



Armin Höll-Steier

Venture Capital

Fund Certification,
Performance Prediction and
Learnings from the Past



This book contains three studies. The first study investigates the relationship between private equity investors and fund managers and how intermediaries can mitigate their agency problems. The incentive structure of three intermediary types and their behavior in signaling fund qualities to investors are studied theoretically. A recommendation which intermediary to consult is given. The second study presents a new statistical method to predict the performance distribution of venture capital direct investments. The accuracy of this method is investigated and compared to existing approaches. The third study is about the European venture capital market's historic development before and after the internet bubble and reasons for the bad development especially after the bubble.

Armin Höll-Steier, born in 1980 in Munich; Master of Business Administration at Ludwig-Maximilians-University (LMU) Munich and master-level studies at the Center for Digital Technology and Management (CDTM) at LMU und Technical University Munich 2000–2004; work-related period of residence in Australia 2004–2005; employment at the strategy advisory Bain & Company since 2005; Master of Business Research in 2009 and doctorate degree (Dr.oec.publ.) at LMU Munich in 2010.

Venture Capital

European University Studies

Europäische Hochschulschriften
Publications Universitaires Européennes

Series V **Economics and Management**

Reihe V Série V
Volks- und Betriebswirtschaft
Sciences économiques, gestion d'entreprise

Vol./Bd. 3381



PETER LANG

Frankfurt am Main · Berlin · Bern · Bruxelles · New York · Oxford · Wien

Armin Höll-Steier

Venture Capital

Fund Certification,
Performance Prediction and
Learnings from the Past



PETER LANG

Internationaler Verlag der Wissenschaften

Bibliographic Information published by the Deutsche Nationalbibliothek

The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data is available in the internet at <http://dnb.d-nb.de>.

Zugl.: München, Univ., Diss., 2010

D 19

ISSN 0531-7339

ISBN 978-3-653-00904-0

© Peter Lang GmbH

Internationaler Verlag der Wissenschaften

Frankfurt am Main 2011

All rights reserved.

All parts of this publication are protected by copyright. Any utilisation outside the strict limits of the copyright law, without the permission of the publisher, is forbidden and liable to prosecution. This applies in particular to reproductions, translations, microfilming, and storage and processing in electronic retrieval systems.

www.peterlang.de

Acknowledgements

"The quest for wisdom starts with the genuine desire to learn."

The Bibel

Every thesis starts with a desire, the desire to wander an unknown and arduous path of learning towards a blurry goal in the future. This path has many crossings, some are misleading and need to be walked back, some are rocky or steep and hard to conquer, only few passages are easy to pass. On this journey other people are waiting on the roadside and support the wanderer to fulfil his quest - some are continuous supporters and encouragers and some just guide the wanderer for a while or give advice for which direction to take. Unless the final goal is clear and the wanderer has enough stamina he will reach his destination. But in the end he will realize that it was not the end of the journey that provides pleasure but what he experienced on his way and the individuals he met, the discussions he had which were most enjoyable.

I had the pleasure to go such a path and I enjoyed the company of many supporters whom I am deeply indebted to:

First, and foremost, I want to thank Prof. Dr. Bernd Rudolph from the Ludwig-Maximilians-University Munich, my doctoral advisor for accepting me as an external doctoral candidate, for his support, encouragement and guidance over the last two and a half years. He granted me a high level of freedom to dive-deep into the research topics I am most interested in and was a reliable source of advice. Despite my external position to his chair

I always felt welcome and part of the group when joining doctoral events, pleasure trips and Christmas parties. Therefore, I also want to thank all doctoral candidates whom I met during my MBR studies and at the chair for Capital Market Research of Prof. Rudolph for sharing their experience, motivating me to pursue and acting as a sounding board for my ideas.

I want thank Prof. Dietmar Harhoff, Ph.D. my thesis referee for his support.

I am grateful to Prof. Dr. Manfred Schwaiger and Prof. Dr. Anton Meyer who have been my advisors during the MBR studies.

My dissertation - especially my second and third study - critically depended on the access to proprietary and confidential data on private equity and venture capital funds, their investors and their investments. I especially wish to thank the CEO of the Center for Private Equity Research (CEPRES) Dr. Daniel Schmidt, the COO Dr. Philipp Krohmer and their colleagues Dr. Axel Buchner, Matthias Kling, Ulrich Häberle and Dr. Miroslav Adamov at CEPRES who have become friends both for their support with data, as well as fruitful discussions and advice during the last years.

I want to thank especially Nora Fenske and Prof. Dr. Helmut Küchenhoff from the Statistical Consulting Unit, Department of Statistics, LMU Munich for their reliable support and advice concerning statistical issues for my second study.

I am grateful to Prof. Dr. Christoph Kaserer from the Center for Economic and Financial Studies (CEFS) at Technical University Munich and to Thomas Meyer from the European Venture Capital Association (EVCA) for their support with my third study and many fruitful discussions. I am indebted to anonymous data providers who supplied data on European funds

and their investors and I wish to thank Mei Niu from the British Venture Capital Association (BVCA) for challenging my results.

My thesis was supported financially by my current employer Bain & Company. I am grateful that Bain offered me the chance to exclusively focus on my thesis for two years and sponsored my living. Moreover, I thank the other doctoral candidates at Bain who went through the same ups and downs with me in parallel for sharing their experiences and challenging my ideas.

I want to express my deepest gratitude to my loving parents Ernst and Brigitte Höll and my dear uncle Prof. Dr. Rudolf Höll who shared both my times of doubt and my times of enthusiasm. They inspired me with their ideas when I was looking for a research topic and guided me during times of disorientation. They kept faith in me and encouraged me. I was allowed to draw from their experience and advice which helped me find my way through the jungle of academia.

Last but not least, I want to thank my wife Veronika Steier who supported me mentally during the last three years doing my MBR and writing my research papers.

To all of them and any other person who supported my development during the dissertation: Thank you very much!

Table of Contents

List of Figures	XIII
List of Tables	XVII
Acronyms	XIX
Nomenclature	XXI
1 Introduction	1
1.1 Markets for Risky Assets	1
1.2 Structure of This Work	2
2 Study 1: External Certification in the Fundraising of First-Time Private Equity Funds	9
2.1 Introduction	9
2.2 Problems and Mitigation Options in Private Equity Fundraising	11
2.2.1 Screening	13
2.2.2 Self-selection and signaling	14
2.3 Intermediaries Supporting Fundraising of First-Time PE Funds	17
2.3.1 The Role of Intermediaries	17
2.3.2 Rating Agencies	18
2.3.3 Placement Agents	21
2.3.4 Lead Investors	25
2.3.5 Interim Summary	27
2.4 The Model	28
2.4.1 Analysis of a Certifier’s Behavior in a Market with Unlimited Capital Supply	28

2.4.2	Comparison of Different Types of Certifiers in a Market with Capital Supply Limitations	44
2.5	Conclusion	72
3	Study 2: A New Approach to Predict the Performance of Venture Capital Direct Investments	79
3.1	Introduction	79
3.2	Related Studies	82
3.3	Methodological Considerations For a New Prediction Approach	87
3.3.1	Data Completeness and Representativeness	88
3.3.2	Performance Measurement	89
3.3.3	Methodology Choice	93
3.3.4	Parameters and Indicators of Investment Performance	104
3.4	Empirical Analysis and Test of the Prediction Methodology .	109
3.4.1	Data Description	109
3.4.2	Parameters of Investment Performance	120
3.4.3	Power of the Prediction of the Direct Investment Return Distribution Pattern	138
3.5	Extensions of the Model to Funds and Funds-of-Funds . . .	142
3.5.1	Approach Using the Mean IRR of a Fund's Direct Investments	142
3.5.2	Approach Using the Mean MIRR of Direct Investment Returns over a Fund's Lifetime	143
3.6	Conclusions	150
4	Study 3: European Venture Capital: What can we learn from the past?	153
4.1	Introduction	153
4.2	Related Literature	155
4.3	Data Description	162
4.3.1	The Fund Sample	164
4.3.2	Composition and Representativeness of the CEPRES Sample	169

4.4	Historical Performance of the European Venture Capital Industry	170
4.4.1	Performance Measures Applied in this Study	170
4.4.2	Development of Venture Capital Before and After the Internet Bubble in Europe and the US	174
4.4.3	Net Performance of European Venture Capital Funds	175
4.4.4	Confirmation of Negative Fund Performance by Other Studies	179
4.4.5	Gross Performance of European Venture Capital Portfolio Companies	181
4.5	Investor Success in European Venture Capital	189
4.5.1	Overview on Limited Partner Sample	189
4.5.2	The Investment Behavior of Different Investor Groups	192
4.5.3	The Investment Success of Different Investor Groups	196
4.6	Reasons for the Low Performance of European Venture Capital	201
4.6.1	European Market Attractiveness	202
4.6.2	European Innovativeness	207
4.6.3	Limited Partner Behavior	211
4.6.4	Fund Manager Behavior	215
4.7	Conclusions	217

Bibliography **221**

Appendices

Appendices for Chapter 2 **237**

1	Proofs of Lemmas and Theorems	237
2	Proofs of Lemmas and Theorems	237
3	Proofs of Lemmas and Theorems	238
4	Proofs of Lemmas and Theorems	239
5	Proofs of Lemmas and Theorems	239
6	Proofs of Lemmas and Theorems	240
7	Proofs of Lemmas and Theorems	240

8	Proofs of Lemmas and Theorems	241
9	Proofs of Lemmas and Theorems	241
Appendices for Chapter 3		243
10	Sector Classification	243

List of Figures

2.1	Model structure concerning interpretation of p . The symbols used are as explained in the text and in the nomenclature . . .	33
2.2	Certifier's option tree. The symbols used are as explained in the text and in the nomenclature	33
2.3	Illustration of p - γ combinations that lead to different relationships between capital supply and demand. The symbols used are as explained in the text and in the nomenclature . . .	47
2.4	Utility functions of investors and PEFs. The symbols used are as explained in the text and in the nomenclature	48
2.5	Overview of possible equilibrium p - γ combinations for a placement agent and a lead investor. The symbols used are as explained in the text and in the nomenclature	58
2.6	Utility function and relevant set of p - γ combinations for placement agents. The symbols used are as explained in the text and in the nomenclature	63
3.1	Example Distribution Pattern of Investment IRRs and Approaches Applied to Predict Different Parts of the Distribution Pattern in the Current Study	96
3.2	Illustration how CPV Based Approach and CREM Based Approach are Used to Estimate the Default Probability of an Investment	98
3.3	Comparison of the Distribution of Investments over Time between the CEPRES Dataset and the VentureXpert Database	116

3.4	Distribution Pattern of Performance (IRR) of Venture Capital Investments between 1985 and 2003	121
3.5	Functional Form of Partial Effects of Covariates in Specification 3 of Table 3.4	124
3.6	Functional Form of Partial Effects of Covariates on μ in Specification 2 of Table 3.6	132
3.7	Functional Form of Partial Effects of Covariates on σ in Specification 2 of Table 3.6	133
3.8	Overall Fit of the Predicted Distribution Pattern to the Real Distribution Pattern of IRRs for All Observations in Sample	138
3.9	Illustration of Approach to Predict the Return Distribution of a VC Fund based on Individual Investments	145
3.10	Functional Form of Partial Effects of Covariates on μ in Table 3.9	148
3.11	Functional Form of Partial Effects of Covariates on σ in Table 3.9	149
4.1	Distribution of full fund sample across countries	165
4.2	Comparison of IRRs of European funds and US funds with vintage years 1994-2005	175
4.3	Development of Interim-IRR of European Venture Capital funds of the vintage years 1997-2005 over time	176
4.4	Performance of European Venture Capital funds	178
4.5	Gross IRRs since inception of European VC investments by investment years (equals the year of the first investment)	187
4.6	Comparison of Gross IRRs since inception of fund investments into portfolio companies from different European countries	188
4.7	Comparison of Gross IRRs since inception of fund investments into portfolio companies belonging to different industry sectors	188

4.8	Development of 12-month-change of MSCI Europe between 1990 and 2009	203
4.9	Quarterly data for the number of Private Equity (Venture & Buyout) backed IPOs in Europe between 1990 and 2009 . . .	204
4.10	Quarterly GDP growth (over 12 month periods respectively) in the six European Countries with the highest representation in the CEPRES sample	205
4.11	Business Climate Index (BCI) in Europe between 1990 and 2008	205
4.12	Founding rates in four European economies	208
4.13	Indexed development in the number of patent applications in 27 European countries between 1990 and 2005	209
4.14	Indexed cumulative development in the number of patent applications in 27 European countries and the VC fund volume raised between 1990 and 2005	210
4.15	Development of cumulative committed capital, cumulative investments and the residual cumulative uninvested capital (called "capital overhang") between 1990 and 2008	211
4.16	Annual fundraising volumes in Europe between 1990 and 2006	212
4.17	Share of different LP groups in the fundraising of Venture Capital in the USA and in Europe 2003	213
4.18	Timing of VC investments between 1997 and 2009 vs. the development of the MSCI Europe	215
4.19	Average number of first-round investments per active fund between 1994 and 2008 vs. the development of the MSCI Europe	216

List of Tables

3.1	Summary Table of All Variables Used in the Analysis and Prediction of Venture Capital Performance	110
3.2	Structure of the Dataset	114
3.3	Distribution Patterns of Return Measures IRR, log(IRR), MIRR and log(MIRR)	118
3.4	Parameters of the Default Rate of Individual Investments (Credit Portfolio View)	122
3.5	Parameters of the Default Rate of Investments in a Quarter (Credit Risk Evaluation Model)	128
3.6	Parameters of Investment Performance of Non-Write-Off Investments Measured in IRR	131
3.7	Parameters of Investment Performance of Non-Write-Off Investments Measured in MIRR	134
3.8	Comparison of results of my prediction approaches (CPV based and CREM based) with results based on Buchner at al. (2009)	139
3.9	Parameters of Investment Duration of Non-Write-Off Investments	147
4.1	Focus of funds in full fund sample along stages and sectors	165
4.2	Comparison of committed capital volumes in full fund sample with EVCA data and VentureXpert data	167
4.3	Comparison of stage focus of funds in full fund sample and in VentureXpert	168
4.4	Logistic regression to detect potential biases in full fund sample	169

4.5	Composition of CEPRES sample of VC investments along realization status, stage and industry	171
4.6	Comparison of fund performance data from VentureXpert, BVCA and my full fund sample	179
4.7	Absolute performance of fully and partially realized European and US Venture Capital investments into portfolio companies measured in Gross IRR since inception and Total Value to Paid-In (TVPI)	182
4.8	Relative performance of fully and partially realized European and US Venture Capital investments into portfolio companies measured in Excess-IRR vs. the MSCI World and Public Market Equivalent (PME) vs. the MSCI World	183
4.9	Comparison of the shares of different LP groups in the funds of the vintage years 1999-2002 between the restricted fund sample and results from an EVCA/Thomson Financial/PWC survey	190
4.10	Descriptive overview on LP behavior and success in the full fund sample	193
4.11	Investment behavior of different groups of limited partners	194
4.12	Investment success of different groups of limited partners	198
13	Overview on Sector Classification, Corresponding CEPRES Industry Classes and US Datastream Stock Price Indices	243

Acronyms

AIC	Akaike Information Criterion
BCI	Business Climate Index
BCPE	Box-Cox Power Exponential
BO	Buyout
BVCA	British Venture Capital Association
CAPM	Capital Asset Pricing Model
CEPRES	Center for Private Equity Research
CPV	Credit Portfolio View
CREM	Credit Risk Evaluation Model
EVCA	European Venture Capital Association
GAMLSS	Generalized Additive Model of Location, Scale and Shape
GDP	Gross Domestic Product
GP	General Partner
IPO	Initial Public Offering
IRR	Internal Rate of Return

LP	Limited Partner
M&A	Mergers and Acquisitions
MCS	Monte Carlo Simulation
MIRR	Modified Internal Rate of Return
NASDAQ	National Association of Securities Dealers Automated Quotations
NAV	Net Asset Value
OLS	Ordinary Least Square
PE	Private Equity
PME	Public Market Equivalent
SBC	Schwarz Criterion
TVE	Thompson Venture Economics
TVPI	Total Value to Paid-In
USA	United States of America
USD	United States Dollar
VC	Venture Capital
VIF	Variance Inflation Factor

Nomenclature

Symbols of Chapter 2

η	A lead investor's share in a private equity fund
γ	Share of good funds in the market
$\gamma^*(p)$	Market clearing share of good funds for a given quality detection skill level
γ_{max}	Share of good funds in the market when placement agents or lead investors support the fund management as good as possible
γ_{min}	Share of good funds in the market when placement agents or lead investors do not support the fund management
\hat{p}_{max}	A monopoly certifier's skill level to correctly identify a fund management's quality
A	Financial return/surplus of a private equity fund
d	A single fund's probability to get a certificate
$d(p, \gamma)$	A single fund's probability to get a certificate at a given probability to correctly identify a fund management's quality and a given share of good funds in the market
E_I	Investors' return/surplus from a private equity fund investment
e_I	An investor's expected return from a private equity fund standardized by the extent of the fund surplus

E_{PEF}	Compensation of private equity fund management
e_{PEF}	A fund management's expected return from a private equity fund standardized by the extent of the fund surplus; equals a fund's probability to get a certificate
k	A lead investor's collusion payments standardized by the extent of the private equity fund surplus
p	Probability to correctly identify a fund management's quality
p'_{max}	Second best certifier's skill level to correctly identify a fund management's quality
$p^* = p^*(\gamma)$	Market clearing detection skill level for a given share of good private equity funds in the market
p_{max}	A certifier's skill level to correctly identify a fund management's quality
p_{min}	Investors' minimum requirement for a certifier's quality detection skill
Q	Ratio between reputation gain from investors and from private equity funds
R	Reputation of a certifier
R^{std}	A certifier's total reputation gain standardized by reputation gain from private equity funds
$R_{I,b}$	A certifier's reputation loss/threat from investors for identifying a badly performing fund
$R_{I,g}$	A certifier's reputation gain from investors for identifying a well performing fund
R_I	A certifier's total reputation gain from investors

R_I^d	A certifier's total reputation gain from investors in a capital over-demand situation
R_I^s	A certifier' total reputation gain from investors in a capital over-supply situation
R_{PA}	A placement agent's total reputation gain
$R_{PEF,b}$	A certifier's reputation loss/threat from fund managers for not certifying a fund
$R_{PEF,g}$	A certifier's reputation gain from fund managers for certifying a fund
R_{PEF}	A certifier's total reputation gain from private equity funds
R_{PEF}^d	A certifier's total reputation gain from private equity fund managers in a capital over-demand situation
R_{PEF}^s	A certifier' total reputation gain from private equity fund managers in a capital over-supply situation
R_{RA}	A rating agency's total reputation gain
s	Share of funded private equity funds that leads to market clearing
W	Compensation of a certifier for his service
W_C	Carried interest payments which a placement agent gets for his support in the fundraising of recommended private equity funds that get capital from investors
W_F	Fixed amount which a placement agent gets for his support in the fundraising of recommended private equity funds that get capital from investors
W_{LI}^C	A lead investor's compensation with collusion payments

w_{LI}^C	A lead investor's compensation with collusion payments standardized by the extent of the private equity fund surplus
W_{LI}^{NC}	A lead investor's compensation without collusion payments
w_{LI}^{NC}	A lead investor's compensation without collusion payments standardized by the extent of the private equity fund surplus
W_{PA}	A placement agent's compensation for his service
W_{RA}	(Fixed) compensation of a rating agency for its service
x	Share of well performing funds of recommended funds
y	Share of badly performing funds of recommended funds
z	Total number of (blindly) certified private equity funds

Symbols of Chapter 3

β	vector indicating the influence of covariates on a dependent variable
δ	probability of default within a group of investments
ϵ	normal distributed regression residual with mean 0 and constant variance
λ	Box-Cox transformation parameter
μ	centrality parameter in GAMLSS regression resp. median of BCPE distribution
ν	skewness parameter in GAMLSS regression
BCPE()	Box-Cox power exponential distribution function
E()	expected value of a variable
F()	distribution function of a return measure (IRR or MIRR)

$P()$	function that returns a probability
π	probability of default of an investment
σ	scale parameter in GAMLSS regression
τ	kurtosis parameter in GAMLSS regression
c	(positive and negative) cashflows
CFI	cashflows from a fund to a portfolio company
CFO	cashflows from a portfolio company to a fund
d	function of an investment's duration
G	MIRR distribution of a fund
g	MIRR distribution
h	share of committed capital of a fund invested in a year
I	duration of the investment period of a fund
i	index of an individual investment
IRR	internal rate of return of an investment
j	index of a group of investments
k	number of covariates describing an investment
l	index of an investment which did not default
m	number of covariates describing a group of investments
$MIRR$	modified internal rate of return
n	total number of investments
o	number of independent observations in GAMLSS

p	return measure (IRR or MIRR)
q	index of a group of investments a new investment belongs to
r	market return resp. return that an investor gets when investing capital in his investment alternative to a Venture Capital fund
s	index of a new investment
T	maturity of an investment or a fund
t	time index
U	total multiple of all investments over the whole lifetime of a fund
u	multiple of an investment over the whole lifetime of a fund
w	dummy variable indicating if an investment defaulted (value=1) or not (value=0)
x	vector of covariates
y	vector of a dependent variable with investment returns
z	vector of the covariates for a group of investments

Symbols of Chapter 4

c	(positive and negative) cashflows
IRR	internal rate of return of an investment
NAV	net asset values of unrealized and/or partially realized investments
T	maturity of an investment or a fund
t	time index