	☐	☐	☐	☐	☐	☐	☐
f. Investment monitoring at strategic level	☐	☐	☐	☐	☐	☐	☐
g. Investment monitoring at operational level	☐	☐	☐	☐	☐	☐	☐
h. Investment monitoring at financial level	☐	☐	☐	☐	☐	☐	☐
i. Investment realisation and exit	☐	☐	☐	☐	☐	☐	☐

6. To what extent does your company pursue a standardised company-wide policy or adapt to local market conditions concerning the different foreign markets?

Please tick whichever boxes apply.

a. Standardised approach in all foreign markets ☐
b. Standardised approach in a sub-set of foreign markets the company operates in ☐
c. Adapted approach to local markets ☐

Section 3: Foreign market entry strategy

7. What entry strategy did you follow in recently entered markets?

	Almost always 7	6	5	4	3	2	*Almost never* 1
a. Investment in a foreign country without physical presence	☐	☐	☐	☐	☐	☐	☐
b. Stake in existing fund in foreign market	☐	☐	☐	☐	☐	☐	☐
c. Licensing and franchising	☐	☐	☐	☐	☐	☐	☐
d. International joint venture/alliance	☐	☐	☐	☐	☐	☐	☐
e. Acquisition of foreign venture capital company	☐	☐	☐	☐	☐	☐	☐
f. Establishment of branch office	☐	☐	☐	☐	☐	☐	☐

8. How important for co-ordinating investments in foreign countries are...

	Very important 7	6	5	4	3	2	*Not important* 1
a. Direct reporting by investment executives in foreign operation to venture capital company's head office	☐	☐	☐	☐	☐	☐	☐
b. Reporting by investment executives in foreign operation							
– to international division at parent company	☐	☐	☐	☐	☐	☐	☐
– to corporate-based regional head office of parent company	☐	☐	☐	☐	☐	☐	☐
– to locally-based regional head office of parent company	☐	☐	☐	☐	☐	☐	☐
c. Highly standardised and formal reporting systems	☐	☐	☐	☐	☐	☐	☐
d. Investment committee membership of investment executives from different geographical parts of the business	☐	☐	☐	☐	☐	☐	☐
e. Temporary transfer, that is secondment of team/task force from domestic market/head office to supervise foreign activity	☐	☐	☐	☐	☐	☐	☐
f. Unscheduled meetings	☐	☐	☐	☐	☐	☐	☐
g. Regular group meetings	☐	☐	☐	☐	☐	☐	☐
h. Regular telephone/email contact	☐	☐	☐	☐	☐	☐	☐
i. Frequent overseas trips and visits by parent company's top management	☐	☐	☐	☐	☐	☐	☐
j. Personnel policies such as selection, training, transfer and executive remuneration	☐	☐	☐	☐	☐	☐	☐

Part B: Venture capitalist internationalisation – drivers and strategy

If your company's involvement in foreign countries entails any physical presence, please **continue** to complete the questionnaire.

If your company's involvement in foreign countries is through investment activity only, the questionnaire **ends** here. Thank you very much for your contribution. Please proceed to the final page to provide your contact details if you wish to receive the summary of results.

9. To what extent does the investment committee give discretion to management in foreign markets where your company has a physical presence with respect to...

	High discretion						*No discretion*
	7	**6**	**5**	**4**	**3**	**2**	**1**
a. Deal generation	☐	☐	☐	☐	☐	☐	☐
b. Deal screening	☐	☐	☐	☐	☐	☐	☐
c. Choice of industry sector	☐	☐	☐	☐	☐	☐	☐
d. Choice of investment stage	☐	☐	☐	☐	☐	☐	☐
e. Deal structuring	☐	☐	☐	☐	☐	☐	☐
f. Deal valuation	☐	☐	☐	☐	☐	☐	☐
g. Investment monitoring	☐	☐	☐	☐	☐	☐	☐
h. Investment realisation and exit	☐	☐	☐	☐	☐	☐	☐

10. How would you describe your company's staffing policy in physical presences in foreign markets?

	Almost always						*Almost never*
	7	**6**	**5**	**4**	**3**	**2**	**1**
a. Transfer of investment executives from head office	☐	☐	☐	☐	☐	☐	☐
– for limited period of time	☐	☐	☐	☐	☐	☐	☐
– with international experience	☐	☐	☐	☐	☐	☐	☐
b. Recruitment of experienced foreign nationals in foreign market	☐	☐	☐	☐	☐	☐	☐
c. Recruitment of experienced foreign nationals from other companies for foreign market	☐	☐	☐	☐	☐	☐	☐
d. Bringing foreign nationals from foreign market to head office							
– to obtain benefits of their local knowledge	☐	☐	☐	☐	☐	☐	☐
– to train them prior to their return to foreign office	☐	☐	☐	☐	☐	☐	☐
e. Appointing a foreign national as head of foreign operation	☐	☐	☐	☐	☐	☐	☐

11. How important is the deployment of expatriates to foreign markets where your company has a physical presence concerning...

	Highly relevant						*Not relevant*
	7	**6**	**5**	**4**	**3**	**2**	**1**
a. Enhancement of parent company's reputation and image	☐	☐	☐	☐	☐	☐	☐
b. Inability to train and develop local executives at head office	☐	☐	☐	☐	☐	☐	☐
c. Establishment of foreign operations in early stages	☐	☐	☐	☐	☐	☐	☐
d. Transfer of company-specific knowledge/way of doing business	☐	☐	☐	☐	☐	☐	☐
e. Parent company's desire for control	☐	☐	☐	☐	☐	☐	☐
f. Provision of international opportunities for executives							
g. Lack of suitable local professional staff	☐	☐	☐	☐	☐	☐	☐
h. Foreign-country expectations that key executives be parent-company nationals	☐	☐	☐	☐	☐	☐	☐
i. Foreign-country legal requirements	☐	☐	☐	☐	☐	☐	☐
j. Compliance with industry codes of conduct	☐	☐	☐	☐	☐	☐	☐

Part B: Venture capitalist internationalisation – drivers and strategy

12. How does your company remunerate investment executives, including those in foreign operations?

Please tick whichever boxes apply.

a. On a company-wide basis, that is remuneration is tied to profits from your company's investments in all other countries. ☐
b. On a regional basis, that is remuneration is tied to profits from your company's investments in some countries. ☐
c. On a country basis, that is remuneration is tied to profits from investments specific to that country only. ☐
d. On a deal basis, that is remuneration is tied to deal participation, irrespective of country or region ☐

13. What were the main issues in staffing physical presences in foreign operations?

	Very important 7	6	5	4	3	2	*Not important* 1
a. Identifying suitably qualified/experienced foreign nationals	☐	☐	☐	☐	☐	☐	☐
b. Persuading executives from parent office to be transferred/ seconded abroad	☐	☐	☐	☐	☐	☐	☐
c. Re-entry difficulties for expatriates	☐	☐	☐	☐	☐	☐	☐
d. Establishing appropriate remuneration package for executives in foreign office	☐	☐	☐	☐	☐	☐	☐
e. Resolving remuneration differentials between expatriates and local executives in foreign market(s)	☐	☐	☐	☐	☐	☐	☐
f. Designing appropriate reporting and management systems	☐	☐	☐	☐	☐	☐	☐
g. Agreeing investment strategies and targets that are in line with overall objectives	☐	☐	☐	☐	☐	☐	☐
h. Turnover of investment staff in foreign operations	☐	☐	☐	☐	☐	☐	☐
i. Providing training in							
– general conduct of venture capital business	☐	☐	☐	☐	☐	☐	☐
– your company's way of doing business	☐	☐	☐	☐	☐	☐	☐

Thank you very much for completing the questionnaire.

Please use this space for further **comments**:

If you would you like to receive a **summary of the results** of this survey, please provide the following details.

Completed by: _____

Position: _____

Venture capital company: _____

Contact details: _____

_____

_____

E-mail: _____

Please use the **enclosed envelope to return** the completed questionnaire to:

Professor Ulrich Hommel, Ph.D.
Center for Entrepreneurial and Small Business Finance (esbf)
at the EUROPEAN BUSINESS SCHOOL
Schloss Reichartshausen
D-65375 Oestrich-Winkel

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