Short and Long-Run Performance of

Initial Public Offerings

in the Austrian Stock Market

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Abstract

This paper investigates the price behaviour of initial public offerings (IPOs) of equities listed on the Vienna Stock Exchange during the period from 1984 to 1996. In accordance with the findings for other markets, the average initial returns of Austrian IPOs are significantly positive. For a total sample of 67 IPOs, an average first day return of 6.5 per cent is documented, which is lower than for most other IPO markets. More than 30 per cent of all IPOs are overpriced with negative initial returns. The cross-section of initial abnormal returns can best be explained by the ex-ante uncertainty about the value of the issue and the existence of "hot-issue" and "cold-issue" periods. In the long-run (first five years) Austrian IPOs underperform benchmark firms by a significant 73.9 per cent (average buy-and-hold abnormal return) with a wealth relative of 0.64. An investor would have had to invest 56 per cent more money in IPOs than in non-IPO firms of similar size to have the same wealth five years after the first aftermarket trading day. This phenomenon can best be explained by cross-sectional differences in the ownership structure: While the underperformance of family-owned IPOs is very poor, no positive or negative abnormal performance can be detected for privatized enterprises or other non family-owned firms going public.

1. Introduction

Numerous studies have investigated unseasoned new issues, especially in the United States, but also in many other countries and financial markets. They mainly document two phenomena: The first one is that initial public offerings (IPOs) show significant positive average first-day returns. This underpricing, as it is often called, varies from country to country and is documented as a permanent and cyclical phenomenon. Loughran et al. (1994) for example show that the average initial return can be as low as 4.2 per cent for French IPOs and as high as 80 per cent for Malaysian IPOs. Many theories and models have been developed to explain the level of underpricing and the cross-sectional differences among IPO firms. One of the most well-known models was established by Rock (1986) who introduced the concept of the winner's curse in the IPO-market. According to this model, a positive underpricing must exist because underpriced IPOs are rationed to a larger extent than overpriced ones and uninformed investors are, in contrast to informed investors, not able to distinguish between over- und underpriced issues.

The second phenomenon is that in the long-run IPOs tend to underperform benchmark firms. Using a sample of 1,526 IPOs that went public in the U.S. during the 1975-1984 period, Ritter (1991) found a significant underperformance of 29.1 per cent in the first three years of public listing. Similar results for a sample of 4,753 IPOs subsequently listed on NASDAQ, the American Stock Exchange (AMEX) or the New York Stock Exchange (NYSE) were reported by Loughran and Ritter (1995). For most non-US stock markets this long-run underperformance exists as well. Compared to the All Share Financial Times Index, for example Levis (1993) finds evidence that UK-IPOs underperform in the first 36 trading months by 26.3 per cent. The negative long-run performance of IPOs is, for example, also documented for Germany (Uhlir (1989a, 1989b) and Ljungqvist (1993)) and Finland (Keloharju (1993)).[1]

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[1]   See Loughran et al. (1994) for a recent survey reviewing the international empirical evidence of IPOs.

Aggarwal and Rivoli (1990) suggest that a reason for this underperformance is a possible over-valuation in early aftermarket trading. Ritter (1991) argues that issuing firms choose to go public when investors are overoptimistic about the firm's future growth potential. As Jain and Kini (1994) document, US IPOs experienced a significant decline in operating performance following the IPO for the period 1976-88. They conclude that in the course of the initial issue the investors may have too high expectations with regard to the future growth in earnings which are not fulfilled subsequently. This could finally lead to a negative performance in the aftermarket. It is puzzling that the market obviously does not account for this negative operating performance in the short-term aftermarket. Another explanation offered for the long-run underperformance is that only good information about the issuing firms is circulated when a firm goes public and that therefore the prices in the early aftermarket are distorted (Uhlir (1989b)).

In contrast to the empirical findings for the initial return, the empirical evidence for the long-run aftermarket performance is not as clear. There are a few recent non-US studies which document a non-negative long-run aftermarket performance. Among these is the study by Kunz and Aggarwal (1994), who report for the Swiss-IPO market non-significant two- and three- year abnormal aftermarket performances of +1.8 and -6.1 per cent respectively. A really extreme result is reported by Kim et al. (1995) for Korean IPOs, where a 3-year buy-and-hold abnormal performance of +91.6 % is documented. This indicates that in Korea IPOs outperform benchmark firms, which is in clear contrast to the empirical evidence of a long-run underperformance in most countries. Table 1 provides a short summary of recent empirical studies measuring the short- and long-run performance of IPOs in different markets.

Given the above background, the present study has four major objectives. First, to record the level of first-day returns for Austrian IPOs over a recent and long period. The investigation focuses on the cross-sectional distribution of these returns and Rock's (1986) winner's curse hypothesis. The second objective is to explain the level of underpricing recorded. Several explanation models de-

rived from the theoretical and empirical literature will be used to formulate testable hypotheses. The third objective is to measure the short-run and long-run aftermarket performance. The aim is to detect whether it has been possible to earn significant positive abnormal returns by purchasing the issues on the first day of aftermarket trading and holding them for up to five years. The fourth objective is to give some explanations for the documented long-run aftermarket performance.

The following section describes the main features of the Austrian new issue market. The third section presents the sampling data, and section four shows the empirical results for the initial returns. After an analysis of the distribution of the initial returns and the possible effects due to rationing, several testable hypotheses to explain the level of underpricing and the cross-sectional differences in the initial returns across firms will be formulated and tested. The fifth section first describes the methodology used to calculate abnormal returns to evaluate the aftermarket performance and then, documents the empirical evidence regarding the aftermarket performance of IPO firms. Explanations for the observed long-run performance conclude this section. Finally, section six will give a summary of the findings.

2. The New Issue Market in Austria

The Vienna Stock Exchange (VSE) is the only stock exchange in Austria and is grouped into three market segments: the Official Market („Amtlicher Handel"), the Semi-Official Market („Geregelter Freiverkehr") and the Unregulated Market („Sonstiger Wertpapierhandel"). By the end of 1996, 118 companies were listed on the Vienna Stock Exchange: 94 in the Official Market, 12 in the Semi-Official Market and 12 in the Unregulated Market. Firms trading in the Official Market account for about 95 per cent of the total market value of all stocks and more than 99 per cent of the total trading volume. The Official Market is therefore the main segement of the stock exchange, where

the most liquid and the biggest Austrian stocks are listed. By contrast stocks listed in the Semi-Official or the Unregulated Market are characterized by considerably thin trading.

In addition to trading volume and market value, the three types of markets also differ with regard to the admission requirements for security listing. The basic listing requirements for the Official and Semi-Official Market can be summarized as follows: (i) Every company has to publish a prospectus containing all information necessary to judge it's assets and liabilities, the earnings and future prospects and their legal position. (ii) The nominal value of the total share capital has to be at least 40 million ATS (10 million ATS for the Semi-Official Market). (iii) The company must have existed for at least three years (one year for the Semi-Official Market) and must have published annual accounts for the most recent three years (one year for the Semi-Official Market). In addition, for shares traded in the Official Market, a minimum of 10 per cent of the share capital has to be widely scattered and the investors have to be informed about the business on a regular basis. No such listing requirements exist for the Unregulated Market. Despite the fact that the listing requirements for the Official Market are the most rigorous, only a minority of all IPOs apply for listing in the Semi-Official Market or the Unregulated Market. Especially the Unregulated Market, which was not established until 1990 to reduce the requirements for admittance to the capital market for smaller companies, has not fullfilled the expectations.

Most IPOs use a firm commitment contract, where the offer price and the issue volume (number of shares issued) are fixed in advance. Several weeks before the offering period starts, a preliminary prospectus containing all relevant information about the economic condition and perspectives of the firm, the possible offer price and the possible number of shares to be sold is circulated among potential institutional as well as private investors.[2] After having collected the state of demand for a given IPO, the final offer price and the number of shares are normally fixed just before the offering

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[2] In recent years a bookbuilding procedure is used to get information about the state of the demand before the offer price and the issue volume is fixed for the subscription period.

period starts. In most cases this official subscription period lasts 2 to 5 days. If the offer is heavily oversubscribed, the subscription period often finishes as early as at the end of the first subscription day. The average time between the first day of the subscription period and the first trading day in the aftermarket is about two weeks. This is in line with other (larger) IPO markets but differs for example from the findings of Keloharju (1993) for the Finnish IPO market, where this time period is approximately three months. Some firm commitment offers also include an overallotment option in which the underwriter has the option to sell additional shares at the offer price because of a large demand during the official subscription period.

3. Data Description

In 1984, after a time of more than 18 years with only delistings, the going public wave in Austria started with two initial public offerings. In the thirteen-year period from 1984 to 1996, the number of all firms listed in the VSE more than doubled from 58 to 118. In total 98 companies went public during this period, 67 of which were listed in the Official Market, 11 in the Semi-Official Market and 20 in the Unregulated Market. In order to secure a homogeneous sample of IPOs with similar listing requirements and a liquid aftermarket trading, the data sample used only consists of all 67 IPOs first listed in the Official Market between 1984 and 1996.[3] This long time period allows studying the long-run performance in bull as well as bear markets. Table 2 summarizes the distribution of the sample of 67 IPOs by years. Most firms went public after the two big bull markets in 1986 (10 IPOs) and 1990 (14 IPOs), whereas the highest total as well as average gross proceeds were earned in 1994.

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[3]   IPO-firms which changed from the Semi-Official or the Unregulated Market into the Official Market are not included.

One special feature of the Austrian new issues market is the distribution of the former owners or sellers of the IPO firms. Nearly 60 per cent of all IPOs in the sample are family-owned (see Table 3). Family-owned IPOs are defined as firms exclusively controlled by a family or by private persons before going public. A second group of IPOs are privatizations. 13 out of 67 IPOs in the Official Market are former (100 per cent) state-owned enterprises. Privatizations have taken place in almost every country where a stock market exists. The main objectives for the Austrian government to execute privatizations are (as in many other countries) (i) to raise revenue for the budget, (ii) to increase the operating efficiency of the privatized enterprise, (iii) to reduce governmental interference in the economy, (iv) to increase the portion of share ownership in the population and (v) to introduce competition. To investigate the long-run aftermarket performance of Austrian IPOs in relation to the ownership structure, the following groups of IPOs are formed: family-owned firms, privatized enterprises and other non family-owned firms.[4]

4. Initial Returns

4.1 Research methodology

To measure the first-day return abnormal returns are calculated for each IPO. The abnormal return for an IPO i is defined as the difference between the observed return of the IPO and the "normal" return, which can be expected from an investment in IPO i:

$$ar_i = R_i - E[R_i], \qquad (1)$$

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[4] Other non family-owned firms are defined as firms which are neither controlled by a family or by private persons nor are privatized enterprises. In most cases such firms are owned by banks or other big companies.

where ar_i is the abnormal return of IPO i, R_i is the observed return and $E[R_i]$ is the expected return. Brown and Warner (1980, 1985) present several alternatives to determine the ex-ante expectations. In the empirical IPO literature, the market-adjusted return method is commonly used. The initial (first day) return for each IPO is then defined as the difference between its (observed) return and the corresponding return on the market index:

$$IR_{i,t} = \frac{P_{i,1} - P_{i,0}}{P_{i,0}} - \frac{I_{i,1} - I_{i,0}}{I_{i,0}}, \qquad (2)$$

where $IR_{i,t}$ is the market index-adjusted initial return of IPO i; $P_{i,1}$ is the closing price of IPO i at the end of the first trading day; $P_{i,0}$ is the offer price of IPO i (the time index 0 refers to the first day of the subscription period); $I_{i,1}$ is the Vienna Stock Exchange Share Index (WBI) at the end of the first trading day of IPO i and $I_{i,0}$ is the WBI on the first day of the subscription period of IPO i.[5]

4.2 Distribution

The first part of the empirical section investigates the question as to whether an investor who purchased every IPO of the sample issued at the offer price and sold it on the first day of public listing earned a significant average abnormal return. This implies a strategy of investing a similar amount of money in each IPO. Therefore, we test the null hypothesis that the average abnormal return is not significantly different from zero. Table 4 reports average first-day returns for a sample of 62 IPOs issued during the period 1984-96 and the main distribution parameters.[6]

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[5] Since the subscription period is very often closed prematurely, the first-day of the subscription period is used for the computation of the market-adjusted returns.

[6] For 5 firms which went public using a tender procedure, no initial return is observable. Therefore the total sample of 67 IPOs is reduced to 62 in investigating the initial return.

The average raw (unadjusted) initial return is 5.75 per cent (with an associated t-statistic of 3.58) and the average market index-adjusted initial return is 6.46 per cent (with an associated t-statistic of 3.80). The null hypothesis of no significant average abnormal initial return can therefore be rejected at the one per cent significance level. This evidence indicates that Austrian IPOs, as is documented for nearly all IPO markets in different countries, are also underpriced, although their underpricing level is lower than reported in most studies. As the distribution of initial returns is not symmetric (positive skewness), the t-statistic must be interpreted with caution. Using a non-parametric sign test, the initial return in both cases is also significantly different from zero at the one per cent level. This supports the rejection of the null hypothesis. As in other studies[7], the distribution of initial returns is skewed to the right and peaked. Column 5 of Table 2 documents the fact that the initial returns for Austrian IPOs are not constant over time. Especially during the first years and in the „hot issue" period of 1990 the observable underpricing is above average.

4.3 Hypotheses to expain the level of underpricing

Many theories have been put forward to explain the underpricing of initial public offerings. In order to formulate hypotheses to explain the first-day return levels of Austrian IPOs, the most common explanations will be examined.

Allocation (winner's curse) hypothesis: In Rock's model (1986) underpricing is a necessary equilibrium condition in a world of informational asymmetry between groups of informed and uninformed investors. Initially, all investors are uninformed about the true value of the issuing firm and its future prospects. This is termed ex-ante uncertainty. However, investors can, for a cost, acquire firm-specific information and become informed. An informed investor can distinguish between underpriced and overpriced new issues and will therefore submit purchase orders only if the

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[7]   See for example Miller and Reilly (1987), Levis (1993) or Ruud (1993).

offer price is less than the true value of the stock. If, on the other hand, the issue is overpriced only uninformed investors submit purchase orders and they subsequently receive a 100 per cent allocation. For underpriced issues, both uninformed and informed investors submit purchase orders and the allocation is subsequently rationed between the two groups. This creates a situation where the average first-day return conditional upon receiving shares is lower than the average first-day return conditional upon submitting a purchase order. Therefore, uninformed investors face a "winner's curse": The chance of being allocated shares in overpriced new issues is greater than in underpriced issues. To keep uninformed investors participating in the IPO market, investment banks underprice to ensure them a non-negative, market-adjusted rate of return.

To test whether Rock's (1986) winner's curse hypothesis holds for the sample under investigation, it is necessary to calculate allocation-adjusted abnormal returns. This would require information of the amount of rationing. As in many other countries, there are no standardized rationing principles in Austria. The percentage allocation an investor receives depends not only on the size of the order or the average oversubscribtion rate. It can differ between banks and can also depend on the relationonship between the customer and the investment bank. Sometimes even lotteries are used in the allocation of very oversubscribed shares.[8] More than 30 per cent of all Austrian IPOs are overpriced with a mean initial return of -3.70 per cent, whereas underpriced IPOs experienced an average first day return of +10.94 per cent.

Similar to other markets, there is a tendency in Austria that underpriced IPOs are oversubscribed and that investors submitting purchasing orders for underpriced IPOs receive less than the number of shares they ordered. On the other hand, overpriced IPOs are not usually oversubscribed and investors submitting purchasing orders for these IPOs are allocated up to 100 per cent.

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[8]   By contrast, Keloharju (1993) describes the allocation system in Finland as much more transparent.

Therefore, the average return available to an uninformed investor who uses a simple stagging strategy (always buy at the offer price and sell on the first trading day in the aftermarket) is reduced due to rationing. This suggests that at least part of the observable unconditional abnormal return of 6.46 per cent can be put down to the phenomenon of the winner's curse.[9]

Ex-ante uncertainty hypothesis: One testable implication of the Rock model (1986) is that the level of underpricing required to attract uninformed investors into the market increases with the ex-ante uncertainty about the true value of the firm. The greater the ex-ante uncertainty, the greater is the advantage of becoming an informed investor. Beatty and Ritter (1986) suggest that there should be a positive relationship between the underpricing and the non-observable ex-ante uncertainty. In order to test their proposition it is necessary to use a proxy for the ex-ante uncertainty. As recommended in the empirical literature[10] the volatility (standard deviation) of daily returns between the second and the forty-second day of trading (first two trading months) is used as a proxy.

Underwriter reputation hypothesis: Another explanation for the level of underpricing is the reputation of the underwriter. Since an investment bank underwrites many offerings in the course of time and in their business with potential investors, an investment bank can develop reputation and earn more on this reputation than on "cheating" by underpricing too much or too little. A systematically too high or too low underpricing would subsequently be followed by a loss in market share. Empirical studies investigating the relationship between the underpricing level and the underwriter's reputation have found that high reputation investment banks underprice less than non-prestigious banks.[11] This is because high reputation underwriters issue firms with lower ex-ante uncertainty.

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[9] Keloharju (1993a), for example, reports for Finland negative initial returns for around 41 per cent of an entire sample of 80 IPOs. For a subscription of FIM 100,000, the difference between the unconditional return and the allocation-weighted return is approximately 11 percentage points.

[10] See for example Ritter (1984) and McGuinnes (1992).

[11] See for example Johnson and Miller (1988).

Carter and Manaster (1990) postulate that the prestige of an investment bank provides a signal for the market about the risk of the issue. They show that, on average, less prestigious investment banks underwrite riskier IPOs than more prestigious banks. The less risky an issue is, the less is the incentive for investors to acquire information to become informed. If an issuing firm is less risky, the ex-ante uncertainty is lower and according to Beatty and Ritter (1986) the underpricing should be lower. Carter and Manaster (1990) suggest that one of the reasons why prestigious investment banks issue low risk firms is that they want to increase the expected present value of subsequent offerings. Low-risk IPO firms are more likely to survive and make subsequent offerings than high-risk IPO firms. Carter (1992) provides empirical evidence that firms with no subsequent offerings have a greater standard deviation of aftermarket returns and are therefore riskier.

To test explanations of underpricing focusing on the reputation of the underwriter, we use the logarithm of the cumulative gross proceeds of all issues an investment bank has already underwritten as lead manager since 1984. This implies that, firstly, the reputation level of an investment bank increases (in a non-linear way) with the total gross proceeds of all IPOs the bank has already issued and that, secondly, the building up of reputation starts in 1984 for all banks. The latter assumption seems to be admissible because no initial public offering took place in Austria in the 18 years before 1984.

Signalling Hypothesis: Studies by Allen and Faulhaber (1989), Grinblatt and Hwang (1989) and Welch (1989) suggest that underpricing may itself be a costly signal of the intrinsic value of the issuing firm. In the Welch signalling approach (1989) for example, high-quality firms deliberately choose an offer price below the intrinsic value to signal their quality to investors. This underpricing is motivated by the possibility of achieving higher offer prices in subsequent seasoned issues. Underpricing is therefore supposed to be a sort of "appetizer" for following issues in the af-

termarket.[12] The investors know that only high-quality firms can afford the costs of underpricing. The main assumption is that low quality firms only have the choice to imitate high-quality firms or to disclose their true quality. The former results in imitation costs and involves the danger of losing part of the imitation expenses if the true quality is recognized after the IPO but before a seasoned offering. The latter creates no imitation costs but it forgoes the possibility of achieving higher prices at the IPO and in subsequent seasoned offerings. High-quality firms (= high underpricing) should therefore only offer a smaller part of their share capital at the initial issue and make subsequent issues in the aftermarket. Advocates of the signalling hypothesis argue therefore that enterprises with a high credit standing deliberately use underpricing as a means of signalling their quality to investors. If this explanation model applies, the level of underpricing should be proportional to the freqency of seasoned issues and inversely proportional to the percentage fraction issued from the share capital.

4.4 Regression analysis

To explain the observed underpricing of Austrian IPOs, the following hypotheses are tested:

Hypothesis H_1:   Ex-ante uncertainty hypothesis: there exists no significant relationship between the level of underpricing and the ex-ante uncertainty measured by the standard deviation (volatility) of the first 42 daily aftermarket trading returns (variable *Vola*).

Hypothesis H_2:   Underwriter reputation hypothesis: There exists no significant relationship between the level of underpricing and the reputation of the underwriter mea-

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[12]   Slovin, Sushka and Bendeck (1994) for example report a non-negative long-run aftermarket performance for IPOs with seasoned equity offerings.

sured by the logarithm of the cumulative gross proceeds of issues an investment bank has already launched as lead manager since 1984 (variable *Rep*).

Hypothesis H_3: Signalling Hypothesis: There exists no significant relationship between the level of underpricing and the fraction of the share capital sold (variable *Frac* in per cent) and the seasoned equity offering activity during the first two years of aftermarket trading (dummy variable *SEO*, which is coded one if a sesoned equity offering is made within 24 months of the IPO).

In order to examine the relationship between the state of the market and the level of underpricing the performance of the market in the three months before the IPO is also considered.

Hypothesis H_4: Market Climate Hypothesis: There exists no significant relationship between the level of underpricing and the performance of the stock market (Vienna Stock Exchange Share Index) in the three month period before the beginning of the subscription period (variable *Market*).

The regression equation used is:

$$UP_i = \alpha_o + \alpha_1 \cdot Vola_i + \alpha_2 \cdot Market_i + \alpha_3 \cdot Rep_i + \alpha_4 \cdot Frac_i + \alpha_5 \cdot SEO_i + \varepsilon_i \qquad (3)$$

where UP_i is the average market adjusted return between the first day of the subscription period and the close of trading on the first day (Underpricing, Initial Return). $Vola_i$ (proxy for the ex-ante uncertainty) is the average aftermarket volatility (standard deviation) of the issuing firm, estimated on the basis of daily returns between the close of trading on the first day and the forty-second day of trading. Rep_i (proxy for the reputation (quality) of the investment bank) is the logarithm of the cumulative gross proceeds of IPOs already launched by a given bank as lead manager since 1984,

and *Frac$_i$* is the percentage portion (fraction) issued from the share capital. *Market$_i$* (market performance prior to the issue) is the percentage change in the Vienna Stock Exchange Share Index for the three-month period prior to the subscription period, and *SEO$_i$* (seasoned equity offering) is a dummy variable coded one if a seasoned issue of equities is made within 24 months of the IPO.

Table 5 shows the results of the multivariate regression analysis. First, a significant and positive relation can be detected between the variable *UP* (undepricing) and the variable *Vola* (ex-ante uncertainty). This supports the Beatty and Ritter (1986) argumentation. A higher ex-ante uncertainty implies a higher underpricing. Second, the relation between *UP* and the variable *Market* (market performance prior to issue) is also significantly positive. This finding suggests that Austrian IPOs issued after an upswing in the stock market experienced a higher underpricing than IPOs following a falling market. This finding is consistent with the existence of "hot-issue" and "cold-issue" markets.[13] After the bear market of 1987 the average initial return in 1988 was -0.14 per cent whereas in the year after the bull market of 1989 the average initial return in 1990 was 12.72 per cent. As the underpricing of an IPO is high following a rising market and increases with the ex-ante uncertainty, this suggests that IPOs which are unknown to investors and therefore more difficult to be evaluated (higher ex-ante uncertainty) are more frequently issued following a rising stock market.

Third, there is no significantly negative relationship between the underpricing level and the reputation of the investment bank (no significant association between *UP* and *Rep*), which is in clear contrast to the reputation hypothesis. In Austria only three banks launched more than 5 issues from 1984 to 1996. They were, however, responsible for more than three quarters of all the IPOs and had an average underpricing of 7.92 per cent. All other banks launched less than five issues in the period considered and jointly accounted for less than one quarter of the IPOs. Surprisingly, their

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[13] The positive relationship between underpricing and the market climate is also reported for other markets (see for example Ritter (1984) for the US, Uhlir (1989a, 1989b) for Germany and McGuinness (1992) for Hong Kong).

underpricing level averaged at 1.86 per cent. It could be that the rejection of the reputation hypo-thesis for the Austrian IPO market is due to the fact that the market structure is oligopolistic and thus not very competitive.

Fourth, no significant relationship can be detected between the underpricing and the fraction of the share capital sold (*Frac*) which is in contrast to the suggestion of the signalling hypothesis that high quality (= high underpricing) firms sell less at the initial offering and more in the aftermarket. In addition, the dummy variable SEO, which controls for seasoned equity offerings in the first two years following the IPO is neither positive nor significantly related to the underpricing level. This implies that the view cannot be supported that firms making secondary offerings in the 24 months following an IPO underprice initial public offerings significantly more than others.[14]

5. Aftermarket Performance

5.1 Research methodology

To measure the abnormal performance of IPOs in the aftermarket it is first necessary to specify appropriate benchmarks. This task is of particular importance because it can affect the measured aftermarket performance. One possibility is to use a matching firm adjustment procedure, in which for each IPO firm a non-IPO firm of approximately similar size and the same industry is chosen.[15] Another possibility, which is used for markets in which the number of potential bench-mark firms is low, is to use one or more indices, e.g. a market index, as a benchmark.[16] To account for the fact

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[14] This is in contrast to the finding by McGuinness (1992) for the Hong Kong IPO market. He detects a significant relation between the underpricing level and secondary offerings in the twelve months following an IPO.

[15] See e.g. Ritter (1991), Loughran and Ritter (1995) or Kim et al. (1995).

[16] See e.g. Keloharju (1993) for the Finnish IPO market or Kunz and Aggarwal (1994) for the Swiss IPO market.

that the Austrian stock market is small and the average number of IPO firms is about the same as for non-IPO firms, a market index is not used as a benchmark. Otherwise IPOs would be compared with a portfolio of IPOs and non-IPOs and a measured abnormal performance would be biased. Instead portfolios of only non-IPO firms (all firms listed in the Official Market of the VSE exclusive of IPOs for their first five years after going public) are formed.

Starting with 1984, all non-IPO firms listed at the beginning of each calendar year are sorted by their market capitalization as of the last trading day of the prior calendar year and grouped into three reference portfolios, each containing an equal number of non-IPO firms. If a non-IPO firm is delisted before the end of the calendar year, its last price before delisting is used till the end of the year. Dependent on its market capitalization at the end of the first trading day, each IPO firm is then assigned to one of these three reference portfolios. On the first trading day of each calendar year, this assignment procedure is repeated to account for size changes in the IPO firms and the firms in the reference portfolios.[17]

The basis for the evaluation of the aftermarket performance of Austrian IPOs are the following ex-ante implementable trading strategies: (a) Purchase each IPO on its first aftermarket trading day[18], (b) purchase each IPO's corresponding reference portfolio on the IPO's first aftermarket trading day, and (c) sell each IPO and its corresponding reference portfolio on the earlier of the last day before the IPO's delisting and (1) the 22nd (i.e. after one month of aftermarket trading), (2) the 125th (after six months), (3) the 251st (after twelve months), (4) the 751st (after three years) and (5)

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[17] This procedure ensures that IPO firms are compared with (a portfolio of) non-IPO firms of approximately similar size. This is important because there is evidence of size-related performance differences in the Austrian Stock Market (see Aussenegg and Grünbichler (1996)). Classifying the reference portfolios by industries is not done because the overall number of non-IPOs is small and only a few publicly traded companies are available in most industries.

[18] It is not difficult to buy shares of Austrian IPOs on the first trading day. Only purchase orders to buy at the offer price are often rationed.

the 1251st trading day (after five years). As the number and size of future IPOs is ex-ante unknown, it is assumed that an equal amount of money is invested in each IPO or each corresponding reference portfolio.

To measure the aftermarket performance for each IPO and its corresponding reference portfolio, buy-and-hold returns are calculated. In contrast to cumulative returns (which are sometimes used to measure long-horizon security price performance) buy-and-hold returns have the advantage that they are based on a realistic ex-ante trading stradegy.[19] The buy-and-hold return for IPO i $\left(BHR_T^{IPO\,i}\right)$ is defined as[20]

$$BHR_T^{IPO\,i} = \left[\prod_{t=1}^{\min[T,delisting]} \left(1 + R_{i,t}\right)\right] - 1 \qquad T = \{22, 125, 251, 751, 1251\} \qquad (4)$$

where $R_{i,t}$ is the return of IPO i in period t, t=1 indicates the first trading day in the aftermarket, T is the aftermarket trading day number 22, 125, 251, 751, or 1251 repectively and min[T, delisting] is the earlier of the last day before delisting and T. The buy-and-hold return for the corresponding reference portfolio of IPO i $\left(BHR_T^{RPF\,i}\right)$ is defined as

$$BHR_T^{RPF\,i} = \left[\prod_{t=1}^{\min[T,delisting]} \left(1 + R_{RPF\,i,t}\right)\right] - 1 \qquad T = \{22, 125, 251, 751, 1251\} \qquad (5)$$

where $R_{RPF\,i,t}$ is the return of the reference portfolio of IPO i in period t, t=1 indicates the first trading day of IPO i in the aftermarket, T is the aftermarket trading day number 22, 125, 251, 751, or 1251 of IPO i respectively and min[T, delisting] is the earlier of the last day before delisting of

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[19] Cumulative returns implicitly assume a periodic (e.g. monthly) portfolio rebalancing, whereas buy-and-hold returns do not. In addition ex-post information about the price performance of each IPO is required to be able to carry out the periodic rebalancing.

[20] This methodology is similar to equation (1) in Loughran and Ritter (1995).

IPO i and T. Therefore, buy-and-hold returns over identical intervals are calculated for each IPO and its corresponding reference portfolio. This procedure introduces no survivorship bias or look-ahead bias. The average buy-and-hold return for a sample of n IPOs $\left(\text{BHR}_T^{\text{IPO}}\right)$ and corresponding reference portfolios $\left(\text{BHR}_T^{\text{RPF}}\right)$ is then measured as

$$\text{BHR}_T^{\text{IPO}} = \frac{1}{n} \sum_{i=1}^{n} \text{BHR}_T^{\text{IPO i}} \tag{6.1}$$

$$\text{BHR}_T^{\text{RPF}} = \frac{1}{n} \sum_{i=1}^{n} \text{BHR}_T^{\text{RPF i}} \tag{6.2}$$

where n is the number of IPOs. To measure the abnormal performance for the above described trading strategies buy-and-hold abnormal returns are calculated for each IPO i as

$$\text{BHAR}_T^{\text{IPO i}} = \text{BHR}_T^{\text{IPO i}} - \text{BHR}_T^{\text{RPF i}} \tag{7}$$

where $\text{BHR}_T^{\text{IPO i}}$ is the buy-and-hold return of IPO i and $\text{BHR}_T^{\text{RPF i}}$ is the buy-and-hold return of the corresponding reference portfolio of IPO i. Then, the average buy-and-hold abnormal return is given by

$$\text{BHAR}_T = \frac{1}{n} \sum_{i=1}^{n} \left[\text{BHAR}_T^{\text{IPO i}} \right] \tag{8}$$

A positive (negative) average buy-and-hold abnormal return can be interpreted as an outperformance (underperformance) of the IPO sample relative to the reference portfolios. Following Ritter (1991), the relative aftermarket performance is also evaluated using wealth relatives. The wealth relative for a portfolio of n IPOs for the described trading strategies is defined as

$$\text{WR}_T = \frac{1 + \text{BHR}_T^{\text{IPO}}}{1 + \text{BHR}_T^{\text{RPF}}} \tag{9}$$

where $\text{BHR}_\text{T}^\text{IPO}$ is the average buy-and-hold return of n IPOs and $\text{BHR}_\text{T}^\text{RPF}$ is the average buy-and-hold return of the corresponding reference portfolios. A wealth relative greater than (below) one indicates that the IPO sample has outperformed (underperformed) a portfolio of benchmark firms.

Another important point in measuring the long-horizon abnormal performance of security prices is the usage of appropriate test statistics. As the simulation results of Kothari and Warner (1997), Barbar and Lyon (1997) and Barbar, Lyon and Tsai (1996) show, conventional tests of long-run abnormal security returns are often misspecified. They find that conventional parametric test statistics often indicate a long-run abnormal performance when none is present (i.e. p-values are too low and the null hypothesis of no abnormal performance is overrejected). They mention especially three main reasons for potential misspecifications: (a) survival-related biases, which occur if failing firms are excluded, (b) rebalancing biases, which arise if cumulative return procedures are used and (c) biases because long-run abnormal performance measures are typically skewed.

To minimize the first two sources of misspecification, this study also includes all firms delisted on the VSE during the investigation period and uses buy-and-hold returns to calculate the long-run performance. In addition, to account for the skewness bias, a skewness-adjusted t statistic with bootstrapped p-values (as suggested by Barbar, Lyon and Tsai (1996)) and a non parametric sign test are used to test the null hypothesis of no abnormal long-run performance.[21]

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[21] As a result of their simulation analyses concerning the long-horizon security price performance, Kothari and Warner (1997) recommend using nonparametric and bootstrap tests to reduce misspecification.

5.2 Short-run performance

As the underpricing of Austrian IPOs is relatively low compared to other markets, an explanation for this could be that the price adjustment process did not finish at the end of the first trading day. If this is true, a significant abnormal performance should be observable during the first trading days of aftermarket trading. For example Kim et al. (1995) document for 169 Korean firms that went public from 1985-89 a significant and huge matching-firm adjusted average buy-and-hold return of more than 31 per cent during the first month of trading in the aftermarkt (exclusive of the first-day return). Table 6 reports the aftermarket performance for the total sample of Austrian IPOs exclusive of the initial return. The first three columns show that the short-run aftermarket performance is neither significantly negative nor significantly positive. At the first anniversary, for example, 36 out of 66 IPOs have a negative and 30 a positive buy-and-hold abnormal return. This evidence suggests that, at least for the short term, the average initial return does not disappear and that the tendency for full price adjustment to occur on the first trading day is apparent for the Austrian IPO market. This is in line with other studies (see e.g. Miller and Reilly (1987) for the USA, Finn and Higham (1988) for Australia, Uhlir (1989a, 1989b) for Germany and Kunz and Aggarwal (1994) for Switzerland).

5.3 Long-run performance

Besides the initial return and the short-run performance of unseasoned new issues, the long-run aftermarket return is also important for underwriters, issuing firms and investors. Significant abnormal returns in the long-run would suggest that IPOs are not priced at true values in the early aftermarket. This would call into question the aftermarket efficiency in valuing newly listed firms.[22] The last two columns of Table 6 report the long-run performance for the first 36 and 60 months following the first day of public trading. 57 (51) firms, which went public during the period 1984-93 (1984-91) are utilized in measuring the three-year (five-year) performance.

Focusing first on the three year performance, an investor purchasing each IPO for an equal amount of money on its first aftermarket trading day would have earned a mean return of 26.02 % (or an average annual return of 8.01 %) holding these IPOs until the third anniversary of public trading. An alternative investment in the corresponding reference portfolio would have yielded a much higher average return of 73.44 % (or an average annual return of 20.15 %) over the same time interval. The mean and median buy-and-hold abnormal return of -47.42 % and -18.75 % respectively are both significantly different from zero at the one per cent level.[23] The null hypothesis of no abnormal three-year performance therefore has to be rejected. The wealth relative of 0.73 implies that an investor would have had to invest 37 % more in each IPO than in each corresponding reference portfolio to achieve the same wealth after three-years of public trading.

Column 5 of Table 6 also shows the results based upon five-year holding periods. The performance of IPOs continues to be poor in the years 4 and 5, with a significantly negative mean and median buy-and-hold abnormal return of -73.95 % and -42.42 % respectively. Only 23 % of the

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[22] See Aggarwal and Rivoli (1990).

[23] The difference in the mean and median values reflects the skewness in the distribution of the buy-and-hold abnormal returns.

sample of 51 IPOs experienced a positive buy-and-hold abnormal return on their fifth anniversary. The wealth relative of 0.64 also documents a severe underperformance of the average Austrian IPO.

This finding, which is in contrast to the observation of a non-negative long-run aftermarket performance for Swiss IPOs (see Kunz and Aggarwal (1994)) and Korean IPOs (see Kim et al. (1995)), is in line with the empirical evidence for the IPO markets in the USA (see e.g. Ritter (1991) and Loughran and Ritter (1995)), in Finland (see e.g. Keloharju (1993)), in Germany (see e.g. Ljungqvist (1993)) or in the UK (see e.g. Levis (1993)).

5.4 Possible explanations for the observed long-run performance

As mentioned in section 3, about 60 per cent of all Austrian IPOs are firms which are exclusively controlled by a family or by private persons before going public. On the other hand about 20 per cent of all Austrian IPOs are enterprises owned by the state before going public. One main difference between these two groups is that in state-owned companies ownership and management are separated, whereas in family-owned firms this is not the case. In the latter the owners are also the managers and in most cases sell part of their company to the public mainly to raise money for their own pocket.[24] The crucial question which arises is: does the long-run aftermarket performance of an IPO depend on its pre-issue ownership structure ?

The ownership structure of family-owned firms going public might fit into one implication of the agency theory: as managerial ownership in a firm is reduced, the managers' incentives to maximize the firms' value decreases. As a consequence, the operating performance after going public should be poor.

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[24] The mean fraction issued from the share capital by family-owned firms is 31.1 %.

Concerning the operating performance, Jain and Kini (1994) document a significant operating underperformance for a sample of (non-privatized) US-IPOs. In contrast to their findings, Megginson et al. (1994 and 1996) analyse the operating performance of privatized firms. They compare the operating performance of 61 companies from 18 countries before and after privatization over the period 1961-91 and document that the profitability and operating efficiency as well as real sales and capital investment spending increased significantly after privatization. This raises the question as to whether a positive operating performance after going public might lead to a non-negative or perhaps positive long-run aftermarket performance of former state-owned enterprises. This would imply at least a better long-run aftermarket performance for privatized enterprizes in comparison to family-owned firms.

Table 7 reports the five-year abnormal performance of family-owned IPOs, privatized firms and the group of other IPOs. Several interesting findings can be observed: first, by implementing a trading strategy to invest an equal amount of money in each family-owned IPO on the first trading day in the aftermarket investors would not only have experienced a poor performance in relation to the alternative strategy of investing in corresponding reference portfolios. In addition they would actually have lost money. The average buy-and-hold return on the fifth anniversary is   -19.69 % (or an average annual return of -4.29 %). This clear evidence of extremely poor performing family-owned IPOs also shows up in the average and median buy-and-hold abnormal returns of -118.60 % and -51.56 % respectively (both are significantly different from zero at the one per cent level). Only 4 out of 31 IPOs managed to outperform non-IPOs or in other words 87 % of all family-owned IPOs underperformed their corresponding benchmark firms over the first five years of seasoning. The wealth relative of 0.40 implies the necessity for an investor to invest 150 % (!) more in family-owned IPOs than in non-IPOs of (approximately) similar size to have the same wealth on the fifth anniversary after going public.

In clear contrast to these findings is the evidence for the two other groups. Privatized firms managed to outperform their benchmark firms on average by +49.85 % (the median value is +28.90 %) with a wealth relative of 1.25, whereas the group of other IPOs underperform by -34.15 % (average buy-and-hold abnormal return) and -25.88 % (median buy-and-hold abnormal return) respectively with a wealth relative of 0.85. Neither the overperformance of privatized enterprises nor the underperformance of the group of other IPOs are significantly different from zero.

At least three main conclusions can therefore be drawn from these findings: first, there is evidence that the main reasons for the underperformance of Austrian IPOs is due to one particular class of IPOs: family-owned IPOs. Second, no significant underperformance can be documented for privatized and other IPOs. Third, the conclusion that privatized enterprises outperformed family-owned firms in the long-run (fifth anniversary of IPO) seems to be appropriate. This evidence shows that in the case of the Austrian IPO market the ownership structure is an important reason for the overall underperformance, which is in line with the expectations formulated above.

5.5 Regression analysis

To get further information about possible explanations for the long-run underperformance of Austrian IPOs, a cross-sectional regression analysis is conducted. The estimated model is

$$\text{BHAR}_T^{\text{IPO i}} = \alpha_o + \alpha_1 \cdot \text{Vola}_i + \alpha_2 \cdot \text{Market}_i + \alpha_3 \cdot \text{Re p}_i + \alpha_4 \cdot \text{Family}_i + \varepsilon_i \tag{10}$$

where $BHAR_T^{IPO\,i}$ is the average buy-and-hold abnormal return from the closing price of the first trading day till the fifth anniversary of IPO i measured using equation (7), $Vola_i$ is the aftermarket standard deviation of the issuing firm, estimated on the basis of daily returns between the close of trading on the first day and the forty-second day of trading; and $Market_i$ (market performance prior

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to the issue) is the percentage change in the Vienna Stock Exchange Share Index for the three-month period prior to the subscription period. Rep_i (proxy for the reputation (quality) of the underwriter) is the logarithm of the cumulative gross proceeds of issues already launched by a bank as lead manager since 1984 and $Family_i$ is a dummy variable coded one if IPO i is family-owned prior to the issue and zero otherwise.

The variable $Vola_i$ is included to test whether higher price fluctuations in the short term aftermarket are associated with a worse long-run performance as the heterogeneous expectation hypothesis would imply.[25] The variable $Market_i$ is used to test the windows of opportunity hypothesis. This hypothesis states that firms time their IPO and go public when investors are overoptimistic. The latter is mostly the case after stock market booms. About 50 per cent of all Austrian IPOs are cumulated after the two stock market booms in 1985 and in 1989/90.

The results presented in Table 8 confirm in essence the above results for the long-run underperformance of Austrian IPOs. Whilst the variable $Vola$ has no explanatory power, it is shown up that the long-run performance is the worse, the better the stock market performance prior to the issue is. This would testify for the windows of opportunity hypothesis, but we have to consider that the variable market is only different from zero at the 10 per cent level. More pronounced are the results for the reputation and the ownership structure hypotheses: First, the higher the reputation of the underwriter, the better is the long-run performance (and vice versa). This is in line with the findings of Nanda, Yi and Yun (1995) who observed significant differences in the average long-run performance of US-IPOs based on the reputation of the underwriter (lead manager). They show that the long-run underperformance is a phenomenon which is primarily associated with IPOs done by less established underwriters with a lower reputation. In addition they document that those underwriters whose IPOs experienced the poorest long-run performance suffered a significant loss of market share. On the other hand, IPOs underwritten by investment banks with a high reputation do

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[25]   See e.g. Jenkinson and Ljungqvist (1996), p. 102.

not experience a long-run underperformance. Second, the very poor performance of family-owned IPOs is also confirmed by the regression results. The variable $Family_i$ is signficantly different from zero at the one per cent level and has a negative sign.

6. Conclusion

This study examines the price behaviour of 67 Austrian IPOs going public in the Official Market of the Vienna Stock Exchange (VSE) over the period 1984-1996. After more than 18 years with only delistings, in every year of the thirteen-year investigation period firms went public. In accordance with the findings for other markets, the average initial returns of Austrian IPOs are significantly positive. At an average level of 6.5 per cent, however, the initial returns are lower than for most other IPO markets. More than 30 per cent of all IPOs are overpriced with negative initial returns.

Several hypotheses to explain the observed unterpricing of Austrian IPOs are tested. The empirical findings only show support for the ex-ante uncertainty and the market climate hypothesis. The underpricing level is significantly positive in relation to the return standard deviation in the short-term aftermarket and to the stock market performance in the last three months prior to the IPO. This supports both the Beatty and Ritter (1986) argument that the underpricing increases with the ex-ante uncertainty and the existence of "hot-issue" and "cold-issue" periods. On the other hand, the underwriter reputation as well as the signalling hypothesis do not explain the cross-sectional differences in the level of underpricing. An additional explanation for the observed underpricing could be Rock's (1986) winner's curse hypothesis. Although it is not possible to directly test this hypothesis due to the lack of a standardized rationing procedure, there is a tendency that the allocation is lower for underpriced issues than for overpriced ones, so that the allocation-adjusted average initial return should be smaller than the unadjusted 6.5 per cent.

In contrast to the findings for the Swiss and Korean IPO markets (see Kunz and Aggarwal (1994) and Kim et. al. (1995) respectively), but in line with the evidence for the US (see e.g. Loughran and Ritter (1995)), Finland (see e.g. Keloharju (1993)), the UK (see e.g. Levis (1993)) and Germany (see e.g. Ljungqvist (1993)) Austrian IPOs significantly underperform in the long-run. An investor purchasing each IPO for an equal amount of money on its first aftermarket trading day would have earned a mean buy-and-hold return of 31.42 per cent till the fifth anniversary, whereas an alternative investment in corresponding reference portfolios of non-IPO firms of approximately similar market capitalization would have yielded a much higher average buy-and-hold return of 105.38 per cent over the same time interval. The mean buy-and-hold abnormal return of -73.95 per cent is significantly different from zero and the wealth relative amounts to 0.64.

The main explanation for the observed severe long-run underperformance are cross-sectional differences in the ownership structure of Austrian IPOs: nearly 60 per cent of all IPOs are firms which are exclusively controlled by a family or by private persons (family-owned IPOs), whereas privatized and other non family-owned firms account for around 20 per cent each. In state-owned and non family-owned companies ownership and management are separated, whereas in family-owned firms this is not the case. In the latter the owners are also the managers and in most cases sell part of their company to the public mainly to raise money for their own pocket. In addition, their going public is clustered after stock market booms, which suggests that they are best able to time an IPO and take advantage of „windows of opportunity".

For family-owned firms going public the average five-year buy-and-hold return is -19.69 per cent which implies that an investor with a simple (ex-ante implementable) trading strategy to purchase only family-owned IPOs would have lost money over the first five aftermarket trading years. The wealth relative of 0.40 implies the necessity for an investor to invest 150 per cent (!) more money in family-owned IPOs than in non-IPOs of (approximately) similar size to have the same wealth at the fifth anniversary after going public. In contrast to this extreme underperformance, no significant

positive or negative abnormal performance can be detected for privatized enterprizes or other non family-owned IPOs.

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Table 1:

Initial returns and aftermarket performance of initial public offerings in some recent studies.

country	study	Time period	Average	3-year aftermarket perfor-	
mance[a]					
			initial return	Return (%)	wealth relative
US	Ritter (1991)[d]	1975-84	+14.1 %	-29.1[b]	0.83
US	Loughran and Ritter (1995)[d]	1970-90	+10.0 %	-26.9[c]	0.80
UK	Levis (1993)[e]	1980-88	+14.1 %	-26.3[b]	0.92
Finland	Keloharju (1993)[e]	1984-89	+8.7 %	-26.4[b]	0.79
Schweden	Loughran et al. (1994)	1980-90	+38.2 %	+2.0[c]	1.01
Switzerland	Kunz and Aggarwal (1994)[e]	1983-89	+35.8 %	-6.1[b]	n.a.
Korea	Kim et al. (1995)[d]	1985-89	+57.6 %	+91.6[b]	1.56
Germany	Ljungqvist (1993)[f]	1978-89	+12.4 %	-18.2[c]	0.87

[a] Exclusive of the initial return.

[b] Cumulative abnormal return.

[c] Buy-and-hold abnormal return.

[d] Matching firm adjusted.

[e] Market index adjusted.

[f] GSC100 Index adjusted.

Table 2:

Distribution of initial public offerings in the Official Market by year.

year	No. of IPOs	Aggregate gross proceeds million ATS	Average gross proceeds million ATS	Average first-day return[a] (%)
1965-1983	0	-	-	-
1984	2	63.8	31.9	11.0
1985	2	965.8	482.9	11.1
1986	10	1,570.1	157.0	3.0
1987	3	1,588.6	529.5	8.5
1988	6	4,227.4	704.6	-0.1
1989	6	2,569.6	428.3	4.8
1990	14	7,035.6	502.5	12.7
1991	8	3,832.6	479.1	7.6
1992	5	2,897.4	579.5	4.9
1993	1	621.6	621.6	8.9
1994	5	10,622.1	2,124.4	2.9
1995	4	5,985.5	1,496.4	0.4
1996	1	542.8	542.8	3.4
Total	67	42,522.9	634.7	6.5

[a] First-day returns are defined as the amount by which the price appreciation of the IPOs exceeds that of the Vienna Stock Exchange Share Index (WBI) for a purchase at the offering date and sale at the close of the first trading day (in percentage points), calculated using Equation (2).

Table 3:

Initial public offerings categorized by ownership, 1984-96.

	No. of IPOs	Aggregate gross proceeds, million ATS	Average gross proceeds, million ATS	No of IPOs %	Aggregate gross proceeds %
Family[a]	40	16,910.17	422.75	59.70	39.77
Priv[b]	13	22,139.30	1,703.02	19.40	52.06
Others[c]	14	3,473.39	248.10	20.90	8.17
Total	67	42,522.86	634.67	100.00	100.00

[a] Former family-owned firms. Family-owned IPOs are defined as firms controlled by a family or by private persons before going public.

[b] Privatized enterprises.

[c] Other firms. They are defined as firms which are neither controlled by a family or by private persons nor are privatized enterprises. In most cases such firms are owned by banks or other big companies.

Table 4:

Descriptive statistics for first-day returns [a] of 62 initial public offerings in 1984-96.

	First-day returns	
	unadjusted returns	market index-adjusted returns
Mean (%)	5.75	6.46
t-value [b]	3.58	3.80
	(0.00)	(0.00)
Standard Deviation (%)	12.66	13.38
Skewness	2.94	2.70
S. E.	(0.30)	(0.30)
Kurtosis	11.41	9.87
S. E.	(0.60)	(0.60)
Maximum (%)	69.16	70.26
3. Quartile (%)	6.59	10.02
Median (%)	2.36	4.04
z-value [c]	4.45	3.05
	(0.00)	(0.00)
1. Quartile (%)	0.00	-0.95
Minimum (%)	-12.63	-14.99

[a]   First-day returns are defined as the amount by which the price appreciation of the IPOs exceeds that of the Vienna Stock Exchange Share Index (WBI) for a purchase at the offering date and sale at the close of the first trading day (in percentage points), calculated using Equation (2).

[b]   p-values in parentheses.

[c]   z-values are calculated using a non-parametric sign test. p-values in parentheses.

Table 5:

Multivariate regression analysis of initial returns against several explanatory variables for 62 IPOs from 1984-96.

Intercept	Vola	Market	Rep	Frac	SEO	$F^{(a)}$	$R^2_{adj}{}^{(b)}$	$DW^{(c)}$
-0.109	5.082	0.349	0.107	-0.094	-0.036		0.261	1.861
(-0.019)	(3.385)	(3.130)	(0.151)	(-1.196)	(-0.010)	5.300		
[0.985]	[0.001]	[0.003]	[0.880]	[0.237]	[0.992]	[0.000]		

[a] The F-statistic tests the null hypothesis that the explanatory variable coefficients are equal to zero.

[b] Adjusted R^2

[c] Durbin-Watson Statistic

t-values ($\bullet$) and p-values [$\bullet$] in parentheses.

The model is:

$$UP_i = \alpha_o + \alpha_1 \cdot Vola_i + \alpha_2 \cdot Market_i + \alpha_3 \cdot Re\,p_i + \alpha_4 \cdot Frac_i + \alpha_5 \cdot SEO_i + \varepsilon_i$$

where UP_i (Underpricing, Initial Return) is the average market adjusted return between the first day of the subscription period and the close of trading on the first day. $Vola_i$ (proxy for the ex-ante uncertainty) is the aftermarket standard deviation of the issuing firm, estimated on the basis of daily returns between the close of trading on the first day and the forty-second day of trading. Rep_i (proxy for the reputation (quality) of the underwriter) is the logarithm of the cumulative gross proceeds of issues already launched by a given bank as lead manager since 1984. $Frac_i$ is the percentage portion (fraction) issued from the share capital und $Market_i$ (market performance prior to the issue) is the percentage change in the Vienna Stock Exchange Share Index for the three-month period prior to the subscription period. SEO_i (seasoned equity offering) is a dummy variable coded one if a seasoned issue of equities is made within 24 months of the IPO.

Table 6:

Short- and long-run aftermarket performance (exclusive of initial return).

	Month relative to IPO				
	1	6	12	36	60
	short-run aftermarket			long-run aftermarket	
Average BHR_{IPOs} (%) [a]	2.09	4.11	16.23	26.02	31.42
Geometric Mean p.a. (%)				8.01	5.62
Average $BHR_{Ref\,PF}$ (%) [b]	1.33	5.12	18.85	73.44	105.38
Geometric Mean p.a. (%)				20.15	15.48
Wealth relative [c]	1.01	0.99	0.98	0.73	0.64
Average BHAR (%) [d]	0.76	-1.02	-2.62	-47.42[‡]	-73.95[‡]
t-value [e]	(0.45)	(-0.25)	(-0.29)	(-3.64)	(-3.14)
Median BHAR (%)	-0.59	-1.28	-5.28	-18.75[‡]	-42.42[‡]
z-value [f]	(-1.10)	(-0.25)	(-0.74)	(-2.78)	(-3.78)
No. of positive BHAR	29	32	30	18	12
No. of negative BHAR	38	34	36	39	39
No. of IPOs (total)	67	66	66	57	51

[‡] Significant different from zero at the one per cent level.

[†] Significant different from zero at the five per cent level.

[a] Average buy-and-holding return for the sample of IPOs.

[b] Average buy-and-holding return for the corresponding reference portfolios.

[c] Wealth relative for the sample of IPOs, calculated using equation (9).

[d] Average buy-and-hold abnormal return for the sample of IPOs, calculated using equation (7) and (8).

[e] Bootstrapped skewness-adjusted t-statistics (as suggested by Barber, Lyon and Tsai (1996)).

[f] z-values are calculated using a non-parametric sign test.

Table 7:

Long-run aftermarket performance: first trading day till the fifth anniversary
(exclusive of initial return) for all issues, family-owned issues (Family),
privatized firms (Privatized) and other issues (Others), 1984-91.

	All issues	Family	Privatized	Others
Average BHR$_{IPOs}$ (%) [a]	31.42	-19.69	152.03	88.36
Geometric Mean p.a. (%)	5.62	-4.29	20.31	13.50
Average BHR$_{Ref\ PF}$ (%) [b]	105.38	98.92	102.17	122.51
Geometric Mean p.a. (%)	15.48	14.75	15.12	17.35
Wealth relative [c]	0.64	0.40	1.25	0.85
Average BHAR (%) [d]	-73.95‡	-118.60‡	49.85	-34.15
t-value [e]	-3.14	-6.12	0.86	-0.62
Median BHAR (%)	-42.42‡	-51.56‡	28.90	-25.88
z-value [f]	-3.78	-4.13	0.38	-1.39
No. of positive BHAR	12	4	4	4
No. of negative BHAR	39	27	3	9
No. of IPOs (total)	51	31	7	13

Family-owned IPOs are defined as firms exclusively controlled by a family or by private persons before going public, privatized firms are former (100 per cent) state-owned enterprises and other firms are firms exclusively controlled by a bank or another big company (not controlled by a family).

‡   Significant different from zero at the one per cent level.

†   Significant different from zero at the five per cent level.

[a]   Average buy-and-holding return for the sample of IPOs.

[b]   Average buy-and-holding return for the corresponding reference portfolios.

[c]   Wealth relative for the sample of IPOs, calculated using equation (9).

[d]   Average buy-and-hold abnormal return for the sample of IPOs, calculated using equation (7) and (8).

[e]   Bootstrapped skewness-adjusted t-statistics (as suggested by Barber, Lyon and Tsai (1996)).

[f]   z-values are calculated using a non-parametric sign test.

Table 8:

Multivariate regression analysis of five-year buy-and-hold abnormal returns ($BHAR_T$) against several explanatory variables, all issues from 1984-91 (51 IPOs).

Intercept	Vola	Market	Rep	Family	$F^{(a)}$	$R^2_{adj}{}^{(b)}$	$DW^{(c)}$
-117.098	20.699	-2.649	19.054	-161.026		0.235	2.135
(-2.243)	(1.060)	(-1.834)	(2.646)	(-3.624)	4.842		
[0.030]	[0.295]	[0.073]	[0.011]	[0.001]	[0.002]		

[a] The F-statistic tests the null hypothesis that the explanatory variable coefficients are equal to zero.

[b] Adjusted R^2

[c] Durbin-Watson Statistic

t-values (•) and p-values [•] in parentheses.

The model is:

$$BHAR_T^{IPO\,i} = \alpha_o + \alpha_1 \cdot Vola_i + \alpha_2 \cdot Market_i + \alpha_3 \cdot Re\,p_i + \alpha_4 \cdot Family_i + \varepsilon_i$$

where $BHAR_T^{IPO\,i}$ is the average buy-and-hold abnormal return from the closing price of the first trading day till the fifth anniversary of IPO i measured using equation (7), $Vola_i$ is the aftermarket standard deviation of the issuing firm, estimated on the basis of daily returns between the close of trading on the first day and the forty-second day of trading; and $Market_i$ (market performance prior to the issue) is the percentage change in the Vienna Stock Exchange Share Index for the three-month period prior to the subscription period. Rep_i (proxy for the reputation (quality) of the underwriter) is the logarithm of the cumulative gross proceeds of issues already launched by a bank as lead manager since 1984 and $Family_i$ is a dummy variable coded one if an IPO is family-owned prior to the issue and zero otherwise.