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THE RISE AND FALL OF EUROPE'S NEW STOCK MARKETS

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THE LONG-TERM PERFORMANCE OF INITIAL PUBLIC OFFERINGS ON EUROPE'S NEW STOCK MARKETS

Giancarlo Giudici and Peter Roosenboom

ABSTRACT

In this chapter we examine the determinants of the long-run stock price performance of Initial Public Offerings (IPOs) on Europe's new stock markets. We report that the average company that went public on these markets has been a very poor long-term investment. We find that the stock price performance during a three-year window is inversely related to first-day returns. We also find that the long-term underperformance of IPO firms begins after the lock-up agreement has expired and insiders start trading in the firm's shares. These findings are consistent with the divergence of opinion hypothesis of Miller (1977).

1. INTRODUCTION

In 2003 the Neuer Markt, at one time Europe's largest market for growth stocks, closed its doors amid scandals and corporate governance failures.[1] Many Neuer Markt companies had seen their stock prices plummet after issuing profit warnings or missing their earnings targets. The stocks that once traded like gold nuggets at the height of the stock market bubble were suddenly sinking like lead (*The Independent*, 15 November 2000). The series of insolvencies and insider trading

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scandals that followed, tarnished the Neuer Markt's reputation and added to the decision to shut the market down. However, this collapse of stock prices was not at all limited to Neuer Markt companies. Many firms that went public on the French Nouveau Marché, the Italian Nuovo Mercato, the Dutch Nieuwe Markt, Euro.NM Belgium and NASDAQ Europe lost nearly all their value. To date, there has been no in-depth study investigating the long-run stock price performance of Initial Public Offerings (IPOs) on these markets. This chapter aims to fill this gap.

What explains this poor long-run stock price performance of the average IPO firm? One plausible explanation is offered by the divergence of opinion hypothesis of Miller (1977). Given the inherent lack of price history and limited accounting information, the opinion about the firm's prospects might range from "this is the next Microsoft" to "this dog will not see its second birthday" (Houge et al., 2001). Miller (1977) argues that in a market with restricted short selling, such as the IPO market, market prices might exceed fundamental values because they are determined by (a minority of) overoptimistic investors who want to believe that the company is "the next Microsoft". Over time, information flows increase and short sale constraints are relaxed allowing more pessimistic investors to enter the market. As a result, the divergence of opinion narrows and prices will gradually converge to fundamental value. Despite its intuitive appeal, there is currently only one paper that directly tests the divergence of opinion hypothesis. Houge et al. (2001) show that a large opening bid-ask spread, a late opening trade and a high flipping ratio (their proxies for divergence of opinion) are associated with poor long-term performance of U.S. IPO firms.

In this chapter we test the divergence of opinion hypothesis. We expect that this hypothesis may partially explain the poor performance of IPO firms on Europe's new stock markets. New issues on these markets were often accompanied by advertising campaigns, including mainstream television, making subjective claims going far beyond the content of the IPO prospectus. In addition, many press officers of companies briefed the press without worrying too much if their claims would prove true in the future (*Financial Times*, 15 January 2001) and stock analysts and TV stock market pundits praised dot.coms to high heaven before prices came crashing down to earth. This is likely to have fuelled overoptimism leading to market prices that initially exceeded fundamental values.

Our results provide some support for the divergence of opinion hypothesis of Miller (1977). In particular, we find that IPO underpricing is negatively related to long-run stock price performance. This suggests that investor overoptimism on the first trading day has a transitory effect on prices. We also find that the long-term underperformance of IPO firms begins after the lock-up agreement has expired and insiders start trading in the firm's shares. It is likely that these insiders have a different information set than outside investors and that this additional information gets incorporated into stock prices once they are allowed to trade in their firm's shares. Additionally, we find that Internet and technology companies that went public during the bubble period of 1999–2000 performed very poorly. This captures the "Tech Wreck" that occurred after the stock market bubble burst. We report that IPOs completed in 1999–2000 that were underwritten by reputable investment banks performed significantly better than other IPOs.

This chapter continues as follows. In section two we discuss the existing literature. Section three describes the data. Section four discusses the measurement of long-term returns. Section five presents our results. Section six concludes.

2. LITERATURE REVIEW

Long-run underperformance is a well-documented anomaly associated with IPOs. For the United States, Ritter (1991) shows that firms going public during 1975–1984, on average, underperform a sample of matching firms over a three-year period by 29%. Loughran and Ritter (1995) test the robustness of this finding and confirm that U.S. IPOs during 1970–1990 have been poor long-term investments for investors. For the United Kingdom, Levis (1993) shows that companies that went public during 1980–1988 underperform market indices by an average of 8–23% (depending on the market benchmark used) for a period of three years after their IPO. Espenlaub et al. (2000) report that UK companies that went public during 1985–1992 show substantial negative abnormal returns after the first three years irrespective of the benchmark used. For Germany, Ljungqvist (1997) reports that companies going public during 1970–1990, on average, underperform the market by 12% in three years. However, Stehle et al. (2000) show that German firms that went public during 1960–1992, on average, underperform a portfolio of stocks with a similar market capitalization by 6% in three years.

This prompts the question why the average IPO firm performs so poorly over the long run. Miller (1977) develops a theory to explain this anomaly. Miller (1977, p. 1156) writes: "the prices of new issues are set not by the appraisal of the typical investor, but by the small minority who think highly enough of the investment merits of the new issue to include it in their investment portfolio." It is this minority of overoptimistic investors that initially sets market prices above fundamental values in a market with restricted short selling. Over time, additional information on the firm becomes available and short sale constraints are loosened. This allows more pessimistic investors to enter the market resulting in a stock price decline.

It is difficult to test the divergence of opinion hypothesis directly because it is difficult to measure the divergence of opinion among investors. However, Houge et al. (2001) develop three opening-day proxies for divergence opinion: opening bid-ask spread, the time of first trade and the flipping ratio (defined as sell-signed block volume divided by total volume on the first trading day). They find that a large opening spread, a late opening trade and a high flipping ratio have significant predictive ability to explain long-run IPO returns in the United States.

Miller's argument relies in part on the presence of short sales restrictions in IPO markets. Gezcy et al. (2002) find that although investors with good access to the equity lending market can short most IPOs, investors without access to specials (i.e. expensive-to-borrow stocks) can short none of them. Ofek and Richardson (2003) argue that lockup agreements represent the most stringent form of short sale constraint because it prevents insiders from trading in the firm's stock. The expiration of the lockup agreement can be thought of as relaxing this short sale constraint. Accordingly, Ofek and Richardson (2003) report that the daily abnormal returns after lock-up expiration are significantly lower than the daily abnormal returns before lock-up expiration. This finding is consistent with the model of Aggarwal et al. (2002) where managers strategically underprice IPOs to maximize wealth by selling stocks at lock-up expiration. In the model, underpricing creates positive momentum that arguably lasts until lock-up expiration.

A number of other studies are broadly consistent with Miller's divergence of opinion hypothesis. Rajan and Servaes (1997) show that more firms go public at times when analysts are overoptimistic. They report that U.S. firms perform poorly over the first four years after their IPO when analysts are more optimistic about their long-term growth potential. Jaggia and Thosar (2004) examine the 6-month aftermarket performance of high-tech U.S. IPOs completed in the late 1990s. They find a pattern of short-run positive momentum followed by a gradual reversal in post-IPO returns. Dorn (2003) examines a unique dataset of clients of a large German retail broker. He reports that retail investors were willing to overpay for IPOs during August 1999 to May 2000. New issues that were more aggressively sought after by retail investors had higher first-day returns and lower aftermarket returns during the first year after the IPO. Dorn (2003) concludes that sentiment drives retail purchases of IPO stocks and has a transitory effect on prices. Loughran and Marietta-Westberg (2001) report strong underperformance of U.S. IPO firms following either a positive or negative extreme one-day price movement of at least $\pm 15\%$. They argue that investors appear optimistic about a variety of news announcements that coincide with one-day extreme returns. Investors seem to overreact to good news events and underreact to bad news events.

Jain and Kini (1994) examine the long-term operating performance of U.S. IPOs. They report that the cash flow-to-assets ratio decreases substantially between the year prior to going public and three years later. Mikkelson et al. (1997) show that cash flows of U.S. IPO firms did not increase sufficiently to justify high valuations at the time of the IPO. Teoh et al. (1998) show that U.S. IPO firms attempt to mislead investors about the operating performance of the company through earnings management. They show that IPO firms that manipulate their earnings in the first fiscal year as a public company experience poor stock price performance over the next three years.

Other studies have examined the relation between long-term IPO returns and underwriter reputation. Carter et al. (1998) report a negative relationship between long-run returns and underwriter reputation. In particular, they find that the average IPO underwritten by a reputable investment bank underperforms the market by 13% whereas the average IPO underwritten by a non-reputable investment bank underperforms the market by 34%. Conversely, Logue et al. (2002) do not find a relationship between underwriter reputation and long-term returns. However, they find that aftermarket underwriter activities such as the decision to exercise the overallotment option and price stabilization, are positively related to longer-run returns. Brav and Gompers (1997) report that U.S. IPO firms that were backed by venture capitalists outperformed IPO firms that did not receive venture backing. However, they conclude that this underperformance is not an IPO effect. Companies with similar size and book-to-market ratios but that did not issue equity performed just as poorly as the IPO firms in their sample did.

3. DATA AND SAMPLE DESCRIPTION

We identify admissions to trading from the *SDC Global New Issues* database and information provided by the stock exchanges. In constructing our sample, we exclude financial companies (SIC codes 6000–6999), spin-offs, privatisation issues and companies previously listed elsewhere. Our final sample includes 555 non-financial companies that went public on the German Neuer Markt (303 firms), the French Nouveau Marché (144), the Italian Nuovo Mercato (35), the Dutch Nieuwe Markt (14), Euro.NM Belgium (13) and NASDAQ Europe (46) during 1996–2000. We obtain prospectuses from the company or *Disclosure Global Access*.

Table 1 shows descriptive statistics. The average (median) company has a market value of €291.4 million (€129 million) on the first day of trading. There is a small number of large companies that go public during this period. The largest company in our sample is T-Online International AG with a market value of €13.2 billion. There are 25 companies that have a market value higher than €1 billion. The market-to-book ratio is defined as the ratio of market value and the post-issue book value of equity. The average (median) company has a market-to-book value of 6.02

Table 1. Descriptive Statistics.

	Mean	Median	Maximum	Minimum	Std. Dev.	Obs.
Market value (€ thousands)	291,445	129,319	13,252,500	9,054	833,118	555
Market-to-book ratio	6.02	4.27	115.07	0.01	7.91	555
Firm age (years)	12.25	9.00	130.00	1.00	12.88	555
EBITDA < 0 dummy	0.305	0.00	1.00	0.00	0.461	555
Internet and technology dummy	0.605	1.00	1.00	0.00	0.489	555
Dilution (%)	32.55	30.00	167.00	0.00	16.70	555
Participation (%)	7.58	5.05	63.67	0.00	9.35	555
Underwriter market share	5.83	3.11	46.01	0.03	7.68	555
VC backing dummy	0.456	0.00	1.00	0.00	0.498	555
First-day return (%)	35.56	10.25	433.33	−25.00	61.84	555
High-low spread (%)	13.06	11.11	85.71	−10.16	10.73	465
Bid-ask spread (%)	1.89	1.54	10.15	0.00	1.62	465
Volume ratio	0.718	0.349	20.82	0.00	1.39	465
Wealth relative (local index)	0.678	0.217	44.08	0.001	2.54	555
Wealth relative (NASDAQ index)	0.722	0.261	51.78	0.001	2.72	555

Note: This table shows descriptive statistics. We compute market value as the number of shares outstanding after the IPO times the closing market price on the first trading day. The market-to-book ratio is measured as the ratio of market value and the post-issue book value of equity. Firm age is defined as the calendar year of the IPO minus the calendar year of founding as mentioned in the prospectus. EBITDA < 0 is a dummy variable that equals one if earnings before interest, taxes, depreciation and amortization is less than zero in the most recent financial year disclosed in the prospectus. Internet and technology is a dummy variable that takes on the value one if the IPO firm is active in the Internet and technology sector. We identify Internet and technology firms as described in Note 2. The dilution factor is defined as the number of newly issued shares at the IPO divided by the number of pre-IPO shares outstanding. The participation ratio is defined as the number of existing shares sold by pre-IPO shareholders divided by the number of pre-IPO shares. Underwriter market share is the sum of gross proceeds (excluding over-allotment option) in all local IPOs lead managed by bank *j* divided by the total proceeds raised in the local market during the 1990–2002. VC backing dummy is a dummy variable if one or more venture capitalists are pre-IPO shareholders. First-day return is measured as: (first-day closing market price - final offer price)/final offer price. The high-low spread is defined as the difference between the highest and lowest price achieved on the first trading day divided by the average of the highest and lowest price on that day. Bid-ask spread equals the difference between the ask and bid price at the close of market on the first trading day divided by the average of the ask and bid price at the close of market on that day. Volume ratio is computed as the ratio of the number of shares traded on the first trading day and the number of shares sold to the public in the IPO. The wealth relative is defined as the ratio of the three-year holding period return on the IPO stock and the three-year holding period return on the local market index or NASDAQ composite index.

(4.27). There is only one company (Netlife AG) that has a negative post-issue book value of equity. In this case we set the market-to-book ratio equal to 0.01.

Age is measured as the difference between the calendar year of the IPO and the calendar year of founding. We find that the average (median) firm age is 12 years (9 years). Table 1 shows that 30.5% of the companies that go public report losses and 60.5% of companies are active in the Internet and technology sector.[2] Dilution is defined as the number of newly issued shares sold at the time of the IPO divided by the number of pre-IPO shares outstanding. The company raises a significant amount of new equity capital at the time of the IPO. The average (median) company has a dilution factor of 32.6% (30%). The participation ratio is measured as the ratio of the number of existing shares sold by pre-IPO owners at the time of the IPO and the number of pre-IPO shares outstanding. The participation ratio has an average value of 7.6% and a median value of 5.1%.

Underwriter market share is calculated as the sum of gross proceeds of all IPOs lead managed by the underwriter divided by the sum of gross proceeds of all IPOs in the local market during 1990–2002.[3] This adopts the approach of Ljungqvist and Wilhelm (2002). The average (median) market share is 5.8% (3.1%). We use underwriter market share as our measure of underwriter reputation in subsequent tests. We find that 45.6% of sample firms are backed by a venture capitalist. Venture capitalists and underwriters are repeated players in the IPO market that may certify the quality of the firm going public (Carter et al., 1998; Megginson & Weiss, 1991).

First-day returns are measured as the percentage difference between the offer price and the first-day closing market price. Table 1 shows that first-day returns average 35.6% with a median of 10.3%. There are 69 companies (12.4% of our sample) that more than double in price on the first day of trade. This shows that first-day returns are highly skewed. First-day returns range from a maximum of 433.33% (Biodata Information Technology AG) to a minimum of −25% (Neue Sentimental Film AG). We use first-day returns as one of our proxies for divergence of opinion. We argue that higher first-day returns point to a higher degree of investor overoptimism.

We follow Houge et al. (2001) and define three other proxies for the divergence of opinion: the high-low spread, the bid-ask spread and the volume ratio. We obtain information about the highest and lowest intraday price, bid and ask price at the close of the first-trading day and the number of shares traded on the first trading day from *Datastream*. We are able to collect this data for 465 sample firms. The high-low spread is defined as the difference between the highest and lowest price achieved on the first-trading day divided by the average of the highest and lowest price on that day. The average high-low spread equals 13.1% and is 11.1% evaluated at the median. We conjecture that the higher the high-low spread on the first trading day, the higher the divergence of opinion among investors.

Table 2. Comparison of the Pre-Bubble and Bubble Period.

	Pre-Bubble Period 1996–1998	Bubble Period 1999–2000	Test for Difference
Market value (€ thousands)	130,010	359,156	2.97***
	63,148	*166,400*	*8.58****
Market-to-book ratio	7.02	5.59	1.94*
	4.34	*4.22*	*0.39*
Firm age (years)	14.25	11.42	2.37**
	11.00	*9.00*	*2.33***
EBITDA < 0 dummy	0.201	0.348	3.46***
Internet and technology dummy	0.470	0.662	4.30***
Dilution (%)	33.09	32.33	0.49
	30.83	*26.85*	*2.54***
Participation (%)	10.47	6.37	4.81***
	7.43	*4.19*	*3.05****
Underwriter market share	6.33	5.62	1.00
	3.66	*2.67*	*1.14*
VC backing dummy	0.469	0.450	0.42
First-day return (%)	29.93	37.92	1.39
	10.00	*10.34*	*0.24*
High-low spread (%)	7.51	14.73	6.29***
	4.18	*13.09*	*7.54****
Bid-ask spread (%)	2.00	1.85	0.86
	1.55	*1.52*	*0.73*
Volume ratio	0.744	0.701	0.23
	0.306	*0.358*	*1.02*
Wealth ratio (local market index)	1.401	0.374	4.42***
	0.460	*0.175*	*6.89****
Wealth ratio (NASDAQ index)	1.289	0.484	3.21***
	0.390	*0.220*	*4.81****

Note: This table compares the pre-bubble period of 1996–1998 and the bubble period of 1999–2000. The first column presents means and medians for 164 initial public offerings during the pre-bubble period and the second column provides means and medians for 391 initial public offerings during the bubble period. We test whether differences exist between the two periods. We use a standard *t*-test for difference in means and the Wilcoxon/Mann-Whitney test for difference in medians. Medians are shown in italics. We have data on the high-low spread, bid-ask spread and volume ratio for 107 initial public offerings during the pre-bubble period and 358 initial public offerings during the bubble period.

*Significant at the 10% level.

**Significant at the 5% level.

***Significant at the 1% level.

We measure percentage bid-ask spreads as the difference between the ask and bid price at the close of the first trading day divided by the average of the ask and bid price. The average (median) percentage bid-ask spread equals 1.9% (1.5%). We argue that market makers quote wider spreads when they face more uncertainty such as divergence of opinion. The volume ratio is calculated as the ratio of the number of shares traded on the first trading day and the number of shares sold to the public at the time of the IPO. The average (median) volume ratio equals 0.72 (0.35). This shows that a substantial fraction of the shares sold to the public is traded on the first trading day. We argue that a high level of trade on the first day indicates divergence of opinion.

Next, we investigate whether descriptive statistics differ between the group of 164 companies that went public during the pre-bubble period (1996–1998) and the group of 391 companies that went public during the bubble period (1999–2000). Ljungqvist and Wilhelm (2003) show that the average U.S. company that went public during the bubble period has a higher first-day return, is more likely to report a loss in the year before the IPO, is more likely to be from the Internet and technology sector and sells less existing shares at the time of the IPO than the average company that went public during 1996–1998. We report similar findings. Table 2 shows that companies going public during 1999–2000 have a significantly higher market value on the first trading day and are significantly younger than companies going public during 1996–1998. Additionally, we find that companies that went public during the bubble period are more likely to report a loss during the financial year before going public and are more likely to be from the Internet and technology sector. They also have a significantly lower participation ratio (i.e. sell less existing shares at the time of the IPO) and have a higher high-low spread than companies that went public during the pre-bubble period. We report on these two subperiods throughout this chapter.

4. MEASURING LONG-RUN STOCK PRICE PERFORMANCE

We calculate cumulative abnormal returns (CARs) with monthly portfolio rebalancing (Levis, 1993; Loughran & Ritter, 1995; Ritter, 1991).[4] Post-IPO returns are measured for an aftermarket period of 36 months where a month is defined as a 21-trading-day interval. We exclude the first 21 trading days after the IPO date to avoid a potential bias from the price stabilization of underwriters during that period. For IPO firms that are delisted before the 36 month holding period, the aftermarket period is truncated, ending with the delisting date.[5] We

use the corresponding return on two different benchmarks: the local Datastream market index and the NASDAQ Composite index.

We measure the abnormal return for stock i in month t as (assuming beta equals one):

$$AR_{i,t} = r_{i,t} - r_{b,t} \tag{1}$$

where $r_{i,t}$ is the raw return on firm i in month t and $r_{b,t}$ is the raw return on the particular benchmark over the same period. The average abnormal return on a portfolio of n stocks for month t is the equally-weighted average of the abnormal returns, defined as:

$$AR_t = \frac{1}{n}\sum_{i=1}^{n} AR_{i,t} \tag{2}$$

The cumulative abnormal returns (CARs) from the beginning of the first month of trading to month s is calculated as:

$$CAR_{1,s} = \sum_{t=1}^{s} AR_t \tag{3}$$

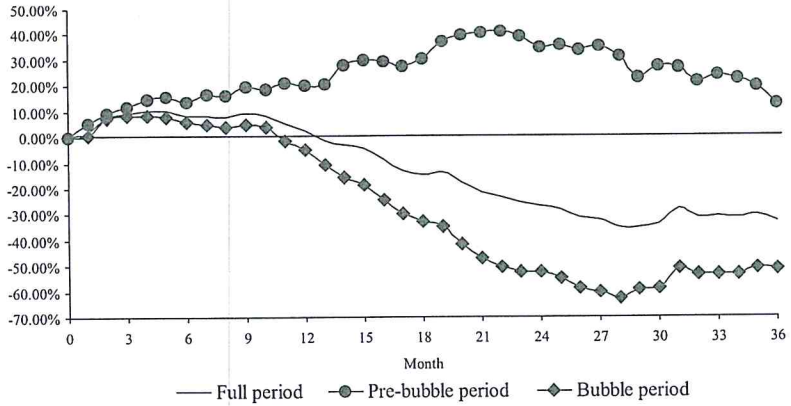

Fig. 1. Cumulative Abnormal Returns Using the Local Market Index as the Benchmark. *Note:* This figure shows cumulative abnormal returns for an equally weighted portfolio of 555 initial public offerings during the full period of 1996–2000, 164 initial public offerings during the pre-bubble period of 1996–1998 and 391 initial public offerings during the bubble period of 1999–2000. We use the local market index as our benchmark to compute abnormal returns.

Figure 1 plots CARs over the 36 month period using the local market index as the benchmark. We find that our sample firms underperform the local market index by 30% in three years. However, companies that went public in the pre-bubble period 1996–1998 outperform the market by 10% in three years. This finding is due to a small number of IPOs that outperform the market. Companies that went public during the bubble period of 1999 and 2000 perform much worse. They underperform the market portfolio by more than 50% in three years. Figure 2 plots CARs using the NASDAQ Composite index as the benchmark. We find similar results.

The use of two different benchmarks makes it harder to dismiss our long-horizon tests as consequence of test misspecifications. Barber and Lyon (1997) show that test statistics based on abnormal returns may be misspecified because of new listing, rebalancing, and skewness bias.[6] To correct for these biases, they advocate computing a benchmark portfolio by matching the sample firms to control firms of similar sizes and book-to-market ratios. However, we cannot compute returns on portfolios of control firms because there are too few control firms that belong to the same size and book-to-market class as our sample firms. We attempt to address this problem by adding firm size and market-to-book ratios as independent

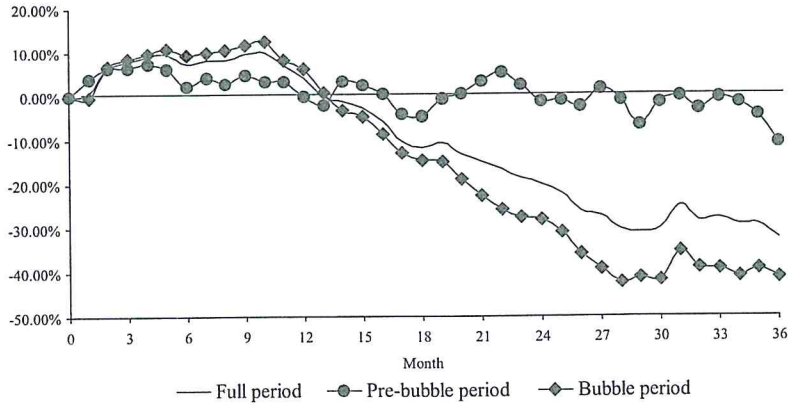

Fig. 2. Cumulative Abnormal Returns Using the NASDAQ Composite Index as the Benchmark. *Note:* This figure shows cumulative abnormal returns for an equally weighted portfolio of 555 initial public offerings during the full period of 1996–2000, 164 initial public offerings during the pre-bubble period of 1996–1998 and 391 initial public offerings during the bubble period of 1999–2000. We use the NASDAQ composite index as our benchmark to compute abnormal returns.

variables in our regressions and using the NASDAQ Composite index as our alternative benchmark. The NASDAQ Composite index captures the performance of Internet and technology stocks in the United States (that are not part of our sample).

Next, we calculate wealth relatives (Ritter, 1991). Wealth relatives are the ratio of the 36 month buy-and-hold returns on the IPO stock and the buy-and-hold returns of the market index (local market index or NASDAQ Composite index) during the same period.

$$\mathrm{WR}_i = \frac{\prod_{t=0}^{\min(T,\mathrm{delist})}(1 + r_{i,t})}{\prod_{t=0}^{\min(T,\mathrm{delist})}(1 + r_{b,t})} \tag{4}$$

where min [T,delist] is the earlier of its delisting date or month 36, $r_{i,t}$ is the raw return on firm i in month t and $r_{b,t}$ is the raw return on the particular benchmark over the same period. Wealth relatives indicate how much money the investor is left with after 36 months compared to one euro invested in the market portfolio. We will focus on wealth relatives throughout this chapter.

The last two rows of Table 1 show that the mean (median) wealth relative equals 0.68 (0.22) using the local market index as the benchmark and 0.72 (0.26) using the NASDAQ Composite index as the benchmark. This indicates that an investor would be left with an average of only 68 cents (72 cents) compared to one euro invested in the local market index (NASDAQ Composite index). Note that the median wealth relative is much lower than the average wealth relative (i.e. wealth relatives are highly skewed). For example, there are 167 companies (30% of our sample) that have a wealth relative less than 0.1. We therefore use the natural logarithm of the wealth relative in our regressions. Table 2 shows that the companies that went public during 1996–1998 outperform companies that went public during the bubble period of 1999–2000. However, the median company that went public during 1996–1998 underperforms the market portfolio as reflected in a median wealth relative below one.

5. EMPIRICAL RESULTS

5.1. Cross-Sectional Determinants of Three-Year Wealth Relatives

We regress the natural logarithm of the three-year wealth relative on firm and offer characteristics, certification variables (underwriter reputation and venture backing dummy) and proxies for divergence opinion (first-day returns, high-low spread,

Table 3. Definition of Variables.

Variable Name	Definition
Divergence of opinion variables	
First-day return	The difference between the first-day closing market price and the final offer price divided by the final offer price.
High-low spread	The difference between the highest and lowest price achieved on the first trading day divided by the average of the highest and lowest price on that day. Data is taken from Datastream.
Bid-ask spread	The difference between the ask and bid price at the close of market on the first trading day divided by the average of the ask and bid price at the close of market on that day. Data is taken from Datastream.
Volume ratio	The ratio of the number of shares traded on the first trading day and the number of shares sold to the public at the IPO. Data is taken from Datastream.
Firm and offer characteristics	
Log (market value)	Natural log of market value (in € thousands). Market value is computed as the number of shares outstanding after IPO times the closing market price on the first trading day.
Log (market-to-book ratio)	Natural log of the market-to-book ratio at issue. The market ratio is computed as the ratio of the first-day market value of equity and the post-issue book value of equity. The post-issue book value of equity equals the sum of the primary offering proceeds (i.e. the number of newly issued shares times the offer price) and the book value of equity from the last pre-IPO financial statement or when available from a later interim statement as disclosed in the prospectus.
Log(1 + age)	Natural log one plus firm age, where firm age is measured as calendar year of the IPO minus the calendar year of founding as mentioned in the prospectus.
EBITDA < 0 dummy	=1 if the IPO firm reports negative EBITDA in the fiscal year before going public; =0 in other cases.
Internet and technology dummy	=1 if the IPO firm is classified as "Internet" or "technology" stock; = 0 in other cases.
Dilution factor	Number of newly issued shares at the IPO / number of pre-IPO shares outstanding.
Participation ratio	Number of existing shares sold by pre-IPO shareholders divided by the number of pre-IPO shares.
Certification variables	
Underwriter market share	percentage market share of the IPO lead manager in the local financial market (measured by gross proceeds raised during 1990–2002 and including main market segments).
VC backing dummy	= 1 if one or more venture capitalists are pre-IPO shareholders of the company; = 0 in other cases.

bid-ask spread and volume ratio). Table 3 gives an overview of the independent variables that we include in our regressions.

We first estimate regressions using the first-day return as our only proxy for divergence of opinion. The first column of Table 4 shows the results for the full period 1996–2000 when we use the local market index as the benchmark to compute the wealth relative. We find that first-day returns are negatively related to the three-year wealth relative. Companies that experience a high return on the first trading day perform worse in the long-run. A one standard deviation increase in first-day return lowers the three-year wealth ratio from the sample average of 0.68 to 0.46, other things equal. In unreported tests, we also include a dummy variable that takes on the value one if the company more than doubles in price on the first trading day. We find that this dummy variable has a coefficient of −0.84 (t-value = 3.12). These findings suggest that first-day returns have a transitory effect on market prices. We interpret this finding as consistent with Miller's divergence of opinion hypothesis. We infer that high first-day returns are due to overoptimistic investors that set market prices above fundamental values. Over time more pessimistic investors enter the market and prices gradually converge to fundamental values.

We also include firm and offer characteristics in the regression model. We find an inverse relation between market capitalization on the first trading day and the three-year wealth relative. However, we do not find any relationship between market-to-book ratios and long-term performance. Our results show that three-year wealth relatives are a positive function of firm age and a negative function of the dummy that indicates whether the company reports a loss in the year before its IPO. This suggests that older and profitable companies perform better in the long-run. Internet and technology companies underperform companies from other industries. This reflects the steep decline of stock prices of high-technology companies around the world (the so-called "Tech Wreck"). We also include the dilution factor and participation ratio in our regression model. However, we do not find any significant relation between these two variables and the three-year wealth relative.

We also include two certification variables. We find that the three-year wealth relative is a positive function of underwriter market share. A one standard deviation increase in underwriter market share increases the three-year wealth relative from its sample average of 0.68 to 0.78, other things equal. New issues that are underwritten by more prestigious underwriters thus perform better in the long-run. This finding is consistent with the U.S. results reported by Carter et al. (1998). We do not find a relation between the wealth relative and the venture capital backing dummy.

Table 4. Determinants of Long-Term Returns Using the Local Market Index as a Benchmark.

	Full Period 1996–2000	Pre-Bubble Period 1996–1998	Bubble Period 1999–2000	Full Period 1996–2000	Pre-Bubble Period 1996–1998	Bubble Period 1999–2000
Divergence of opinion variables						
First-day return	−0.636	−0.206	−0.688	−0.398	0.091	−0.450
	(−3.67)***	(−0.58)	(−3.77)***	(−1.93)*	(0.25)	(−1.95)**
High-low spread				−1.624	−1.140	−0.979
				(−1.73)*	(−0.56)	(−0.60)
Bid-ask spread				−0.958	−6.138	−1.356
				(−0.72)	(−0.82)	(−1.00)
Volume ratio				0.038	0.083	0.016
				(1.11)	(0.97)	(0.45)
Firm and offer characteristics						
Log (market value)	−0.214	−0.033	−0.132	−0.214	−0.092	−0.124
	(−2.88)***	(−0.23)	(−1.45)	(−2.43)**	(−0.45)	(−1.21)
Log (market-to-book ratio)	0.024	−0.343	−0.114	−0.087	−0.048	−0.439
	(0.10)	(−0.80)	(−0.38)	(−0.29)	(−0.10)	(−1.05)
Log (1 + age)	0.157	−0.040	0.187	0.145	−0.061	0.157
	(1.66)*	(−0.21)	(1.71)*	(1.42)	(−0.26)	(1.35)
EBITDA < 0 dummy	−0.416	−0.478	−0.364	−0.354	−0.275	−0.302
	(−2.41)**	(1.22)	(−1.95)*	(−1.93)*	(−0.53)	(−1.56)
Internet and technology dummy	−0.323	−0.154	−0.352	−0.326	−0.414	−0.350
	(−2.49)**	(−0.60)	(−2.35)**	(−2.43)**	(−1.31)	(−2.22)**
Dilution factor	−0.168	0.156	−0.443	−0.177	0.731	−0.861
	(−0.38)	(0.25)	(−0.68)	(−0.32)	(0.99)	(1.15)
Participation ratio	0.948	1.354	−0.336	0.797	0.953	−0.341
	(1.36)	(1.28)	(−0.34)	(1.00)	(0.62)	(−0.33)

Table 4. (*Continued*)

	Full Period 1996–2000	Pre-Bubble Period 1996–1998	Bubble Period 1999–2000	Full Period 1996–2000	Pre-Bubble Period 1996–1998	Bubble Period 1999–2000
Certification variables						
Underwriter market share	1.770	−1.710	2.358	3.083	−1.765	3.431
	(2.06)**	(−1.45)	(1.97)**	(2.98)***	(−0.75)	(2.98)***
VC backing dummy	0.168	0.536	0.073	0.098	0.325	0.103
	(1.20)	(2.02)	(0.44)	(0.76)	(1.06)	(0.61)
Intercept	0.809	0.030	0.030	1.043	0.282	0.666
	(0.82)	(0.01)	(0.02)	(0.93)	(0.14)	(0.47)
R^2 adjusted	16.64%	2.20%	18.11%	17.95%	1.29%	17.91%
F-statistic	12.06***	1.37	9.63***	8.81***	0.82	6.99***
Observations	555	164	391	465	107	358

Note: Table shows the OLS regression results using the log of three-year wealth ratio (local market index) as the dependent variable. See Table 3 for variable definitions. White (1980) heteroscedastic-consistent *t*-statistics are within parentheses.
*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

Next, we split the sample into two groups: 164 companies that went public on new markets during the pre-bubble period 1996–1998 and 391 companies that went public during the stock market bubble in 1999–2000. The results are shown in columns 2 and 3 of Table 4. We find that none of the explanatory variables are significant in the earlier part of our sample period. However, with the exception of market capitalization, the independent variables that were significant in the full period regressions are again significant in the regression for the bubble period. We conclude that most of our findings are specific to the companies that went public during the bubble period of 1999–2000.

We now include our other three proxies for divergence of opinion (high-low spread, bid-ask spread and volume ratio on the first day of trading). This data is available for 465 companies. We report full period results in column 4 of Table 4. We find that the coefficient of the high-low spread is significantly negative (at a 10% level). A one standard deviation increase in the high-low spread decreases the three-year wealth relative from the sample average of 0.68 to 0.57, other things equal. The negative association between first-day returns and long-run performance weakens but remains significant at the 10% level. However, the coefficients for bid-ask spread and volume ratio are not significant. One problem might be that our divergence of opinion variables are highly correlated. In unreported tests we find that the highest correlation coefficient (0.44) is that between first-day returns and high-low spreads (all other correlations between the divergence of opinion variables are below 0.10). We therefore estimate regressions that only include one divergence of opinion variable at a time (not tabulated). We find that the high-low spread is highly significant (coefficient −2.34; t-value = 2.74) but that the bid-ask spread (coefficient −0.31; t-value = −0.26) and the volume ratio (coefficient 0.03; t-value = 0.83) remain insignificant. We investigate the two subperiods in columns 5 and 6 of Table 4. Results show that the coefficient on first-day returns is statistically significant only for bubble period IPOs. All other divergence of opinion variables are insignificant in both subperiods. We also use the wealth relatives using the NASDAQ Composite index as the benchmark as our dependent variable. Results are shown in Table 5.

We find that most of our earlier findings remain the same. We also use three-year CARs as our dependent variable (not reported). We find similar results. We conclude that there is mixed support for the divergence of opinion hypothesis. Three-year wealth relatives are inversely related to first-day returns for the companies that went public during 1999–2000. But three-year wealth relatives are only weakly inversely related to high-low spreads and not related to bid-ask spreads and volume ratios. In the next subsection we investigate daily abnormal returns surrounding lockup expiration.

Table 5. Determinants of Long-Term Returns Using NASDAQ as a Benchmark.

	Full Period 1996–2000	Pre-Bubble Period 1996–1998	Bubble Period 1999–2000	Full Period 1996–2000	Pre-Bubble Period 1996–1998	Bubble Period 1999–2000
Divergence of opinion variables						
First-day return	−0.575	−0.158	−0.685	−0.365	0.065	−0.420
	(−3.36)***	(−0.47)	(−3.67)***	(−1.80)*	(0.17)	(−1.82)*
High-low spread				−1.751	−1.191	−1.379
				(−1.90)*	(−0.58)	(−1.31)
Bid-ask spread				−1.210	−5.971	−1.318
				(−0.90)	(−0.78)	(−0.95)
Volume ratio				0.033	0.064	0.021
				(1.03)	(0.73)	(0.60)
Firm and offer characteristics						
Log (market value)	−0.186	−0.061	−0.166	−0.193	−0.092	−0.154
	(−2.60)***	(−0.44)	(−1.85)*	(−2.25)**	(−0.45)	(−1.52)
Log (market-to-book ratio)	−0.066	−0.400	0.008	−0.133	−0.122	−0.328
	(−0.26)	(−0.99)	(0.02)	(−0.44)	(−0.24)	(−0.81)
Log (1 + age)	0.135	−0.070	0.178	0.118	−0.088	0.141
	(1.49)	(−0.39)	(1.64)	(1.19)	(−0.39)	(1.24)
EBITDA < 0 dummy	−0.431	−0.588	−0.345	−0.330	−0.303	−0.290
	(−2.57)**	(−1.55)	(−1.86)*	(−1.83)*	(−0.61)	(−1.51)
Internet and technology dummy	−0.273	−0.103	−0.346	−0.313	−0.390	−0.346
	(−2.14)**	(−0.41)	(−2.30)**	(−2.27)**	(−1.23)	(−2.20)**
Dilution factor	−0.291	0.043	−0.365	−0.309	0.495	−0.775
	(−0.65)	(0.07)	(−0.55)	(−0.58)	(0.63)	(−1.05)
Participation ratio	0.724	1.015	−0.037	0.832	0.867	0.011
	(1.08)	(0.97)	(−0.04)	(1.08)	(0.57)	(0.01)
Certification variables						
Underwriter market share	1.630	−1.552	2.477	2.936	−1.764	3.572
	(1.93)*	(−1.35)	(2.08)**	(2.82)***	(−0.73)	(3.09)***
VC backing dummy	0.191	0.530	0.093	0.105	0.313	0.109
	(1.41)	(2.05)	(0.57)	(0.74)	(1.04)	(0.64)
Intercept	0.833	0.466	0.408	1.152	0.567	1.059164
	(0.85)	(0.28)	(0.34)	(1.06)	(0.28)	(0.76)
R^2 adjusted	15.44%	3.24%	17.51%	17.38%	1.78%	18.00%
F-statistic	11.12***	1.55	9.28***	8.51***	0.78	7.03***
Observations	555	164	391	465	107	358

Note: Table shows the OLS regression results using the log of three-year wealth ratio (NASDAQ composite index) as the dependent variable. See Table 3 for variable definitions. White (1980) heteroscedastic-consistent *t*-statistics are within parentheses.

*Significant at the 10% level.

**Significant at the 5% level.

***Significant at the 1% level.

5.2. *Daily Abnormal Returns Before and After Lock-Up Expiration*

Most companies in our sample have mandatory lock-up agreements ranging from 6 months (Neuer Markt, NASDAQ Europe) to 12 months (Nouveau Marché, Nuovo Mercato and EuroNM Belgium) following the IPO date. Insiders are prohibited from selling any of their shares during this period. Ofek and Richardson (2003) argue that the lock-up agreement can be thought of as a stringent form of short sale restriction. The expiration of the lock-up agreement loosens this short-sale constraint and allows insiders to start trading in their firm's shares. It is likely that these insiders have private and more realistic information about the firm's prospects than (overoptimistic) outside investors that have been determining stock prices before lock-up expiration. We hypothesize this private information gradually gets incorporated into stock prices resulting in a stock price decline after lock-up expiration.

We investigate daily abnormal returns surrounding the earliest unlock date. This is the first time that (part of the) pre-IPO owners are allowed to sell their shares and private information about the future prospects of the company can get incorporated into share prices.[7] We are able to determine the earliest unlock date for 547 sample firms. In eight cases we could not determine the exact unlock date because it is conditioned on the company being profitable in the future or the information is missing from the prospectus. In our sample, the average (median) lock-up agreement expires 13.4 (12.1) months after the IPO date.

Table 6 shows that there is an average cumulative abnormal return of −0.2% during day −1 to day 0, where day 0 is the earliest unlock date. A total of 54% of our sample firms experience negative abnormal returns during this interval. However, the stock price reaction is not significantly different from zero. We find that the average five-day cumulative abnormal return during days [−4,0] is significantly negative at −1.4% with 62% of sample firms having negative returns. The average cumulative abnormal return during days [−10,0] equals −2.1%. This is consistent with U.S. studies that report a significantly negative stock price reactions surrounding lock-up expiration (Field & Hanka, 2001; Brav & Gompers, 2003). Table 6 also shows that the cumulative abnormal returns for the various time intervals are more negative for those companies that went public during 1999–2000. In fact, the cumulative abnormal returns during [−4,0] and [−10,0] are only significant for companies that went public during the stock market bubble. Table 6 also shows cumulative abnormal returns using the NASDAQ Composite index as the benchmark. Results are similar.

In order to examine the long-run effects of lock-up expiration we measure returns during a period of 100 trading days before and 100 trading days after the earliest lock-up expiration. Each company has to have at least 50 trading

Table 6. Abnormal Returns Around Lockup Expiration.

	Cumulative Abnormal Returns (Local Market Index) (%)	*t*-Stat	Cumulative Abnormal Returns (NASDAQ Index) (%)	*t*-Stat
Full period 1996–2000				
Days −1 to 0	−0.23	−0.70	−0.14	−0.40
Days −4 to 0	−1.40	−2.36**	−1.30	−2.12**
Days −10 to 0	−2.06	−2.31**	−1.90	−2.17**
Days 1 to 10	−0.25	−0.30	−0.47	−0.56
Pre-bubble period 1996–1998				
Days −1 to 0	0.16	0.32	0.13	0.24
Days −4 to 0	1.12	1.16	0.35	0.36
Days −10 to 0	1.83	1.28	0.26	0.18
Days 1 to 10	−0.63	−0.45	−1.34	−0.94
Bubble period 1999–2000				
Days −1 to 0	−0.38	−0.94	−0.25	−0.57
Days −4 to 0	−2.42	−3.30***	−1.96	−2.57**
Days −10 to 0	−3.63	−3.29***	−2.77	−2.56**
Days 1 to 10	−0.10	−0.09	−0.12	−0.12

Note: Table shows abnormal returns around the earliest lockup expiration date at which at least one of the pre-IPO owners is allowed to sell (part of) his shares. Day 0 is the earliest expiration day of the lockup agreement. The abnormal returns are computed as the difference between the return on the stock and the return on the local market index or the NASDAQ composite index. The dataset includes 547 initial public offerings during the full period of 1996–2000, 157 initial public offerings during the pre-bubble period of 1996–1998 and 390 initial public offerings during the bubble period of 1999–2000.

**Significant at the 5% level.

***Significant at the 1% level.

days during the pre-lock period to be included in the sample. We exclude the 21 days surrounding lock-up expiration during days [−10,+10] that we investigated earlier. Following Ofek and Richardson (2003), we argue that the 100 days trading interval after the earliest unlock date is a long enough period to allow more "pessimistic" investors to sell their shares. The comparison to the period before lock-up expiration controls for the inability to sell shares. Table 7 reports the results. We find that there is a highly significant difference between the average daily abnormal return in the period before and after lockup expiration. Before lock-up expiration the average daily abnormal return is positive at 0.07%, whereas after lock-up expiration the average daily abnormal return is negative at −0.06%. The difference of −0.13% (or −12.2% during the 100 trading day interval) is highly significant. This suggests that the long-run underperformance sets in after lock-up expiration. Table 7 also shows that this pattern applies to

Table 7. Comparison of Daily Abnormal Returns Before and After the Expiration of the Lockup Agreement.

	Daily Abnormal Returns (Local Market Index) (%)	Daily Abnormal Returns (NASDAQ Index) (%)	Observations
Full period 1996–2000			
Post-lockup expiration	−0.06	−0.04	54,700
Pre-lockup expiration	0.07	0.07	54,415
Difference	−0.13	−0.11	
t-stat (difference = 0)	−3.72***	−3.03***	
Pre-bubble period 1996–1998			
Post-lockup expiration	−0.01	−0.04	15,700
Pre-lockup expiration	0.16	0.11	15,591
Difference	−0.17	−0.15	
t-stat (difference = 0)	−2.90***	−2.34**	
Bubble period 1999–2000			
Post-lockup expiration	−0.09	−0.04	39,000
Pre-lockup expiration	0.03	0.06	38,824
Difference	−0.12	−0.10	
t-stat (difference = 0)	−2.66***	−2.17**	

Note: Table compares average daily abnormal returns between a period of 100 trading days before and after expiration of the lockup agreement. These averages exclude days −10 to +10 around lockup expiration (day 0). At lockup expiration at least one of the pre-IPO owners is allowed to sell (part of) his shares. The dataset includes 547 initial public offerings during the full period of 1996–2000, 157 initial public offerings during the pre-bubble period of 1996–1998 and 390 initial public offerings during the bubble period of 1999–2000. Each company has to have at least 50 trading days during the pre-lock period to be included in the sample. The abnormal returns are computed as the difference between the return on the stock and the return on the local market index or the NASDAQ composite index.

**Significant at the 5% level.

***Significant at the 1% level.

both the firms that went public during 1996–1998 and the companies that went public during 1999–2000. In addition, the abnormal returns using the NASDAQ Composite index as the benchmark display a similar pattern. We interpret this finding as consistent with the divergence of opinion hypothesis of Miller (1977).

6. CONCLUSIONS

In this chapter we investigate the determinants of the long-run performance of IPOs on Europe's new stock markets. We report that the average company that went public on these markets has been a very poor long-term investment. Investors would be left with an average of only 68 cents (72 cents) compared to one euro invested in the local market index (NASDAQ Composite index).

We test the divergence of opinion hypothesis of Miller (1977) as one possible explanation for why the average company performs so poorly. We find that the stock price performance during a three-year window is inversely related to first-day returns. This is consistent with the divergence of opinion hypothesis. This hypothesis states that overoptimistic investors initially set market prices above fundamental values (resulting in high first-day returns) and that prices gradually decline to fundamental values over time as more pessimistic investors enter the market. However, the other three proxies for divergence of opinion (high-low spread, bid-ask spread and volume ratio on the first trading day) are not significantly associated with long-run stock price performance. We therefore conclude that there is mixed support for the divergence of opinion hypothesis. In addition, we find that Internet and technology companies that went public during the bubble period of 1999–2000 performed very poorly. We also report that IPOs completed in 1999–2000 that were underwritten by reputable investment banks performed significantly better than other IPOs.

Next, we investigate daily abnormal returns surrounding lockup expiration. Lock-ups prevent insiders from selling their shares in the period immediately following the IPO. The expiration of the lock-up agreement enables insiders to sell their shares. In our sample, the average (median) lock-up agreement expires 13.4 (12.1) months after the IPO date. It is likely that these insiders have private and more realistic information than the (overoptimistic) investors that have been determining market prices in the period before lock-up expiration. The divergence of opinion hypothesis predicts that this private information gradually gets incorporated into stock prices resulting in a stock price decline after lock-up expiration. Accordingly, we find that the average daily abnormal return during 100 trading days after lock-up expiration is significantly lower than the average daily abnormal return during 100 trading days before lock-up expiration. Overall, our results provide some support for the divergence of opinion hypothesis of Miller (1977). However, it is difficult to directly measure the divergence of opinion among investors. It may be impossible to distinguish between measures of uncertainty and divergence of opinion (Houge et al., 2001). Our results should therefore be interpreted with care.

NOTES

1. The most notorious example is that of Comroad, a "traffic-navigation technology" company that went public in 1999. In April 2002 it was revealed that nearly all of the

company's $94 million in reported revenue for 2001 was fictitious. Comroad has been delisted and Comroad's CEO is facing criminal charges (*Wall Street Journal*, 1 October 2002).

2. High-tech companies are active in SIC codes 3571, 3572, 3575, 3577, 3578 (computer hardware), 3661, 3663, 3669 (communications equipment), 3674 (semiconductors), 3812 (navigation equipment), 3823, 3825, 3826, 3827, 3829 (measuring and controlling devices), 3841, 3845 (medical instruments), 4812, 4813 (telephone equipment), 4899 (communications services) and 7370, 7371, 7372, 7373, 7374, 7375, 7378 and 7379 (software). We collect SIC codes from *COMPUSTAT Global Vantage* and *Worldscope Disclosure*. We identify European Internet firms using the list provided by Knauff et al. (2003). They provide a list of 138 European Internet IPOs based on membership of the *Bloomberg European Internet Index* and talks with investment bankers.

3. Note that the percentage market share of the lead manager is based on all IPOs on the local stock market. For example, we calculate the percentage market share of underwriters in Germany including all IPOs on the new market segment (Neuer Markt) and main market segments (Amtlicher Handel and Geregelter Markt) of the Frankfurt Stock Exchange.

4. We do not investigate long-term operating performance because several Neuer Markt companies have published false annual and quarterly accounting data (D'Arcy & Grabensberger, 2003).

5. The average holding period is 35.2 months. Firms are delisted because of takeovers (13 firms) and financial distress (22 firms). Although many of the Neuer Markt companies in our sample became insolvent during the 36-month holding period, it was relatively difficult for these companies to be expelled from the market. It became easier to delist companies as from October 2001. Neuer Markt companies with a stock price less than €1 and a market capitalization of less than €20 million for a period of 30 days were put on a surveillance list. If there was no change in this situation for a further period of 90 days these companies were delisted.

6. Lyon et al. (1999) and Brav (2000) also show that long-horizon event studies are associated with statistical difficulties.

7. For example, existing shareholders of ABIT AG agreed not sell their shares for a period of 6 months from the IPO date. In addition, they agreed (with the exception of the venture capitalist 3i plc) not to sell shares for a further period of 6 months without consent of the lead manager. In this example, we take the earliest unlock date to be 6 months after the IPO date (the earliest time at which one of the pre-IPO shareholders (3i plc) is allowed to sell its shares).

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