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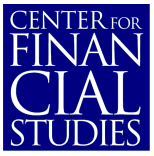

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Underpricing of Venture-Backed and Non Venture-Backed IPOs: Germany's Neuer Markt

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Abstract: This paper analyzes a comprehensive data set of 108 non venture-backed, 58 venture-backed and 33 bridge financed companies going public at Germany's Neuer Markt between March 1997 and March 2000. I examine whether these three types of issues differ with regard to issuer characteristics, balance sheet data or offering characteristics.

Moreover, this empirical study contributes to the underpricing literature by focusing on the complementary or rather competing role of venture capitalists and underwriters in certifying the quality of a company when going public. Companies backed by a prestigious venture capitalist and/or underwritten by a top bank are expected to show less underpricing at the initial public offering (IPO) due to a reduced ex-ante uncertainty. This study provides evidence to the contrary: VC-backed IPOs appear to be *more* underpriced than non VC-backed IPOs.

Keywords: Venture Capital, Underwriter, Initial Public Offering, Underpricing, Neuer Markt

JEL classification: G32

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1. Introduction

Venture capitalists are described as experts in the field of high-risk company funding (see for example FENN/LIANG/PROWSE (1997), SAHLMAN (1990) and LERNER (1995)). They not only specialize by concentrating on certain industry sectors and specific stages of a company's development, but also actively engage in monitoring and consulting activities. Since they often serve as members on the "Aufsichtsrat"[1] and frequently invest their capital linked to intermediate goals, they are able to influence the behavior and corporate strategy of the company under consideration. Their incentive to improve corporate governance is on the one hand due to the finite life of the partnership and - since their compensation is linked to the firm's performance - to the maximization of the exit price.[2] On the other hand, being repeat players who regularly have to raise new funds, venture capitalists face reputational risk. One would therefore expect that, much like prestigious underwriters or auditors, venture capitalists certify the quality of a company when going public.

Within the extensive underpricing literature some empirical studies examine whether the market honors the presumed monitoring-activities of venture capitalists. Since this control benefit may reduce the ex-ante uncertainty for future investors, it should lead to lower underpricing. Underpricing is defined as the spread between the initial offering price and the opening price on the first day of trading. However, empirical evidence is mixed. Among others, BARRY/MUSCARELLA/PEAVY/VETSUYPENS (1990) and MEGGINSON/WEISS (1991) confirm the certification role of venture capitalists for the US market. They find evidence for venture capital (VC)-backed IPOs suffering less underpricing than non VC-backed IPOs. On the other hand, FRANCIS/HASAN/HU (1999), who also analyze US data, find initial returns of venture-backed IPOs on average to be higher than those of non venture-backed IPOs.
LJUNGQVIST (1999) analyzes these contradicting results. Using the data set of MEGGINSON/ WEISS (1991), he demonstrates that the finding of venture-backed IPOs appearing less underpriced has to be attributed to the incentives of the old shareholders to reduce underpricing and not to the circumstance of venture-backing. Old shareholders will care for the pricing of an issue or for the choice of an underwriter to the extent that such decisions affect their wealth. LJUNGQVIST illustrates, that underpricing-induced wealth losses increase with the number of shares sold in the IPO. As a consequence companies selling a lot of old

[1] The „Aufsichtsrat" is similar to the supervisory board and plays an essential in corporate governance.
[2] When selling at the time of the initial public offering (IPO), this price is equivalent to the offer price.

shares should show little underpricing, due to the incentives of the old shareholders to reduce underpricing. It follows, that when testing hypotheses that make predictions concerning the consequences of venture-backing on underpricing, it is necessary to control for the incentives of old shareholders to influence underpricing.

This paper will deepen the discussion by analyzing a unique German data set of companies going public at Neuer Markt. The analysis of German data seems to be of particular interest as it provides additional evidence on the importance of venture capital in a bank-based financial system. Since the major banks act as lenders of IPO companies and/or as underwriters of an offering, they (might) play an essential (certification) role, too.[3] Moreover, since VC financing has only recently taken off as an important part of the financial services industry in Germany, only little empirical work is available to date. Hence, this paper has two objectives. First, enlarging the level of knowledge with respect to the economic consequences of venture capital financing in Germany. Second, comparing the results found with those of international studies.

The remainder of this paper is organized as follows: Section II summarizes the history of venture capital in Germany and its driving factors. Section III outlines the impact of the introduction of the Neuer Markt at Frankfurt Stock Exchange on the primary equity market in Germany. It also provides an analysis of the IPO-costs at the Neuer Markt. In section IV – based on the theoretical literature on underpricing and certification mechanisms – the testable hypotheses are formulated. Section V describes the data set and the design of the empirical analysis. In sections VI and VII descriptive statistics and the empirical results are presented. The paper concludes with a summary and an outlook in section VIII.

2. Venture Capital Financing in Germany

The definition of the notion "venture capital" is non-uniform[4]. In the American understanding, "venture capital" stands primarily for early-stage financing. In Germany, "venture capital" is more comprehensive, since it contains not only early-stage capital (such as seed and start-up financing) but also later-stage capital (such as expansion-, bridge-, buy

[3] Due to the narrow underwriting market until lately, only two empirical studies exist analyzing the certification role of underwriters in Germany (see WASSERFALLEN/WITTLEDER (1994) and KASERER/KEMPF (1995)).

[4] For a deeper discussion see e.g. STEDLER (1986), BETSCH/GROH/SCHMIDT (2000) and BALZER (2000).

out-, and turnaround-financing).[5] While the former types of investments are crucial for the development and implementation of business ideas by young growth companies, the latter types of investments are important for capital structure reasons of more mature, small to medium-sized companies. To be aware of venture capital's different meanings is important when interpreting (German) figures and in particular when comparing empirical results of various international studies.

VC financing in Germany has been insignificant and underdeveloped until recently.[6] The literature analyzing the manifold reasons, discusses in particular the social environment (e.g., status of entrepreneurs, the relationship of academia and trade and industry), legal and tax regulations and the exit conditions for venture capitalists (see e.g. LEOPOLD/FROMMANN (1998), BECKER/HELLMANN (2000) and BETSCH/GROH/SCHMIDT (2000)).

Searching for the roots of the current German venture capital industry one has to go back to the year 1965, when the first "Kapitalbeteiligungsgesellschaften" (KBGs) were founded, most of them by banks.[7] The success of KBGs was modest, the number of investments, primarily in established medium-sized companies was small.[8]

With the launch of the European Recovery Program (ERP-Program) initiated by the German government in 1971 the investment focus was extended to small- to medium sized companies and business foundations. Content of the program was (and still is) to refinance such investments at a preferential interest rate and to insure against losses that might occur.[9] Since the existing KBGs made only little use of this form of refinancing, the German states started to support the establishment of "Mittelständische Beteiligungsgesellschaften" (MBGs). Primarily MBGs had the task to improve the equity capital base of local companies by investing the financial means offered by the ERP-program. Even though publicly subsidized equity for investment purposes became relatively more important, the major part (amounting to 70% of the total volume) was more or less exclusively provided by banks. In total, the

[5] This broader expression is comparable to the American understanding of private equity.

[6] The historical overview presented here follows the description of LESSAT ET AL. (1999).

[7] To compare, in England going back to the initiative of the Bank of England and with the cooperation of major banks the Industrial and Commercial Finance Corporation Ltd. (ICFC), today known as 3i was established in 1945. On the other hand in the United States the first professional venture capital company named "American Research and Development Corporation" (ARD) was founded in 1949.

[8] According to LEOPOLD/FROMMANN (1998) 33 KBGs have been founded between 1965 and 1972. Even though 20 of these do still exist, only 2 have some importance within the VC-industry today.

[9] Such programs are carried out by the "Kreditanstalt für Wiederaufbau" and the "Deutsche Ausgleichsbank". The internet page of the FEDERAL MINISTRY OF ECONOMICS AND TECHNOLOGY offers further information: http://www.bmwi.de/

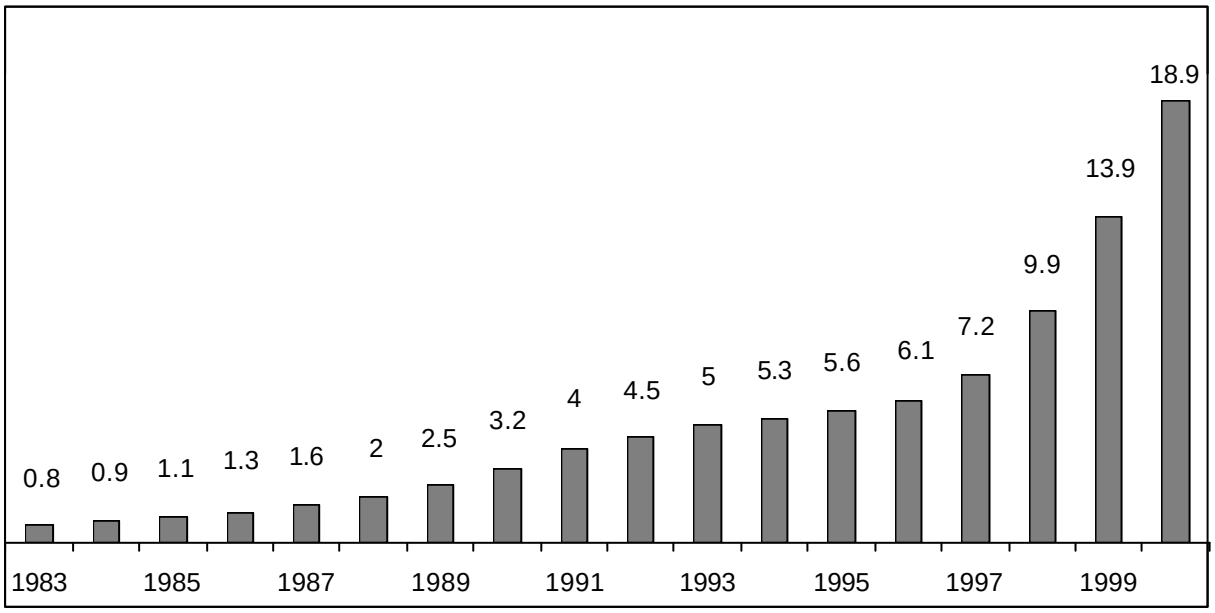
venture capital market developed only little. The level of the invested volume was rather low, amounting to approximately DM 0,56 billion by the end of 1979.

After all, in 1983 the German VC industry started to expand. German equity investment companies copying the sucessful setup of American venture capitalists were founded. MBGs, which had to experience little deal flow during the seventies, became reactivated. Banks and industrial companies expanded their involvement, e.g., by founding affiliated VC companies.

With the beginning of the nineties, the time of the German reunification, the importance of early-stage financing grew and the number of newly established businesses[10] increased. Venture capitalists started to specialize, e.g., on early-stage or buy-out financing. Moreover the government extended its program, offering financial support[11].

Until 1996, a continuous, almost linear growth of the VC industry could be observed, followed by a period of exponential growth that lasts to this day. [12, 13]

Figure 1: Total Portfolio Held by Members of the Bundesverband Deutscher Kapitalbeteiligungsgesellschaften e.V. (BVK) (in DM Billion)[14]



[10] In the appendix figure A.1 presents estimations of the INSTITUT FÜR MITTELSTANDSFORSCHUNG (IFM) about business foundations since 1975 in Germany.

[11] To be mentioned are programs of the "Deutsche Ausgleichsbank" and the "Kreditanstalt für Wiederaufbau", such as the „Beteiligungskapital für junge Technologieunternehmen" (BJTU) or the „Beteiligungsprogramm für kleine Technologieunternehmen" (BTU), respectively.

[12] Figures containing data of the members of the BVK account to (according to BVK) 90% of the volume of the German VC market.

[13] For the development of gross investments and disposals of BVK members see figure A.2. in the appendix.

[14] For the year 2000 the result is preliminary.

This recent development can mainly be attributed to the increasing liquidity of investors, the foundation of new VC companies, the rising public interest and in addition, following HEILMANN (2000), to the considerable number of foreign venture capitalists entering the German market.

The increase would have been impossible without a fundamental change in Germany's funding and investment environment. Accompanied by regulatory changes[15] and an upswing in the German equity culture[16], the launch of the Neuer Markt in March 1997, offering a further exit mechanism for venture capitalists, has to be seen as most stimulating for the German venture capital industry.[17] Compared to other strategies, exiting a VC investment by the means of an IPO is attractive as it usually results in the highest valuation of a company. Furthermore, it is crucial for the design of the contracts between entrepreneur and venture capitalist and therewith the corporate control.[18]

Table 1 describes volume and percentage of various exit vehicles. The table shows a relation between the introduction of Neuer Markt and the increasing importance of IPOs for venture capitalists in Germany since 1998.

Table 1: Volume and Percentage of Exit Vehicle

	1995		1996		1997		1998		1999	
	DM mio.	%	DM mio.	%	DM mio.	%	DM mio.	%	DM mio.	%
IPO	58.00	9.8	47.43	8.9	38.70	3.8	148.00	19.7	290.06	19.1
Buy back	152.73	25.7	300.85	56.8	325.96	32.3	319.10	42.4	312.81	20.6
Trade sale	246.61	41.5	161.67	30.5	540.64	53.6	241.66	32.1	385.38	25.4
Other[19]	136.82	23.0	20.10	3.8	103.20	10.2	43.38	5.8	531.26	35.0
Total	594.16	100.0	530.05	100.0	1,008.50	100.0	752.14	100.0	1,519.51	100.0

[15] Amendment of the "Gesetz für Unternehmensbeteiligungsgesellschaften" (UBGG) within the changes of the 3rd „Finanzmarktförderungsgesetz".

[16] According to a survey of the magazine DIE BANK (2000), Germany is more and more establishing an equity culture, since the circle of investors in stocks (equity funds) has risen from 13% (9%) in 1996 to 22% (28%) in 1999 in Germany. Moreover the DAI-FACTBOOK (2000) of the "Deutsches Aktieninstitut" (DAI) shows that stocks constitute about 13% (8%) of the financial assets of private households in 2000 (1996).

[17] According to BECKER/HELLMANN (2000), the launch of the "Geregelter Markt" in 1987 had almost no effect on the venture capital industry.

[18] For a detailed discussion see e.g. JENG/WELLS (1998) and BLACK/GILSON (1998).

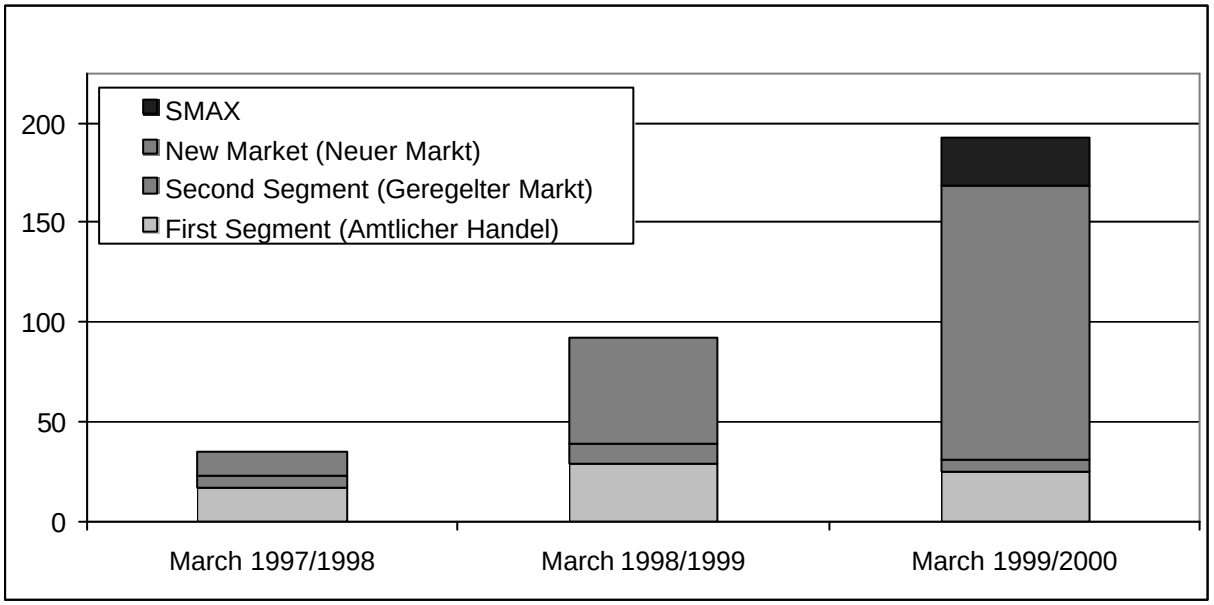
[19] The classification "Other" in 1999 contains, among other things, selling to a financial investor or divestment through write-off (see BVK yearbook 2000).

Therefore, a closer examination of this market segment seems worthwhile, as it covers on average about 53% of public offerings backed by venture capital since 1998.[20]

3. Germany's Neuer Markt and the Costs of Raising Capital

The Neuer Markt is Germany's trading segment for innovative growth companies. It was launched in March 1997 as a subsidiary of the Deutsche Börse AG, with the objective to attract small- to medium-sized, young technology firms. As figure 2 indicates, the number of companies that have gone public in Germany or rather on the New Market has increased dramatically, since 1997.

Figure 2.: New Issues in Germany[21] (in DM million)
During the Period March 10, 1997 to March 10, 2000



From March 1997 through March 2000, over 200 companies went public on the Neuer Markt, while at the same time new listings at the first and second segment stayed close to their previous levels. In total about 320 new listings were recorded for that period.[22]

[20] The remaining 47% can be split into IPOs on other German stock markets (20%) and listings on foreign stock exchanges (27%) such as the NASDAQ.
Beyond that there is evidence for the international acceptance of this market as it is more and more chosen as exit mechanism by foreign venture capital funds (7 Ö/3 CH/3 USA-C/2 Isr/2 UK during the period March 1997 to March 2000).

[21] On the SMAX (Small Cap Exchange) - introduced in April 1999 - second market stocks are traded. The listing requirements of the SMAX follow - apart from small modifications - those of the Neuer Markt.

[22] According to JOHNSON (2000), from 1949 through 1996 a total of only 356 companies went public in Germany.

In order to provide investors with information about the quality of these IPO candidates, the Neuer Markt set up much stricter listing and disclosure requirements than the established exchanges. JOHNSON (2000) describes and compares the standards in Germany (all markets of the Frankfurt Stock Exchange) and the United States (NYSE, NASDAQ) in detail.[23] He states that more rigid rules of disclosure on Neuer Markt have an effect both on the number and on the nature of companies that go public.[24]

What is remarkable about the "how to go public" at the Neuer Markt is that from March 1997 to March 2000 all but one company (TRIUS AG)[25] chose book-building to price the shares.[26] Although during the observation period two out of three issues were oversubscribed[27], the final issue price was always fixed within the book-building range[28] and never above; merely twice[29] it remained under the minimum price limit. Following LJUNGQVIST/JENKINSON (2000), the reluctance to price outside the range is distinct in Germany compared to international practice. The major potential benefit of book-building, to raise the price, if demand is unexpectedly high, seems hardly be exhausted.[30] This is worth mentioning as the pricing has influence on the costs of going public.

In order to analyze the issuing costs for companies at Neuer Markt in more detail, one can distinguish between direct and indirect costs, as listed in table 2.[31]
The direct costs contain for example auditing and consulting fees, underwriting fees, marketing costs, or fees raised by the Frankfurt Stock Exchange for the admission to the first

[23] For an assessment, whether the high listing and information demands of the Neuer Markt lead to the desired increased transparency and improved liquidity, thus providing confidence to investors, see e.g. LEUZ (2000), GERKE/BOSCH (2000) and THEISSEN (1998).
[24] He underpins his view by the significant increase in IPOs and the high number of small, young companies that went public at Neuer Markt. However, more rigid disclosure rules might be one reason for the increase of IPOs, but other explanations are manifold. Just to mention some: The IT-revolution, the high number of newly founded companies since the German reunification, the simultaneous decline of margins at the bank lending business and the growing popularity of investment banking.
[25] Trius AG went public by using a tender procedure, selling the stocks via an auction.
[26] Until 1995 it was common to use the fixed-price method in Germany. One of the main imperfections of this method in comparison to book-building is, that underwriting banks have a vital interest to set up a low offer price: Since they do not receive any information concerning demand (e.g. through bids by institutional and retail investors) before the price fixing, they have more to care for the placement risk.
[27] This is in the interest of the management as an oversubscription of the offering enables the management to take more influence on the allotment (see among others BRENNAN/FRANKS (1997)).
[28] 80,4% of the IPOs of the sample have been fixed exactly at the upper price limit.
[29] These companies have been MSH International Services AG (book-building range/issuing price: EUR 18.50-21.50/EUR 15.50) and Euromed AG (EUR 10.50-13.50/EUR 9.00).
[30] LJUNGQVIST/JENKINSON (2000) merely conject that local regulations, the costs caused by price revisions or the market power of domestic investors could serve as explanations for the unwillingness to raise the price.
[31] For a cross-sectional analysis of the costs of raising capital in Germany, see: KASERER/KRAFT (2000).

segment, for the filing of the prospectus and for services provided by Deutsche Börse AG.[32] The numbers quoted here are calculated from information indicated in the issuing prospectuses of the companies under consideration. During the period of March 1997 through March 2000, companies going public on the Neuer Markt had to bear on average total direct flotation costs of 7.90% of gross proceeds. As part of these costs the average underwriting fee amounted to 4.79% of gross proceeds, respectively.

The indirect costs in the form of underpricing[33] average 63.37%. In other words, the average issuing company could have raised about EURO 29 million more, if the first market price would have been in correspondence with the offering price.

Table 2.: Costs of Going Public at Neuer Markt (March 1997 - March 2000)

„Money left on the table" is calculated by multiplying the total volume of issues with the initial return or rather the underpricing, which is the spread between the opening price at the first day of trading and the initial offering price. Dividing the direct flotation costs by the gross proceeds of an issue, one receives the relative direct costs. The relative underwriting fee is defined as the underwriting fee paid at IPO normalized by the gross proceeds of the issue.

In EURO thousand respectively %	Mean	Median	Std.Dev.	Min.	Max.	Obs[34].
Direct flotation costs	3,427	2,594	2,495	562	14,640	176
Underwriting fees	2,209	1,700	1,786	225	11,600	168
Indirect costs: Money left on the table	28,991	9,180	47,415	-10,800	356,250	199
Gross issue proceeds	48,767	36,500	42,836	8,278	283,650	199
Relative direct costs	7.90%	7.21%	2.75%	0.39%	17.11%	176
Relative underwriting fees	4.79%	4.77%	1.34%	0.78%	9.78%	168
Initial return	63.37%	30.43%	82.18%	-14.50%	433.33%	199[35]

[32] Strictly speaking the value of the greenshoe-option has to be added to these costs. To stabilize the stock price following the IPO, the issuer grants the underwriter the option to sell additional shares at the issue price and trade them for a time period of thirty days, if necessary. According to OCHNER (2000), underwriters do almost constantly retain the earnings gained by selling additional shares at the issue price (or eventually a higher secondary market price) and purchase them back as soon as the price of the shares falls below the issue price. This "gift" of the issuer to the underwriter can be explained by the high number of issues, which shifts the bargaining power to the underwriter.

[33] Underpricing is equivalent to a positive initial return, as the first market price exceeds the offer price.

[34] These are the observations of the sample used for the analysis in section five, The number of observation is varying, since some issuing prospects offered only aggregated information.

[35] 13 of the 199 observations are overpriced as indicated by the negative initial return. 17 observations have an initial return of 0.00%.

Compared to the degree of underpricing on the German IPO market earlier studies[36] report, the extent of underpricing at Neuer Markt seems to be remarkably high. This might be in line with the finding of STEHLE/ERHARDT (1999), that small, relatively unknown companies have high initial returns.

4. Related Literature and Hypotheses

The theoretical literature on underpricing (for an extensive overview, see JENKINSON/ LJUNGQVIST (1998)) can be divided into two main categories.
There is theoretical work which focuses on asymmetric information within the group of investors, between issuer and underwriter and between issuer and investors. Secondly, there are institutional explanations that try to attribute the existence of underpricing to factors such as price support by the underwriting bank, liability regarding the statements made in the issuing prospectus or aspects of corporate ownership and control.

This paper focuses on theories based on asymmetric information *between issuer and investors*. Within this branch different methods are discussed in order to reduce this "market imperfection". Signaling models e.g. by ALLEN/FAULHABER (1989), GRINBLATT/HWANG (1989) or WELCH (1989) suggest that from the level of underpricing investors can draw conclusions about the quality of the issuing companies.[37] CARTER/MANASTER (1990) and BOOTH/SMITH (1986) however emphasize the signaling and certification-of-quality role fulfilled by prestigious underwriters, the like goes for auditors and venture capitalists. In the following I will concentrate on the latter explanatory approach.

The certification mechanism works according to the subsequent principle: Given that outside investors believe in the information advantage of a third party (underwriter or venture capitalist), this party is able to certify the quality of a company going public if it has reputational capital at stake, "which must be greater than the largest possible one-time wealth transfer or side payment which could be obtained by certifying falsely. Furthermore it must be

[36] See for example ERHARDT (1997), LJUNGQVIST (1997), KASERER/KEMPF (1995) or WASSERFALLEN/ WITTLEDER (1994). A recent study by LÖFFLER (2000) on the Neuer Markt offers comparable numbers.

[37] The authors hypothesis is, that given companies plan to carry out a seasoned equity offering, a separating equilibrium of high- and low-value firms exists, permitting high-value firms to costly signal their quality by underpricing. JENKINSON/LJUNGQVIST (1989) criticize, that the whole mechanism of the models using the level of underpricing as signal depends on a two-stage selling decision, which has to preclude shareholder's pre-emptive rights to seasoned offerings of primary equity, in order to recoup the costs of the signal.

costly for the issuing firm to purchase the service of the certifying agent." (MEGGINSON/WEISS (1991, p.881))

Underwriters and venture capitalists should be able to carry out the role of a certifying authority, as they often have insider information, for instance about the company's financial situation or the quality of management. The underwriting bank's information results from the involvement in due diligence activities and a potential lending relationship[38] prior to the IPO. Their incentive to examine the quality of the firm in detail goes back to their liability extending to statements made in the issuing prospectus.[39]

Since venture capitalists belong to the actively engaged group of owners, they have profound knowledge about the company's history, management, financial situation and so on. Moreover they involve themselves merely out of self-interest, due to the circumstance that their compensation is linked to the partnership's performance.

Both parties have reputational capital at stake as their future success is closely linked to their current reputation. The better the reputation, the easier the attention of trading partners can be caught: Underwriters regularly have to attract issuers and venture capitalists frequently have to raise new funds.

One can therefore conclude that the involvement of a prestigious underwriter or venture capitalist should certify and credibly signal the quality of the issuing company to the market. I thus assume that it should pay to hire a prestigious intermediary, as it leads to a higher offer price, which in turn implies lower underpricing.

Going back to ROCK (1986), CARTER/MANASTER (1990) and BOOTH/SMITH (1986) the following hypotheses are formulated:

1. The higher the ex ante uncertainty concerning the issue, the higher the expected underpricing.
2. The more prestigious the underwriter (*UWrank*) involved in the IPO, the lower the underpricing.

3a. The more prestigious the venture capitalist backing the company before the IPO (*VCrank*), the lower the underpricing.

[38] For an extensive discussion of the characteristics of relationship lending in Germany see ELSAS (2001).

[39] It has to be mentioned that this liability can lead to a considerable litigation and thus lawsuit risk. Therefore a competitive approach e.g. by TINIC (1988) suggests, that intentional underpricing may serve as an insurance against such securities litigation. For counterarguments see ALEXANDER (1993).

Because the incentive to engage in the venture-backed company and thus the informative value of the signal "backed by a prestigious venture capitalist" depends in particular on the venture capitalist's equity holdings prior to the IPO[40], hypothesis 3a should be narrowed down:

3b. The more prestigious the venture capitalist and the bigger the venture capitalist's equity holdings of the issuer prior to the going public (*VCholding*), the lower the underpricing.

Following LJUNGQVIST (1999) and BARRY (1989) a focus on underpricing alone possibly misleads: Underpricing per se is uninformative when not controlling for the former shareholders' incentives to influence underpricing. Figuratively spoken, entrepreneurs and venture capitalists will not care for the wealth loss occurring through underpricing when selling a single share, but they will care the higher their participation in the offering, i.e. the more shares they sell at the IPO.[41] HABIB/LJUNGQVIST (1998) extend this idea[42] by assuming that the wealth loss of former shareholders at the IPO is a function of a) underpricing, when selling old shares, b) dilution of the value of retained shares[43] and c) costs arising in connection with activities that reduce underpricing and wealth losses, such as extensive marketing efforts prior to the IPO or the hiring of IPO experts.

But this leads to an endogenous relation between the costs and underpricing. Since only aggregated figures of costs are available in most of the issuing prospectuses, the driving factors of these costs and with that their effect on underpricing are unclear. Therefore I dispense with costs as an explanatory variable and estimate a reduced form.

Finally hypothesis 4 is introduced:

4. The higher the participation ratio (*partratio*) of former shareholders (e.g. venture capitalists or managers, respectively) the lower the underpricing.

In line with LJUNGQVIST (1999) the dilution factor is taken into account, as well, when running the regressions. However, the predicted sign of this parameter is unclear.

[40] This is in line with earlier findings of BARRY/MUSCARELLA/PEAVY/VETSUYPENS (1990).

[41] The participation ratio (*partratio*) is calculated dividing the number of old shares sold by the number of shares outstanding before flotation.

[42] In the appendix I present the underlying model by BARRY (1989) and the extension by HABIB/LJUNGQVIST (1998).

[43] The dilution factor (*dilution*) is determined dividing the number of new shares by the number of shares outstanding before flotation.

Holding risk, dilution and participation constant and controlling for the quality of an underwriter I now should be able to analyze, whether venture capitalists are able to certify the quality of a company when going public.

5. Data Set and Design of Analysis

In total the collected data set contains 225 IPOs. Each of these companies were listed for the first time during the period of March 10th, 1997 to March 10th, 2000 on the Neuer Markt. The employed sample (comprising 199 IPOs) does not contain those 22 companies that merely changed the market tier or had already been listed at a foreign stock exchange before going public at Neuer Markt.[44] In addition, four companies, three of them from the financial services industry, have been excluded, each with extremely high values for balance sheet data or volume of issue.[45]

Given the differences in the definition of venture capital in the US and Germany, I establish comparability of the empirical studies by dividing the Neuer Markt data set into three groups: 108 non venture-backed IPOs (54.27%), 58 venture-backed IPOs (29.15%) and 33 companies (16.58%)[46], that merely received bridge financing by investors. As the latter investors typically have not invested seed, start-up and expansion capital next to bridge financing and therefore engage themselves at a rather late stage of the development of an IPO company, the division made can be justified by the assumption that monitoring activities and thus the insider knowledge of these investors is of lower quality and thus of less worth with respect to their certification ability.[47]

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[44] The following 22 companies have therefore been excluded: BB Biotech, BB Medtech AG, Bertrandt AG, Broad Vision Inc., COPE Inc., COR AG Insurance Technologies, Dialog Semiconductor Plc., DICOM Group, ebookers.com Plc., Fortec Electronik Vertriebs AG, GfN AG, integra S.A., LHS Group Inc., Lobster Technology Holding AG, Micronas Semiconductor Holding AG, Mühl Product & Services AG, Pankl Racing Systems AG, Pfeiffer Vacuum Technology AG, Quiagen N.V., TEAM Communications Group Inc. and TIPTEL AG.

[45] These companies are ConSors Discount Broker, Direkt Anlage Bank AG, Entrium Direct Bankers AG and Carrier 1 International S.A..

[46] The sum of companies in the VC- and bridge financed group is lower than the number of venture-backed IPOs indicated by Deutsche Börse AG. The reason for this is that some of the backed IPOs have received equity as indicated by Deutsche Börse AG, which can neither be called venture capital nor private equity (including bridge financing), but was offered by investment companies, e.g. by DEKA mbH., Rothschild Asset Management Ltd. or Invesco, without a selling intent. These IPOs have not been considered as backed IPOs.

[47] In order to find support for this assumption the monitoring skills of venture capitalists in comparison to those of bridge financiers are examined in more detail using proxies such as: the fraction of the issuing firm's shares owned by the venture capitalist / bridge financier or the length of time that a venture capitalist / bridge financier has served on the supervisory board, see table 4.

In the descriptive study I therefore separately compare the venture-backed group and the sub sample of companies that received bridge financing to the non-venture backed group.[48] Because of the focus on venture capitalists and their certification role, I concentrate on the venture and non venture-backed sub samples when testing the hypotheses.[49]

Detailed information was collected from the issuing prospectus for each IPO on the total volume of issues, the issuing procedure, the offering expenses, the number of shares outstanding, the age of the company, the number of employees, the ownership structure, who is members of the "Aufsichtsrat", the identity of invested venture capitalists or rather private equity companies and underwriters, and data of the financial statements.
Additionally, further information was obtained through the media such as the first day of trading, the book-building spread, the initial offering price and the closing day bid price for the first day and 20 days after the IPO and information on the over-allotment option exercise (greenshoe).
To clearly identify the VC-firms and private equity companies and their age, internet pages and company reports (if available), as well as the list of the full members of Bundesverband Deutscher Kapitalbeteiligungsgesellschaften – German Venture Capital Association e.V. (BVK) and the European Venture Capital Association (EVCA) were used.
For the construction of the underwriter's ranking the information needed on lead management at all Frankfurt stock market segments since 1990 was provided by Deutsche Börse AG.

A total of 86 different underwriters (48 different *lead* underwriters) have been involved in IPOs at Frankfurt stock exchange from March 1997 to March 2000.[50] Because of the changing or rather increasing issuing activity during that time period I construct a ranking for each year[51]. That is because the ranking of an underwriter can change over time. The data of banks that merge during the investigation period (such as Bankhaus Gontard and Metallbank or Bayerische Vereinsbank and Bayerische Hypotheken- und Wechselbank) are aggregated in

[48] For the results of the tests (for equality of means (t-test) and equality of median (Mann-Whitney) see table 3, 4 and table 6.
[49] But the results do not change qualitatively when treating the 33 bridge financed companies as non venture-backed companies, thus enlarging the data base to be analyzed.
[50] WASSERFALLEN/WITTLEDER (1994) stress the dominant role of Deutsche Bank in the underwriter market during the time period 1961 to 1987, since Deutsche Bank has functioned as lead manager for slightly less than half of the issues. This has changed during the time period 1990 to 2000. Although Deutsche Bank still belongs to the top issuers, their supremacy in underwriting has relatively been decreasing.
[51] Table A.2. presents the twelve best ranked underwriters serving as lead underwriter at Neuer Markt during the time period 1997 – 2000.

order to avoid major changes in the ranking. However, changes in ranking are desired in case of a relative increase of the issuing activity or a relative increase of the underwritten volume of issues. The parent population is divided into five ranking categories and condensed to a dummy in the regressions.[52] In detail, the rankings of the years 1998, 1999 and 2000 are constructed using equally the track record of each underwriter as gauged by the relative share of lead management at all Frankfurt stock market segments since 1990[53] and the relative volume of launched issues at Neuer Markt [54] as reported on December 31st of the precedent year. Due to the lack of a track record of the relative volume of launched issues at Neuer Markt for the year 1997, the ranking of 1997 is solely based on each bank's relative share of lead management at all Frankfurt stock market segments since 1990.

However the (one) ranking that represents the quality of the venture capitalists and private equity companies is mainly based on the age of the company. VC and private equity companies founded before 1980 receive a very good ranking (equivalent to 1), companies founded before 1995 and after 1980 receive a mediate ranking (equivalent to 2). Companies founded after 1995 get the lowest ranking (equivalent to 3). For some companies it was impossible to find information regarding their age. In these cases the assumption of little prestige resulting in a low ranking (equivalent to 3) seems to be reasonable. The motive for solely using the age as proxy for reputation is that in general there is a lack of a past performance. This fact is reflected in a total of 112 venture funds/companies or private equity companies backing 91 IPO firms: 75 of these (66.96%) back only one IPO firm, 32 (28.57%) back between 2 and 5, and only 5 (4.46%) back more than 5, up to 10 IPOs during the time period March 1997 – March 2000. Thus only in two cases[55] a relative high backing activity during the period under consideration leads to an upgrade in ranking. In analogy to the

[52] The dummy has the value one in case the underwriter's ranking is very good; in any other case (1.5, 2, 2.5 or 3) the dummy is equivalent to zero. From 199 IPO companies under consideration, 108 have been underwritten by a prestigious lead underwriter ranked very good.

[53] The relative share of lead management at all Frankfurt stock market segments for each year is calculated by cumulating the number of lead management for each bank since 1990 and dividing this number by the cumulated number of IPOs that took place since 1990.

[54] In order to calculate the relative volume of issues at Neuer Markt for each bank I cumulate the volume of issues each bank has underwritten (as lead- or co-underwriter) since 1997 and divide it by the total volume of issues of all IPOs at Neuer Markt since 1997.

[55] These financial intermediaries have been Commerz Unternehmensbeteiligungs AG and Gold Zack AG.

underwriters' ranking, the information concerning the quality of the lead venture capitalist is condensed to a dummy when in the regressions.[56]

In line with LJUNGQVIST (1999), the venture capitalist with the biggest stake (which usually corresponds with the longest investment horizon within the portfolio company) is defined as the lead venture capitalist. 54 of the 112 venture funds/companies or private equity companies act as lead financier, whereas the remaining 58 merely engage themselves within a syndicate.

[56] The dummy is equal to unity if the financier's ranking is very good (this is the case in about one third of the 58 venture-backed IPOs or rather 33 IPOs backed by bridge financing); in any other case (2 or 3) the dummy is equivalent to zero (see table 4).

6. Descriptive Statistics

Table 3.: Issuer and Offering Characteristics and Costs of Venture-Backed respectively Bridge Financed Companies to Non Venture-Backed Companies Listed at Neuer Markt.

The data set consists of 108 non venture-backed IPOs (*NVC*), 58 venture-backed IPOs (VC) and 33 companies (BF) that received bridge financing. The participation ratio (e.g., of the manager) is calculated by dividing the number of old shares sold (by the manager) by the (manager's) number of shares outstanding before flotation. Underpricing is measured as the spread between the initial offering price and the opening price at the first day of trading. NEMAX is the stock market index of Neuer Markt at Frankfurt stock exchange. The test for differences in means is a standard *t*-test, allowing for unequal variance. The test for differences in medians is the Mann-Whitney test. One, two and three asterisks indicate significance at the 10%, 5% and 1% level, respectively.

		Obs.	Mean	Value	*p*-value	Median	Value	*p*-value
Employees	*NVC*	*108*	*250*			*117*		
	VC	58	220	0.556	0.5788	110	0.168	0.8669
	BF	32	197	0.755	0.4514	115	0.883	0.3771
Age of company	*NVC*	*108*	*11*			*9*		
	VC	58	10	0.934	0.3516	7	1.224	0.2208
	BF	33	10	0.607	0.5449	9	0.399	0.6897
Balance sheet total,	*NVC*	*108*	*51,566*			*24.220*		
in thousand DM	VC	58	61,249	0.588	0.5577	22.567	0.164	0.8695
	BF	32	27,229	1.939*	0.0545*	16.206	1.844*	0.0652*
EBIT in thousand DM	*NVC*	*108*	*51*			*18*		
per employee	VC	58	-12	3.092***	0.0023***	-3	3.724***	0.0002***
	BF	32	5	1.816*	0.0716*	8	2.156**	0.0311**
Sales revenues	*NVC*	*108*	*525*			*211*		
in thousand DM	VC	58	266	2.190**	0.0299**	208	0.979	0.3277
per employee	BF	32	323	1.259	0.2101	193	0.794	0.4272
Growth rate	*NVC*	*88*	*70.86*			*44.21*		
of sales revenues,	VC	47	86.96	0.562	0.5750	25.10	0.654	0.5134
in %	BF	26	80.39	0.306	0.7602	54.65	0.314	0.7535
Total volume	*NVC*	*108*	*1,962*			*1,451*		
of issues,	VC	58	2,519	1.801*	0.0735*	1,870	2.278**	0.0227**
in thousand	BF	33	1,939	0.065	0.9484	1,600	0.355	0.7222
Old stocks sold in %	*NVC*	*108*	*16.35*			*10.22*		
of total volume	VC	58	22.33	1.935*	0.0547*	23.04	1.854*	0.0637*
of issues	BF	33	19.99	1.025	0.3071	22.12	1.405	0.1601
Participation old	*NVC*	*108*	*0.0600*			*0.0357*		
Stockholders	VC	58	0.1166	3.832***	0.002***	0.0829	2.811***	0.0049***
	BF	33	0.0762	1.168	0.2446	0.0732	1.449	0.1474
Participation	*NVC*	*108*	*0.0681*			*0.0451*		
Managers	VC	58	0.0559	0.843	0.4007	0.0000	2.330**	0.0198**
	BF	33	0.0333	2.477**	0.0145**	0.0117	2.849***	0.0044***
Underpricing in %	*NVC*	*108*	*61.18*			*26.46*		
	VC	58	64.63	0.251	0.8025	32.00	0.539	0.5902
	BF	33	68.34	0.428	0.6690	38.86	1.152	0.2495
20 day log return of	*NVC*	*108*	*5.72*			*2.95*		
NEMAX before IPO	VC	57	6.37	0.261	0.7942	1.48	0.183	0.8545
in **%**	BF	33	4.86	0.289	0.7727	-0.18	0.735	0.4622

In terms of *issuer characteristics*, venture-backed companies differ most from non-venture backed with regard to EBIT and sales revenues in thousand DM per employee. Both ratios are on average significantly smaller: -12 versus 51 and 266 versus 525. Given no significant differences in the number of employees, in age, balance sheet total and in growth rates of sales revenues, there seems to be evidence that these otherwise comparable IPO companies are less profitable and less strong at selling when going public. This is remarkable.

At the first glance the findings concerning *offerings characteristics* are in line with the results of LJUNGQVIST (1999). Venture-backed IPOs show a significantly higher volume of issues compared to non venture-backed IPOs. In particular venture-backed companies sell more old shares when going public. This is reflected by an average of 22.33% versus 16.35% of secondary sales of the total volume issued, and by an on average higher participation ratio of old stockholders (11.66% versus 6%). But – and that might have a reversal effect to venture-backers being more concerned with pricing – the median participation ratio of managers in venture-backed IPOs is zero and thus lower. To keep an eye on that and to differentiate between different groups of former stockholders, such as venture capitalists, managers and underwriters owning shares of the issuing company before the IPO seems to be worthwhile when running the regressions.[57]

Furthermore, the univariate analysis shows that venture-backed companies do not seem to be less underpriced compared to non venture-backed (see table 4).

Before turning to the empirical results I will briefly highlight some further characteristics of venture-backed companies that distinguish them from those which received bridge financing and justifies the three categories made: On average about 57% of the VC-backed companies have been financed by a syndicate before the IPO[58], whereas issuing companies that received bridge financing dealt with more than one bridge financier only in one out of three cases (not reported).

Compared to the stake of the lead venture capitalist that of the lead bridge financier is on average significantly higher before (26.48% versus 11.97%) and also after the IPO (14.47% versus 6.61%)[59]. This fact is all the more true for the average stake of the syndicate of venture

[57] These groups do overlap as venture capitalists sometimes belong to the management.

[58] On average a venture-backed company is financed by three, on maximum by nine different venture firms/funds.

[59] The numbers are much higher compared to those stated by BARRY/MUSCARELLA/PEAVY/VETSUYPENS (1990) or HAMAO/PACKER/RITTER (2000).

capitalists compared to the stake of the group of bridge financiers (before the IPO 40.48% versus 13.63%; after the IPO 22.39% versus 7.87%). In addition this means, that both groups of financial intermediaries sell on average 25% of their pre-IPO stake at the IPO which seems to be much higher than in the United States.[60]

Table 4.: Characteristics of Financial Intermediaries and Offering Characteristics of Venture-Backed and Bridge Financed IPO Companies at Neuer Markt.

The data set consists of 58 venture-backed IPOs (VC) and 33 companies (BF) that received bridge financing. The participation ratio (e.g., of the lead venture capitalist or bridge financier, respectively) is calculated by dividing the number of old shares sold (by the lead venture capitalist or bridge financier, respectively) by the (lead venture capitalist's and bridge financier's respectively) number of shares outstanding before flotation. The test for differences in means is a standard *t*-test, that allows differences in variance. The test for differences in medians is the Mann-Whitney test. One, two and three asterisks indicate significance at the 10%, 5% and 1% levels, respectively.

		Obs.	Mean	Value	*p*-value	Median	Value	*p*-value
Number of venture capitalists or bridge financiers forming a Syndicate	VC	58	2.60	3.495***	0.0007***	2.00	2.964***	0.0030**
	BF	33	1.36			1.00		
Stake of lead venture capitalist/ lead bridge financier before IPO, in %	VC	57	26.48	3.839***	0.0002***	20.00	3.755***	0.0002***
	BF	33	11.97			13.47		
Stake of venture capitalists/ bridge financiers before IPO, in %	VC	58	40.48	6.086***	0.0000***	36.40	5.935***	0.0000***
	BF	33	13.63			13.85		
Stake of lead venture capitalist/ lead bridge financier after IPO, in %	VC	57	14.47	3.740***	0.0003***	11.44	4.052***	0.0001***
	BF	33	6.61			6.30		
Stake of venture capitalists/ bridge financiers after IPO, in %	VC	58	22.39	5.328***	0.0000***	21.30	5.217***	0.0000***
	BF	33	7.87			7.50		
Participation lead venture capitalist/ bridge financier	VC	57	0.2246	0.806	0.4223	0.2034	0.355	0.7227
	BF	32	0.2679			0.2404		
Seats on the "Aufsichtsrat" held by venture capitalists or bridge financiers, in %	VC	58	25.37	2.851***	0.0054***	33.33	2.497**	0.0125**
	BF	33	14.09			0.00		
Duration of financial relationship in years	VC	57	2.9649	5.004***	0.0000***	2.0000	4.940***	0.0000***
	BF	33	1.0303			1.0000		
Dummy ranking of lead venture capitalist/ bridge financier = 1	VC	58	0.3448	0.179	0.8586	0.0000	0.144	0.8851
	BF	33	0.3636			0.0000		
Number of IPOs where venture capitalists/ bridge financiers do not sell, in %	VC	58	27.27	0.711	0.4792	0.00	0.516	0.6059
	BF	33	20.69			0.00		

[60] According to a study by BARRY/MUSCARELLA/PEAVY/VETSUYPENS (1990) US-venture capitalists own on average 34.3% prior and 24.6% after the IPO, thus they sell on average only 6.6% of their pre-IPO shares.

Furthermore, venture capitalists are to be considered as much more insiders compared to bridge financiers as they hold on average 25.37%[61] versus 14.09% of the seats on the "Aufsichtsrat" and have engaged themselves much longer in the issuing company before the IPO, namely about two years longer on average.

7. Empirical Results

Taking these differences into account, the results presented in the following are dispensed with the bridge financed sub sample.
The determinants of underpricing are examined applying an ordinary least square regression analysis with underpricing as depended variable.

In order to measure the ex-ante uncertainty concerning the value of an IPO company two different proxies are used: In line with e.g. RITTER (1984) and WASSERFALLEN/WITTLEDER (1994), for each IPO company the standard deviation of the log returns from day two to twenty (*vola*) are calculated, which I expect to reflect uncertainty concerning the degree of dispersed information. Theory predicts a positive relation between uncertainty and underpricing. Since this proxy might be distorted due to underwriter price support in the aftermarket (see LJUNGQVIST (1997)) the log of the number of employees (*empl*) is included, as well. Large companies that go public and employ many people should be less underpriced than small companies.[62] Following LJUNGQVIST/JENKINSON (2000) and LOUGHRAN/RITTER (1999), I calculate to what extend the book-building range (*bookb*) was exhausted. Issues priced at the maximum price limit, exhausting 100% of the book-building range, should be more underpriced compared to IPOs with an issue price that falls within the book-building range or below the minimum price limit.

Besides that I use the proxy LÖFFLER (2000) and earlier UHLIR (1989) employed in their examination of underpricing, namely the market trend, which is estimated using the NEMAX[63] for the period twenty days before the IPO (*nemax*). As LÖFFLER documents, there

[61] This number is lower as the one reported by BARRY/MUSCARELL/PEAVY/VETSUYPENS (1990).
[62] I also checked whether the age or the total volume of assets could serve as an explanatory variable for the amount of underpricing, but found no significant correlation.
[63] NEMAX is the stock market index of Neuer Markt at Frankfurt stock exchange. The introduction of this variable does not affect the other results found.

seem to exist (psychological/market) factors that lead to a significant positive relation between the trend of the Nemax and the degree of underpricing.
One can either apply a dummy for "backed by venture capital" or less condensed information, i.e., the percentage of the venture capitalists' equity holdings prior to the IPO (*VCholding*). Since it should make a difference whether a venture capitalist holds for instance 5% or 50% of a company prior to IPO, (as explained in section 4, see hypothesis 3b) I will use the latter.

With reference to the hypotheses discussed in section 4, this leads to the following predicted signs for the regressions:

	∂vola	∂empl	∂bookb	∂nemax	∂UWrank	∂VCrank	∂VCholding	∂partratio	∂dilution
∂ UP	+	-	+	+	-	-	-	-	?

The results are presented in table 5, page 21.

Columns (1) and (2) of table 5 ignore the incentive argument of LJUNGQVIST (1999) and thus resemble earlier studies, e.g., the analysis of MEGGINSON/WEISS (1991). All parameter estimates that represent the degree of ex ante uncertainty (*vola*, *bookb*) or size (*empl*) show the predicted signs on a significant level. Thus, there is clear evidence that the higher the ex ante uncertainty about the value of the company going public and the smaller the company, the higher the underpricing. This result is in line with earlier studies on the German market, such as WASSERFALLEN/WITTLEDER (1994). The highly significant coefficient for the market trend (*nemax*) supports the findings of LÖFFLER (2000): The initial return rises on average about between 2.2% and 2.3% with each percentage point the log return of the Nemax is rising prior to the IPO.

Concerning the certification role of venture capitalists and underwriters, I do not find any support either for hypotheses 2 or 3. On the contrary, companies that are backed by a prestigious venture capitalist experience *greater* underpricing: The coefficient *VCrank=1* is positive and significant at the 10% or rather 5% level. Remarkably, there is no significant output when controlling for venture capitalists with a lower ranking (not reported). However, the effect found seems to be obscured: When interacting the dummy for the ranking of prestigious venture capitalists with the percentage of the venture capitalist's equity

Table 5: Test of the Certification Hypotheses: Underpricing.

The dependent variable is underpricing. The variable *vola* is equivalent to the standard deviation of the log returns from day two to twenty prior to the IPO, *empl* represents the log of the number of employees, *bookb* reflects the extend to which the book-building range was utilized, *nemax* incorporates the market trend twenty days before the IPO. The variables *UWrank=1* and *VCrank=1* are dummies for underwriters and venture capitalists, respectively ranked very good. *VCholding* presents the venture capitalist's equity holding prior to the IPO, *partratio* and *dilut* are explained in footnotes 41 and 43, respectively. The variable *nosal_VC* is a dummy equal to 1 if the syndicate of venture capitalists does not sell shares at the IPO and zero otherwise. The dummy *conflict* is equal to 1 if the venture capitalist is affiliated with one of the (lead-) underwriters. Throughout, the interference is based on White's heteroskedasticity-consistent standard errors. One, two and three asterisks indicate significance at the 10%, 5% and 1% level, respectively. In columns 5 and 6, the total effect of the presence of a prestigious venture capitalist is tested in an F-test.

Variables:	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.574	0.569	0.544	0.624*	0.527	0.542
	0.1120	*0.1161*	*0.1317*	*0.0939*	*0.1583*	*0.1519*
Vola	4.194*	4.469**	4.599**	4.262*	4.242*	4.303*
	0.0611	*0.0462*	*0.0418*	*0.0579*	*0.0580*	*0.0550*
Empl	-0.112*	-0.108*	-0.109*	-0.115*	-0.119*	-0.121*
	0.0648	*0.0760*	*0.0812*	*0.0639*	*0.0559*	*0.0533*
Bookb	0.293***	0.233**	0.219**	0.242**	0.327***	0.316***
	0.0057	*0.0380*	*0.0487*	*0.0285*	*0.0020*	*0.0028*
Nemax	2.302***	2.238***	2.241***	2.283***	2.309***	2.314***
	0.0000	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0000*
UWrank=1	-0.050	-0.033	-0.037	-0.039	0.009	0.010
	0.6655	*0.7744*	*0.7500*	*0.7371*	*0.9383*	*0.9301*
VCrank=1	0.406*	0.856**	0.869**	1.022**	0.842**	0.896**
	0.0781	*0.0463*	*0.0443*	*0.0213*	*0.0384*	*0.0326*
VCholding	-0.306	-0.125	-0.172	0.110	-0.174	-0.208
	0.2187	*0.6579*	*0.5903*	*0.7482*	*0.6173*	*0.5490*
partratio_Old			0.088			
			0.8860			
dilution_Old			0.090			
			0.4362			
partratio_VC				-0.331	0.087	0.126
				0.2997	*0.8113*	*0.7249*
dilution_VC				-0.054	-0.079	-0.067
				0.3246	*0.1419*	*0.2289*
nosal_VC					0.566***	0.626***
					0.0093	*0.0034*
Conflict						-0.182
						0.4345
Interaction term:		-1.080	-1.089	-1.406*	-1.250*	-1.315*
VCrank=1 * VCholding		*0.1187*	*0.1178*	*0.0542*	*0.0681*	*0.0672*
Adj. R^2	30.53%	31.12%	30.30%	31.24%	32.97%	32.73%
p-value (*F*-statistic)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
F-test: VCrank					0.0852	0.0701
Number of observations	164	164	164	164	164	164

holdings prior to the IPO, the interaction term is negative. Though this term is only significant when controlling for the venture capitalists incentives to take influence on underpricing (see table 5, column (4)). Anyway, controlling for incentives or not, the finding of venture-backed issues appearing, if anything, to be *more* underpriced is in line with the results of LJUNGQVIST (1999) for the 1990´s and those of FRANCIS/HASAN/HU (1999), but in contrast with those of LIN/SMITH (1998) or BARRY/MUSCARELLA/PEAVY/VETSUYPENS (1990). They show that the higher the venture capitalist's reputation (measured e.g. by the venture capitalist's age and the former backing activity), the lower the underpricing. I have re-estimated the regression using other factors that usually serve as proxies for the monitoring or backing-quality of venture capitalists, such as the natural logarithm of the age of the lead venture capitalist at IPO, the number of seats on the "Aufsichtsrat" held (in percent) and the age of the financial relationship. Unfortunately I did not get any further insights. Since the venture capitalists' ranking is based on the age of the lead venture capitalists, it is not astonishing that this coefficient behaves equivalent: it is positive and significant. Concerning the other two coefficients, they are not statistically significant.

Analyzing the marginal effect of underwriter reputation there is a general lack of significance of the coefficients. This suggests that companies, that have hired a prestigious lead underwriter when floating stocks are not better off than others. This result corresponds to earlier findings of KASERER/KEMPF (1995) for the German market. As expected, I obtain the same result when adding a term to the regression that interacts the ranking of the underwriter with that of the venture capitalist (not reported).
The results for controlling incentives are presented in column (3) and subsequent columns of table 5. I have controlled for both, the incentives of the group of the former shareholders as a whole and for the managers (not reported) and venture capitalists separately. But due to the lack of significance - irrespectively of the identity of the group controlled for - I am not able to confirm the results found by LJUNGQVIST (1999). There is no evidence for underpricing to be lower due to controlling incentives of former owners with a high selling intensity at the IPO.

In summary, no certification effect at the IPO could be found for venture capitalists or underwriters. Furthermore, there is no evidence that former stockholders selling shares at the IPO are particularly concerned about wealth loss and thus control for underpricing. Only

hypothesis (1), which offers ex-ante uncertainty as a factor that determines underpricing finds considerable support.

Extensions

The question is why issues backed by prestigious venture capitalists appear to be *more* underpriced?

It seems to be puzzling, but similar results have been found before. FRANCIS/HASAN/HU (1999) analyze a data set of companies going public in the United States during the period 1990 – 1993 using a stochastic frontier model. They show that VC-backed IPOs suffer higher underpricing due to greater pre-market pricing inefficiencies, which are to a significant portion deliberate and should compensate investors for information production.

LJUNGQVIST (1999), on the other hand, illustrates for a data set of the 1990s that what is specific about venture-backed IPOs is that curiously enough underpricing appears to increase with underwriter quality. He solves the puzzle in explaining that there are situations, that which are characterized by a conflict of interest between entrepreneur and venture capitalist, e.g. given the entrepreneur sells some shares but the lead venture capitalist none. He demonstrates that under such circumstances the lead venture capitalist, in his data set usually belonging to the group of low ranked venture capitalists, is *not* concerned about to choose an underwriter who underprices more than the average, as the wealth loss has to be borne by the selling owners rather than by himself.

In my sample, in particular IPOs backed by *prestigious* or rather older venture capitalists are considerably *more* underpriced than IPOs that belong to any other segment, namely on average 91.07% compared to 50.71% when backed by a less prestigious venture capitalist or 61.18% when non venture-backed. It is surprising as these companies seem to be relatively large with respect to balance sheet totals and employees. It thus seems to be rather interesting to analyze, whether this significant difference in underpricing be explained by the argument of a missing incentive to control underpricing, too.

Table 6.: Characteristics of IPOs Backed by Prestigious Venture Capitalists (PVC) and Those With Lower Reputation (NPVC) at Neuer Markt

		Obs.	Mean	Value	*p*-value	Median	Value	*p*-value
Underpricing in %	PVC	20	91.07	1.895*	0.0632*	46.55	1.423	0.1547
	NPVC	38	50.71			25.98		
No sale	PVC	20	30.00	0.996	0.3234	0.00	0.712	0.4767
venture capitalists	NPVC	38	18.42			0.00		
Employees	PVC	20	347	2.771***	0.0076***	193	2.102**	0.0355**
	NPVC	38	152			97		
Balance sheet total,	PVC	20	71,428	0.3849	0.7017	46,054	3.247***	0.0012***
in thousand DM	NPVC	38	55,961			18,137		

The descriptive statistic shows that 30% of the prestigious and still about 18.4% of the lowest ranked venture capitalists do not sell at IPO. These are 13 out of 58 VC-backed cases in total. In column (5) of table 5 I re-estimated the previous regression including a dummy for venture capitalists not selling at the IPO (*nosal_VC*). Indeed, the impact of such a non-selling behavior of venture capitalists is in any case (regardless of the ranking) a significant increase in underpricing. This result is robust but does not solve the original puzzle, since the coefficient for the dummy of IPOs backed by prestigious venture capitalists remains significant and positive, though smaller.

A further explanation why VC-backed IPOs are *more* underpriced is offered by HAMAO/PACKER/RITTER (2000). These authors examine IPOs in Japan. In Japan, venture capital funds are often affiliated with major financial institutions. This circumstance can lead to potential conflicts of interest, since the underwriting bank, if an owner of the issuing company, is interested in setting a higher offer price than it would if it was merely acting as a financial intermediary. Furthermore, these banks have increased incentives to overstate the company value to investors. Given that IPO investors do anticipate this conflict of interest, they will, according to theory, demand more underpricing as a compensation. In line with this, HAMAO/PACKER/RITTER find higher initial returns for IPOs in which the lead venture

capitalist is also the lead underwriter.[64] Although affiliations between venture capitalists and underwriting banks exist in Germany, too,[65] they are not as common as in Japan. I have tried to control for this phenomenon of affiliation for the German market, though I have only eleven observations in my data set. However, the result lacks of significance and thus does not support this explanatory approach (see table 5, column 6).
Even though I could demonstrate that the non-selling behavior of venture capitalists drives underpricing, the appearance of IPOs backed by prestigious venture capitalists being more underpriced deserves further examinations.

A final approach will be presented to explain the results found:
A major German venture capitalist provided data on the historical costs of the shares of four IPO companies in my data set. I calculated the approximate return[66] from investment until IPO, using the offering price (*OP*) and the closing price (*CP*) on the first tradingday.[67] In doing so I would like to illustrate the relative effect of underpricing on the venture capitalist's return on investment when selling at IPO.

Table 7.: Returns on Four Investments of one Major German Venture Capitalist

	A	**B**	**C**	**D**
Return *OP*	258%	132%	200%	519%
Return *CP*	294%	182%	530%	506%

As easily can be seen, each of these investments was a success story for the venture capitalist, which partially was realized through selling at IPO.[68] But at least in the first three cases the good result had the negative taste, that the return on investment could have been better, if there had been no underpricing.

[64] Apart from this special case mentioned, HAMAO/PACKER/RITTER (2000) find that VC-backed IPOs exhibit a significant reduction in underpricing relative to other issues.
[65] Examples are Deutsche Venture Capital Gesellschaft and Deutsche Bank, Beteiligungsgesellschaft für die Deutsche Wirtschaft and Dresdner Bank AG, TFG Venture Capital and Concord Effekten AG or Commerz Unternehmensbeteiligungs AG and Commerzbank AG.
[66] As no information regarding the exact date of the initial investment is available, I am not able to calculate a time-adjusted return.
[67] In cases A, B and C, the offering price was fixed at the maximum price limit. In case D, which was overpriced, the offering price was fixed at the lower bound of the book-building range.
[68] As mentioned, on average venture capitalists sell 25% of their pre-IPO stake. Dividing the group into venture capitalists that sell and those that do not sell, the venture capitalists who sell shares at the IPO, sell on average about 32%. Only in one case the venture capitalist sold 100%.

Given, for the period under consideration the four companies above are a good example for an IPO portfolio of a venture capitalist in Germany, I would like to formulate some hypotheses, that could serve as further explanations for the findings of my empirical study and should therefore be tested in future:

Venture capitalists seem not to care in particularly about underpricing, as the bad news of money left on the table comes as part of a package that includes the good news of a successful partial exit.[69] Moreover venture capitalists seem to be more concerned about the long-run performance and the timing of the further exit, since they retain on average two third of their shares beyond the IPO-date. (For empirical studies on the U.S. market see for instance BRAV/GOMPERS (1997)).

8. Summary and Outlook

The main contribution of this empirical study is to shed further light on the growing importance of venture capital in Germany after the introduction of Neuer Markt at the Frankfurt Stock Exchange.

In particular the role of venture capitalists and underwriters in certifying the quality of a company when going public is examined. Two different explanatory approaches form the background of this study. On the one hand, based on papers by CARTER/MANASTER (1990) and BOTH/SMITH (1986), it is argued, that due to a reduced ex ante uncertainty concerning the value of the issuing company, the spread between the initial offering price and the opening price on the first day of trading should be lower for venture-backed IPOs compared to non venture-backed IPOs. On the other hand – according to LJUNGQVIST (1999) – it is argued that venture capitalists will take influence on underpricing, the more they participate in the offering, which means the more shares they are selling at the IPO.

When running the regressions to test the hypotheses that venture-backed IPOs are less underpriced compared to non venture-backed IPOs, I control for ex-ante uncertainty, for the market trend, for the venture-capitalists' share of the company prior to the IPO, and for the incentives of old shareholders to reduce underpricing.

Turning to the results of this study, the huge number of financial intermediaries engaged in IPOs at Neuer Markt is worth mentioning: 86 underwriters and 112 venture capitalist or rather private equity companies.

[69] A similar argumentation based on the prospect theory can be found by LOUGHRAN/RITTER (1999).

Concerning the companies that went public at Neuer Markt, I found that VC-backed companies are less profitable and less strong at selling compared to non venture-backed companies, though similar with respect to number of employees, age, balance sheet total, growth rates of sales revenues or the amount of underpricing. Venture-backed firms issue significantly more shares compared to non venture-backed ones. However, this difference might be attributed to the circumstance that VC-backed companies sell more old shares when going public. The fact that the group of venture capitalists sells an average 25% of their pre-IPO stake at the IPO supports this assumption.

More than half of the VC-backed companies have been financed by a syndicate of venture capitalists. They seem to have considerable influence, since they hold on average a stake of 40% of the company before the IPO and about 25% of the seats on the "Aufsichtsrat".

With reference to the results of the regressions, there is strong evidence that the higher the ex-ante uncertainty about the value of a company going public the higher the underpricing. Furthermore, the market trend has a positive impact on the amount of underpricing that cannot be neglected. However, the use of this variable does not affect the other results found.

Concerning the certification role of underwriters and/or venture capitalists, I am unable to provide evidence. It does not seem to pay to hire a prestigious intermediary, at least in the context of underpricing. On the contrary: The involvement of a prestigious venture capitalist leads to a higher underpricing. This finding holds, irrespective of whether I control for venture capitalist not selling at the IPO (following the argumentation of LJUNGQVIST (1999)) or for conflicts of interest due to an affiliation of the venture capitalist and the underwriting bank (in line with HAMAO/PACKER/RITTER (2000)). The finding that prestigious venture capitalists appear to lead to more underpricing, warrants further research.

When interpreting theses results one has to keep in mind that the data set under consideration was collected in a period, that can be characterized as a bull market. With the end of the examined period, i.e. since March 2000, there has been a sharp depression at Neuer Markt along with a relative decline in IPOs. It would be worthwhile to enlarge the sample to check whether in bear markets a value of certification either through underwriters or venture capitalists exists. Moreover, this would allow to study the effect of an affiliation between underwriter and venture capitalist based on more observations.

In addition, since venture capitalists only sell on average about 25% of their shares at the IPO, an examination of their further exit strategy would be of utmost interest. Not least as the

(timing of the) exit seems to be decisive for the success of the VC-investment and thus the building up of further reputation.

Moreover, an extensive study of the direct costs that arise when going public at Neuer Markt seems to be worthwhile. Since on average companies going public at Neuer Markt have to bear direct costs of 7.90% of the gross proceeds, it would be interesting to know in how far these costs are of discretionary nature (e.g. on pre-IPO marketing activities) and thus could be used in order to reduce underpricing.

Appendix Figures:

Figure A.1: Business Foundations in Western Germany; since 1990 in the Old West and Newly-Formed German States (in Numbers of Newly Established Businesses)[70]

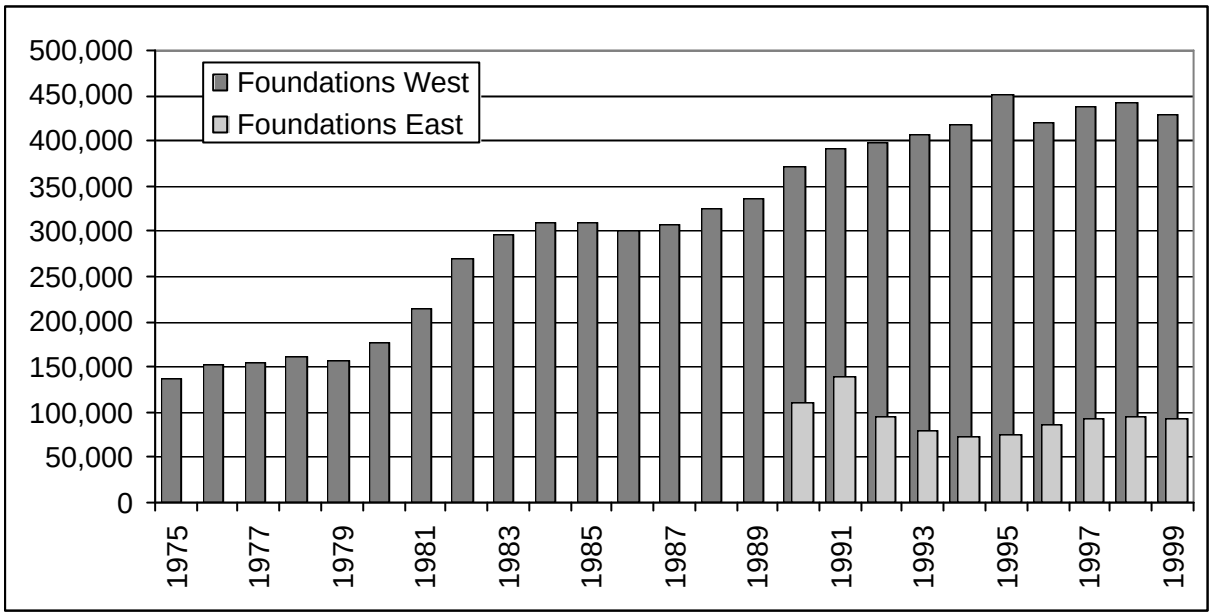
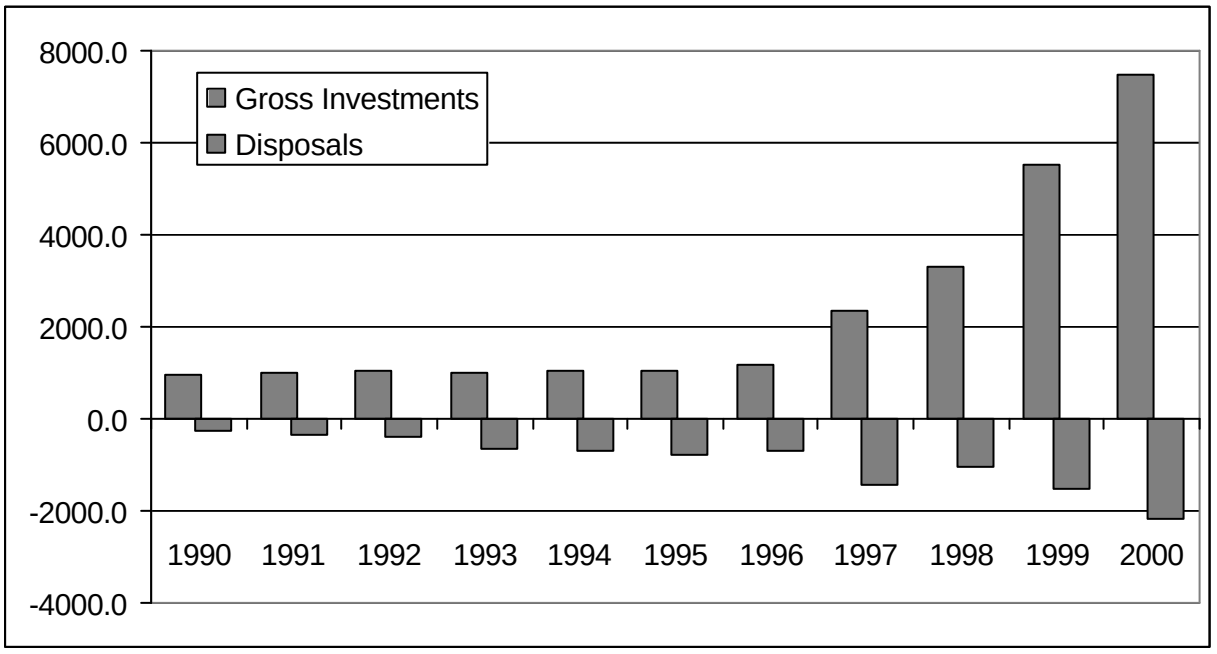


Figure A.2.: Development of Gross Investments and Disposals of BVK Members (in DM Mio.)[71]



[70] These numbers are estimations of the INSTITUT FÜR MITTELSTANDSFORSCHUNG (IFM).
[71] For the year 2000, the result is preliminary.

Appendix Tables:

Table A.1: Data Set Neuer Markt - March 10, 1997 - March 10, 2000

Year	Number of Venture-Backed IPOs	VC in %	Number IPOs Backed by Bridge Financing	BF in %	Number of Non Venture-Backed IPOs	NVC in %	Total
1997	6	54.55%	1	9.09%	4	36.36%	11
1998	9	21.95%	9	21.95%	23	56.10%	41
1999	37	29.37%	19	15.08%	70	55.56%	126
2000	6	28.57%	4	19.05%	11	52.38%	21
Total	58	29.15%	33	16.58%	108	54.27%	199

Table A.2: The Twelve Best Ranked Underwriters Serving as Lead Underwriter at Neuer Markt During the Time Period 1997 - 2000

The underwriter rank of the year 1997 is based on the relative share of lead management at all Frankfurt stock market segments since 1990; rankings of the years 1998, 1999 and 2000 are using equally weighted the track record of each underwriter concerning the relative share of lead management at all Frankfurt stock market segments since 1990 and the relative volume of launched issues at Neuer Markt since 1997. A top ranking is equivalent to one, the lowest ranking equals the value of 3.

Underwriter	Ranking 1997	Ranking 1998	Ranking 1999	Ranking 2000
Commerzbank AG	1	1	1	1
Deutsche Bank AG	1	1	1	1
Bayerische Hypo- und Vereinsbank AG (Bayerische Hypotheken- u. Wechselbank / Bayerische Vereinsbank)	1	1.5	1	1
BHF-Bank AG	1	1.5	1	1
DG BANK AG	2	1	1	1
Dresdner Bank AG	2	1	1	1
West LB Girozentrale	2	1	1	1
Goldman, Sachs & Co. OHG	2	2	1	1
Bankgesellschaft Berlin AG	1	2	1.5	1.5
Gontard & MetallBank AG (Heinrich Gontard & Co. OHG / Metallbank GmbH)	3	2	1.5	1
Sal. Oppenheim jr. & Cie. KgaA	3	2.5	1.5	1
HSBC Trinkaus & Burkhardt KgaA	2	2	2	1

Table A.3: The Eleven Best Ranked Venture Capitalists /Private Equity Companies

Backing Companies that Went Public

at Neuer Markt During the Period March 1997 - March 2000

The ranking representing the quality of the venture capitalists and private equity companies is mainly based on the age of the company. VC and private equity companies founded before 1980 received a very good ranking (equal to 1), companies founded before 1995 and after 1980 received a mediate ranking (equivalent to 2). Companies founded after 1995 got the lowest ranking (equivalent to 3). Thus only in two cases (Commerz Unternehmensbeteiligungs AG and Gold Zack) an relative high backing activity during the time period under consideration leads to an upgrade in ranking.

VC / private equity companies	Founded in	Number of backed IPO companies	Ranking
3i Group Plc. /3i Deutschland	1945	10	1
Apax Partners & Co. Beteiligungsberatung AG	1969	5	1
Atlas Venture Germany	1980	4	1
BdW Beteiligungsgesellschaft für die deutsche Wirtschaft mbH & Co. KG	1969	2	1
Deutsche Beteiligungs(gesellschaft) AG	1965	2	1
General Atlantic Partners	1980	1	1
Goldman Sachs Group, L.P.	1950	1	1
Gold-Zack AG	1990	10	1
Commerz Unternehmensbeteiligungs AG	1987	6	1
Schroders Ltd.	1957	3	1
WestKB Westdeutsche Kapitalbeteiligungs mbH	1969	1	1

Appendix

Model of BARRY (1989) extended by HABIB and LJUNGQVIST(1998):

Consider a company that has (S_0) shares outstanding prior to going public and that issues (S_N) new shares at the IPO. In such a case the former shareholders suffer a wealth loss due to underpricing and dilution. The amount of wealth loss is inter alia dependent on the participation ratio and the dilution factor.

The participation ratio (*partratio)* is the ration of the number of old shares sold ($S_{0,S}$) to the number of shares outstanding before the flotation (S_0). The dilution factor (*dilution*) is the ratio of new shares (S_N) to the number of shares outstanding before the flotation (S_0).

$$partratio \equiv \frac{S_{0,S}}{S_0} \qquad\qquad dilution \equiv \frac{S_N}{S_0}$$

Let (P_0) be the initial offer price, and let (P_1) be the opening price at the first day of trading. In an efficient-market, this opening price at the first day of trading should reflect the (unobservable) value of the company prior to the IPO (S_0 P^*) plus the value of the money raised through flotation (ignoring the commission and other direct costs of going public):

$$P_1 = \frac{(S_0 P^* + S_N P_0)}{(S_0 + S_N)}$$ by transformation this is equivalent to

$$P^* = P_1 + \underbrace{\frac{S_N}{S_0}(P_1 - P_0)}_{dilution}$$

The smaller the offering in relation to the number of shares previously outstanding, the smaller the dilution effect. Thus the aggregated wealth loss of the former stockholders per old share (*awl*) is equivalent to:

$$awl \equiv [S_{0,S}\,(P^* - P_0) + (S_0 - S_{0,S})\,(P^* - P_1)] : S_0$$

$$\equiv \underbrace{part(P^* - P_0)}_{participation} + \frac{(S_0 - S_{0,S})}{S_0}\,(P^* - P_1)$$

Given that the offering is underpriced, that is $P^* > P_1 > P_0$, old shareholders suffer the greatest aggregate wealth loss when selling all of their shares in the IPO. In summary, former owners "will be more concerned with underpricing as the size of the issue grows (relative to their own holdings) or as they participate more by offering more of their own shares" (BARRY (1989), p. 1102).

The extension of this model takes the possibility of costly actions into consideration, namely actions that influence the offer prices and thus reduce underpricing and wealth losses. Such costs (*exp*) could for example arise in connection with extensive marketing efforts prior to the IPO. These costs have to be add to the aggregated wealth loss arising from underpricing and dilution. Former shareholders therefore are assumed to minimize these so called total wealth losses per old share (*twl*):

$$twl \equiv awl + exp$$

"There is a trade-off between spending more (higher *exp*) and tolerating higher underpricing. At the optimum, the marginal effect of increasing *exp* to reduce underpricing should equal the marginal costs of doing so, implying that total wealth losses are invariant, at optimum, to *exp*." (see LJUNGQVIST (1999), p.6).

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