Market Segmentation and IPO-Underpricing: The German Experience

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Symbols

UP	Underpricing
UP_i	Underpricing of Share i
R_i	Raw Return of Share i
R_m	Raw Return of the Market-Adjustment Term
P_i	First Trading Price of the Share i at its first Trading Day
P_0	Issue Price of the Share i
I_i	Price of the Market Portfolio at the First Trading Day of Share i
I_0	Price of the Market Portfolio at the End of the Offer Period of Share i

1. Introduction

Underpricing of initial public offerings (IPOs) as a worldwide phenomenon in financial markets is well known. Several studies deal with the difference between the issue price of new shares and their first trading price in the secondary market.[1] A range of theoretical approaches show, how this phenomenon of efficient capital markets could be explained. One of the best-known approaches[2] of initial underpricing is *Rock's* winner's curse model (*Rock*, 1986). In this equilibrium model, underpricing is necessary to hold uninformed investors in the market, because it is assumed that they subscribe to every IPO whereas informed investors only subscribe to IPOs that are offered at a discount. An assertion of the model is that the underpricing is assumed to be smaller the larger the market is because in large markets the IPO represents a small fraction of each investors' total wealth only.[3] Of similar importance is the explanation from *Beatty/Ritter* (1986) who argue that the underpricing is expected to be lower the lower the ex-ante uncertainty is about the value per share. Under the implication that an issuer has an incentive to reduce this uncertainty by disclosing information it can be assumed that underpricing is the lower the more information about the firms value is disclosed.

Empirical evidence comes from *Ritter* (1984), *Koh/Walter* (1989), *Levis* (1990) or *Keloharju* (1993) and many others, but they all refer to the whole capital market, neglecting existing market segmentation.[4] However, a closer look at such institutional arrangements might be useful. For example, *Schmidt* states that the extent of underpricing differs among the market

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1 The extent of underpricing varies for instance from 4.00 percent in France (*Husson/Jacquillat*, 1989) over 9.52 percent in the United Kingdom (*Brennan/Franks*, 1997) to 26.50 percent in the USA (*Ritter*, 1984) or 45.40 percent in Singapore (*Saunders/Lim*, 1990).

2 *Jenkinson/Ljungqvist* (1996, p. 43), who refer especially to asymmetric information models.

3 Rock, 1986, p. 196.

4 For an IPO at the US-Stock Markets securities have to be registered by the *Securities and Exchange Commission* (*SEC*) which settles rules under the *Securities Act* that is valid for the whole nation. However, the individual stock exchanges mention their own special listing requirements, which are subject to the „*Blue Sky Laws*" of each federal state (*Schuster*, 1996, p. 113). Insofar, there is also market segmentation in the US-equity market. Furthermore, the single Stock Exchanges often differentiate the requirements with respect to the size of the issuers (cf. for instance *NASDAQ, Listing Requirements*, 1997). In his investigation, *Ritter* does not differentiate between these segments (*Ritter*, 1984). The Singapore stock market is segmented in the *SESDAQ* and the *Big Board* since 1987 (*Saunders/Lim*, 1990), but *Koh/Walter* refer to the period until 1987 only. Up to 1995, the British equity market was segmented into the *Official List,* the *Unlisted Securities Market* and the *Third Market* but *Levis* does not differentiate his results with regard to this segmentation (Levis, 1990). The stock market in Finland is segmented in the *first market*, the *second market* and the *third market* (*Keloharju*, 1993, p. 255) but concerning the test of *Rock's* model *Keloharju* does not differentiate between these segments.

segments of the German stock markets but he gives no further information why.[5] *Wasserfallen/Wittleder* mark out that in Germany a „stock can be traded in one of four segments, differing with respect to listing requirements", but they neglect this fact because these „distinctions do not influence the empirical results",[6] even though they state that „Legal and *institutional arrangements* may also influence the pricing process"[7]. Further on, *Ljungqvist* points out in his investigation on German IPOs that the *Ungeregelter Freiverkehr* (unregulated over-the-counter-market) „is an opaque and illiquid inter-broker telephone market with low listing requirements" in comparison to the *Official Trading* and the *Regulated Market* which are the „higher-tier" markets.[8]

These findings lead to the question whether the theoretical framework of, for instance, *Rock* and *Beatty/Ritter* can also be related to segmented markets like the German one. Until 2002, with the *Official Trading (Amtlicher Handel)*, the *Regulated Market (Geregelter Markt)*, the *Unofficial Regulated Market (Freiverkehr)* and the *Neuer Markt* the German equity market consisted of four independent market segments, each different from each other with respect to the listing requirements and the relevance in the market. The *Official Trading*, for instance, has the biggest relevance in German's equity market – in 1998 about 95 percent of the total equity turnover at Frankfurt Stock Exchange was settled at this segment.[9] The *Neuer Markt*, the *Regulated Market* and the *Unofficial Regulated Market* play a minor role with regard to the equity turnover. In contrast, the *Neuer Markt* absorbed about 43 percent of the total gross proceeds concerning the initial public offerings from 1997 to 2002 (54 percent the *Official Trading*) and is therefore the second largest market segment.

In view of the findings of *Rock* and *Beatty/Ritter,* this investigation has two related objectives. The first one is to test whether there is a market segment specific underpricing in the German equity market in relation to the market size. The second objective is to test if there is evidence in the German equity market for the implications of *Beatty/Ritter* that the underpricing is lower the lower the information asymmetry is.

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5 *Schmidt* reports for the 32 IPOs in 1984/85 an underpricing of 25 percent in the *Unofficial Regulated Market* and 17.6 percent in the *Official Trading* (*Schmidt,* 1988 b, p. 1201).

6 *Wasserfallen/Wittleder*, 1994 p. 1516

7 *Wasserfallen/Wittleder*, 1994 p. 1512

8 Even if he reports an IPO-underpricing of 37.48 percent for the IPOs of the *Ungeregelter Freiverkehr* in contrast to the 10.57 percent underpricing for all tiers, *Ljungqvist* does not analyse this difference; *Ljungqvist*, 1997 p. 1311/1312.

9 *Deutsche Börse AG*, Fact Book 1998, p. 28

A further aspect to discuss is the effect of the termination of the *Neuer Markt* within the year 2003. With regard to the *Viertes Finanzmarktförderungsgesetz*, in force since July 1st, 2002, the German equity market will be subdivided in two segments apart from the *Unofficial Regulated Market*. The first segment should be equivalent to the current *Official Trading*; the second segment should be equivalent to the current *Regulated Market*. Moreover, the stock exchanges are enabled to create additional requirements within the two segments. Because the *Deutsche Börse AG* will realize a new concept of market segmentation within the year 2003 it is questionable which future effect such a renewal of the market segmentation on the IPO underpricing has.

For a sample of 435 IPOs from 1997 – 2002 in Germany I observe an average underpricing of about 42.34 percent for the whole market that differs widely among the respective market segments. Underpricing is the highest in the *Neuer Markt*, although the *Neuer Markt* is the second largest market segment for IPOs and demands the highest listing requirements. Furthermore, underpricing is overshooting the market, i.e. it tends to be higher in periods of an increasing market return while it tends to be lower in periods of a decreasing market return.

The study is organized as follows. Section 2 supplies an overview of the present explanations for the underpricing phenomenon in a market-segmented context, while section 3 gives an overview of the microstructure of the German equity market from 1997 to 2002. Section 4 provides the empirical findings and section 5 summarizes.

2. The Winner's Curse, Uncertainty, and other Explanations of Underpricing

The IPO-literature shows a variety of approaches explaining the IPO-underpricing. *Jenkinson/Ljungqvist* (1996), for example, give an overview over 62 possible explanations. Many of them are developments or interpretations of a few basic theoretical approaches, from which *Rock's* model of asymmetric information is the most popular one.

Rock (1986) states that investors have different information about the fair value of the shares. While uninformed investors subscribe to every IPO, informed investors only buy new shares if the issue price is less than the fair value. This causes a „winner's curse" for the uninformed investors. Therefore, shares must be offered at a discount to hold the uninformed investors in the market. According to *Baron* (1982), the underwriters have superior information about demand for new shares and therefore deliberately underprice the offerings in order to minimize the risk of failing to place all available stocks. *Beatty/Ritter* (1986) find evidence that the greater is the ex ante uncertainty, the higher is the underpricing, which is also a consequence of *Rock's* model (*Kunz/Aggarwal*, 1994).

For *Grinblatt/Hwang* (1989), *Allen/Faulhaber* (1989), *Welch* (1989) and *Chemmanur* (1993), underpricing serves as a signal for high quality firms to maximize the expected proceeds of the going public in a two-stage sale of the shares. Therefore, high-quality firms underprice their shares at the initial public offering deliberately. In the second period, only high-quality firms are able to pay, for example, the announced high dividends (*Allen/Faulhaber*, 1989) which leads to increase in share prices. These increased share prices then lead to higher proceeds for the shares issued at a subsequent equity offering compensating the firm for the losses at the initial public offering. While *Grinblatt/Hwang* (1989) stress the low free-float of shares as a signal, *Welch* (1989) or *Chemmanur* (1993) assume that high-quality firms deliberately underprice their shares to reveal the imitation costs of low-quality firms.

Beatty/Ritter (1986), *Carter/Manaster* (1990) and *Carter/Dark/Singh* (1997) suppose that the reputation of the underwriters is responsible for the existence of underpricing. They argue that the lower the research intensity of the underwriter is the lower is the information about the fair value of the issuing shares and therefore the higher is the risk of a misjudgment. To avoid the risk of a non-placement of the shares, the underwriters with low research intensity deliberately reduce the offering price. Therefore, underpricing is the higher the lower the reputation of the underwriter is.

The same seems to be valid if the underwriter is a venture capitalist. Following *Gompers* (1996), IPOs are more underpriced if they were brought to the market by young venture capitalists because of the grandstanding benefits, which are not so important for established venture capitalists. *Booth/Smith* (1986) find evidence that IPOs of venture capitalists are lower underpriced because the continuing involvement of the investors lowers the costs of going

public. According to *Hamao/Packer/Ritter* (2000), the underpricing of venture capital-backed IPOs depends on the institutional affiliation of the venture capitalists.

According to *Ritter* (1984) or *Beatty/Ritter* (1986), insufficient competition in the underwriter market could also be an explanation for underpricing, because the underwriters are able to lower the issue price to avoid the risk of a non-placement of the shares. *Ibbotson* (1975), *Tinic* (1988) and *Hughes/Thakor* (1992) state that a deliberately underpricing of the underwriters serves as an insurance against legal liability because the higher the underpricing is the lower is the likelihood of being sued by an investor if the share prices decrease after the placement due to missing or incorrect mentioned facts in the prospectus. *Ruud* (1993) finds evidence that the underwriter price support is responsible for the underpricing.

The underpricing phenomenon for the German equity market has been analyzed by, for instance, *Schmidt* (1988 b), *Uhlir* (1989), *Wasserfallen/Wittleder* (1994), *Kaserer/Kempf* (1995), *Ljungqvist* (1997) and *Hunger* (2001). While *Schmidt* (1988 b) finds evidence for the underwriter-reputation thesis, *Kaserer/Kempf* and *Hunger* reject coherence between the underpricing and the underwriter. The monopsony-power thesis is supported by *Kaserer/Kempf* and *Uhlir*, but rejected by *Hunger*, who rejects also the thesis concerning legal liability. *Ljungqvist* finds evidence for the signaling theories as well as for macroeconomic conditions. *Rock's* implications about the correlation between the ex-ante uncertainty and underpricing are confirmed by *Schmidt*, *Kaserer/Kempf*, *Uhlir* and *Wasserfallen/Wittleder*.

The mentioned theoretical approaches as well as the empirical evidence refer to a whole capital market, neglecting existing market segmentation. On the other hand, it is possible to show the potential effects of market segmentation according to the implications of the theories, provided that the single market segments are different from each other.[10]

Following *Rock's* equilibrium model, for instance, underpricing is a consequence of asymmetric information between the investors concerning the fair value of a new issue. In the model the issuer has the most 'material information' about the plans and activities and therefore knows more than any single individual in the market. By revealing this proprietary knowledge to the market direct through the prospectus, the firm gives up some of its informa-

[10] Obviously, if there were no material differences between the segments, the segmentation would be useless.

tional advantage. In addition, some of the investors may have other inside information so that the issuer knows less than all the individuals in the market combined.

Hence, the informational advantage of the so-called informed investors is the smaller the more ‘material information‘ is disclosed by the issuer. All other investors with no additional information are called the uninformed investors. They are assumed to subscribe to every IPO, whereas the informed investors only subscribe to IPOs offered below the fair value. However, the wealth neither of the informed investors nor of the uninformed investors is assumed to be sufficient to absorb the whole issue. Therefore, the shares have to be underpriced to place the whole issue. Thus, an issue price above or equal to the fair value will lead to an excess supply of shares to the uninformed investors with subsequently decreasing prices. Consequently, the uninformed investors face a “winner’s curse”. Insofar, the uninformed investors have to be hold in the market by underpriced new shares. But even if some of the investors have favorable information about the prospects of the offerings, the uncertainty about the shares value once public trading starts remains. *Beatty/Ritter* call this uncertainty the ‘ex ante uncertainty‘.[11]

One assertion of *Rock’s* model is that the underpricing is expected to be smaller the larger the market is.[12] In a large market „the risky asset represents a small fraction of each investor’s total wealth“ (*Rock*, 1986, p. 196) which means that more investors are needed in a small market to place the whole issue. Moreover, because the informed investors can purchase a larger fraction of the issue the lower is the issue price, underpricing is the lower the smaller is the market.

According to these implications, *Rock’s* model could be transferred to segmented markets like the German, if the number of investors is different from segment to segment. If this is the case, one could expect that the underpricing is the lowest in the *Official Trading* and the highest in the *Unofficial Regulated Market*, because the latter one is substantially smaller than the first one in absolute and relative figures (cf. Table 1-3 in section 3.2.). In so far *the first hypothesis is that the underpricing is the smaller the larger the market segment is* in relation to the other segments of the respective equity market.

[11] *Beatty/Ritter* (1986), p. 213/214
[12] A large market is a market in which the *number of investors* is very large (*Rock*, 1986, p. 196)

A further aspect is that the underpricing is expected to be higher the higher is the ex ante uncertainty of the informed investors about the shares value. Because of this ex ante uncertainty, „a potential investor has an incentive to incur costs doing security analysis to discern which issues are likely to appreciate in price".[13] Additionally, an investor has to scrutinize if the proposed issue price accurately reflects the firm's prospects.[14] Because the costs of doing security analysis increase the greater is the uncertainty about a shares value, an investor „will demand that more money ‚be left on the table', in an expected value sense, via underpricing".[15] These conclusions lead to the proposition that the greater is the ex ante uncertainty about the value of an issue, the greater is the expected underpricing. For this proposition *Beatty/Ritter* find evidence and conclude that an „implication of this findings is that ... an issuing firm has an incentive to reduce this uncertainty by voluntarily disclosing information".[16] These findings lead to the assumption that the underpricing is the lower the more 'material information' about the value of an issue is disclosed.[17]

In a segmented market, like the German one, where the segments are different from each other concerning the quantity and quality of information which has to be published for a going public it could therefore be expected that the underpricing is the lower the higher the degree of published information is. This is because the more information is published voluntarily (or bound by law) the greater is the knowledge about the value of an issue and the lower is the ex ante uncertainty. Thus, the incurred costs of an investor of doing security analysis are lower and the compensation via underpricing could be smaller.

Therefore it could be expected that the ex ante uncertainty in the German equity market is the lowest in the *Neuer Markt* and the *Official Trading* because these market segments demand the highest requirements concerning the publication of information. On the other hand the ex ante uncertainty is expected to be the highest in the *Unofficial Regulated Market* and the *Regulated Market* because lower requirements are demanded. *This leads to the second hypothesis that the underpricing is expected to be the lowest in the market segment, which requires the most information because of the less ex ante uncertainty.*

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[13] *Beatty/Ritter* (1986), p. 215
[14] *Rock* (1986), p. 190
[15] *Beatty/Ritter* (1986), p. 216
[16] *Beatty/Ritter* (1986), p. 227
[17] It is not important whether the disclosure is voluntarily or involuntarily and due to, for instance, the listing requirements because the focus is on the degree of information asymmetry.

3. The German Issue Market

3.1. The Microstructure

The German capital market is both horizontally and vertically segmented (*Schmidt*, 1988 a). The horizontal segmentation is historically determined through the coexistence of the eight stock exchanges in Frankfurt, Stuttgart, Düsseldorf, Berlin, Munich, Hamburg, Hanover and Bremen. According to this horizontal segmentation, a share can be listed at more than one stock exchange simultaneously. The *Frankfurt Stock Exchange* has a dominant position. About 86 percent of the total turnover of all German stock exchanges is settled in Frankfurt.[18] The vertical segmentation arises from the *Stock Exchange Act (Börsengesetz)*, which defines the *Official Trading* (*Amtlicher Handel*), the *Regulated Market* (*Geregelter Markt*) and the *Unofficial Regulated Market* (*Freiverkehr*) depending on different listing- and selling-requirements. This means that a share can be listed at one stock exchange in one of these segments only, of which the *Neuer Markt* is an additional market segment, established by the *Deutsche Börse AG* in 1997. It is privately organized but, from a jurisdictional point of view, part of the *Unofficial Regulated Market*.

Before the German *Stock Exchange Act* came into force on January 1st, 1897, there had existed an unregulated (OTC) market only.[19] After the regular stock exchange trading was established, it was the solely governmental controlled market segment apart from the OTC-market. In the course of time, the OTC-Market has been developed into a regular and an unregular OTC-Market. Numerous amendments, especially directives of the *European Community* to harmonize the EU capital markets,[20] led in 1987 to the present form of the German stock market. After the previous regular stock exchange trading had been renamed into *Official Trading*, a less controlled market segment was founded (*Regulated Market)* and the original regular OTC-market was submitted as the *Unofficial Regulated Market* under the *Stock Exchange Act*. Thus, there is apart from an unregulated OTC-Market threefold market segmentation in the German stock market according to the *Stock Exchange Law*: the *Official Trading*, the *Regulated Market* and the *Unofficial Regulated Market* (*Mues*, 1997, *Kümpel*, 1985). The

[18] *Deutsche Börse AG*, Fact Book 1999, p. 27
[19] Cf. *Mues*, 1997
[20] These directives are the Börsenzulassungsrichtlinie 79/279/EWG, the Börsenprospektrichtlinie 80/390/EWG and the Zwischenberichtsrichtlinie 82/121/EWG of the European Community.

Neuer Markt was founded by the *Deutsche Börse AG* and started trading on March 10th, 1997. Listing requirements refer to the stock exchange guidelines only because of its privately organization. However, the *Neuer Markt* was admitted as a regulated market in the sense of the *Wertpapierdienstleistungsrichtlinie* because the stock exchange guidelines require a formal admission to the *Regulated Market*, even though the *Neuer Markt* is privately organized.[21]

This evolution already shows differences between the single market segments. The *Official Trading* is the eldest market segment in the German stock exchanges while the *Regulated Market* was founded ninety years later to lower the market-entry-barriers for small caps to facilitate their possibilities to raise capital. The *Unofficial Regulated Market* was submitted to the *Stock Exchange Act* to enable stock trading at the stock exchanges especially for shares of regional and foreign companies, unwilling to be listed at a regulated market[22] but still requiring the certainty of a duly market. Because of the different purposes of the prevailing market segments the *Stock Exchange Act* and referring *Regulations* state for each market segment special listing- and trading-requirements for securities. The objective of these requirements is to enable the public to make a proper assessment of the issuer and the securities (*Securities Prospectus Act*, § 7).[23]

Concerning the listing requirements, securities can be admitted to the *Unofficial Regulated Market* if the trading guidelines of the stock exchanges ensure a proper conduct of trading and settlement (*§ 78 BörsG*). The *Securities Prospectus Regulation* (*Verkaufsprospekt-Verordnung*) settles the contents of the prospectus, which has to „provide such information about the factual and legal circumstances as are necessary for the assessment of the securities offered, and shall be correct and complete“ (*Securities Prospectus Regulation*, § 2). In consequence, only general statements are required about the issuer, the securities, the issuer's capital, the business activities, the financial situation and recent developments. Further requirements are not demanded either for the period after the going public.

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[21] Potthoff/Stuhlfauth, 1997

[22] According to the Wertpapierdienstleistungsrichtlinie 93/22/EWG a market is regarded as a “regulated market” if, for instance, the *Stock Exchange Supervisory Authority* enacts the trading conditions and listing requirements. The classification of a market segment as a “regulated market” is an important qualification especially for international investors (Potthoff/Stuhlfauth, 1997, p. 6).

[23] The translations of the national laws and regulations stem from Krause, Hartmut, German Securities Regulation, Verlag C.H. Beck, München, 2001

For an admission to the *Regulated Market,* an *Admissions Committee* (*Zulassungsausschuss*) decides on the registration based on an admission- and sales-prospectus, which is the same as for an admission to *the Unofficial Regulated Market*. But additional to these requests the issuers have to meet the Stock Exchange Rules (*§72 BörsG*), which requires an equity capital of at least EUR 250,000.-- for an admission at the *Frankfurt Stock Exchange (§58 Exchange Rules*) and the submission of additional documents (*§ 59 Exchange Rules*) like statements concerning disruptions of operations, patents or legal disputes as well as annual financial statements and management reports for the three business years preceding the year of application. Beyond these requirements financial statements, management reports and interim reports have to be published annually after the going public.

A decision about the admission of securities to the *Official Trading* is made by the *Admissions Office* (*Zulassungsstelle*) based on requirements listed in the *Stock Exchange Admission Regulation* (*Börsenzulassungs-Verordnung; BörsZulVO*). The issuer‘s equity capital has to be at least 1.25 Mio. EUR, the company has to exist for at least three years and the free float after the going public has to be at least 25 percent of the aggregate nominal value *(§ 2,3 and 9 BörsZulVO).* The content of the sales prospectus is almost the same as for an admission to the *Regulated Market* but furthermore the *Stock Exchange Admission Regulation* requires more detailed specifications about the issue, the capital and the financial situation. Additional economic information has to be given concerning the sources and applications of funds, affiliated enterprises and profits, losses and dividends. After the going public, the issuer is obliged to publish the financial statements, management reports and interim reports with detailed specifications concerning the actual business situation. Furthermore, the issuer has to publish information about the shareholders‘ meeting and the balance sheets as well as modifications of the statutes and of the securities.

For an admission to the *Neuer Markt*, the *Stock Exchange Guidelines* require the issuer‘s official application for a listing at the *Regulated Market* (to meet the legal requirements) with a simultaneous waiver of being listed at the *Regulated Market* in favor of a listing at the *Neuer Markt* (*No. 2.3 Rules and Regulations Neuer Markt*). Therefore, the legal listing requirements for the *Neuer Markt* are the same as for the *Regulated Market*, but additional requirements are stated in the *Rules and Regulations Neuer Markt*, the Stock Exchange Guidelines for the *Neuer Markt* of the Deutsche Börse AG. They are almost the same as for the *Official Trading* but additional statements are required concerning, for instance, risk factors. Risk factors are

„information regarding any factors which could have a substantial negative influence on the financial condition of the issuer or which could endanger the issuer's business success" (*Rules and Regulations Neuer Markt*, No. 4.1.16). Beyond these requirements, the estimated aggregated market price of the issued shares must amount to at least five Mio. EUR. After the going public quarterly reports, financial statements and management reports according to IAS or US-GAAP have to be published in German and English as well as the notification of every share transaction of the issuer or the management. Furthermore, the issuer is required to hold an analysts' meeting at least once a year (*Rules and Regulation Neuer Mark,* No. 7.1 - 7.3)

To sum up, the lowest demands concerning the disclosure of valuable information of the issuers have to be fulfilled with an admission to the *Unofficial Regulated Market*. There are no requests concerning size or age of the company; the content in the sales-prospectus has to be concise and there are no requests to the issuer after going public. More requirements are made with an admission to the *Regulated Market* because the issuer has to have a certain starting capital and has to publish more information about his business situation. Regular information are to be published even after going public. Even more information requires the *Official Trading*, and that concerning not only size and age of the company but also with regard to quantity and quality of the information that has to be published for an admission and after the going public. Most information about an issuer's business situation has to be disclosed for an admission at the *Neuer Markt*. In addition to the requirements of the *Official Trading,* further requirements are demanded for an admission and for the time after the going public.

Therefore, it could be assumed that the four market segments cause a different degree of information asymmetry, which is the lowest in the *Neuer Markt* and the highest in the *Unofficial Regulated Market*. With respect to *Beatty/Ritter,* it could be expected that the underpricing therefore is the lowest in the *Neuer Markt* following by the underpricing in the *Official Trading* and than of the *Regulated Market*. The underpricing of the *Unofficial Regulated Market* is expected to be the highest.

3.2. Facts & Figures

In the year 2000, approximately 87 percent of the total German stock exchange turnover in equities was settled at the Frankfurt Stock Exchange.[24] Therefore, the following data refer to the Frankfurt Stock Exchange only. Until the foundation of the *Neuer Markt* in 1997, approximately 70 percent of the listed domestic companies were listed in the *Official Trading*, 17 percent in the *Regulated Market* and 13 percent in the *Unofficial Regulated Market*. In the year 2001, five years after the foundation of the *Neuer Markt* only 40 percent of the listed domestic companies are listed in the *Official Trading* and 30 percent in the *Neuer Markt*.

Table 1: Number of Domestic Quoted Companies at Frankfurt Stock Exchange

	Number of Domestic Quoted Companies								
Year	Official Trading		Regulated Market		Unofficial Reg. Market		Neuer Markt		Total
1995	297	68.91%	77	17.87%	57	13.23%	0	0.00%	431
1996	303	69.98%	73	16.86%	57	13.16%	0	0.00%	433
1997	305	67.78%	75	16.67%	57	12.67%	13	2.89%	450
1998	323	59.81%	75	13.89%	88	16.30%	54	10.00%	540
1999[1]	354	50.43%	88	12.54%	92	13.11%	168	23.93%	702
2000	366	40.44%	95	10.50%	161	17.79%	283	31.27%	905
2001	**359**	**39.36%**	**118**	**12.94%**	**163**	**17.87%**	**272**	**29.82%**	**912**

1 Source: Börsenzeitung from 31.12.1999

Source: Deutsche Börse AG, Fact Books, several issues; own calculations

A stronger impression of the relevance of the *Official Trading* shows Table 2, listing the equity turnover in domestic shares from 1995 to 1998. In 1998, 97.20 percent of the total equity turnover in domestic shares was settled at the *Official Trading*, whereas only 0.67 percent was settled at the *Regulated Market* and the *Unofficial Regulated Market* together.

Table 2: Equity Turnover in Domestic Shares 1995 – 1999 at Frankfurt Stock Exchange

	Equities - Turnover Domestic Shares (in Mio. EUR)								
Year	Official Trading		Regulated Market		Unofficial Reg. Market		Neuer Markt		Total
1995	631,302	98.64%	4,810	0.75%	3,916	0.61%	0	0.00%	640,029
1996	940,134	99.02%	6,950	0.73%	2,309	0.24%	0	0.00%	949,393
1997	1,396,787	99.02%	9,652	0.68%	673	0.05%	3,498	0.25%	1,410,610
1998	2,139,573	97.20%	9,926	0.45%	4,791	0.22%	46,918	2.13%	2,201,209
1999	n.a.		n.a.		n.a.		189,016	8.24%	2,293,532

Source: Deutsche Börse AG, Fact Books, several issues; own calculations

[24] Including Xetra-turnover; source: Deutsche Börse AG, Fact Book 2000, p. 34

However, in 1998, the second year after the foundation of the *Neuer Markt*, already 2.13 percent of the equity turnover was settled at the *Neuer Markt*. This is more than three times of the turnover of the *Regulated Market* and the *Unofficial Regulated Market* together but still negligible in comparison to the *Official Trading*. In 1999, already 8.24 percent of the total equity turnover was settled at the *Neuer Markt*. Even if the equity turnover of the *Neuer Markt* is relatively small in absolute figures, the increasing position of the *Neuer Markt* is still evident. In 1997, the equity turnover of the *Neuer Markt* in relation to the equity turnover of the *Official Trading* is 0.25 percent only. This share increases to 2.19 percent in 1998 and approximately 16 percent in 2000.[25] Unfortunately, special data for the single market segments for the years after 1998 are not available probably because of a shift in the business policy of Deutsche Börse AG.

Insofar, these data show following. First, the *Official Trading* plays the main part in the German domestic equity market. Secondly, the importance of the *Neuer Markt* is increasing, even though the relevance is minor in absolute figures. Thirdly, the relevance of the *Regulated Market* and the *Unofficial Regulated Market* is negligible both in absolute and in relative figures – also in relation to the relevance of the *Neuer Markt*.

The increasing relevance of the Neuer Markt is also given by the market segments chosen by issuers for their IPO as it is shown in Table 3. According to the numbers of IPOs, the *Neuer Markt* plays a dominant role of all market segments for going public companies. 298 of 435 IPOs (or 68.51 percent) take place in the *Neuer Markt*. On the second place, the *Official Trading* absorbs 70 IPO's (or 16.09 percent); the both remaining market segments play only a subordinated role (with 15.40 percent). But considering the gross proceeds and the nominal equity capital of the IPOs the *Official Trading* is still the dominant market segment. The nominal equity capital amounts to 82.20 Mio EUR on average and the gross proceeds are about 25.6 billion EUR. The gross proceeds in the *Neuer Markt* amounts to 20.4 billion EUR (or 43.44 percent) and the nominal equity capital is 14.04 Mio. EUR on average. Table 3 provides a detailed overview.

[25] *Deutsche Börse AG*, Fact Book 2000, p. 28/29

Table 3: Numbers of IPOs, Initial Capital and Gross Proceeds 1997-2002

Panel A	Official Trading	Regulated Market	Unofficial Regulated Market	Neuer Markt	Total
Number of IPOs	70	45	22	298	435
Number of IPOs (in percent of total)	16.09	10.34	5.06	68.51	100
Gross Proceeds (in Mio. EUR)	25,648.64	784.10	145.18	20,415.55	46,993.48
Gross Proceeds (in percent of total)	54.58	1.67	0.31	43.44	100
Gross Proceeds on average (in Mio. EUR)	366.41	17.42	6.60	68.51	108.03
Nominal Equity Capital (in Mio. EUR)	5,754.28	272.87	66.49	4,183.16	10,276.80
Nominal Equity Capital (in percent of total)	55.99	2.66	0.65	40.70	100
Nom. Eq. Capital on average (in Mio. EUR)	82.20	6.06	3.02	14.04	23.62

Source: Deutsche Börse AG, Fact Books, several issues, Going-Public statistics of the Börsenzeitung and the Hoppenstedt-Börsenforum; own calculations

These findings lead to the first conclusion that the *Neuer Markt* is the most important segment for domestic IPO‘s in Germany in absolute figures with regard to the number of IPOs. Considering the size of an IPO the *Neuer Markt* is in the second place with regard to the equity capital and the gross proceeds. Secondly, it can be concluded that the *Official Trading* is still the main segment concerning IPO’s of companies with a relative high market capitalization. Thirdly, the *Regulated Market* and the *Unofficial Regulated Market* only play a minor role for domestic IPO’s both in absolute and relative figures.

A similar importance of the market segments is given considering the reporting of the market performance. Since December 30th, 1987, the Deutsche Börse AG (resp. its predecessor) has published price- and performance-indices representing the 30 (70 and 100) most actively traded German blue chip stocks (DAX 30-, MDAX-, DAX 100-index). Furthermore, the development of the entire *Official Trading* and the *Regulated Market* (and later on the *Neuer Markt*) is represented in the CDAX-Index. With the foundation of the *Neuer Markt,* an additional index was created representing the 50 most actively traded shares in this segment as well as an All-Share-Index of the *Neuer Markt*. Thus, only the development of the *Official Trading* and of the *Neuer Markt* is represented by stock exchange indices. Neither for the *Regulated Market* nor for the *Unofficial Regulated Market* indices is calculated. This fact em-

phasizes the minor importance of these two market segments for domestic equities or stresses the leading role of the *Neuer Markt* and the *Official Trading* respectively. In so far, it could be expected that underpricing is the lowest in the *Official Trading*, the second lowest in the *Neuer Markt* and the highest in the *Unofficial Regulated Market*.

4. The IPO-Underpricing – Empirical Evidence

4.1. Dataset and Methodology

The data for this empirical investigation refer to the period from March 10th, 1997, to October 31st, 2002. Sources of the data were the Going-Public Statistic of the *Börsenzeitung*, the Going-Public Statistic of the *Hoppenstedt Börsenforum* and the Fact Books of the *Deutsche Börse AG* as well as the prospectus of the respective issuers.

Market-adjusted underpricing for the different market segments as well as for the whole market was calculated as the difference of growth rates according to the following formula:

$$(1) \quad UP = \frac{1}{N}\sum_{i=1}^{N} UP_i \quad = \quad \frac{1}{N}\sum_{i=1}^{N} R_i - R_m \quad = \quad \frac{1}{N}\sum_{i=1}^{N}\left(\left(\frac{P_i}{P_0} - 1\right) - \left(\frac{I_i}{I_0} - 1\right)\right)$$

UP_i denotes the Underpricing of the share i, R_i is the initial or raw return of share i (calculated with the first price on the first trading day) and R_m is the market adjustment-term. P_i is the first trading price of the share i at its first trading day and P_o is the issue price of the share i. I_i denotes the price of a market portfolio at the first trading day of share i and I_o denotes the price of the market portfolio I of the day at the end of the offer period of the share i.

The market adjustment-term R_m refers to the DAX-100 Index of the *Deutsche Börse AG* and is computed to the end of the time of the drawing period. For the *Neuer Markt* the initial return R_i was adjusted with the NEMAX-All-Share-Index of the *Deutsche Börse AG* additionally. Unfortunately, it is not possible to adjust the initial returns of each market segment with a specific index for the respective market because no indices are available neither for the

Regulated Market nor for the *Unregulated Market*. Therefore, the market-adjustment for the whole panel was taken with the DAX-100 index. Here, it can be objected that the DAX-100 index is not representative for the whole market because the index includes the hundred shares of the *Official Trading* with the highest turnover only. Therefore, it would be more representative to take an index, which represents the whole stock market like the CDAX-index because the market adjustment should describe an alternative investment in the market.[26] However, an alternative investment in the market could also be an investment in the portfolio represented by the DAX-100 index. Secondly, the CDAX-index represents the *Official Trading*, the *Regulated Market* (and the *Neuer Markt*) neglecting the *Unofficial Regulated Market* only. Third, the correlation between the DAX-100 index and a broad-market index like the CDAX-Index is 0.98.[27] Therefore, the DAX-100 index is an acceptable market-adjustment term.

All monetary items are quoted in EUR; quotations in DEM of the period preceding the introduction of the Euro (at January 1st, 1999) were converted into EUR with the official rate of exchange. The data were collected for all German stock exchanges and therefore refer in the first place to the market segment and in the second place to the stock exchange. For example, the Cash Medien AG went public on September 21st, 1999 in Frankfurt and Hamburg at the *Regulated Trading* and in Berlin, Düsseldorf, Munich and Stuttgart at the *Unofficial Regulated Market*. Hence, the used data refer to the *Regulated Market* and the Frankfurt Stock Exchange. Based on this methodology, 457 companies went public in the corresponding period. For 22 issues no sufficient data were available so that the whole panel consists of the remaining 435 initial public offerings (Panel A). For additional analysis Panel A was adjusted by the exclusion of extreme values of the underpricing. These extreme values are out of the 1.5-fold of the quartiles-distance.[28] The results are shown in Panel B in the appendix.

The following analysis of the panel uses a univariate data-description as well as a cross-sectional OLS-regression. First, underpricing is described in total and for each market segment by its mean, median, minimum, maximum, standard deviation and its skewness and kurtosis. Additional information is given by the values of the t-statistic (test of the mean under-

[26] Another possibility is that the initial returns were adjusted with the performance of a portfolio that has the same systematic risk as the IPO. Unfortunately, no data about such a portfolio was available. Thus, the adjustment with a broad market index could be an acceptable alternative.

[27] On the basis of the daily data from 09/1999-03/2002; source: Dresdner Bank AG, own calculations

[28] General Rule by *Tukey* (1977), quoted by *Schlittgen*, 1993, p. 232.

pricing), the Wilcoxon-Signed-Rank-statistic (test of the median underpricing) and the Jarque-Bera-statistic (test of the normal distribution). Second, the distributions of the underpricing of each individual market segment are compared to each other by the F-test-statistic (test for the equality of the mean underpricing) and the Kruskal-Wallis-test-statistic (test for the equality of the median underpricing). Additionally, the results are shown graphically by the density functions. Third, a cross-sectional OLS-regression uses the market adjusted mean underpricing as the dependent variable to show the influence of several explanatory variables on the underpricing. These explanatory variables are the gross proceeds per initial capital (as a proxy for the issuers' size), the free-float, the market power of the lead-underwriters, the industrial sector (old or new economy), the trend of the market, represented by the DAX-100 index and the listing at the *Neuer Markt*.

$$(2) \quad UP_i = \beta_0 + (VOLCAP)\,\beta_1 + (FREEFLOAT)\,\beta_2 + (UNDERWR)\,\beta_3 + (NEWECO)\,\beta_4 + (DAXTREND)\,\beta_5 + (NEUMARKT)\,\beta_6 + \varepsilon_i$$

To examine whether there is a relation between the size of a company and the degree of underpricing it is assumed that the gross proceeds per nominal equity capital is a proxy for the company's size. The free-float as an explanatory variable was choosen to test whether there is empirical evidence for the signaling-thesis of Grinblatt/Hwang.[29] The validity of the underwriter-reputation thesis is tested by the differentiation of reputational and non-reputational underwriters. Under the assumption that an underwriter is the more reputational the more often he is the lead underwriter of an initial public offering, five underwriters are assumed to be the reputational ones. For 177 of 435 IPOs (i.e. 40.69 percent) the lead underwriters were the Commerzbank, the Deutsche Bank, the DG-Bank, the Dresdner Bank or the HypoVereinsbank[30] (out of 52 underwriters) during the investigation period.

The industrial sector was chosen as an explanatory variable because the *Neuer Markt* address especially to the firms of the new economy, represented by the industrial sectors of services, financial services, media, software, technology and telecommunication. To test whether the market performance has an influence on the degree of underpricing the trend of the alternative

[29] Since the signalling theses assume a two-stage sale of the shares, it is not possible to test the thesis of *Grinblatt/Hwang* directly because this investigation aimed on the initial public offering only. However, this regression analysis test if there is coherence between underpricing and the free-float at all.

[30] Or one of the subsidiary companies like Dresdner Kleinwort Wasserstein or Deutsche Morgan Grenfell, as well as the independent predecessors of the HypoVereinsbank AG, the Bayerische Vereinsbank AG and the Bayerische Hypotheken- und Wechselbank AG.

portfolio (DAX-100 index) is an explanatory variable, as well as the market segment "*Neuer Markt*" itself. The latter one is a dummy variable to scrutinize whether this market segment has a direct influence on the degree of underpricing.

Table 4: Definition of the Explanatory Variables for the Multiple Regression

Variable	Definition	Value
VOLCAP	Nominal Gross Proceeds/Initial Capital	
FREEFLOAT [1]	Public distribution of the shares	
UNDERWR [2]	Lead-Underwriter of the IPO	1 = Commerzbank, Deutsche Bank, DG-Bank Dresdner Bank or HypoVereinsbank 0 otherwise
NEWECO [3]	Industrial sector of the "New Economy"	1 = yes 0 otherwise
DAXTREND [4]	Increasing/Decreasing DAX-100 performance	1 = increasing 0 = decreasing
NEUMARKT	IPO at the Neuer Markt	1= yes 0 otherwise

1 The test of a correlation between the underpricing and the free-float is regardless whether the free-float is required to be at least 25 percent of the aggregate nominal value of the shares for an admission to the Official Trading and the Neuer Markt.

2 The 435 IPOs of Panel A are accompanied by 52 different lead underwriters. 177 (or 40.69 percent) of them were accompanied by only 5 Underwriters, which are the DG-Bank, the Dresdner Bank, the HypoVereinsbank, the Deutsche Bank and the Commerzbank

3 For this investigation the "New Economy" comprises the following industrial sectors: services, financial services, media, software, technology and telecommunication.

4 During the considered period the highest level of the DAX-100 index was on March, 8th in 2000. Insofar, an increasing performance is assumed for IPOs up to this date

Further variables could be the issue price itself, the book building-range or the absolute amount of the raw return. However, it is obvious that there is a positive relation between the degree of underpricing and the issue price or the book building-range in case of a positive correlation of the underpricing and the market performance.[31]

Another question is whether there is coherence between the degree of underpricing and the *absolute* amount of the issue price and/or the middle of the book building range or the absolute difference between them. If so, it would be a benefit for the issuers to reduce or raise the absolute amount of the issue price to influence the degree of underpricing. However, this is not possible because most of the companies issue shares with a par-value of EUR 1,-- of the capital stock. Insofar, the absolute amount of the issue price depends on the company's' size.

[31] If there is a positive correlation between the underpricing and the market performance there must be also a positive correlation between the underpricing and the issue price or the middle of the book-building range. This is because the book-building range is created before the issue price is defined. If there is an oversubscription additionally, the underpricing is the higher the more the issue price exceeds the middle of the book-building range.

However, this relationship is already tested with the gross proceeds per nominal capital as an explanatory variable.

4.2. Empirical Findings

Based on Panel A the average market-adjusted underpricing of the 435 initial public offerings is 42.34 percent in total. The median is 11.25 percent and the standard deviation is 75.80, which shows a high concentration of the underpricing in the left tail of the distribution. Concerning the individual market segments, the mean underpricing is, with 53.64 percent, the highest in the *Neuer Markt* and with 11.16 percent the lowest in the *Official Trading*.

Table 5: Underpricing in Germanys' Market Segments 1997-2002 (Panel A)

Panel A	Official Trading	Regulated Market	Unofficial Regulated Market	Neuer Markt	Total
Numbers of IPOs	**70**	**45**	**22**	**298**	**435**
Underpricing (Mean)	**11.16**	**17.30**	**39.65**	**53.64** (54.30)[4]	**42.34**
Median	2.67	4.65	16.98	19.97	11.25
Minimum	-14.67	-80.92	-35.67	-24.31	-80.92
Maximum	139.07	176.00	236.44	768.20	768.20
Standard Deviation	26.95	45.20	61.24	84.90	75.80
Skewness	3.12	1.80	1.63	3.28	3.56
Kurtosis	12.63	7.26	5.88	21.19	24.99
t-statistic [1] (p-value)	3.46 (0.0009)	2.57 (0.0137)	3.04 (0.0063)	10.91 (0.0000)	11.65 (0.0000)
Wilcoxon-Signed-Rank [2] (p-value)	4.78 (0.0000)	3.23 (0.0012)	2.76 (0.0058)	13.03 (0.0000)	14.50 (0.0000)
Jarque-Bera [3] (p-value)	383.55 (0.0000)	58.33 (0.000)	17.29 (0.0002)	4,644.74 (0.0000)	9,682.49 (0.0000)

1 H_0 : Mean Underpricing = Zero
2 H_0 : Median Underpricing = Zero
3 H_0 : Mean Underpricing is normally distributed
4 Initial Return adjusted with the NEMAX-All-Share-Index

Considering the t-statistics, the results for a positive mean underpricing are all significant at $\alpha = 0.01$, except for the *Regulated Market* (significant at $\alpha = 0.05$). But the Jarque-Bera-test-statistic shows that the underpricing is not normally distributed (significant at $\alpha = 0.01$), which is obvious because of the positive values of the skewness and kurtosis-values bigger

than 3. Insofar, the non-parametric Wilcoxon-Signed-Rank-Test is a better test for a positive underpricing. But even these results are statistically significant at $\alpha = 0.01$ for each individual market segment as well as for the whole market.

Therefore, the results as shown in Table 5 imply three features. First, the results about the degree of underpricing confirm the findings of *Hunger* but are two to four times higher than the findings of, for instance, *Ljungqvist, Kaserer/Kempf, Wasserfallen/Wittleder* or *Uhlir*. [32] Second, the underpricing is different in each individual market segment. Underpricing is the highest in the *Neuer Markt* and the lowest in the *Official Trading*. Third, this result stands in contrast of what would be expected regarding *Rocks* implication of his model that the underpricing is expected to be lower the larger the market is. As it is shown in Table 3, the *Neuer Markt* is the second largest market segment for IPOs regarding the initial capital and the gross proceeds of the issuers, and the largest market segment regarding the number of IPOs. 68.51 percent of the IPOs happened in the *Neuer Markt* and 43.44 percent of the total gross proceeds are raised at the *Neuer Markt*. Assuming that the number of IPOs, the initial capital and the gross proceeds are proxies for a high number of (potential) investors the *Neuer Markt* is the second largest IPO-market segment in the German Equity Market. Insofar, the underpricing in the *Neuer Markt* was expected to be not the highest.

To rule out a mere coincidence of these findings it is necessary to have a closer look on the underpricing of the individual market segments. Therefore, it is tested, if the mean- and the median-underpricing of the market segments are equal or if they are significant different from each other. The results are shown in Table 6.

The F-Test-statistic with 8.19 shows that the mean-underpricing in the four market segments is not equal (significant at $\alpha = 0.01$); but because of the leptokurtic distribution with a long right tail, the non-parametric Kruskal-Wallis-Test may be a better test-statistic for the above mentioned purpose. However, even the Kruskal-Wallis-Test-statistic for the four segments confirms with 36.41 that the mean-underpricing is not equal (significant at $\alpha = 0.01$).

[32] According to *Hunger* (2001), the market-adjusted underpricing for 262 IPOs from 1997 to 1999 is about 43.70 percent and differs among the market segments. *Ljungqvist* (1997) states an underpricing of about 10.57 percent for 189 IPOs from 1970-1993 for the whole market. *Kaserer/Kempf* (1995) do not mention the market segmentation in their empirical findings and estimate the underpricing for the whole market with 13.99 percent. *Wasserfallen/Wittleder* (1994) do not distinguish between market segments and state the average underpricing from 1961-1987 with 17.58 percent. According to *Uhlir* (1989), the average underpricing is without considering the market segmentation, about 21.46 percent from 1977-1987.

Table 6:Test of Equality of the Mean- and Median Underpricing

Test	Test-statistic	p-value
F-Test (for the equality of means between all segments)	8.188689	0.0000
Kruskal-Wallis-Test (for the equality of medians between all segments)	36.41321	0.0000
Kruskal-Wallis-Test (for the equality of medians between …)		
Official Trading / Regulated Market	0.500903	0.4791
Official Trading / Unofficial Regulated Market	3.435904	0.0638
Official Trading / Neuer Markt	29.58806	0.0000
Regulated Market / Unofficial Regulated Market	2.216132	0.1366
Regulated Market / Neuer Markt	12.38522	0.0004
Unofficial Regulated Market / Neuer Markt	0.567592	0.4512

In this context it is remarkable that the underpricing of the *Neuer Markt* is different from the underpricing of the *Official Trading* and the *Regulated Market* (significant at $\alpha = 0.01$) and that the underpricing of the *Official Trading* is significantly different from the underpricing of the *Unofficial Regulated Market* at $\alpha = 0.1$. These findings confirm two facts. Firstly, there is a market segment specific underpricing. Secondly, the underpricing of the *Neuer Markt* is significantly higher than the underpricing of the *Official Trading* and the *Regulated Market*. Consequently, *Rocks* implication that the underpricing is expected to be lower the larger the market is could not be confirmed considering the *Neuer Markt*.

A graphical version of the different underpricing distribution in the market segments is shown in **Figure 1 in the appendix**, where the density functions for the *Neuer Markt* and the remaining segments are plotted.

On the other hand, the results confirm coherence between the extent of underpricing and the size of the market relating to the *Official Trading* and the (*Unofficial*) *Regulated Market*. This raises the question whether the extent of underpricing depends on the fact whether an issue happens in the *Neuer Markt* or not. To have a closer look at this question, a cross-sectional OLS-regression is used with the underpricing as the dependent variable and the *Neuer Markt*, among others, as explanatory variable. The results of the regression analysis confirm the supposition of a dominant role of the *Neuer Markt*, because the regressor "NEUMARKT" is strongly significant. The results are shown in Table 7.

Table 7: Results of the Cross-Sectional-OLS-Regression of the Market-Adjusted Mean Underpricing (Panel A)

Diagnostics				
Dependent Variable	Underpricing			
Observations	435			
R-squared	0.1110			
Adjusted R-squared	0.0986			
F-Test (p-value)	8.9102 (0.0000)			
White-Heteroskedasticity-Test (p-value)	0.7925 (0.7417)			
Durbin-Watson-Test	1.6763			
	Coefficients	**Standard Errors**	**t-statistics**	**p-value**
CONSTANT	-7.8254	11.7328	-0.6670	0.5052
VOLCAP	0.8933	0.9719	0.9191	0.3585
FREEFLOAT	-0.3306	0.2797	-1.1818	0.2379
UNDERWR	-8.8671	7.2413	-1.2245	0.2214
NEWECO	16.0000	8.8251	1.8130	0.0705
DAXTREND	32.8353	7.6622	4.2854	0.0000
NEUMARKT	34.7814	8.3705	4.1552	0.0000

Apart from the *Neuer Markt*, an increasing market-performance is also of significant influence on the extent of underpricing (at $\alpha = 0.01$), as well as IPOs of the New Economy (at $\alpha = 0.1$). In contrast, the gross-proceeds per initial capital, the free-float or the market-power of the lead underwriters are statistically not significant. On the other hand it has to be considered that there is with 33 percent a weak explanation of the regression only because of the R-squared of 0.1110, even if the F-statistic with 8.9102 is strong significant at $\alpha = 0.01$. Heteroskedasticity of the residuals is, with a p-value of 0.7417 for the White-Test, not detectable. The Durbin-Watson-Test, showing with a value of 1.6763 that there is no autocorrelation of the residuals, is only of weak evidence because the database is no time-series even if data for underpricing as the dependent variable is arranged in chronological order.

Insofar, the multiple regression analysis gives evidence that the extent of underpricing is not related to the size of an issue or the size of a market. In contrast, the extent of underpricing seems to depend rather on the facts that in the relating period most of the issuers belong to the "New Economy" and went public in the *Neuer Markt*, because this segment addresses especially to this kind of issuers. Insofar, it can be assumed that the underpricing is higher for companies doing their business in the industrial sectors of (financial-) services, media, software, technology or telecommunication. This result is in contrast with the findings of

Kaserer/Kempf who reject coherence for the underpricing and an industrial sector for the 171 IPO from 1983-1992 in Germany.[33] Instead, the results concerning the relative high underpricing of the "New Economy" of the late 1990s are similar to the findings of *Ritter* for natural resource issues in the USA during the oil and gas boom of 1980.[34] But even if *Ritter* finds evidence that especially start-up natural resource firms were at the mercy of exploiting underwriters, a parallel to the German "Hot-Issue-Market" of the late 1990s could be drawn if there is a positive relation between risk and initial return. In the USA, there was an oil and gas boom in the early 1980s with many start-up firms in this industrial sector bearing a relative high risk and therefore high underpricing is reported.[35] In Germany, there was a boom of New Economy-(start-up) firms in the late 1990s bearing a high risk as well (relative to non-New Economy firms). Insofar the relatively high underpricing of issues in the *Neuer Markt* is not surprising, because the *Neuer Markt* addresses especially to these (start-up) firms of the New Economy. Therefore, there seems to be a relation between the risk of an investment and the underpricing. On the other hand, the *Neuer Markt* requires the most extensive listing requirements and the most information is disclosed to the public, which reduces the risk of an investment tendentiously. And concerning *Beatty/Ritter* the underpricing is the lower the more material information is disclosed. Insofar, the underpricing ought to be not the highest in the *Neuer Markt* because of the high listing requirements for new issues.

With respect to the advanced hypothesis, these empirical findings now allow the following statements. First, underpricing is not necessarily smaller the larger the market is because of the highest underpricing in the second largest market segment. Second, underpricing is not necessarily smaller the more 'material information' is given to the (potential) investors because the underpricing is the highest in the *Neuer Markt* although this segment requires the most extensive listing requirements concerning the disclosure of information.

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[33] *Kaserer/Kempf* (1995)

[34] While *Ritter* (1984) reports for non-natural resource issue from 1977-1982 an underpricing of 17.3 percent the underpricing for natural-resource issue is about 56.2 percent. Natural-resource related companies are companies, involved in oil and gas exploration and development, oil and gas field services and refining, coal, and mineral exploration; Ritter, 1984, p. 224.

[35] Cf. *Ritter* (1984), p. 239

4.3. Discussion

The empirical results of IPOs in Germany from 1997 to 2002 confirm that underpricing exists in Germany as well although the extent of the mean underpricing is much higher than in former studies.[36] However, with the exception of Hunger (2001), former studies do not consider the specific market segmentation this investigation finds out that there is a market specific underpricing.

Considering the implications of *Rocks* equilibrium model and the assumptions of *Beatty/Ritter* underpricing would not be expected to be the highest in the *Neuer Markt*. An explanation for the empirical results might be that *Rocks* implications of the market size do not play a role on segmented markets. That means that the market segments are not different enough concerning their size to show difference between the *Official Trading* and the *Neuer Markt*. This is insofar quite conceivable because *Rock* differentiates between a small market and a market in which „the number of investors is very large“ only, i.e., „infinitely many uninformed investors“ (*Rock*, 1986, p. 196 and 201). That means, Rock considers two extreme market sizes only. Thus, these implications may not be applicable to smaller differences of market segments. Another possibility is that the segments are already different from each other concerning the number of investors but there are other facts, which overcompensate the effects of the market size with respect to the underpricing.

Concerning the implications of *Beatty/Ritter* it is still puzzling why the underpricing is the highest in the *Neuer Markt*, even if the quantity and quality of published information by an IPO in the *Neuer Markt* is the highest. A possible explanation could be that the *Neuer Markt* addresses especially to “small to medium-sized … innovative enterprises which develop new sales markets, utilize new methods of, for example, procurement, production or distribution, or offer new products and/or services, and whose activities can be expected to generate high turnover and profits in the future” (*Rules and Regulations Neuer Markt, No. 1, Scope of Applicability*). Concerning the ex-ante uncertainty about the future value of an enterprise it might be convincing that in comparison to „traditional“ enterprises the uncertainty is higher for ´innovative enterprises using new methods or offering new products or services´. Therefore, the ex-ante uncertainty about the value of an issue is the highest in the *Neuer Markt* be-

[36] See footnote 32 on page 22

cause the *Neuer Markt* addresses especially to these enterprises while the other market segments especially do not. In so far it seems to be obvious why the ex-ante underpricing ought to be the highest in the *Neuer Markt* in comparison to the other segments. Additionally, the *Neuer Markt* is a new, privately organized market segment of the Deutsche Börse AG. However, neither the Deutsche Börse AG nor the *Neuer Markt* has a historical reputation in the investors market. In contrast to the *Neuer Markt*, the other market segments have a history related to the *Stock Exchange Act*. Insofar the lacking reputation of the *Neuer Markt* may also be one reason for the relative high underpricing.

Considering the highest listing requirements of the *Neuer Markt,* it is not quite obvious why the underpricing is in fact the highest in the *Neuer Markt*. In contrast, it could be expected that the high requirements of disclosing information would reduce the information asymmetry. But the empirical investigation shows that there is despite of the high disclosure of information a high underpricing. That might lead to the conclusion that the currently valid requirements of an admission to the *Neuer Markt* are not sufficient for a reduction of the information asymmetry and therefore are not suitable to reduce the misallocation of capital.[37] In connection with the above mentioned statement of the lacking market reputation of the *Neuer Markt* this argument gains in importance.

In this context, it is questionable which effect has the topical development of the market segmentation on this underpricing-puzzle. With regard to the *Viertes Finanzmarktförderungsgesetz*, in force since July 1st, 2002, the *Stock Exchange Act* will be modified.[38] Apart from the *Unofficial Regulated Market* there will be a first segment which will take the place of the current *Official Trading* and a second segment which will take the place of the current *Regulated Market*. But the stock exchanges are enabled to create additional requirements for listing. Insofar, the *Deutsche Börse AG* will have the following structure of market segments.[39] Apart from the *Unofficial Regulated Market* there will be a "*General Standard*"-segment that will adopt all the requirements of the current *Official Trading* and a "*Prime Standard*"-segment with the additional requirements of the current *Neuer Markt*. Indices will only be computed for the "*Prime Standard*"-segment so that there will be one Index for the

[37] Insofar, the requirements are either not sufficient to prevent a high information asymmetry or they are not effective enough to punish its violation.

[38] Cf. 'Fortentwicklung des Finanzplatzes Deutschland: Viertes Finanzmarktförderungsgesetz', Bundesregierung Deutschland, REGIERUNGonline, 10.06.2002

[39] Cf. Rundschreiben Listing 06/2002; Neusegmentierung des Aktienmarktes, Deutsche Börse AG, 22.11.2002

large caps (like the DAX-30), and further indices for the mid-caps. The latter ones will comprise one index for the classical industrial sectors (MDAX and SDAX) and one index for technological industrial sectors (TecDax).[40]

The effect of this coming structure on the underpricing-phenomenon depends on the causes of the actual underpricing. If the underpricing of the last years is on average higher in comparison to former periods because of a hot-issue period in the late nineties, than the underpricing might be lower on average in the future. Nevertheless, it is supposed that the underpricing in the *Prime Standard* will be lower than the underpricing in the *General Standard* and that the underpricing in the *Unofficial Regulated Market* will be the highest because of the different uncertainty resulting of the different listing requirements. However, if the relative high underpricing of the last years (in contrast to former periods) is due to the lacking reputation of the new founded and privately organized *Neuer Markt* than the development of the average underpricing in the future is uncertain.

On the one hand, the underpricing could be lower on average because the *Prime Standard* is clearly the "higher" segment that is expressed by the higher listing requirements and the designation as the "first segment" in the *Stock Exchange Act*. On the other hand the higher listing requirements of the *Neuer Markt* (in comparison to the *Official Trading*) have not contributed to lower the underpricing on average. If, for instance, the listing requirements in the *Neuer Markt* had not been sufficient to reduce the information asymmetry it can be assumed that the underpricing will be nearly the same in the future because the *Prime Standard* will adopt the requirements of the *Neuer Markt*. However, the end of the hot-issue phase and the lawful designation of the *Prime Standard* as the "first segment" could be enough to lower the underpricing on average although the main problem of the underpricing-puzzle of the last years is not solved.

[40] Cf. 'Deutsche Börse stellt neue Indexsystematik vor', Deutsche Börse AG, 31.10.2002

5. Summary

This contribution to the well-known and worldwide underpricing phenomenon discusses the coherence of market segmentation and the extent of underpricing. Based on the implications of *Beatty/Ritter* and *Rock* the German equity market was analyzed. 435 IPOs took place from 1997-2002 in one of the four market segments *Official Trading, Regulated Market, Unofficial Regulated Market* and *Neuer Markt*. These segments are different from each other with regard to their size, market relevance and listing requirements. Considering the whole market there is a restricted evidence of the suggestions of *Rock* and *Beatty/Ritter* only. Merely for the *Official Trading*, the *Regulated Market* and the *Unofficial Regulated Market* the empirical findings confirm the implications that the underpricing is the lower the larger the market size and that the underpricing is the lower the lower the information asymmetry is respectively. Concerning the *Neuer Markt* the empirical findings are not clear in harmony with what would be expected because the underpricing is in comparison to the other segments far higher even if the *Neuer Markt* is the second largest market-segment for IPOs and demands the highest listing requirements. These findings leads to the conclusion that first, the ex-ante uncertainty of the enterprises which apply for a listing at the *Neuer Markt* is incomparable high and second, the listing requirements of an admission for an IPO at the *Neuer Markt* are not sufficient to reduce the uncertainty about the value of the issuer and consequently the extent of underpricing. Insofar, the effect of the renewal of the market segmentation within in the next year on the extent of underpricing is not obvious because it is questionable if the information asymmetry of an IPO could be reduced with a new segmentation only but without stronger listing requirements.

Appendix

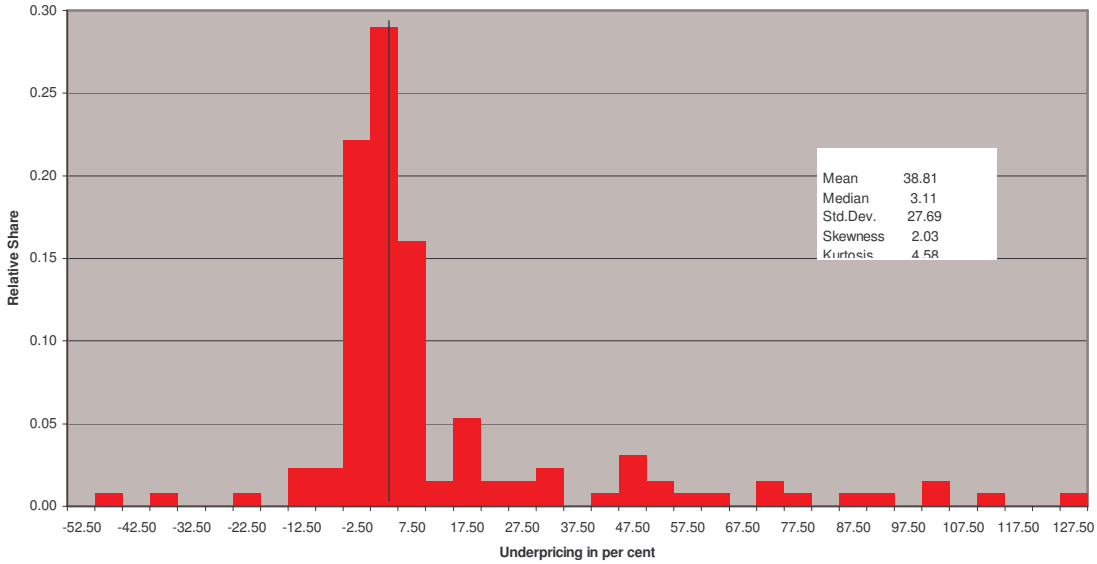
Table 8: Underpricing in Germanys' Market Segments 1997-2001 (Panel B)
(Panel A adjusted by the extreme values of the underpricing)

Panel B	Official Trading	Regulated Market	Unofficial Regulated Market	Neuer Markt	Total
Numbers of IPOs	**69**	**41**	**21**	**256**	**387**
Underpricing (Mean)	**9.31**	**9.62**	**30.27**	**26.57**	**21.90**
Median	2.66	4,45	16,85	13,16	6,83
Minimum	-14,67	-48,35	-35,67	-24,31	-48,35
Maximum	103,85	79,28	125,98	129,01	129,01
Standard Deviation	22,21	22,54	43,70	34,94	33,28
Skewness	3,08	1,21	0,70	1,21	1,42
Kurtosis	12,38	5,92	2,59	3,45	43,24
t-statistic [1] (p-value)	3,4819 (0,0009)	2,7345 (0,0093)	3,1746 (0,0048)	12,1704 (0,0000)	12,9467 (0,0000)
Wilcoxon-Signed-Rank [2] (p-value)	4,6756 (0,0000)	3,1230 (0,0018)	2,5721 (0,0101)	11,4460 (0,0000)	12,9496 (0,0000)
Jarque-Bera [3] (p-value)	361,98 (0,0000)	24,59 (0,0000)	1,85 (0,3960)	64,52 (0,0000)	155,14 (0,0000)

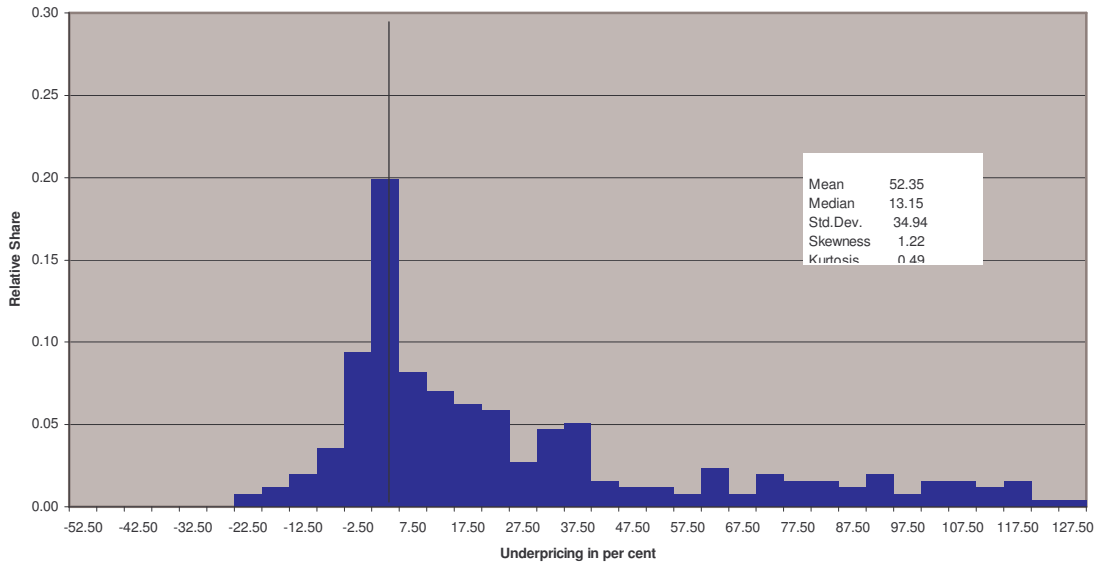
4 H_0 : Mean Underpricing = Zero
5 H_0 : Median Underpricing = Zero
6 H_0 : Mean Underpricing is normaly distributed
4 Initial Return adjusted with the NEMAX-All-Share-Index

Figure 1: Density Functions for the IPO-Underpricing in Germany 1997-2002 (Panel B)

Official Trading, Regulated Market and *Unofficial Regulated Market*:



Neuer Markt:



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Ich erkläre hiermit ehrenwörtlich, dass ich die vorliegende Arbeit selbständig angefertigt habe; die aus fremden Quellen direkt oder indirekt übernommenen Gedanken sind als solche kenntlich gemacht.

Die Arbeit wurde bisher keiner anderen Prüfungsbehörde vorgelegt und auch noch nicht veröffentlicht.

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(Adrian Hunger)