

Post-Dotcom IPOs In Germany: After Crisis Developments In Underpricing

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ABSTRACT

After the dotcom-breakdown in 2000, German IPOs came to a sudden standstill and recovery took several years. Empirical evidence on German IPO activities so far focused mostly on the preceding new economy bubble. In contrast, this contribution aims at investigating the post-dotcom IPO market in Germany, using a sample of 182 IPOs between March 2002 and April 2011. The influences of private equity investors, underwriters and the market segment on the flotation are analyzed. Subsequently, driving factors of underpricing are identified. Our results indicate that especially offering characteristics affect underpricing. Furthermore, the company's age and the industry have a significant impact. Private equity investors, major underwriters and the market segment lost their empirically observable influence on underpricing. For the post-dotcom market environment, the results show a shift towards other hot-issue industries, a cooling down of investor sentiments and no significant reduction in ex-post uncertainty concerning new market segments.

Keywords: IPO; Underpricing; Private Equity; Underwriter

INTRODUCTION

Since a vital stock market is the main requirement for a successful IPO, the issuing volume relies on the economic environment (Jenkinson and Ljungqvist 2001). German IPO activity traditionally is less distinct in comparison to the US or the UK, regarding the number of flotations and volume raised (Black and Gilson 1998). Between 1984 and 1996 the average number of IPOs had been 19.5 per year (Franzke et al. 2003), a remarkably low figure for one of the world's leading economies. This case changed fundamentally in 1997 with the implementation of the *Neuer Markt* (New Market), a market segment for technology and growth companies. This innovation was responsible for a tremendous increase in IPOs in Germany (see *Figure 1*). For the first time, young and innovative German enterprises gained direct access to the stock market and therefore to equity supply. The boom, combined with the worldwide information technology hype, led to inappropriate valuations. The burst came in 2000, when the dotcom-crisis arose, heading to the final collapse of the *Neuer Markt* in 2003. Within the next years, the Deutsche Börse AG (Frankfurt stock exchange) restructured and renamed all market segments. The IPO activity in this time was overshadowed by the aftermath of the dotcom-bubble, resulting in only 12 IPOs from 2002 to 2004 (see *Figure 1*).

After four years of recovery, the IPO market returned to former strength. The IPO volume from 2006 to 2008 even outperformed the activity before the dotcom-hype (pre-1997). By the end of 2007, first indications of a new financial crisis came up that reached its peak with the bankruptcy of Lehman Brothers. The US housing bubble and the subprime crisis were basically responsible for this financial crisis. Within one decade, this was the second shock for the German IPO market. In comparison to the dotcom-crisis, where the IPO market totally broke down, the IPO activity recovered within two years: in 2010 already 14 companies went public in Germany again. This paper aims to focus on the latest, very recent period of the German IPO market: the time after the dotcom-bubble.

In all kind of market conditions IPOs are accompanied by the underpricing phenomenon. It describes the substantial price jump after listing compared to the issuing price (Ljungqvist 2007). This price revision during the first trading day means a loss of money for the issuer and a gain for investors (Loughran and Ritter 2002). It is a

well-documented miracle in the existing literature. Hence, the German market is also affected by underpricing, as shown below in *Figure 2*.

Additionally to its very specific IPO-history, Germany also provides a unique institutional framework for an analysis of underpricing. Elston and Yang (2010) describe these features with high insider ownership, a strong role of banks and a less developed equity market (see Theissen 2003 for an overview of the German equity market). Furthermore, the rearrangement of stock market segments, VCs with a rather short track record and an excessive dotcom-bubble make up an exceptional setting to analyze stock flotations. The case of Germany in the period 2002-2011 (after crisis developments) also perfectly contributes to three shortcomings of the existing research so far:

- Former analyzes on German IPOs investigated nearly exclusively the *Neuer Markt*. This segment includes a wide range of dotcom-IPOs within abnormal market conditions (Günther and Rummer 2006) and does not seem to be representative for the German market in general. Studies prior to the bubble years are rare and only provide few insights regarding multivariate analysis. After reorganizing the market segments, the *Neuer Markt* does not exist anymore. A detailed view on IPOs in the newly created market segments therefore promises new insights regarding flotations in the German institutional setting during non-bubble-times.
- The reasons for underpricing vary over time. Loughran and Ritter (2004) find a shift from the winner’s curse problem and dynamic information acquisition towards agency problems and market conditions. The sample used in this study consists of very recent IPOs from 2002 to 2011, analyzing present developments and the impact of experience gained during the dotcom-period in Germany. Hence, this study aims to identify the lessons learnt as well as the consequences of the excesses in the bubble-period.
- Studies so far provided no clear evidence regarding several research questions and leave various puzzles concerning private equity (PE) involvement, the role of underwriters (UW), market regulation and the hot-issue theory. Furthermore, we do not limit our study on the first trading day, but also take post-IPO returns into account.

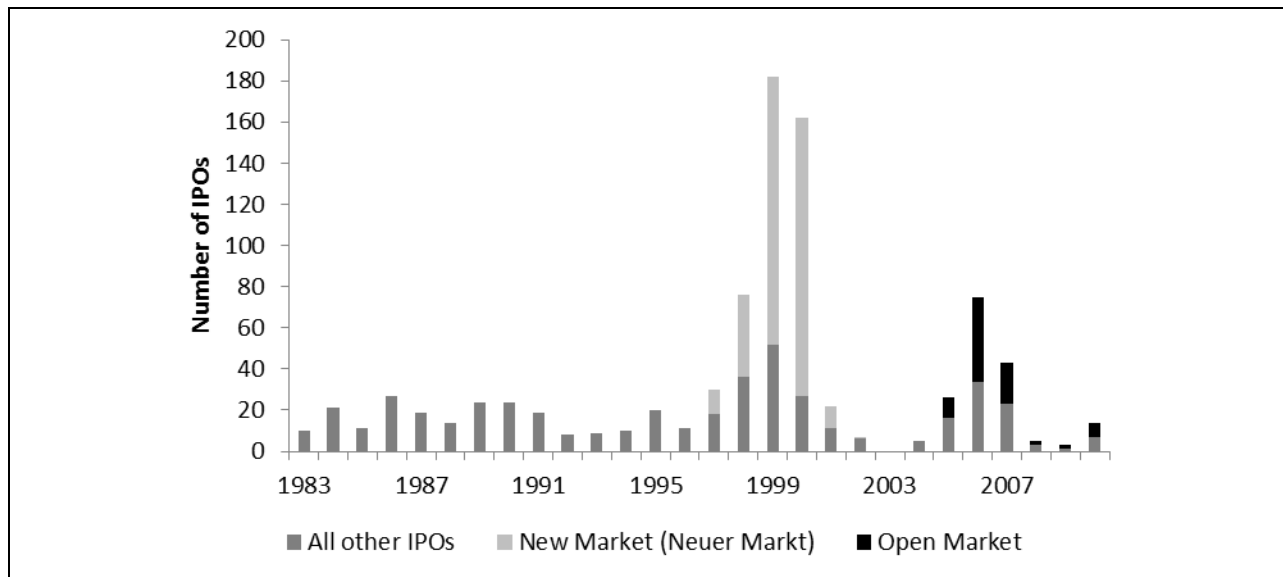


Figure 1. Number of IPOs in Germany and Market Segment of Listing
 Source: DAI Factbook (2004) and Deutsche Börse AG.

This contribution hence aims at providing evidence on these shortcomings and testing theories with a focus on after crisis developments on the German market. For this purpose, we analyze a unique data sample consisting of 182 German IPOs in the period from March 2002 to April 2011. At first, we check for differences in means regarding PE involvement, major UWs’ presence and the market segments. Then, a regression analysis is performed to find possible factors of influence on underpricing as well as short- and medium-term abnormal returns. At that, we employ a variety of 22 independent variables to investigate hypotheses based on theoretical foundations.

This contribution is organized as follows. The next section outlines the theoretical background of underpricing by presenting the relevant models and their underlying theory. Afterwards, an overview of literature addressing the German as well as European IPO market is given. The subsequent part formulates hypotheses based on the theory presented. The next section introduces the data and variable description as well as the empirical approach, followed by the main results and a discussion. The last section concludes and gives an outlook on further fields of research.

THEORETICAL FOUNDATIONS AND LITERATURE REVIEW

Underpricing is an intensely analyzed phenomenon within the IPO process and financial market research in general. Ljungqvist (2007) categorizes the theories regarding reasons for underpricing as follows: asymmetric information models, institutional and behavioral models, as well as ownership theories. The asymmetric information theory is the most prominent one, grounding on the winner’s curse model (Rock 1986), the ex-ante uncertainty model (Beatty and Ritter 1986) and the signaling theory (Allen and Faulhaber 1989; Welch 1989). They all point out differences in knowledge between issuer, UW and investors.

Private Equity’s Certification Role

The opinions on the role of PE in the IPO process are contrary. According to the definition of the European Private Equity and Venture Capital Association (EVCA), PE includes the following investment stages: venture capital (VC), growth capital, replacement capital, rescue/turnaround capital and buyouts (EVCA 2011). Megginson and Weiss (1991) highlight the participation of PE in the IPO process as a proof of quality for the issuing firm. From this point of view PE fulfills a certification role. On the other hand, following the grandstanding theory, the role of a PE investor is said to be critical. PE investors have incentives to push the IPO process, even though the firm is not ready. IPOs generate cash for new investments and increase the investor’s reputation, which is an important factor in the following fundraising. Since PE holdings are of temporary character - the average life-time of a VC-fund has a maximum of 10 years (Gompers and Lerner 2006) - time is of critical relevance. These incentives lead to premature IPOs and therefore to higher underpricing (Gompers 1996; Gompers and Lerner 2006). Former research shows mixed results and provides evidence for both hypotheses (Megginson and Weiss 1991; Lin and Smith 1998; Francis and Hasan 2001; Lee and Wahal 2004).

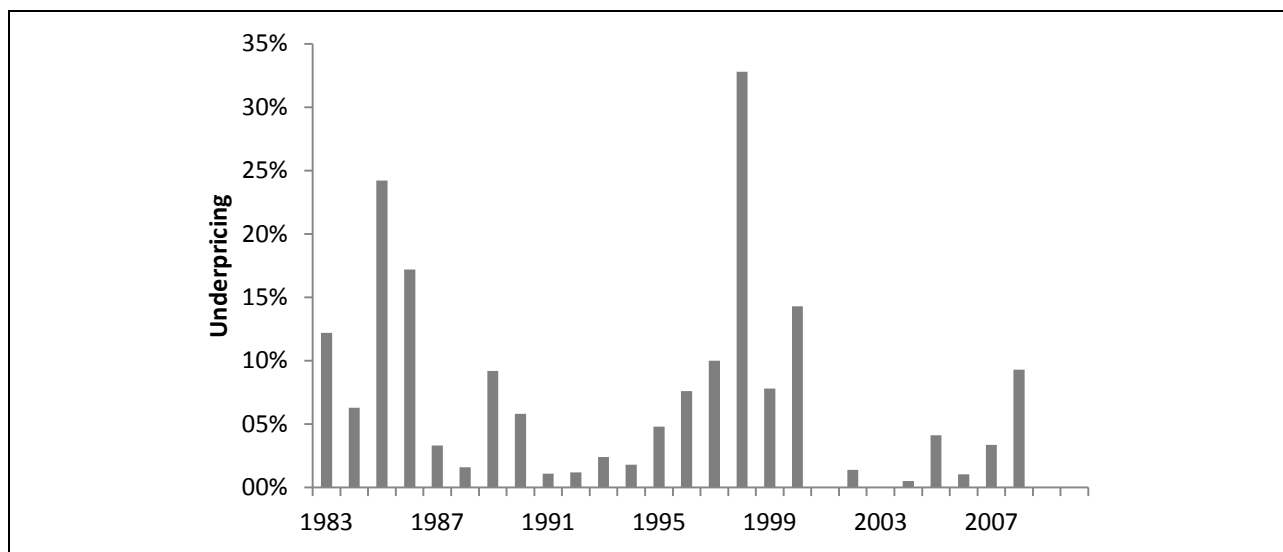


Figure 2: Median Underpricing of German IPOs.
 Source: Höllbacher (2011) till 1996, afterwards own calculations.

Underwriters' Affiliations and Maximization of its Investors' Shares

The UW is another important institution involved in the IPO process and possibly also influences underpricing. The role of an UW is typically taken by an investment bank (IB). The underwriting process contains a wide range of steps. During the preparation of the IPO main tasks are the due diligence and prospectus drafting followed by the application for listing. The second step is to set up with the market approach including pre-IPO research reports and all kinds of marketing activities, which lead to the final book-closing. In the end, the IB and the issuer have to set the offering price. This is a crucial point regarding profit maximization for both the issuer as well as the investor. In doing so, the IB has to match the interests of both sides (Iannotta 2010).

For Carter and Manaster (1990) the IB's reputation is the key factor influencing underpricing. Only large UWs are able to realize the required analytical activity and network to ensure a successful placement (Hill and Wilson 2006). The costs of such research are high, so only "high value" firms are able to afford this service. Due to the implied accuracy of the firm's valuation, underpricing is reduced and investors do not have to fear negative underpricing. Moreover, Baron (1982) highlights the better information access of IBs in comparison to issuing firms or investors. For IBs, preplanned underpricing is necessary in two ways. First, the underpricing rewards old and attracts future investors and, in a second step, it guarantees the placement of all shares. Contrary to previous studies, Pollock et al. (2004) ground their theory on the well-developed investor-UW-issuer-relationship. Due to these sensitive business relations, the UW cannot take the risk to play an active role in influencing the underpricing process. Ljungqvist and Wilhelm (2003) argue that underpricing is reduced, if the IB holds shares in the issuing company. Such affiliations improve the alignment of UW and issuer. For his own benefit, the UW sets a higher offering price. Especially the German bank-based system could be affected by this theory (Bessler and Kurth 2007). In the dotcom-bubble, VCs and UWs acted as repeat players. Hoberg and Seyhun (2006) argue that both collaborate and exchange favors. VCs, on the one hand, accept higher levels of underpricing, favoring the UWs. On the other hand, UWs provide marketing support and favorable analyst coverage after the IPO. This enables the VCs to sell their retained shares at a high price (Loughran and Ritter 2004; Tykvova and Walz 2007).

Underpricing and Market Regulations

Another effect on underpricing is set by financial market regulations. Hunger (2005) shows in a European study, that mean underpricing is significantly lower in official markets. Therefore greater corporate transparency reduces the cost of information gathering and - considering the asymmetric information model - decreases the level of underpricing (Hopp and Dreher 2007). For the German market, basic requirements for the regulated market are annual and interim reports in accordance with IFRS, while for the exchange regulated market (open market) an annual report in national GAAP is sufficient (Deutsche Börse AG 2011). The regulated market also has admission criteria regarding the company's age, equity amount and free float according to the German Stock Exchange Admission Regulation (Börsenzulassungsverordnung BörsZulV). Nevertheless, in comparison to these current non-regulated market segments, the *Neuer Markt* offered a wide range of requirements to ensure transparency: reports on a quarterly basis according to US-GAAP or IAS had to be published (Vitols and Engelhardt 2005).

Investor Activity in Certain Sectors: The Hot Issue Theory

Some authors argue that focused interest and investors' activity in certain sectors leads to underpricing. During certain times investors develop extraordinary interest for specific industries. Within these "hot issue" periods and industries, the number of IPOs increases. The rising IPO activity leads to overvaluation and therefore to underpricing (Ritter 1984; Ibbotson and Jaffe 1975). The *Neuer Markt* is a well-known example for this phenomenon, in which investors bought high tech shares without looking at fundamental values.

Recent Developments in the German IPO Market

Though not catching as much attention as Anglo-American capital markets (recent contributions are provided by Dolvin and Bradford 2008, Arthurs et al. 2008, Guo et al. 2006; Hill and Wilson 2006), the literature provides a variety of studies on the Continental-European IPO market. For example, Kunz and Aggarwal (1994) as well as Drobetz et al. (2003) focus on Switzerland, while Aussenegg (2007) analyzes the Austrian market (other European studies can be found in Engelen and Essen 2010 and Gregoriou 2006).

There are only few contributions dealing with underpricing in the German market prior to 1997 and hence the beginning of the dotcom-period. Uhlir (1989a) shows that there had been hot-issue markets even then. Uhlir (1989) provides evidence that stocks with high underpricing underperform in the following months. Wasserfallen and Wittleder (1994) as well as Ljungqvist (1997) only find coherence between underpricing and market conditions. Ljungqvist (1997) also detects a positive relation to share retention and a negative to the proceeds. Other authors, such as Schmidt (1988) and Göppl and Sauer (1990) only show descriptive statistics.

The vast majority of following-up studies solely focused on the *Neuer Markt*. Those contributions were provided by Mayer (2001), Schertler (2002), Leuz (2003), Hunger (2003), Rindermann (2004), Löffler et al. (2005) and Franzke (2004). Showing a lot of contradictory evidence, the authors mostly agreed on the enhancing impact of bear markets and market conditions on underpricing. Some authors found no relation between institutional investors' ownership (such as PE or VC), some detect an underpricing driving effect.

More recent studies are those by Aussenegg et al. (2006), Günther and Rummer (2006), Tykvova and Walz (2007), Dorn (2009) and Elston and Yang (2010). Some found a negative effect of VC and positive coherence with previous market returns and the company's market value. Like German studies, international and European contributions show quite puzzling results (Sentis 2009; Ferretti and Meles 2011). For a summary of studies on Securities Offerings see Eckbo et al. (2007), Cornelli et al. (2006) or Florin and Simsek (2007).

HYPOTHESES

This section develops five hypotheses (H1 to H5) to be tested in the empirical analysis of the following section. H1 covers prospects about the influence of PE involvement. As shown before, the role of PE in the IPO process is highly controversial. Common hypotheses are set up according to the certification role and the grandstanding theory. In our contribution, we focus on the after crisis effects of PE. Following the grandstanding theory only young and less experienced PE firms need to use their track record as a marketing instrument and therefore have to accelerate the IPO process (Gompers 1996). During the dotcom-bubble many new PE firms were established (Tykvova and Walz 2007). The growth rates in this industry were tremendous and not all firms were experienced enough to make proper investment decisions (Rindermann 2004). Many PE investments were inappropriate and based on mispricing. After the dotcom-bubble, many of these inexperienced firms went out of business and a self-purification of the PE market started (Leopold et al. 2003). As a result, the players described in the grandstanding-process are no longer active on the market. This indicates that grandstanding is perhaps not an issue anymore. Additionally, we assume that during the dotcom-crisis PE firms lost much of their reputation and yet were not able to regain their certification role in the after crisis years. Hence, we argue that PE is no proof of certification and underpricing of PE backed firms does not differ significantly.

H1. PE backed IPOs does not affect underpricing.

Loughran and Ritter (2004) argue that – during the internet bubble period – there had been a shift in the willingness of firms to employ underwriters with a history of underpricing. In exchange, UWs provide analyst coverage and side payments to the CEO. During the dotcom-era the German market featured one of the most severe underpricing in the world (Engelen and Essen 2010) leading to high losses of investors when the bubble burst. Thus, the certification role of major underwriters (Booth and Smith 1986) and their analysts might have suffered badly. This may lead to a situation in which companies no longer accept high amounts of money left on the table, because UWs - due to lost reputation - cannot provide as much demand for their stocks as in former times.

In a bank-based system like Germany major UWs are intensely affiliated. The probability that the UW holds equity stakes in the issuing company is even higher. This leads to reduced underpricing, if a major underwriter is involved. In this contribution, the UW's market shares are used as a surrogate for its reputation (for a detailed explanation see table 2). The post 2002-period became a success story for IBs: never before, they earned such enormous amounts of money. These times ended with the financial crisis in 2008 and the bankruptcy of Lehmann Brothers. Afterwards, competition became more aggressive and IBs had to fight for market shares. In this environment, it was essential to maximize the value of their investors' shares (Loughran and Ritter 2002; Baron and Holmström 1980; Reuter 2006). Due to this competition, each IB tries to serve their investors best, leading to higher

underpricing during these times. In this context underpricing serves as a marketing instrument for customers. On the other hand, such behavior could have a bad impact on the sensitive relations to the issuer (Dunbar 2000). According to the market conditions in Germany, UW affiliations seem to outweigh the function as a marketing instrument (Muscarella and Vetsuypens 1989; Ljungqvist and Wilhelm 2003).

H2. IPOs using major underwriters are less underpriced.

The main German stock exchange in Frankfurt provides several market segments with differing listing requirements. Regarding the former *Neuer Markt*, Hunger (2003) notices that its higher listing requirements did not lead to lower underpricing, contradicting the theory of a reduced ex-ante uncertainty. During the dotcom-breakdown, the *Neuer Markt* totally lost its reputation. Hence, there was a need for new market segments which have been installed after the crisis. It seems interesting whether Hunger's observation still holds for the new market segments that divide into the *Regulierter Markt* (*regulated Market* by European law) and the *Open Market* (regulated unofficial market). The experiences during the dotcom-bubble, involving mispricing of start-ups led to higher demand for older and more mature firms. These are more likely to be listed in the regulated market. Due to higher transparency, such regulations should reduce underpricing.

H3. After crisis IPOs listed in the Regulated Market are less underpriced.

According to the hot-issue hypothesis there are periods of special demand for certain industry sectors. Public interest for the IT sector cooled down due to experiences during the burst of the dotcom-bubble. New hot-issues could be the biotech or cleantech sectors, because of the growing number of IPOs in these fields of technology. The rising demand for those flotations might also lead to a higher underpricing. In our sample, 12 IPOs belong to the biotech and 15 to the cleantech industry.

H4. IT firms are less underpriced.

H5. Biotech and cleantech IPOs feature more underpricing.

EMPIRICAL ANALYSIS

Our sample consists of 182 IPOs in the period between March 2002 and April 2011, representing all IPOs in Germany after the dotcom-bubble burst to present. The data is collected out of the Hoppenstedt Aktienführer¹ (2002-2011), BVK² studies (2007) and publications of German stock exchange. Additional information is taken out of company reports and IPO prospectuses. Stock quotations are gathered from *yahoo-finance*.

The variables investigated in the empirical part of the study can be separated into dependent variables, company characteristics, IPO-features and market circumstances. The dependent variables are underpricing as well as short- and medium-term buy-and-hold abnormal returns (BHAR). Following a wide range of empirical studies, we define *Underpricing* of the i^{th} IPO as the difference between the issuing price (P_I) and the first trading day's closing price (P_C , see *Formula 1*).

$$\text{Underpricing}_i = \frac{(P_{C,i} - P_{I,i})}{P_{I,i}} \quad (1)$$

Since UWs are said to influence trading in the first days of quotation to ensure a positive underpricing to leave a good taste in the mouth (Ibbotson 1975a; Ellis et al. 2000), a look on the short- and medium term development of share prices may show a less distorted picture of the extent of underpricing. Short- and medium-term abnormal returns are calculated as the stock's return (r_t^i) over $n=20$ and $n=60$ trading days, corrected for market movements, using the SDAX as benchmark (r_t^{Index}). The SDAX consists of 50 German smallcaps. The returns include underpricing, assuming that shares are bought at the offering price. Hence, the other dependent variables are created, following Formula 2 (Bessler and Kurth 2007).

¹ Annual containing a variety of information regarding shares listed in Germany.

² The BVK is the German Private Equity and Venture Capital Association.

$$BHAR_n^i = \prod_{t=0}^n (1 + r_t^i) - \prod_{t=0}^n (1 + r_t^{Index}) \quad (2)$$

Table 1: List of Variables

Variable	Description
Underpricing	Simple Underpricing, see formula (1)
BHAR ₂₀	BHAR 20 trading days after IPO, relative to the SDAX
BHAR ₆₀	BHAR 60 trading days after IPO, relative to the SDAX
LN(Age)	log of (Age + 1)
PEInvestor	Dummy variable indicating the presence of a private equity investor (=1, 0 otherwise)
MTB	The Market to Book Ratio of the Stock
CFperEquity	The Cash Flow to Equity ratio of the Stock
IT	Industry Dummy taking the value of 1, if the stock is active in the Information Technology industry (0 otherwise)
Biotech	Industry Dummy taking the value of 1, if the stock is active in the biotechnology industry (0 otherwise)
Cleantech	Industry Dummy taking the value of 1, if the stock is active in the cleantech industry (0 otherwise)
LN(Vol)	log of Issuing volume (no. Of shares offered x issuing price)
UWMShare	Market Share of UW (>0,5%), in %, for a more detailed description see Table 2 (0, else)
Retention	Percentage of shares Retained by former owners
BookB	Dummy for the presence of bookbuilding (=1, 0 otherwise)
WidthBBRange	the width of the offering range relative to the midpoint of the offering range
WidthBBPeriod	number of days in which the bookbuilding takes place (0, if another procedure is used)
AllotmenttoEmission	number of days between the allotment and the first trading day
PriceUpdate	The percentage difference between the midpoint of the offering range and the issuing price
CeilingLow	Dummy variable taking the value of 1 if the issuing price is the lower ceiling of the offer range
CeilingHigh	Dummy variable taking the value of 1 if the issuing price is the upper ceiling of the offer range
RegulatedMarket	Dummy taking the value of 1, if the stock is listed in the regulated market (0 otherwise)
IndexReturn	SDAX market return, within the last 20 trading days prior to the IPO
NoIPOs	number of IPOs within the last 30 days prior to issue
MeanUnderpricing	mean underpricing of the IPOs within the last 30 days

Note: This table shows the description of the variables used in the empirical analysis.

Table 2: Calculation of UW market shares

Investment Bank	Volume	Market-Share [%]	Sole-lead manager	Co-lead manager
Deutsche Bank	6,657	26.5	7	17
Morgan Stanley	3,359	13.4	1	10
Goldman Sachs	2,174	8.6	1	6
UBS	2,128	8.5	3	8
J. P. Morgan	1,903	7.6	1	7
Credit Suisse FB	1,420	5.6	0	6
Dresdner Bank	1,221	4.9	3	6
Citigroup	1,099	4.4	1	3
Sal. Oppenheim	865	3.4	8	4
Commerzbank	686	2.7	2	5
HVB / Uni Credit	655	2.6	3	0
Equinet	276	1.1	9	2
Cazenove	274	1.1	1	2
WestLB	217	0.9	6	2
LBBW	209	0.8	5	0
Lehman Brothers	187	0.7	0	3
ABN AMRO	167	0.7	0	1
M.M.Warburg	159	0.6	3	2
Macquarie	148	0.6	1	1
quirin Bank	144	0.6	7	0
VEM Aktienbank	133	0.5	18	0
DZ Bank	127	0.5	4	0
All Others: 28 banks (sum)	950	2.7	59	4

Note: This table gives an overview on all UWs with market shares above 0,5%. Market shares are calculated as the sum of the IPO-volume the bank had been lead manager (see Aussenegg et al. 2006). In case of various co-lead managers, the sum is distributed equally on all lead-managers. Those with a market share above 1% are treated as major IBs.

Table 3: Descriptive Statistics

Variable	Arithmetic Mean	Median	Minimum	Maximum	Standard Deviation
Underpricing	0.054	0.015	-0.233	1.000	0.143
BHAR ₂₀	0.027	-0.018	-0.453	1.459	0.232
BHAR ₆₀	0.005	-0.042	-0.579	1.349	0.254
Ln(Age)	1.849	1.946	0.000	5.318	1.133
PEInvestor	0.451				0.499
MTB	3.574	3.042	-1.193	54.000	4.180
CFperEquity	2.416	0.210	-15.594	241.538	19.763
IT	0.137				0.345
Biotech	0.066				0.249
Cleantech	0.082				0.276
Ln(Vol)	3.381	3.135	0.000	7.607	1.834
UWMSHare	3.902	0.632	0.000	26.48	6.465
Retention	0.647	0.672	0.003	0.984	0.179
BookB	0.753				0.433
WidthBBRange	0.139	0.154	0.000	0.545	0.103
WidthBBPeriod	7.456	7.000	0.000	95.000	7.836
AllotmenttoEmission	6.681	3.000	0.000	197.000	20.874
PriceUpdate	-0.020	0.000	-0.273	0.135	0.070
CeilingLow	0.236				0.426
CeilingHigh	0.192				0.395
RegulatedMarket	0.538				0.500
IndexReturn	0.011	0.021	-0.160	0.113	0.047
NoIPOs	4.841	4.000	0.000	15.000	3.883
MeanUnderpricing	0.057	0.032	-0.072	0.347	0.083

Note: This table shows the arithmetic mean, median, minimum, maximum as well as the standard deviation of the sample.

This approach – with a much shorter time horizon than Dorn (2009) or Rindermann (2004) – bears two advantages: first, within only short periods the bias of the chosen benchmark is not material (Sapusek 2000). Second, this contribution focuses on the reasons of underpricing as the difference between issuing price and the company's market value. We think that within at least three months the market will lead to an adequate pricing. It is hard to believe that offering characteristics will drive stock performance in the following years. Our approach primarily aims at correcting for UW stabilization activities (Aggarwal 2000). Additionally, we can check for rebounds caused by investors that only participate in the bookbuilding process to take advantage of the underpricing and sell shortly after the IPO.

To capture company characteristics through fundamental valuations this study involves the market to book ratio (*MTB*). The *MTB* is defined as the ratio of the equity's book value and the market capitalization, employing *Formula 3*.

$$MTB_i = \frac{\text{Shares Outstanding}_i \cdot P_{1,i}}{\text{Equity}_i + \text{New Shares Offered}_i \cdot P_{1,i}} \quad (3)$$

As a second fundamental accounting measure, the cash flow is taken into account. One aim is to correct for earnings management (Teoh et al. 1998, Tykvovala 2006). This figure is taken as a proportion in relation to the company's equity for comparability reasons. An overview of all variables used is stated in *table 1*. For differences in the bookbuilding procedure between Germany and the US, see Aussenegg et al. (2006). To correct for size-effects, some exogenous variables are taken as logarithmic values. Descriptive statistics are shown in *table 3*. To identify differences in subsamples, we use the Wilcoxon rank sum test (Bauer 1972). Inference of the regression analysis is tested through heteroskedasticity-consistent standard errors proposed by White (1980). Our regression model is structured as followed:

$$\text{Dep} = \alpha_0 + \beta_1 \ln(\text{Age}) + \beta_2 \text{PEInvestor} + \beta_3 \text{MTB} + \beta_4 \text{CFperEquity} + \beta_5 \text{IT} + \beta_6 \text{Biotech} + \beta_7 \text{Cleantech} + \beta_8 \ln(\text{Vol}) + \beta_9 \text{UWMSHare} + \beta_{10} \text{Retention} + \beta_{11} \text{BookB} + \beta_{12} \text{WidthBBRange} + \beta_{13} \text{WidthBBPeriod} + \beta_{14} \text{AllotmentToIssue} + \beta_{15} \text{PriceUpdate} + \beta_{16} \text{Ceiling}_{\text{Low}} + \beta_{17} \text{Ceiling}_{\text{High}} + \beta_{18} \text{RegulatedMarket} + \beta_{19} \text{IndexReturn} + \beta_{20} \text{NoIPOs} + \beta_{21} \text{MUP} + \varepsilon_i \quad (4)$$

To check for multi-collinearity, we calculate variance inflation factors for all independent variables in each regression model. None of these were upon the critical value of 10, indicating that our results bring out valid individual predictors (Kennedy 2003).

RESULTS

The descriptive statistics including the arithmetic mean, the median, min and max as well as the standard deviation of the 182 observations are stated in *table 3*. The table shows high standard deviations with the offering volume, indicating a wide range of offering features. Accounting fundamentals also indicate great differences. The mean underpricing of the sample is 5.4%. After some trading months, mean underpricing gets smaller the longer the period gets, but on the other hand the standard deviation rises. This observation gives support to a development that may lead to the documented long-run underperformance of IPOs (Loughran and Ritter 1995).

The results regarding differences in means are presented in *table 4*. They indicate significant differences regarding sub-samples segmented by the presence of a PE investor or a major IB as UW and the market segment, in which the shares are listed.

Private Equity

Companies with PE investors use prestigious UWs far more often than those without. These investors focus especially on the *IT* and *biotech* industry. For the issuing procedure, their investment companies tend to have a shorter period between allotment and first trading day. PE investors also seem to choose the IPO day more selective: their investment companies go public within more positive market circumstances and in periods, where IPOs happen more frequently.

Summarizing, there is no clear evidence that PE backed companies differ significantly regarding fundamental figures, such as *age*, offering *volume*, *cash flow* generated or the *MTB*-ratio. Main differences are the industry focus as well as a more professional IPO procedure. Especially the timing of the market entry is well prepared. There is also no significant evidence to support *H1* since PE investors do not seem to have any impact on underpricing.

The UW Reputation: Major IB's Influence on the IPO

Regarding the differences between companies employing a major IB and those that do not, there are more significant observations. Companies with a mean UWMSHare above 1% are backed by PE investors more often (as seen above). These companies tend to have larger emissions and are mainly listed in the *regulated market* after using a *bookbuilding* procedure. The fact that the *retention* rate is smaller cannot be explained by the huge stake of PE backed IPOs in this group, because there seems to be no significant relation between PE investors and retention (see comparison above). Especially in the *cleantech*-industry, more prestigious UWs are used more often.

The bookbuilding range is bigger, but the time between allotment and first trading day is shorter. These companies generate much more *cash flow* than the rest of the sample. Though there is no difference in simple underpricing, the short- and medium-term abnormal return differs significantly between both groups. Especially within the first 20 trading days, those companies with major IBs outperform the others and even after 60 trading days this effect still holds. This observation may provide evidence for the assumption that IBs provide stabilization activities for the recently issued company.

Therefore *H2* cannot be supported. Obviously, the major UWs' affiliations do not have a reducing impact on underpricing. However, the short-/medium-term effects induce the opposite: underpricing may be used as a marketing instrument for investors.

Market Segment

Due to the fact that the *regulated market* is a new segment for IPOs, it is of special interest to identify what kinds of companies are listed in this market. As seen in the other two comparisons, companies listed in the *regulated market* are accompanied by more prestigious UWs, also implying that their retention rate is smaller and a bookbuilding procedure is employed more frequently. As a market segment for more mature companies it is no surprise that these companies are larger. Nevertheless, companies going public in the *regulated market* are not significantly older than the others. The width of the bookbuilding range is larger. An explanation for this might be a more frequent usage of bookbuilding, since the bookbuilding range of a fixed-price offer is defined as 0 in this sample (see table 1). The time between allotment and emission is significantly smaller.

Taking these facts together, IPOs at the *regulated market* seem to be managed more professionally, by major IBs, using a bookbuilding procedure. Placement is executed in a quicker time span between allotment and emission. These conditions and special rules of the *regulated market* surprisingly do not have any effects on underpricing, hence providing no evidence for *H3*.

Table 4: Differences in Means

Variable	With PEInvestor	Without PEInvestor	p-value	With major IB	Without major IB	p-value	IPOs Regulated Market	IPOs non-Regulated Market	p-value
Underpricing	0.053	0.054	0.543	0.070	0.042	0.231	0.041	0.069	0.469
BHAR ₂₀	0.030	0.025	0.339	0.065	0.000	0.010	0.023	0.033	0.455
BHAR ₆₀	-0.006	0.014	0.638	0.050	-0.027	0.015	0.010	-0.001	0.199
Ln(Age)	1.779	1.907	0.313	1.844	1.853	0.665	1.890	1.802	0.740
PEInvestor				0.566	0.368	0.008	0.500	0.393	0.149
MTB	3.906	3.302	0.855	3.257	3.801	0.985	3.157	4.061	0.341
CFperEquity	4.234	0.925	0.886	2.319	2.485	0.110	4.224	0.306	0.095
IT	0.207	0.080	0.013	0.118	0.151	0.532	0.122	0.155	0.531
Biotech	0.110	0.030	0.032	0.066	0.066	0.997	0.082	0.048	0.360
Cleantech	0.085	0.080	0.898	0.145	0.038	0.010	0.102	0.060	0.301
Ln(Vol)	3.614	3.191	0.114	4.896	2.295	0.000	4.531	2.041	0.000
UWMShare	5.557	2.545	0.025				6.749	0.582	0.000
Retention	0.629	0.662	0.113	0.577	0.697	0.000	0.596	0.706	0.000
BookB	0.780	0.730	0.435	0.895	0.651	0.000	0.857	0.631	0.000
WidthBBRange	0.148	0.130	0.366	0.160	0.123	0.024	0.162	0.111	0.000
WidthBBPeriod	6.524	8.220	0.265	7.105	7.708	0.802	7.020	7.964	0.849
AllotmenttoEmission	6.012	7.230	0.055	4.355	8.349	0.000	3.449	10.452	0.000
PriceUpdate	-0.023	-0.018	0.448	-0.010	-0.028	0.096	-0.020	-0.020	0.709
CeilingLow	0.220	0.250	0.632	0.211	0.255	0.491	0.265	0.202	0.321
CeilingHigh	0.159	0.220	0.298	0.276	0.132	0.015	0.214	0.167	0.419
RegulatedMarket	0.598	0.490	0.149	0.842	0.321	0.000			
IndexReturn	0.019	0.004	0.025	0.012	0.010	0.585	0.013	0.009	0.673
NoIPOs	5.500	4.300	0.062	4.974	4.745	0.528	4.551	5.179	0.216
MeanUnderpricing	0.057	0.057	0.871	0.064	0.052	0.509	0.063	0.050	0.644
n	82	100		76	106		98	84	

Note: This table shows the differences of the arithmetic means of the variables employed and the p-value indicated by the Wilcoxon rank sum test with continuity correction. Bold figures represent significance levels below 10%.

Table 5: Regression Results

Variable	St. Beta	t-value		St. Beta	t-value		St. Beta	t-value		St. Beta	t-value		St. Beta	t-value		St. Beta	t-value	
Dep	Underpricing			Underpricing			BHAR ₂₀			BHAR ₂₀			BHAR ₆₀			BHAR ₆₀		
(Intercept)	-0.023	-0.534		-0.006	-0.154		-0.155	-1.822	.	-0.146	-1.645		-0.199	-2.130	*	-0.060	-1.185	*
LN(Age)	0.113	1.699	.	0.110	1.884	.	0.129	1.836	.	0.114	1.841	.	0.124	1.797	.	0.156	2.353	.
PEInvestor	0.030	0.393					0.040	0.566					0.037	0.524				
MTB	-0.082	-1.492					-0.071	-1.566					-0.051	-1.208				
CFperEquity	0.045	1.430					0.016	0.516					-0.003	-0.084				
IT	-0.125	-2.052	*	-0.121	-2.178	*	-0.065	-1.039					-0.081	-1.294				
Biotech	-0.060	-0.948					-0.122	-1.829	.	-0.101	-1.912	.	-0.115	-1.653				
Cleantech	0.124	2.259	*	0.133	2.596	*	0.070	0.964					0.054	0.765				
LN(Vol)	0.070	0.628					0.353	2.652	**	0.378	4.214	**	0.369	2.860	**	0.179	2.932	**
UWMShare	0.104	1.328		0.093	2.016	*	-0.014	-0.191					-0.068	-0.951				
Retention	0.222	3.209	**	0.173	2.414	*	0.178	2.142	*	0.167	1.951	.	0.184	2.159	*			
BookB	-0.272	-2.336	*	-0.330	-3.883	***	-0.301	-1.971	.	-0.300	-3.274	**	-0.304	-1.982	*	-0.255	-2.888	**
WidthBBRange	-0.042	-0.411					0.018	0.130					0.095	0.677				
WidthBBPeriod	-0.096	-2.084	*	-0.080	-2.254	*	-0.107	-2.245	*	-0.088	-2.310	*	-0.086	-1.736	.			
AllotmenttoEmission	0.033	0.322					0.069	0.631					0.058	0.499				
PriceUpdate	0.068	0.543					0.062	0.408					0.134	0.869				
CeilingLow	0.031	0.466					0.039	0.454					0.099	1.140				
CeilingHigh	0.269	2.560	*	0.321	4.493	***	0.126	1.485		0.134	2.112	*	0.158	1.770	.	0.237	3.705	**
RegulatedMarket	-0.103	-1.282					-0.147	-1.620		-0.59	-1.723	.	-0.115	-1.276				
IndexReturn	0.251	3.211	**	0.246	3.746	***	0.130	1.282					0.042	0.441				
NoIPOs	-0.019	-0.280					0.030	0.424					-0.095	-1.337				
MeanUnderpricing	-0.029	-0.527					-0.067	-1.020					-0.061	-0.974				
Adj. R-squared / (n):	0.22	(182)		0.25	(182)		0.08	(182)		0.12	(182)		0.09	(182)		0.12	(182)	

Note: This table shows the empirical results out of the regression analysis on model. “.”, “*”, “**”, “***” represent 10%, 5%, 1% and 0,1% significance levels respectively (bold figures).

Regression Results: Drivers of Underpricing

The results of the regression analysis for the three dependent variables - underpricing and short-/medium-term abnormal returns after 20 resp. 60 trading days - are stated in *table 5*. Beside the coefficients and t-values for the whole range of variables, we employed a stepwise exclusion of variables (those with the smallest coherence) to test for the robustness of coherences.

The figures stated in *table 4* imply that IPOs with PE involvement always employ prestigious UWs. This feature of the German market may raise doubts about the independence of both variables. For our regression analysis, we address this threat on the one hand with the stepwise exclusion of variables; on the other hand, we run our regressions excluding PE resp. IB_{big} . The latter results (not stated) do not show any difference regarding the insignificance of both variables.

Variables influencing simple underpricing are especially industry and transaction characteristics. The company's age is positively related to underpricing. The *IT* sector reduces, while the *cleantech* industry drives underpricing, providing evidence for *H4* and *H5* (hot-issues/cold-issues). However, *H5* seems not to hold in case of the *biotech* industry. Regarding the offering characteristics, *retention* enlarges and *bookbuilding* reduces underpricing significantly. An enlarging width of the bookbuilding period brings out smaller underpricing, while the variable *CeilingHigh* leads to higher underpricing. The index return prior to the IPO has a positive effect on underpricing. After stepwise exclusion, the *UWMSHare* also shows positive linkage to underpricing. For all other variables, results regarding the significance are robust.

Looking at the short-term performance after 20 trading days, the companies' *age* drives stock performance. The intercept also shows a significant negative estimate. A larger *issuing volume* goes in line with superior performance. Like the previous regressions, *retention*, *bookbuilding* and the width of the bookbuilding period influence underpricing in the same directions. While *IT* and *cleantech* are not significant, *biotech* has a negative influence on underpricing. Stepwise exclusion leads to varying results indicating that the relations shown are not as robust as with the simple underpricing: the *intercept* loses significance, while *CeilingHigh* and the market segment become significant.

Within 60 trading days after going-public the company's *age*, the *issuing volume*, *bookbuilding* and *CeilingHigh* have significant influence on out- and underperformance. The *intercept* indicates that IPOs in general underperform significantly. Less robust are those relations between BHAR and *retention*.

DISCUSSION

This study aims not only to identify reasons for underpricing but also to discuss changes in regard to those findings for the bubble period. To make these changes more clearly, *table 6* provides an overview on the main results of former studies dealing with the dotcom-bubble and those of our study. The most striking change regarding reasons for underpricing in the *Neuer Markt* and the after crisis environment is that market sentiments lost most of their influence on valuation. In fact, underpricing is still positively related to the index return prior to the IPO, but neither the number of IPOs nor recent mean underpricing have explanatory power in our sample. This underlines the observation that investor sentiments cooled down considerably. The return of the benchmark index only influences the initial return and not short- and medium-term abnormal returns. Hence, market returns of the time between bookbuilding and first trading day seem to be priced into the first quotations but do not matter for later trading anymore.

However, when regarding investors' interest for certain industries, our results validate the hot-issue hypothesis even in the post-bubble environment. Within our sample, we identified two potential hot-issue industries: the *cleantech* and *biotech* sector. The results can only confirm an outstanding demand for the *cleantech* industry, whereas the *biotech* sector does not seem to gain special interest in Germany. *Biotech* only shows a negative coherence once after 20 trading days of listing, therefore findings are only little reliable. As a former bubble-industry the *IT*-sector has now become more realistic in market expectations. Due to lessons learned in the *NeuerMarkt* the valuations came down and today, there is rather an "overpricing" in the *IT* sector. These results

considering *IT* and *cleantech* are only significant for initial returns. Former research – except Mayer (2001) and Ljungqvist and Wilhelm (2002) – also showed that it is hard to detect robust linkages. In contrary, most European studies found clear evidence for a relation between the *IT* sector and underpricing in the dotcom-period. Nevertheless, our short-term results are consistent with a strong demand for the *cleantech* industry and lower-than-average demand for *IT* shares. In the post-dotcom period, investor activities focus on other industries due to changes in the market environment.

The new segments in the German stock market do not influence underpricing, indicating that the regulations are not differing regarding the reduction of information asymmetry. This may imply that the differences in listing requirements are not considerable. This evidence is contrary to Franzke (2004), Günther and Rummer (2006) for the *Neuer Markt* and contrary to H3. Since the *Neuer Markt* – despite having the most comprehensive listing requirements - was denoted by the highest underpricing, market segments also may lead to higher demand due to a very positive reputation. As the participants do not seem to honor any of the market segments, this argument also does not seem to hold.

Looking at the firm's age, the positive coherence is remarkable, because an older company is said to bear less risk and hence a lower ex-ante uncertainty. Besides some authors that do not find significant relations, Günther and Rummer (2006) document this expected negative correlation. Only Tykvova and Walz (2007) also show that older firms are more underpriced. Reasons might be found in a higher demand for more mature IPOs that leads to rising valuations. The superior medium-term performance of older companies (as well as larger ones) might provide evidence for this assumption. Our findings regarding the retention rate are also difficult to interpret. The intuition leads to the suggestion that a higher retention rate signals the quality of the IPO and hence reduces ex-ante uncertainty. Nevertheless, we find that underpricing correlates positively with the fraction of shares unsold. This confirms the results of Leuz (2003) and Aussenegg et al. (2006) but is contrarian to those of Günther and Rummer (2006) or Elston and Yang (2010). Bradley and Jordan (2002) argue that the cost per share caused by underpricing drops if a higher fraction of shares is retained by the issuers. Thus, underpricing is not that harmful for former owners. Further, a rising retention rate reduces the number of shares offered and higher underpricing might be caused by a smaller supply meeting a given level of demand (Ritter 2003). Our observation that the coherence still holds after some weeks supports this argumentation.

The market to book ratio (*MTB*), as an accounting measure, does not explain underpricing in our models (except in one regression). This evidence goes in line with the results of Elston and Yang (2010), while Dorn (2009) Tykvova and Walz (2007) find positive relations. This implies that differences between book and market values are not helpful to capture ex-ante uncertainty. Even the *cash flow per equity* has no observable impact on underpricing, involving that both fundamentals do not seem to influence neither underpricing nor performance.

Referring to offering characteristics, our study provides various insights. While past publications, such as Löffler et al. (2005), Leuz (2003) or Tykvova and Walz (2007) show a reducing effect of the offering volume on underpricing, those of Dorn (2009), Günther and Rummer (2006), Tykvova and Walz (2007) as well as Elston and Yang (2010) provide evidence that underpricing rises with higher total company's value (Mayer 2001, Schertler 2002, Ljungqvist and Wilhelm 2002 and Aussenegg et al. 2006 find no significant relation). The results at hand indicate positive coherence between the volume issued and abnormal performance after some trading days, indicating that the volume sold does not affect underpricing but begins to matter after trading started. This may be caused by a higher public interest in bigger IPOs. *Bookbuilding*, *CeilingHigh* and the bookbuilding period show a strong coherence with underpricing. This evidence shows that the bookbuilding procedure is able to reduce underpricing and that issuing prices set at the upper limit of the offering range lead to positive initial returns (these results go in line with those of Elston and Yang 2010 and Aussenegg et al. 2006). Longer bookbuilding periods seem to lead to a more accurate pricing, since this variable is negatively related to underpricing.

Our analysis finds no evidence to confirm either the certification role or the grandstanding hypothesis for PE investors. Though PE significantly focuses on growth industries and is able to manage an IPO more professionally, their presence does not affect underpricing at all. This evidence goes in line with findings of Mayer (2001), Hack and Lehmann (2006) and Elston and Yang (2010). Beside Schertler (2002), who finds slight evidence that PE involvement leads to higher underpricing, Franzke et al. (2003) and Tykvova and Walz (2007) document

that underpricing is in positive relation to the rank of the VC. These observations may not be explained by grandstanding but rather a higher affiliation of VCs and UWs (Loughran and Ritter 2004, Hoberg and Seyhun 2006). In case those rather prestigious and experienced PE investors are more likely to have survived the crisis, one could expect the underpricing to rise, if the old coherence still holds. Since our sample does not show this result, these agency conflicts do not seem to matter anymore. Due to bad sentiments during the dotcom-bubble, after-crisis-investors do not seem to trust the certification role of PE investors. On the other hand, there is no evidence, that PE investors foster the IPO process for their own benefit. The affiliation theory of PE and UWs in the German bank-based market cannot be confirmed. Hence, we do not observe the certification role of PE in the post-dotcom period, supporting H1. This expands former results that were solely focused on the *Neuer Markt*-period.

Table 6: Evidence on Underpricing for the Neuer Markt (New Market) and the Post-Dotcom Period

Variable	Neuer Markt	Post-Dotcom period
Age	-/o/+	o/+
PE involved	o/+	o
Market to book ratio	o/+	o
Cashflow per Equity	o	o
IT	o/+	-
Biotech		o
Cleantech		+
Volume	o/-	o
UWMShare	-/o/+	o/+
Retention	-/o/+	+
Bookbuilding used		-
Width bookbuilding range	-	o
Width bookbuilding period		-
Allotment to emission		o
PriceUpdate	-/+	o
CeilingLow		o
CeilingHigh	+	+
RegulatedMarket	+ (<i>Neuer Markt</i>)	o
IndexReturn	o/+	+
NoIPOs	o/+	o
MeanUnderpricing	o/+	o

Note: This table shows the empirical results of this study (right column) and the different evidence for underpricing in Germany out of the studies presented in the literature review. Negative significant results are denoted as “-”, positive as “+”, if significant results are lacking the symbol “o” is used. Empty spots have not been analyzed in the *Neuer Markt*.

Empirical studies regarding the dotcom bubble showed slight evidence that the more prestigious the IB acting as UW, the lower the underpricing. Through this study, we cannot find such results. Our findings induce little evidence for the opposite. Like other studies – e.g. Schertler (2002), Aussenegg et al. (2006), Leuz (2003) or Franzke (2004) -, we do not find a robust influence of the presence of a major UW on underpricing (Günther and Rummer 2006 find a negative one). Nevertheless, it seems that IPOs managed by major UWs differ significantly in the going-public procedure. This observation can be caused by a loss of certification role of major UWs. Investors, who lost enormous sums of money in the *Neuer Markt*, might not be willing to trust in particular those IBs that accompanied IPOs during the bubble. Even the higher affiliation of UWs in the German bank-based systems does not seem to lead to a reduced information asymmetry and hence to lower underpricing.

Regarding the institutional framework in Germany, our results go in line with these of Elston and Yang (2010) who find no influence of PE or major IBs’ involvement on underpricing. The authors argue that German VCs are too young and relatively weak to lower information asymmetry. Though PE became more mature in Germany, we still do not find significant influences. The lack of significance indicates on the one hand, that agency conflicts are not that heavy to lead to a higher underpricing but, on the other hand, the institutions involved are not able to reduce money left on the table.

CONCLUSION

This contribution investigates the underpricing phenomenon in a post-crisis environment with special emphasis on the role of PE investors, UWs and market segments. Furthermore a large scale of underpricing driving

factors is analyzed. The data set grounds on 182 IPOs that took place in the German market between March 2002 and April 2011, representing all IPOs of the post-crisis period in Germany.

Within the most recent period, underpricing reduced to a level comparable to that before the dotcom-bubble (see Figure 2). Our sample provides evidence that especially company characteristics, like age and industry, offering characteristics, such as retention rate or the employment of bookbuilding as well as the market environment influence underpricing. There is only slight evidence for an influence of major UWs in the German bank-based market. The most striking change in regard to the bubble-period is the reduction in investor sentiments. The market environment does no longer drive underpricing significantly. Nevertheless the industry-focus of investors seems to have shifted from IT towards cleantech.

This study is limited by its focus on the German market. To shed further light on this issue, the perspective should be broadened with additional countries to get deeper insights in this field of research.

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