

**Studienreihe der Stiftung Kreditwirtschaft  
an der Universität Hohenheim**

**Susanna Holzschneider**

# **Valuation and Underpricing of Initial Public Offerings**

**Evidence from Germany in Different Market Cycles**



**Verlag Wissenschaft & Praxis**



## Valuation and Underpricing of Initial Public Offerings

**Studienreihe der Stiftung Kreditwirtschaft  
an der Universität Hohenheim**

Herausgeber:

Prof. Dr. Joh. Heinr. v. Stein

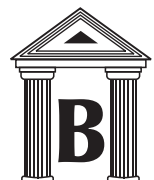
**Band 48**

Susanna Holzschneider

# **Valuation and Underpricing of Initial Public Offerings**

Evidence from Germany in Different Market Cycles

Verlag Wissenschaft & Praxis



## **Bibliografische Information der Deutschen Nationalbibliothek**

Die Deutsche Nationalbibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über <http://dnb.d-nb.de> abrufbar.

ISBN 978-3-89673-583-6

© Verlag Wissenschaft & Praxis  
Dr. Brauner GmbH 2011  
D-75447 Sternenfels, Nußbaumweg 6  
Tel. +49 7045 930093 Fax +49 7045 930094  
[verlagwp@t-online.de](mailto:verlagwp@t-online.de) [www.verlagwp.de](http://www.verlagwp.de)

Alle Rechte vorbehalten

Das Werk einschließlich aller seiner Teile ist urheberrechtlich geschützt. Jede Verwertung außerhalb der engen Grenzen des Urheberrechtsgesetzes ist ohne Zustimmung des Verlages unzulässig und strafbar. Das gilt insbesondere für Vervielfältigungen, Übersetzungen, Mikroverfilmungen und die Einspeicherung und Verarbeitung in elektronischen Systemen.

Printed in Germany

# Vorwort

Die Dissertation „Valuation and Underpricing of Initial Public Offerings – Evidence from Germany in Different Market Cycles“ ist im Rahmen meiner Tätigkeit am Lehrstuhl für Bankwirtschaft und Finanzdienstleistung der Universität Hohenheim und in den zwei Semestern als Visiting PhD an der Stern School of Business der New York University entstanden. Die Dissertation wurde von der Fakultät für Wirtschafts- und Sozialwissenschaften der Universität Hohenheim im November 2010 angenommen.

Ich möchte mich bei Herrn Prof. Dr. Burghof und den Kolleginnen und Kollegen des Lehrstuhls für Bankwirtschaft für die Betreuung und Unterstützung sowie für die Aufnahme der Dissertation in die Studienreihe der Stiftung Kreditwirtschaft bedanken.

Besonderer Dank geht an meine Eltern, die mich immer unterstützt haben und mir jederzeit mit Rat und Tat zur Seite standen.

München, 22. Dezember 2010

Susanna Holzschneider



# Table of Contents

|  |    |
|--|----|
| Table of Contents.....   | 7  |
| Tables .....   | 11 |
| Figures.....   | 13 |
| Abbreviations .....  | 14 |
| Introduction.....  | 17 |
| Chapter I: Theory and Evidence of IPO Underpricing.....                  | 21 |
| I Introduction.....  | 21 |
| II Theory and Evidence Based on Asymmetric Information Distribution..... | 22 |
| II.1 Information Asymmetries between Issuer and Investor.....            | 22 |
| II.1.1 Signalling Theory.....  | 22 |
| II.1.2 Certification of Quality .....                                    | 25 |
| II.2 Information Asymmetries between Investors.....                      | 29 |
| II.2.1 The Winner’s Curse .....  | 29 |
| II.2.2 Information Revelation .....                                      | 32 |
| II.3 Information Asymmetries between Underwriter and Issuer .....        | 37 |
| III Theory and Evidence Based on Symmetric nformation Distribution ..... | 38 |
| III.1 Underwriter Price Support.....                                     | 38 |
| III.2 Litigation Risk .....  | 39 |
| III.3 Company’s Ownership Structure .....                                | 41 |
| III.4 Behavioral Finance .....   | 43 |
| III.5 Information Momentum .....   | 45 |
| IV Discussion.....   | 46 |
| V Conclusion .....   | 49 |
| Chapter II: How Do Pre-IPO Shareholders Determine Underpricing? .....    | 51 |
| I Introduction.....  | 51 |
| II Related Literature and Development of Hypothesis .....                | 52 |
| III Research Design .....  | 56 |
| III.1 Sample Selection and Data Sources .....                            | 56 |



|                     |   |     |
|---------------------|---|-----|
| III.2               | Definition of Variables .....   | 57  |
| III.3               | Definition of Hot and Cold Periods.....   | 63  |
| IV                  | Empirical Results.....  | 63  |
| IV.1                | Firm and Transaction Characteristics .....                                      | 63  |
| IV.2                | Pre-IPO Ownership Characteristics.....  | 69  |
| IV.3                | Regression Analysis .....   | 74  |
| IV.3.1              | Variables Explaining IPO Underpricing .....                                     | 74  |
| IV.3.2              | Determinants of IPO Underpricing in 1997-2001 and<br>2002-2007 .....            | 79  |
| IV.3.3              | Pre-IPO Ownership and Underpricing in Different Market<br>Phases .....          | 83  |
| IV.3.4              | Pre-IPO Ownership and Underpricing with Positive Investor's<br>Information..... | 88  |
| V                   | Conclusion .....  | 96  |
| Chapter III:        | Do “Herding” Effects on Firm Multiples Determine IPO<br>Valuation? .....        | 97  |
| I                   | Introduction.....   | 97  |
| II                  | Related Literature and Development of Hypotheses.....                           | 98  |
| III                 | Research Design .....   | 102 |
| III.1               | Sample Selection and Data Sources .....   | 102 |
| III.2               | Methodology and Definition of Variables.....                                    | 103 |
| IV                  | Empirical Results.....  | 108 |
| IV.1                | Descriptive Statistics of Firm and Market Characteristics.....                  | 108 |
| IV.2                | IPO's and Comparable Firm Multiples .....                                       | 114 |
| IV.3                | IPO Valuation .....   | 124 |
| IV.3.1              | Regression Estimates on IPO Valuation .....                                     | 124 |
| IV.3.2              | IPO Valuation in Hot and Cold Markets.....                                      | 127 |
| IV.3.3              | Information Asymmetries and IPO Valuation .....                                 | 132 |
| V                   | Conclusion .....  | 136 |
| Conclusion          | .....   | 139 |
| References          | .....   | 141 |
| Appendix: Chapter I | .....   | 153 |

|  |     |
|--|-----|
| AI Information Asymmetries between Issuer and Investor .....   | 153 |
| A I.1 Signalling Theory .....                                  | 153 |
| A I.2 Certification of Quality .....                           | 156 |
| AII Information Asymmetries between Investors .....            | 160 |
| A II.1 The Winner's Curse .....                                | 160 |
| A II.2 Information Revelation .....                            | 164 |
| AIII Information Asymmetries between Issuer and Investor ..... | 166 |
| AIV Symmetric Information .....                                | 166 |
| Appendix: Chapter II .....                                     | 173 |
| Appendix: Chapter III .....                                    | 175 |



## Tables

|                         |  |     |
|-------------------------|--|-----|
| Chapter II: Table I     | Defintion of Variables.....  | 62  |
| Chapter II: Table II    | Firm and Offer Characteristics.....  | 67  |
| Chapter II: Table III   | Firm Characteristics in Hot and Cold Markets .....                                 | 68  |
| Chapter II: Table IV    | Ownership Structure.....   | 71  |
| Chapter II: Table V     | Ownership Structure in Hot and Cold Markets .....                                  | 73  |
| Chapter II: Table VI    | Regression Models on Underpricing (1).....   | 76  |
| Chapter II: Table VII   | Regression Models on Underpricing (2).....   | 78  |
| Chapter II: Table VIII  | Regression Models on Underpricing: 1997-2001,<br>2002-2007.....                    | 81  |
| Chapter II: Table IX    | Regression Models on Underpricing: Hot Time Period ..                              | 83  |
| Chapter II: Table X     | Regression Models on Underpricing: Hot IPO<br>Underpricing.....                    | 85  |
| Chapter II: Table XI    | Regression Models on Underpricing: Hot IPO Volume ..                               | 87  |
| Chapter II: Table XII   | Regression Models on Underpricing: Price Level .....                               | 91  |
| Chapter II: Table XIII  | Regression Models on Underpricing: IPO Underpricing<br>and Price Level.....        | 94  |
| Chapter II: Table XIV   | Regression Models on Underpricing: IPO Volume and<br>Price Level.....              | 95  |
| Chapter III: Table I    | Definition of Variables.....   | 108 |
| Chapter III: Table II   | Firm Characteristics .....   | 110 |
| Chapter III: Table III  | Offer Characteristics .....  | 111 |
| Chapter III: Table IV   | Macroeconomic Conditions .....   | 113 |
| Chapter III: Table V    | Regression Models on Market Value.....   | 125 |
| Chapter III: Table VI   | Regression Models on Market Value: Cold Market .....                               | 128 |
| Chapter III: Table VII  | Regression Models on Market Value: Hot Market .....                                | 131 |
| Chapter III: Table VIII | Regression Models on Market Value: Controlling for<br>Asymmetric Information ..... | 135 |

|                       |  |     |
|-----------------------|--|-----|
| Appendix II: Table I  | Underwriter Activity .....                         | 173 |
| Appendix III: Table I | Regression Models on Market Value (Hot/Cold) ..... | 177 |

## Figures

|                          |   |     |
|--------------------------|---|-----|
| Chapter II: Figure I     | IPOs per Month between 1997-2007 .....                              | 64  |
| Chapter II: Figure II    | Initial Returns per Month between 1997-2007 .....                   | 65  |
| Chapter III: Figure I    | MB Ratios of IPOs .....   | 115 |
| Chapter III: Figure II   | MB Ratios of Technology IPOs .....                                  | 115 |
| Chapter III: Figure III  | MB Ratios of Industry IPOs .....                                    | 116 |
| Chapter III: Figure IV   | PE Ratios of IPOs .....   | 117 |
| Chapter III: Figure V    | PE Ratios of Technology IPOs .....                                  | 118 |
| Chapter III: Figure VI   | PE Ratios of Industry IPOs .....                                    | 118 |
| Chapter III: Figure VII  | IPOs per Year and Industry .....                                    | 119 |
| Chapter III: Figure VIII | Cross-Correlation of MB Ratios of IPOs and Market ...               | 120 |
| Chapter III: Figure IX   | Cross-Correlation of PE Ratios of IPOs and Market ....              | 121 |
| Chapter III: Figure X    | Autocorrelation of MB Ratios of IPOs .....                          | 122 |
| Chapter III: Figure XI   | Autocorrelation of PE Ratios of IPOs .....                          | 123 |
| Appendix III: Figure I   | Auto/ Cross-Correlation of MB/PE Ratios of all IPOs ..              | 175 |
| Appendix III: Figure II  | Auto/ Cross-Correlation of MB/PE Ratios of<br>Technology IPOs ..... | 176 |
| Appendix III: Figure III | Auto/ Cross-Correlation of MB/PE Ratios of Industry<br>IPOs .....   | 176 |

## Abbreviations

|            |  |
|------------|--|
| BVK:       | Bundesverband Deutscher Kapitalbeteiligungsgesellschaften - German Private Equity and Venture Capital Association e.V. |
| CAPEX:     | capital expenditure  |
| CDAX:      | Composite DAX (Deutscher Aktienindex)  |
| CEO:       | chief executives officer   |
| CRSP:      | Center for Research in Security Prices   |
| DCF:       | discounted cash flow   |
| DDM:       | dividend discount model  |
| EBITDA:    | earnings before interest, taxes, depreciation and amortization   |
| e.g.:      | for example, abbreviation of Latin “ <i>exempli gratia</i> ”   |
| EPS:       | earnings per share   |
| et. seq.:  | and the following, abbreviation for Latin “ <i>et sequens</i> ”  |
| et. seqq.: | and those that follow, abbreviation for Latin “ <i>et sequentia</i> ”  |
| etc.:      | and so forth, abbreviation for Latin “ <i>et cetera</i> ”  |
| EVCA:      | European Venture Capital and Private Equity Association  |
| FAZ:       | Frankfurter Allgemeine Zeitung   |
| ICB:       | Industry Classification Benchmark  |
| IPO:       | initial public offering  |
| M&A:       | merger and acquisition   |
| MB:        | market-to-book   |
| Mio:       | million  |
| MLP:       | master limited partnership   |
| NASDAQ:    | National Association of Securities Dealers Automated Quotations  |
| NEMAX:     | performance index of “Neuer Markt”   |
| NVCA:      | National Venture Capital Association   |
| OLS:       | ordinary least square  |
| PE:        | price-earnings   |

|      |                          |
|------|--------------------------|
| pp.: | Pages                    |
| R&D: | research and development |
| ROE: | return on equity         |
| SEO: | seasoned equity offering |
| S&P: | Standard and Poor        |
| USA: | United States of America |
| VC:  | venture capital          |
| VCs: | venture capitalists      |





# Introduction

The valuation of firms going public is a very complex topic and one often discussed in corporate finance literature. When firms decide to complete an initial public offering (IPO), to raise new equity by issuing shares on a public stock market, their shares have to be priced to allow potential investors to be found. The valuation of a private firm and its shares is quite difficult, because the stock market value, normally the best indicator of expected firm's growth and profitability in the eyes of investors, is not available. In almost every stock market across several countries the phenomenon of "underpricing" can be seen in the process of going public.<sup>1</sup> Share prices in the secondary market on or after the first day of trading are higher than the initial offering price. These shares are allocated to investors at considerably lower prices than could normally be attained.

This dissertation investigates the puzzle of IPO valuation and underpricing, focusing on the German stock exchange and newly-listed firms, in three chapters. Some explanations of initial returns after the first trading day of stocks have been theoretically explored and related empirical investigations have confirmed some theories and contradicted others. Previous research papers have mainly considered the USA stock market and have investigated several explanations based on the given market environment. The German stock exchange, however, can be described as less developed and less liquid than the USA's. The number of completed IPOs is considerably lower, because German firms rely less on the market for public equity and bank financing is generally very important. There has been a distinct historical development of the institutional environment in both countries. Although interesting differences in stock market and financing systems exist, recent literature about IPO underpricing does not include any direct comparison between offering prices in the USA and in Germany. The impact of institutional factors and the role of investment banks on the phenomenon of IPO underpricing are especially interesting to consider. Therefore, chapter I (Theory and Evidence of IPO Underpricing) of this dissertation focuses on the existing literature, to highlight differences or similarities in IPO underpricing. Overall, the existing theories and empirical findings do not allow consideration of one of these explanations in isolation, and therefore the effects of institutional environments are difficult to determine. Over time, some changes in the explanatory factors have been recognised. However, the empirical results for the German IPO market mainly consider the period of the Neuer Markt, which was the most important stock segment for small-

---

<sup>1</sup> Underpricing is measured as the difference between the shares' closing price after the first trading day and IPO offer price divided by the offer price.

and medium-sized companies during the dot-com phase of 1997 and 2001. These years were characterised by enormous stock price increases, especially in the technology and internet sectors. IPO volume increased exceptionally during these years and provided a large sample for empirical investigation into this research topic. Some literature suggests that those very high offer prices were even higher than the “true value” of the firms concerned, although prices of newly issued shares increased rapidly after the first day of trading. Germany saw average initial returns of 31% from 1997 to 2001. The market phases of high IPO volume as well as high underpricing, or rather initial returns, are described as “hot” market periods. A “cold” period with oppositional characteristics often follows, with saturated demand for new stocks. Also, in Germany, hardly any firm decided to complete an initial public offering after the bursting of the technology bubble. After 2004, the market started to recover and IPO volume increased again, although the enormous average levels of initial returns seen previously have not since been reached.

These market cycles make drawing a conclusion about the determinants of IPO underpricing even more difficult. The extreme differences in the market characteristics of the German stock exchanges have to be taken into account in investigating the decision to go public and the market value of a firm. Therefore, the empirical studies in this dissertation focus on both market phases, with a sample of IPOs from 1997-2007. This is the longest time period investigated with German data and offers the largest sample of IPOs, compared to previously finished papers related to the Neuer Markt and this research topic. Furthermore, chapter II (How Do Pre-IPO Shareholders Determine Underpricing?) investigates the pre-IPO ownership structure of firms in more detail. This requires the collection, by hand, of information from IPO prospectuses, something which has not previously been completed for an 11-year time period. The firm’s shareholder structure prior to the initial public offering is interesting to analyse, as several theories consider information asymmetries, monitoring requirements and agency conflicts between owners, as well as investment banks and potential investors, to influence the optimal offer price and the amount of “money left on the table” due to underpriced shares. German firms in particular are often held by only few shareholder groups prior to the IPO, compared to the USA, which enables reassessment of previous research results into different firm’s conditions. Furthermore, the analysis includes the implications of ownership structures in different market cycles and their effects on IPO underpricing, which further contributes to the existing research literature. The results confirm that, in the German market, the determinants of initial returns have changed over the time period investigated. Indications of different pre-IPO shareholders’ bargaining interests in terms of offering prices and underpricing are also confirmed, for the divergent market environments.

Although the empirical findings suggest a degree of willingness to leave money on the table, the offering prices of newly issued shares should reflect the firm's value. Investment banks, acting as underwriters in the IPO process, have to value the firm according to their characteristics, accounting information and expected profitability, and so determine approximate share prices. Chapter III, entitled "Do "Herding" Effects on Firm Multiples Determine IPO Valuation?" discusses this issue in more detail. The system of using comparable multiples (e.g. price-earnings ratios or market-to-book ratios) of firms already publicly traded in order to determine the expected market value of the IPO is investigated in particular detail. The German stock market during the period of the Neuer Markt showed severe variability of valuation, especially in particular industry segments. Here, the question of whether changes in IPO valuation can be explained by the corresponding development of public industry-related firms is analyzed. Herding effects on specific information and the neglect of firm characteristics are considered as possible explanations. However, the results indicate that the valuation of industry-related firms or their multiple ratios are minor explanatory factors. Overall stock market performance seems to be a more reasonable value driver for IPOs, especially in hot markets. Overall, the findings of this dissertation make major contributions to the research of IPO underpricing and valuation. Its focus on the German market and the environment of different market cycles in particular give further insights into this topic.