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Long-run Performance Patterns on the Initial Public Offerings Market of Continental Europe

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PREFACE AND ACKNOWLEDGEMENTS

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ABSTRACT

This thesis examines the long-run performance of the initial public offerings held in Continental Europe, represented by the markets of France, Germany, Italy, Spain, and Sweden. It seems that the companies issued on these markets over the period January 1992 – June 2012 and purchased at the closing price of the first day of public trading tend to underperform non-IPO firms with similar characteristics over the three years following the offering. Over shorter investment horizons (up to one year), the IPOs demonstrate superior performance. Companies with high initial returns, younger firms, and companies backed with venture capital realize the poorest long-run returns. Furthermore, the underperformance seems to be concentrated in the years of high IPO activity, whereas companies issued during "cold" periods actually manage to outperform. These patterns are consistent with the presence of fads on the IPO market caused by the overoptimistic investor expectations about the growth prospects of the issuing firms.

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1 Introduction

As important events in the records of every publicly traded company, initial public offerings (IPOs) have been studied extensively in the academic literature. The academia has identified and studied three interesting patterns related to the IPO markets that have been reported internationally: "hot issue" markets, short-run under-pricing, and long-run underperformance. Ibbotson & Jaffe (1975) and Ritter (1984) describe the "hot issue" phenomenon as cyclical periods in which the initial returns and the number of companies going public are abnormally high. In particular, in the latter paper Ritter reports an average initial return of 48.4 percent during the "hot" market, compared to an average of 16.3 percent during the "cold" market of the studied period. Second, a vast amount of papers examine and provide different explanations[1] of the initial IPO under-pricing measured as the difference between the first day closing price and the offer price. The recently updated Table 1 of Loughran et al. (1994) shows that the average initial returns among the 52 included countries vary from 3.3% (Russia) to 239.8% (Saudi Arabia). Finally, the research on share price performance over the longer-run indicates that the newly issued securities underperform various benchmarks throughout the following three to five years in the aftermarket. This notion is also supported internationally, as can be seen in Ritter (1998). Since this thesis studies the long-run performance of IPOs, a more elaborate literature review on the topic is provided in the corresponding chapter.

1.1 Research topic and contribution

The objective of this thesis is to study the aftermarket performance of Continental European IPO companies and identify the relevant factors at the time of the issue that may determine it. The topic is relevant to both practitioners and the academia. From investors' perspective, the results would be useful for investment strategies, whereas they would also add to the existing literature on market efficiency, market timing, the area of behavioural finance, and the aforementioned IPO knowledge. The traditional view of market efficiency suggests that all publicly available information is reflected in market prices and therefore the average stock or other financial instrument is fairly priced. Hence, the finding of any abnormal performance will challenge the efficiency of the European IPO market. Market timing refers to the ability of managers to issue equity when investors are willing to pay high prices for their companies. Finding poor long-run performance after years with a high number of new listings when the market is typically buoyant would support that concept. The behavioural theory of market overreaction assumes that market participants overreact to certain information, causing the

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[1] A comprehensive summary of the theories is provided in Schuster (2003b) and Ritter (1998).

market value of the company to deviate from its true value. Later, the stock price will tend to return to its true value which would assume that IPOs with the highest initial returns should perform poorly in the long-run if these returns were driven by an actual overreaction to the growth prospects of the companies at the time of going public. On the other hand, the signalling hypothesis, which is focused on the initial under-pricing of the IPOs, assumes the opposite outcome. According to it, the promising firms indicate their high quality to the prospective investors by offering their shares at a lower price. The initial loss caused by the under-pricing would be later recouped in a seasoned equity offering, which is hard to be done by lower quality companies. Hence, a positive relation between the initial return and long-run performance would provide evidence in support of this hypothesis.

The contribution of this study to the research field is not providing a new methodology for studying long-term performance of IPOs, nor a new theory. Rather, it will use the existing research methods to provide insights about the overall Continental European IPO market. Usually, research is done on the new issue market of a particular country and there are almost no studies about the overall picture of Continental Europe[2]. A study like this would provide several benefits. First, it would provide the general characteristics of the European IPO market. Moreover, it would serve as a benchmark for the expectations about the aftermarket performance of the new issues. Finally, by pooling the data for several countries, the sample size would be large enough to result in powerful statistical tests for the performance patterns. Evidence demonstrating the relevance of this pooled approach is found in Schuster (2003a), who reports similar patterns in the IPO performance across several countries from Continental Europe, indicating that the overall market is enough homogenous for this type of study.

The majority of international evidence supports the early findings of Ritter (1991) for the US market that IPOs underperform significantly in the long-run. Whereas the academic interest in the initial under-pricing has not faded out, the same cannot be said about the long-term performance. The studies covering the latter problem examine mainly the period from the 1970s till the early 2000s, leaving the literature slightly outdated, especially in the case of Europe. Therefore, another contribution of this thesis is that it provides up-to-date insights about the aftermarket IPO performance (and the IPO market itself) in Continental Europe. Globalization, new technology, the continuing integration in the case of Europe, and the 2007 financial and economic crisis are part of the factors that have affected and shaped the global economy throughout the past couple of decades. To illustrate, in his original paper Ritter (1991) reports a cumulative underperformance of 29.13 percent for the three years following the initial public offering, covering the period 1975 –

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[2] In fact, the only study to my knowledge of the overall European market is provided by Schuster (2003b).

1984. In a file from his online database (Ritter, 2015), he reports 3.2 percent underperformance over the 3-year horizon for the much broader period from 1980 – 2013, using a similar methodology. Apparently, the results are sensitive to the chosen period, as can also be seen form the other tables in the same file which split the period into decades.

Finally, an additional study of the long-term IPO anomaly will add to the robustness of the previous studies. As stated by Van Gelderen & Huij (2014) "…it is important that empirical evidence withstands a significant number of attempts of falsification before investment strategies are engineered that incorporate this knowledge."

1.2 Findings and structure of the study

The empirical findings of this thesis provide evidence that the IPOs held in Continental Europe, represented by the markets of France, Germany, Italy, Spain, and Sweden tend to underperform in the 3-year aftermarket period. The performance is measured using two different return metrics and against two different benchmarks over the period January 1992 – June 2012. The sample for the first benchmark – matching firms with similar size in terms of market capitalization, comprises 1522 IPOs which realize 3-year cumulative average abnormal return of -19.23% and an average buy-and-hold abnormal return over the same investment horizon of -16.1%, where the IPO is purchased at the closing price of the first day of public trading. The second employed benchmark is again matching firms, this time with similar book-to-market ratios as well as size. Due to tighter matching criteria and missing book value data, the sample for this benchmark includes 978 observations. The incorporation of the book-to-market effect in the matching criteria results in lower estimates of underperformance: the 3-year CAAR equals -11.37%, whereas the average BHAR demonstrates even lower underperformance of -6.49%, and it also reduces the statistical significance of the results to the 10% confidence level in the case of the buy-and-returns and even lower for the cumulative measure. Therefore, the return estimates should be interpreted cautiously, as it is the case in every long-run event study due to the flaws of the existing methodologies.

The thesis also identifies several factors among the offer characteristics which have an effect on the long-run performance of the IPOs. The results suggest negative relations between the 3-year performance and the size of the firm at the time of going public, the realized initial return, the IPO activity during the year of issuing, and the backing by a venture capital firm.

On the other hand, there seems to be a strong positive relation between the age of the firm at the time of the IPO and its long-run returns. More specifically, the cross-sectional analysis reveals that the companies with the highest initial returns, the youngest, and the firms issued in years with high IPO activity realize the worst aftermarket performance. Thus, the evidence suggests the presence of overoptimistic fads on the IPO market of Continental Europe which seem to be successfully exploited by the managers of the issuing companies.

The rest of this study is organized as follows. Chapter 2 provides a thorough review of the international evidence about the long-run IPO performance. Chapter 3 describes the data used for this research and the implemented methodology. Chapter 4 is focused on the analysis of the empirical results. Finally, Chapter 5 concludes.

2 Previous findings on long-run IPO performance

2.1 Evidence from the Americas

2.1.1 The US

There are numerous studies focusing on the American IPO market. One of the earliest studies of the aftermarket (and initial) IPO share price performance is presented by Ibbotson (1975). Although his results are consistent with market efficiency in the long-run, there are some interesting patterns in the findings. By a random selection of one offering per month for the period 1960 – 1969, the performance for a period of up to sixty months following the IPO is estimated. His results for both one and six-month holding periods[3]   report positive stock price performance in the first year, negative performance throughout the subsequent three years, and again positive performance during the fifth year. However, due to the high standard errors of his estimates, the results are in general statistically insignificant. On the other hand, when the initial return is included into the long-run estimates and the holding period is extended to one, two, three, four, and five years, the performance becomes positive. Again, the results are insignificantly different from zero with the exception for the first year.

Aggarwal & Rivoli (1990) examine the 250 day (one year) aftermarket performance of 1598 common stock IPOs during the period 1977 – 1987. They report statistically significant underperformance relative to the NASDAQ index over the stated aftermarket period for both investors purchasing at the first day closing price and investors purchasing at the offer price. In the former case the average index adjusted return is estimated to be -13.73 percent and in the latter it equals -5.45 percent. Aggarwal and Rivoli suggest that the results might be explained by the presence of fads on the IPO market. Their results show positive initial returns which is consistent with the fads interpretation of a temporary overvaluation caused by investor over-optimism. Later, this overvaluation gets corrected, resulting in the negative returns. The cross-sectional analysis performed by the authors additionally supports the fads explanation and demonstrates that the reported underperformance is present over the entire sample, regardless of the issue size, offer price, and underwriter class.

In his emblematic paper, Ritter (1991) reports that IPOs issued in the years 1975 to 1984 underperformed a control sample of industry- and size-matched firms over the three years after going public. In particular, the cumulative average abnormal return of the 1526 IPO companies in his

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[3] Table 11 and Table 13 respectively. One month holding period refers to any month between 1 and 60. Six month holding periods are as follows: months 1 to 6, 7 – 12, etc.

sample equals -29.13 percent and is highly significant. The underperformance is also persistent relative to two market indices and a custom benchmark representing small firms and when it is measured via buy-and-hold abnormal returns. The cross-sectional results presented by Ritter reveal that there is a tendency for the smaller offers to have higher initial returns and the worst following performance. Furthermore, he reports substantial variation in the IPO performance within different industries. In general, the underperformance is present across eleven out of the fourteen industry groupings with the financial institutions having the best long-run performance and oil and gas firms performing the worst[4]. Another two interesting patterns are reported by Ritter – first, a negative relation between the aftermarket performance and the number of issues per year and second, a positive relation between age and long-run performance. Thus, his empirical evidence provides support to the fads, overreaction (De Bondt & Thaler, 1987), and the market timing hypotheses.

Similarly, Loughran & Ritter (1995) report that companies issuing stock during the period 1970 to 1990 underperformed both - a sample of size matched firms and five common indices as benchmarks. Their IPO sample consists of 4753 companies, reporting an average 8.4% 3-year buy-and-hold return and 15.7% for a five-year holding period. In contrast, the matching firms have achieved 35.3% and 66.4% respectively. Thus, as stated by the authors, "an investor buying IPOs at the first closing market price would have to invest 43.8 percent more money than if nonissuers of the same size were purchased at the same time, in order to achieve the same terminal wealth level five years later". When considering annual performance, Table III of their study indicates that the underperformance during the fifth year has decreased and is statistically undistinguishable from zero which is in line with Ibbotson's (1975) findings. The long-run patterns, according to Loughran and Ritter, are consistent with the windows of opportunity (market timing) hypothesis, in which the companies issue equity when the market is willing to pay higher prices.

Contrary to the aforementioned literature, Brav & Gompers (1997) and Brav et al. (2000) provide evidence that the long-run underperformance is not exclusively an IPO effect. Rather, it is caused by the fact that the majority of initial offerings are of small low book-to-market companies. Brav and Gompers differentiate between venture-capital-backed and non-backed IPOs, showing that the latter are weaker performers. Both of the groups underperform various market indices over the five years following the initial offer. However, when measured against benchmark portfolios matched on size and book-to-market ratio, the newly listed firms actually outperform the benchmarks, consistent with the findings of Brav et al. (2000). In addition, the two studies indicate that the results are

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[4] The substantial drop of oil prices in the early 1980s affected unfavourably the industry.

sensitive to the selected weighing method - value weights tend to reduce the magnitude of under/outperformance.

2.1.2 Canada

Kooli & Suret (2004) report that Canadian IPOs held between 1991 and 1998 underperform a sample of matched by size firms in the long run. Their results however are not always statistically significant and are highly sensitive to the used weighting schemes. For instance, the equally weighted 3-year CAAR equals -6.15%, the analogous BHAR -19.96%, and the calendar time abnormal return -15.12%[5]. These numbers should be interpreted cautiously since they are statistically significant only for the calendar time approach. Consistent with the findings of Ritter (1991) for the US, smaller firms perform worse and IPOs issued in hot periods underperform the cold period issues. Additionally, for larger IPOs, the results support the fads notion, by indicating negative relation between the initial returns and the long-run performance.

2.1.3 Brazil, Chile, and Mexico

Aggarwal et al. (1993) examine the IPO performance on the emerging markets of Brazil, Chile, and Mexico throughout the 1980s. The long-run underperformance phenomenon is evident across the three countries when measured against local market indices. In particular, for Brazil, the average 3-year adjusted return is estimated to be -47 percent and is statistically significant. Chilean IPOs perform better but still the value is negative 23.7 percent, although not significant. Due to data availability, the adjusted returns for Mexico are calculated only for the first aftermarket year and are equal to -19.6 percent. Additionally, the results for Brazil indicate that the companies with the highest initial returns underperform the most, suggesting the presence of overoptimistic investors on the Brazilian IPO market. As noted by the authors the results should be interpreted cautiously due to the small sample sizes and the volatile and inflationary economic conditions.

2.2 Evidence from Europe

2.2.1 The UK

Levis (1993) reports that the long-run underperformance phenomenon is also present on the UK market. The presented cumulative abnormal returns for the 36 months following the first month of

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[5] The stated results are measured using the closing first trading day market price as a purchase price. The authors also provide estimates if the IPO stocks were purchased at the offer price; underperformance is still evident in that case.

trading are all negative and significant. They are measured against three benchmark indices (value- and equally-weighted all share, and a small capitalization index) and take values between -22.96% and -8.31%, depending on the benchmark. However, when the first month returns are included, the IPOs actually outperform two of the benchmarks. The results do not indicate a clean relation between the annual volume of new issues and the long-run performance but show a tendency for the firms with the highest initial returns to perform the worst in the aftermarket, providing evidence of overoptimistic investors at the time of the offering.

Leleux & Muzyka (1998) also provide evidence of long-run IPO underperformance on the UK market, by studying the period 1987 – 1993. Using stock market index as a benchmark they estimate 3-year cumulative abnormal return of -21.8%, whereas the BHAR shows similar value of -19.2%. Additionally, their results document a positive relation between the size of the firms and aftermarket performance and, as in Levis (1993), negative between initial return and long-run returns. However, due to the small sample size the coefficients of the two relations are statistically insignificant.

Espenlaub et al. (2000) provide a methodologically rich study of the aftermarket performance of 588 non-financial companies that went public in the UK throughout the period 1985-1992. They estimate abnormal returns up to five years after the offering (excluding the month of issue) using four different models and a matched on size portfolio. The five-year CAARs vary between -4.3[6] and -42.77 percent depending on the employed benchmark. Their results indicate that the underperformance slows down throughout the final two years as in the US studies and that it is higher for the smaller companies. Surprisingly, the highest underperformance is reported when the Fama and French model (which considers size and book-to-market effects[7]) is used to estimate the abnormal returns. Therefore, Espenlaub et al. question the applicability of the latter model in the UK due to differences in treatment of some balance sheet items relative to the US. However, when returns are estimated in calendar time via the method developed by Jaffe (1974) and Mandelker (1974)[8], the statistical significance of the underperformance becomes weaker.

A more recent study of the UK IPO market is provided by Gregory et al. (2010). Their sample of 2499 companies issued between 1975 and 2004 indicates a significant underperformance relative to matched on size portfolios and firms. The 3- and 5-year BHARs equal -16.4% and -47.6% measured

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[6] However this number is statistically insignificant.
[7] According to Fama (1998) almost all of the reported anomalies disappear when controlled for size and book-to-market effects.
[8] The method deals with the cross correlation in returns which overstates the t-statistics in the event-time regressions (the t-test assumes that the observations are independent)

against equally-weighted size-matched portfolios and are much higher when matching firms serve as a benchmark (-30.1% and -69% respectively). The underperformance is mainly driven by the poor performance of the IPOs on the Alternative Investments and Unlisted Securities markets, which incorporate lighter entry requirements and smaller companies on average. The calendar time results confirm the underperformance patterns and consistent with the findings for the UK of Leleux & Muzyka (1998), indicate that larger IPOs outperform smaller issues.

2.2.2 Germany

Ljungqvist (1997) studies the German IPO market in the period 1970-1993 and finds that his sample of 180 firms underperforms a broad market index over the three years following the issue. The mean three year market-adjusted performance equals -12.11 percent and is statistically significant where the underperformance occurs during the second and third aftermarket years. During the period 1970-1987, the IPO abnormal returns are slightly negative but insignificantly different from zero. Thus, the years from 1988 to 1990 drive the long-run underperformance which indicates that the returns might be time dependent.

Stehle et al. (2000) conclude that size portfolios and matching firms are better benchmarks than broad market indices for measuring the abnormal performance of IPOs. Their sample includes 187 IPOs that were listed by a bank on the German market in the years 1960 to 1992. As in other countries, the companies that went public are typically small or medium size. The results indicate negative abnormal performance over the three years following the issue regardless of the benchmark used. They are statistically significant for the second aftermarket year; however they are not for the third. When measured against portfolios matched on size, the average 3-year BHAR varies between -6.61 and -9.87 percent[9].

Bessler & Thies (2007) provide additional insights about the aftermarket performance of German IPOs. Their sample includes 218 companies issued between 1977 and 1995 and indicates that the IPOs have underperformed the market in the long-run. In particular, the underperformance starts after the first year following the offering and reaches -12.7 percent, measured as 3-year BHAR against the DAX index. Similar performance is reported when the abnormal returns are estimated relative to two other indices, whereas the IPOs outperformed a value-weighted small capitalization index. Additionally, the authors report a positive relation between the aftermarket performance and subsequent equity issues by the same company. IPOs that were able to raise additional capital via an

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[9] The authors use three different sets of size portfolios to measure the abnormal performance (p. 188 – 190).

SEO have actually outperformed the market. Contrary to the findings for the US, smaller companies and companies with high initial returns perform better[10], although the results are not statistically significant due to the high standard deviations.

As can be seen, the aforementioned studies focus on similar time periods resulting in similar values for the abnormal returns. Jaskiewicz et al. (2005) study the later and shorter period between 1990 and 2000 and report much higher magnitude of underperformance. Using three different benchmarks their BHARs vary between -32.5% and -33.8% indicating that the IPO underperformance in Germany during the nineties was more severe. They also find evidence that nonfamily businesses perform better than family firms and report positive relation between firm size and performance. However, the authors exclude financial companies and firms from the "New Market" segment.

Without these restrictions, Schuster (2003a) reports a BHAR of 98.5% relative to a broad-market index for IPOs that took place between 1988 and 1998, indicating the growth potential of the new industries. Particularly, his results reveal that younger companies perform better than older ones, as well as "companies in the New Economy[11], companies with a small public float and companies with higher initial returns".

2.2.3 France

Leleux & Muzyka (1998) also provide evidence about the long-run performance of 56 IPOs that took place in France between 1987 and 1993. Using a stock market index as a benchmark, they estimate 3-year cumulative abnormal return of -29.2%, whereas the BHAR shows similar values (-30.3%). Their results also indicate a tendency for larger firms and firms with higher initial returns to perform better over the long-run.

In contrast, Schuster (2003a) reports a negative relation between initial returns and the aftermarket performance for the French IPOs. By extending the sample period by five years, he reports slightly lower underperformance; in particular -19.01% CAAR and -20.74% BHAR. Additionally, the provided empirical evidence shows that companies with high public float and older companies are the worst performers.

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[10] Thus the underpricing could be interpreted as a signal of quality.
[11] The New Economy is defined to comprise the Technology, Media, Telecommunications, and Healthcare sectors, following the Dow Jones STOXX global sector classification standard.

2.2.4 Finland

Keloharju (1994) provides evidence that the long-run underperformance is also present on the Finnish market. His sample includes 80 initial public offerings that took place between 1984 and 1989. The 3-year reported CAAR equals -26.4 percent, measured over the Helsinki stock market index. Interestingly, his Table 5 reveals that the negative abnormal performance is mainly concentrated in the first aftermarket year. Over the following two years of holding, the IPOs perform better, although still underperforming the benchmark. Similarly to the findings for the US market, the smaller companies tend to perform the worst.

2.2.5 Switzerland

Surprisingly, Drobetz et al. (2005) find that Swiss IPOs do not underperform during the first three post issue years. Their study includes 109 IPOs issued over the period 1983 - 2000 and estimates the performance relative to two different benchmarks. However, the new issues underperform the Swiss broad value-weighted market index over longer horizons. The buy-and-hold abnormal return on the fifth year equals -26.17% and increases to -173.46% on the tenth. On the other hand, when the performance is measured against a small capitalization index, "hardly any evidence for underperformance remains". In fact, the average abnormal return after three years of holding is calculated as 5.12% and 11.56% after five, although not statistically significant, whereas it becomes negative after the seventh year. Similarly to Brav et al. (2000), the authors conclude that the performance is not caused by an IPO effect. Rather it is explained by the fact that Swiss IPOs tend to be primarily small companies.

2.2.6 Spain

Alvarez & Gonzalez (2005) analyse the long-run performance of Spanish companies that went public during the period 1987 to 1997. The majority of the newly listed firms are of smaller size and have lower book-to-market multiples, similar to other countries. The authors measure the performance relative to six different benchmarks including market indices, matched portfolios and control firms. Regardless of the chosen benchmark, the buy-and-hold abnormal returns are negative over the longer run. Particularly, the three year BHAR estimated against firms matched on size and book-to-market ratios equals -24.56%, and -24.37% when the holding period is extended to five years. However, due to the small sample size, the results are not statistically significant. Schuster (2003a)

reports similar[12] results and suggests that the poor performance in Spain is caused by the low number of New Economy offerings. His findings that younger companies perform better than older ones are in line with this notion. Additionally, Alvarez & Gonzalez report a positive relation between the initial under-pricing and the long-run aftermarket performance. The latter is also positively related to the number of SEOs following the IPO and the percentage of stocks retained by the company at the time of the offering which is interpreted as evidence in support of the signalling hypothesis.

Jaskiewicz et al. (2005) study the slightly later period between 1990 and 2000 and report BHARs in the range between -27.3 and -38 percent depending on the employed benchmark. Additionally, they find evidence that nonfamily businesses perform better than family-owned firms.

2.2.7 The Aggregate European Market

Schuster (2003a) concludes that the overall Continental European IPO market is homogeneous, with companies across the different countries showing similar performance over the short- and long-run. This allows him to study the European IPO market as a whole in Schuster (2003b), instead of focusing on each country individually. His sample includes 973 companies that went public between 1988 and 1998 in the seven Continental European countries with the most developed stock markets. Consistent with previous studies concerning Europe, the average age of the companies going public is relatively high – 28 years, as well as the median firm size which equals 73.93 million Euro. It should be noted however, that the average age and size has declined over the sample period, indicating the rise of the New Economy sectors which represent 28% of the sample. The long-run performance is measured against four market indices including a broad one, large-capitalization, mid-capitalization, and a small-capitalization index. Interestingly, over the three years following the issue, the IPOs outperform all of the stated indices except the large-capitalization benchmark. For instance, the IPOs realized 67.91% over the three years, whereas the market had a return of 59.47%. However, over the following two years the IPO performance deteriorates and the buy-and-hold returns fall below the returns of the broad-market and the larger companies. In contrast to the evidence for the US, Schuster finds that "the favourable aftermarket IPO performance is mainly driven by outperformance of IPOs issued in "hot" markets. IPOs issued in "cold" markets underperform in the long-run." The cross-section of the results reveals a tendency for companies with the highest initial returns to report the highest aftermarket performance which is consistent with the signalling hypothesis of Allen and Faulhaber (1989) or Grinblatt and Hwang (1989). Contrary to the findings for the US, younger firms

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[12] Highly significant -30.21% CAAR and -30.89% BHAR (significant at the 10% level).

perform better than older firms and smaller companies have achieved the highest long-run performance. Additionally, a negative relation is reported between the aftermarket performance and the amount of public float which is again in support of the signalling hypothesis. Another interesting result is the superior performance of the New Economy firms relative to both the market and the Old firms. The highest spread between the two groups is reported at the end of the third year of trading and equals 159.3 percentage points.

2.3 Evidence from Asia

2.3.1 China

Chan et al. (2004) study the IPO performance of companies listed in China during the 1990s. It should be noted that in China the amount of shares issued each year is determined by the government and the shares that are not publicly floated are possessed by a state or other legal entities. The study discusses two types of shares. A-shares which can be purchased only by Chinese residents, and B-shares which are available only to foreign investors. The pattern that emerges is that the former type of shares underperforms the sample of matching firms, whereas the latter demonstrates positive abnormal returns. To illustrate, the three year buy-and-hold abnormal return measured against firms with similar size and book-to-market multiple equals -19.77% for the A-shares and 25.06% for the B-shares. However, a major part of the results are not statistically significant.

2.3.2 Japan

Evidence on the long-run performance of initial public offerings in Japan is provided by Cai & Wei (1997). The 180 companies, issued between 1971 and 1992, included in the sample on average underperform all of the eight different benchmarks employed by the authors over the three- and five-year periods following the offerings. For instance, the 3-year buy-and-hold return of the IPOs equals 34.2 percent, whereas it is 75% for the matched on size and book-to-market companies, indicating severe underperformance. The cross sectional results show that out of 15 industry groups only Drugs and Retail trade outperform their matching firms. Additionally, there is a tendency that firms with the highest initial returns underperform the most. This combined with the provided evidence that the operating performance peaks about one year prior the IPO and then starts to deteriorate supports the windows of opportunity hypothesis reported in the literature.

2.3.3 Korea

Kim et al. (1995) report large positive abnormal return for their sample of 169 IPOs held in Korea in the period 1985-1989 measured against three benchmarks over the three years following the issue. In particular, the newly listed companies report 91.59% BHAR by the end of the third post-issue year relative to firms from the same industry and similar size. However, when the first month of seasoning is excluded, the outperformance vanishes and the IPOs perform similarly to their matching counterparts. Interestingly, Fig. 2 (p.440) reveals that the daily abnormal returns during the first week after the issue are much higher than those during the rest of the month which indicates that the investors may still benefit by acquiring shares during these days, without necessarily having to purchase on the offer price. Additionally, Kim et al. provide evidence that smaller firms in Korea perform better over the long-run compared to larger companies. The findings are consistent with market on which the new issues are systematically under-priced and after the price has reached the intrinsic value of the company, the IPOs do not perform differently than firms with similar characteristics.

2.3.4 Malaysia

Evidence for Malaysia is provided by Ahmad-Zaluki et al. (2007). They report that firms going public during the 1990s outperform the market but do not perform superior when matching firms are used as a benchmark. The 36-month CAAR equals 0.43% when the performance is measured relative to matched on size companies and 32.63% relative to the Kuala Lumpur composite index. The equally weighted buy-and-hold returns are in line with this pattern – the IPOs outperform the market significantly whereas they perform as well as companies of the same size. Additionally, the results indicate that smaller firms in Malaysia outperform larger ones in the long-run buy a great amount and that the long-run performance is positively related to initial under-pricing; in fact, the high initial return group reports positive BHARs, whereas the low initial return firms underperform their matching counterparts.

2.4 Oceania and South Africa

2.4.1 Australia

The long-run underperformance phenomenon seems to be also present on the Australian IPO market. Lee et al. (1996) report buy-and-hold returns for up to three years after the issue for 266 industrial companies listed between 1976 and 1989. Measured against a market index, the BHAR on

the third year equals negative 51.26 percent. Furthermore, Fig. 1 of their study reveals that the IPOs have negative unadjusted returns, whereas the performance of the market was strong. Similar to the findings for some European and Asian countries, the relation between the initial under-pricing of the issues and their long-run performance is found to be positive which is in support of the signalling hypothesis.

2.4.2 New Zealand

Firth (1997) studies the performance of 143 IPOs that were held in New Zealand during the period 1979 to 1987. The IPOs underperform a sample of matched on industry and size firms over the long-run. In particular, the 3-year CAAR equals -14% and continues to decrease to -17.91% on the fifth year. Contrary to the findings for Australia, Firth finds evidence in support of the investor overreaction hypothesis due to the negative relation between initial returns and the one year aftermarket performance and between the latter and the performance of the stock market in the year prior the issue.

2.4.3 South Africa

Evidence for South Africa is provided by Page & Reyneke (1997). They report long-run underperformance for a sample of 118 companies that went public in South Africa throughout the period from 1980 to 1991. The IPOs underperform all of the three used benchmarks (matched on size, matched on P/E ratio, and industry matched firms) over the 4 years following the issue and interestingly, the holding period unadjusted returns remain negative during the first 33 months[13]. Looking at the results reveals that the 3-year BHARs vary between -50.62 and -73.47 percent depending on the benchmark, whereas the interval becomes -63.45 to -106.91% on the fourth year and all of the stated values are statistically significant. Consistent with the findings for the US for instance, the underperformance is much higher during the high issue year (1987) and it is more pronounced for the smaller companies.

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[13] The negative values can be explained by the October market crash in 1987 which is the year with the highest concentration of new issues in the sample.

2.5 Summary

Table 1 summarizes the return estimates of the reviewed academic literature and provides some general information about the studies. For consistency and size purposes, only selected results from the papers are presented. In general, the IPOs manage to perform similarly or to outperform their benchmarks only in a few countries, whereas the long-run underperformance phenomenon is strongly prevailing, although with different magnitude across the markets. The studies also provide empirical evidence supporting different theories aimed to explain the aftermarket IPO performance and report various empirical patterns. As can been seen from the table, the majority of the papers cannot be considered as recent, indicating the relevance of a newer study.

Table 1: *International evidence on long-run IPO share price performance*

The table summarizes the results of the discussed papers. For consistency, when available the returns are reported as 3-year BHARs. For the same reason, they are measured against a market index, unless a matching firm or portfolio is available, which are considered to be the more appropriate benchmark. In the third column, VB and NVB denote "venture-backed" and "non-venture-backed" respectively, whereas A and B indicate the type of shares. * in the final column indicates statistical insignificance at conventional levels.

Study	Period	Sample size	Return metric	Benchmark	Abnormal return
USA					
Aggarwal & Rivoli (1990)	1977 – 1987	1598	1-year RAR	NASDAQ index	-13.73%
Ritter (1991)	1975 – 1984	1526	3-year BHAR	Industry and size matched firms	-27.39%
Loughran & Ritter (1995)	1970 – 1990	4753	3-year BHAR	Size-matched firms	-26.9%
Brav & Gompers (1997)	1972 – 1992 / 1975 – 1992	934 VB / 3407 NVB	5-year BHAR	Size and B/M-matched portfolios	16.5% / 0.9%
Brav et al. (2000)	1975 – 1995	4622	5-year BHAR	Size and B/M-matched portfolios	6.6%
Canada					
Kooli & Suret (2004)	1991 – 1998	445	3-year BHAR	Size-matched firms	-19.96%*
Brazil					
Aggarwal et al. (1993)	1980 – 1990	62	3-year RAR	Broad-market index	-47.0%
Chile					
Aggarwal et al. (1993)	1982 – 1990	36	3-year RAR	Broad-market index	-23.7%*
Mexico					
Aggarwal et al. (1993)	1987 – 1990	44	1-year RAR	Broad-market index	-19.6%
The UK					
Levis (1993)	1980 – 1988	712	3-year BHAR	Broad-market index	-6.77%
Espenlaub et al. (2000)	1985 – 1992	588	3-year CAAR	Size-matched portfolio	-16.24%
Gregory et al. (2010)	1975 - 2004	2499	3-year BHAR	Size-matched firms	-30.1%
Germany					
Ljungqvist (1997)	1970 – 1993	180	3-year lnBHAR	Broad-market index	-12.11%

Stehle et al. (2000)	1960 – 1992	187	3-year BHAR	Size-matched portfolios	-6.64%*
Schuster (2003a)	1988 – 1998	155	3-year BHAR	Broad-market index	98.5%*
Jaskiewicz et al. (2005)	1990 – 2000	153	3-year BHAR	Broad-market index	-32.5%
Bessler & Thies (2007)	1977 – 1995	218	3-year BHAR	DAX	-12.7%
France					
Leleux & Muzyka (1998)	1987 – 1993	56	3-year BHAR	Broad-market index	-30.3%
Schuster (2003a)	1988 – 1998	213	3-year BHAR	Broad-market index	-20.74%*
Finland					
Keloharju (1994)	1984 – 1989	80	3-year CAAR	Broad-market index	-26.4%
Switzerland					
Drobetz et al. (2005)	1983 – 2000	109	3-year BHAR	Broad-market index	-1.69%*
Schuster (2003a)	1988 – 1998	31	3-year BHAR	Broad-market index	-9.43%*
Spain					
Schuster (2003a)	1988 – 1998	53	3-year BHAR	Broad-market index	-30.89%
Alvarez & Gonzalez (2005)	1987 – 1997	52	3-year BHAR	Size and B/M matched firms	-24.56%*
Jaskiewicz et al. (2005)	1990 – 2000	43	3-year BHAR	Broad-market index	-38.0%
Italy					
Schuster (2003a)	1988 – 1998	58	3-year BHAR	Broad-market index	-49.24%
Netherlands					
Schuster (2003a)	1988 – 1998	68	3-year BHAR	Broad-market index	7.27%*
Sweden					
Schuster (2003a)	1988 – 1998	99	3-year BHAR	Broad-market index	-7.25%*
Europe overall					
Schuster (2003b)	1988 - 1998	973	3-year BHAR	Broad-market index	8.44%
China					
Chan et al. (2004)	1993 – 1998	570A 39B	3-year BHAR	Size and B/M matched firms	-19.77% 25.06%*
Japan					
Cai & Wei (1997)	1971 – 1992	180	3-year BHAR	Size and B/M matched firms	-40.8%
Korea					
Kim et al. (1995)	1985 – 1989	169	3-year BHAR	Industry and size-matched firms	91.59%
Malaysia					
Ahmad-Zaluki et al. (2007)	1990 – 2000	454	3-year BHAR	Size matched firms	-2.01%*
Australia					
Lee et al. (1996)	1976 - 1989	266	3-year BHAR	Industrial index	-51.26%
New Zealand					
Firth (1997)	1979 – 1987	143	3-year CAAR	Industry and size-matched firms	-14.0%
South Africa					
Page & Reyneke (1997)	1980 – 1991	118	3-year BHAR	Size-matched firms	-50.62%

3 Data and Methodology

3.1 Data Sample

The IPO dataset is obtained from SDC's Thomson One database and includes the companies that went public between January 1992 and July 2012 in the five countries with the largest capital markets in terms of market capitalization from Continental Europe – France, Germany, Italy, Spain, and Sweden. There are several reasons for focusing only on Continental Europe and not including the UK IPO market in this study. First, the primary role of the capital markets is embedded within the model of the Anglo-Saxon economies, whereas the European model tends to be oriented towards the market to a lesser extent. Along with the other differences between the two types of economies, this would result in a less consistent sample. Furthermore, due to its size, the UK market would take a large portion of the IPO sample, having a strong impact on the results. Finally and not surprisingly, the UK market has received a lot of attention among the academic researchers and the long-run underperformance phenomenon has been studied well.

Figure 1: *IPO distribution per year*
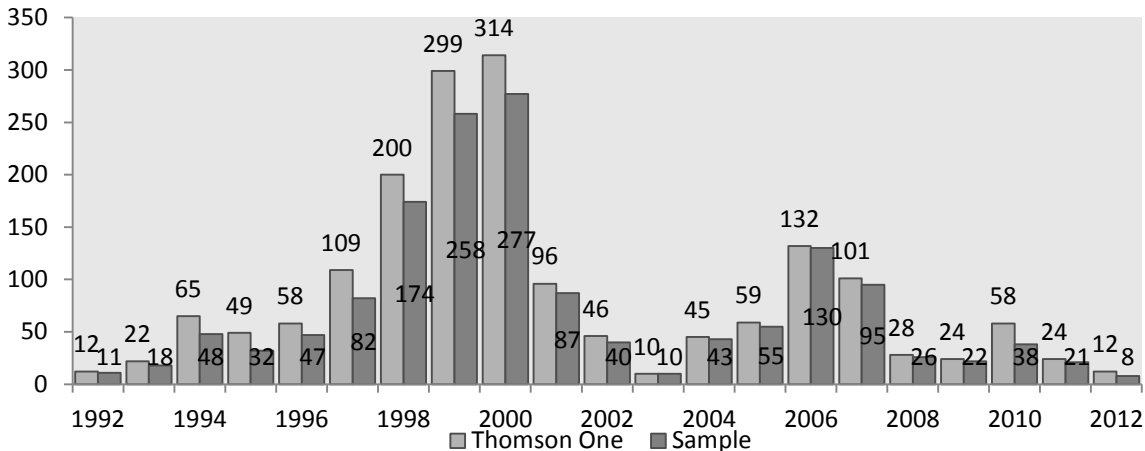
The Figure compares the yearly number of IPOs in the sample with the initial file from Thomson One. The initial file comprises 1763 unique common stock issues. Originally, the file contained an additional 688 companies for which the offer price was missing. This is interpreted as an indicator for an unsuccessful IPO and therefore these observations are not included.

The final sample consists of 1522 common stock issues for which the offer price was at least 1 Euro per share, there is available data on Datastream, and the company started trading within 12 months after the issue. Figure 1 depicts the IPOs from the sample relative to the total number of new issues available on Thomson One and demonstrates the representativeness of the sample. For each firm, the offer price, offer date, proceeds, industry, investor type, founding year, whether the company

was backed with private equity or venture capital, and some additional identification variables were collected from Thomson One. Duplicates, firms with missing offer prices or identifiers, and issues that had several target markets were excluded from the initial file. Table 2 presents the distribution of the sample by year and country in terms of the number of IPOs.

Table 2: *Sample distribution by year of issuance and country*

The table presents by country the number of IPOs in each year in the period 1 January 1992 – 30 June 2012 which meet the following criteria: only common stock involved in the offering, at least 1 Euro per share offer price, available data on Datastream, and start of trading within 12 months after the issue.

Year	France	Germany	Italy	Spain	Sweden	Total
1992	5	5	1	0	0	11
1993	7	8	0	1	2	18
1994	31	6	4	1	6	48
1995	11	10	6	0	5	32
1996	35	3	6	2	1	47
1997	45	16	9	5	7	82
1998	76	67	15	10	6	174
1999	86	124	26	10	12	258
2000	105	112	38	6	16	277
2001	42	21	17	2	5	87
2002	25	5	6	1	3	40
2003	7	0	3	0	0	10
2004	23	6	8	2	4	43
2005	28	12	9	1	5	55
2006	50	43	16	10	11	130
2007	43	28	13	5	6	95
2008	23	1	1	1	0	26
2009	19	1	2	0	0	22
2010	19	6	2	8	3	38
2011	14	3	2	2	0	21
2012	4	2	1	1	0	8
Total	698	479	185	68	92	1522

The table reveals that the issues held are not evenly distributed throughout the years and among the countries. Consistent with the "hot issue" hypothesis, a cyclical pattern in the volume of issues persists among all of the countries. The periods 1998-2000 and 2006-07 can be defined as "hot" markets in which the number of IPOs is substantially higher, whereas the early 1990s and the post-2007 period are years of low issuing activity. Particularly, more than 61% of initial public offerings included in the sample were held during the five "hot" years.

All of the public companies traded on the markets of the five countries in the period January 1992 to June 2012 were collected from Compustat Global to form the sample with the matching firms. Finally, Datastream was used to obtain the closing prices (end-month and daily, both adjusted and unadjusted for capital actions), number of shares, and the book value of equity for the IPOs and the matching firms. Since the data for the year of founding provided by Thomson One is incomplete, the same variable for the IPOs was collected also from Datastream and used to add some of the missing values. Unfortunately, for some companies the founding year was not available. Also, it should be noted that the currency for all money-measured variables from Thomson One and Datastream was set to be euro.

Table 3 summarizes some of the offer characteristics of the 1522 IPOs included in the sample. As can be seen from the table, the firms going public in Continental Europe are in general larger and more mature, consistent with the findings of the existing literature. For instance, the median size of the firm going public of 75.8 million euro is close to the 73.9 million reported by Schuster (2003b). The average age reported here, however, is lower than in his study by 5 years which is explained by the fact that more younger firms have started entering the market after his sample period. This does not come as a surprise, considering the Internet bubble and the development of the modern economy.

Table 3: *Descriptive statistics*
The table presents descriptive statistics of the 1522 IPOs included in the sample. Size is estimated as the market capitalization of the company at the time of issuing (shares outstanding times offer price in euro). Age is defined as the difference between the year of issue and the year of founding of the company. Due to data unavailability the age statistics are based on 1142 observations. Initial return refers to the raw return from the offer price to the first closing price (referred in the table as First day of trading closing price) that is different from the offer price and the presented statistics are based on 1520 observations due to extremely high and unrealistic initial returns for two IPOs (the two excluded companies have initial returns of 2684% and 5099%). The book-to-market ratios for the companies are estimated by dividing their end-year book value by the market value at the end of the first month of trading. Due to missing book-value data, the statistics are based on 1339 observations. Negative or higher than 3 B/M ratios (11 companies in total) are also not considered in the calculation of the statistics.

	Mean	*Median*	*Min*	*Max*	*St. Deviation*
Size (in thousands)	635 452	75 784	153	58 037 376	3 336 802
Age	23	12	0	527	34
Offer price	21.47	14.86	1.00	511.29	32.52
First day of trading closing price	27.05	16.01	0.53	1329.36	53.30
Initial return	17.19%	2.88%	-93.53%	692.00%	47.88%
Book-to-market ratio	0,35	0,29	0,01	2,11	0,27

The average initial return of 17.19% is consistent with the 16.52% reported by Schuster (2003b) for the Continental European market and a look at the 2015 update of Table 1 in Loughran et al. (1994) reveals that it is similar in magnitude to the returns reported in the US (16.9%), the UK (16%), and other European countries, which cannot be considered as high compared to the Asian markets. However, the low median indicates that more than a half of the 1522 IPOs in the sample have realized much smaller initial returns and therefore IPO flipping is not always a lucrative strategy in the case of Continental Europe. Moreover, Table 3 also reveals that all of the included variables are positively skewed since the mean values are always higher than the medians.

3.2 Methodology

The academia has identified two approaches in measuring long-run abnormal performance – either event-time or calendar-time methodologies. The former method assess the performance in a window following a corporate event (in the case of this study the IPO), whereas the latter calculates the abnormal returns in each calendar month for each sample company that had an event in the previous, say, three years (depending on the event window of interest[14]). The calendar time approach weights each month equally and thus will result in weak tests when the events are clustered in time as it is the case with the "hot issue" markets (Loughran & Ritter, 2000). Furthermore, as noted by Gregory et al. (2010), the calendar-time method does not reflect investor's experience as well as the event-time approach, resulting in "portfolios which seem implausible from an investor point of view". For these reasons, this research is conducted in event-time.

Two measures are used to estimate the long-run IPO performance – cumulative average abnormal returns (CAARs) and buy-and-hold abnormal returns (BHARs). Fama (1998) summarizes the problems with the two types of returns. Although he favours the use of CAARs, their main disadvantage is that the inherent monthly portfolio rebalancing is unrealistic from an investor's perspective. BHARs on the other hand, capture better the long-term investor's experience but cause more statistical problems and can continue to grow when there is no abnormal return after a particular period[15]. To calculate the abnormal return, a measure for the normal return is necessary. For that purpose, for each of the 1522 IPOs in the sample, a matching firm was chosen and its return fulfils that role. As demonstrated by Barber & Lyon (1997), this method results in well-specified test statistics.

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[14] For more details on the calendar-time approach see Jaffe (1974) and Mandelker (1974).
[15] For an example of how the overstatement occurs, see Fama (1998) p. 294.

In order to understand which factors can indicate the long-run performance of the initial public offerings, following Ritter (1991), Chapter 4 of this thesis provides various cross-sectional and time-series tables. Without doubt, fundamentals of the company have an important role as firm factors in the determination of the long-run performance. Therefore, only the effect of IPO-specific characteristics is included in the scope of this research. To conclude, a multiple regression of the long-run IPO returns on relevant factors identified in the literature is run. The explanatory variables are the size of the company at the time of the offering, the initial return, the number of IPOs in the year of issue, the age of the company, and dummy variables indicating private-equity- or venture-capital-backing, purchase availability for institutional investors at the time of the offering, and whether the company belongs to a New Economy sector.

3.2.1 Matching procedure

The matching firms for the IPOs are selected via two criteria, first - similar size, and second - both similar size and book-to-market multiple. Unfortunately, due to data unavailability and some matching restrictions, the sample based on the second approach includes fewer observations. Although industry matching looks appropriate, it is not considered because if managers in a particular industry are able to time their IPOs when this industry is subject of a general misevaluation, the result will be reduced ability to identify abnormal performance (Loughran & Ritter, 1995). The latter authors also note that there is usually only a limited number of companies with similar size within an industry, which in turn would negatively affect the matching procedure (either by having the same firm as the benchmark for several issues, or by reducing the sample size), a problem which is especially relevant for the smaller market of Continental Europe.

To find matching firms with similar size, the market capitalization of each IPO is computed by multiplying the first available end-month closing price[16] by the number of shares outstanding on the same date[17]. The matching firm is found among all companies listed in the IPO's country available on Compustat Global. The company that is closest to the market capitalization of the IPO on the aforementioned date (the end of the first trading month) is chosen as the matching firm. Only IPOs for which the market value of the matching firm is between 75% and 125% of the value of the IPO are kept in the sample. The IPOs are also present in the data files from Compustat Global. In order to

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[16] Usually, this is the last trading day of the month of issue. However, for some companies there is a lag between the IPO and the actual start of trading. As stated in Section 2.1, this lag is limited to not exceed 12 months.
[17] Since the number of shares variable from Datastream is not adjusted for splits or repurchases, the unadjusted share price is used for the calculation.

eliminate the benchmark bias discussed in Loughran & Ritter (2000), they are allowed to be used as potential matching firms only after their third anniversary, or in other words, three years must have passed in order for an IPO to be eligible as a matching firm for another IPO. Additionally, a company can be used as a matching firm only once every three years. For some of the IPOs the matching firm was delisted before the 3-year period or the delisting of the IPO. For these companies, a second matching firm was chosen by the same mechanism. However, several IPOs left unmatched after the second matching. In that the case, the returns of the benchmarks are kept as zero for the remainder of the aftermarket period.

As a second approach, IPOs are matched with companies with similar book-to-market ratio and size. To do this, the book-to-market ratio for all of the companies available on Compustat Global, which were traded on the markets of the five countries, are estimated at the end of December each year from 1992 to 2012. The companies with negative or higher than 3 B/M multiples are excluded from the sample and the rest are formed into quintiles for each year. The breakpoints of these quintiles are obtained and all of the IPOs and potential matching firms are assigned into different groups based on these breakpoints[18]. Subsequently, each IPO is matched with the companies from the same B/M group which are then filtered to find the best match by following the described above matching on size procedure.

3.2.2 Returns estimation

Returns are calculated for two periods – initial and aftermarket. First, the initial returns are calculated as the raw return from the offer price to the first available closing price which is not equal to the offer price[19]. Next, the first aftermarket month return is estimated from this closing price to the closing price at the end of the same month and the returns for months 2 to 36 are estimated as the raw returns between the end-month closing prices. Measuring the aftermarket performance when the stock is purchased at the first available closing price instead of the offer price is a standard practice in the literature. The reason for it is that the average investor is less likely to purchase at the offer price due to over-subscription for the initial share allocation. The monthly returns are calculated with closing prices which are adjusted for capital actions (for instance, stock splits, repurchases, or dividends) and all of the prices are obtained in euro. For IPOs that are delisted prior

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[18] Due to data restrictions, the B/M ratios for the companies are estimated by dividing their end-year book value by the market value at the end of the month of issue. As noted by Brav et al. (2000), using the end-year book value in the calculation should not be too much of an issue "because the increment in book value due to retained earnings in the first year is likely to be very small for newly public companies".

[19] For nearly half of the sample the first available closing price was equal to the offer price, most likely due to regulations or inaccurate data.

their 3-year anniversary, the aftermarket period is truncated on the last end-month closing price available on Datastream.

The abnormal returns of the IPOs in event month t are calculated as the difference between the monthly IPO return and the corresponding monthly matching firm return:

$$ar_{it} = r_{it} - r_{mt}$$

r_{it} – return of IPO i for month t

r_{mt} – return of the matching firm for month t

The average abnormal return for the portfolio of IPOs in event month t is calculated as the equally-weighted arithmetic mean of the abnormal returns:

$$ARR_t = \frac{1}{n}\sum_{i=1}^{n} ar_{it}$$

Finally, the cumulative average abnormal return is just the sum of the AARs over a specified period:

$$CAAR_T = \sum_{t=1}^{T} AAR_t$$

Implicitly, CAARs incorporate monthly portfolio rebalancing. Thus, when an IPO firm is delisted, the next month AAR includes only the companies that are still present in the sample.

Additionally, average long-run buy-and-hold abnormal returns are calculated by compounding the monthly returns of each of the IPOs and the corresponding matching firm and then averaging the differences for each period of interest[20]:

$$BHAR_T = \frac{1}{n}\sum_{i=1}^{n} \left[\prod_{t=1}^{T}(1 + r_{it}) - \prod_{t=1}^{T}(1 + r_{mt}) \right]$$

This procedure estimates the average return from a buy-and-hold strategy where the IPO's stock is purchased at the first closing price (that is different from the offer price) following the issue and held for period T.

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[20] Compounding the monthly returns of the IPOs and their matching firms over the specified periods gives the buy-and-hold returns of the two groups. Then the buy-and-hold abnormal return for each IPO is just the difference between its buy-and-hold return and the buy-and-hold return of its matching firm.

Since the goal of this study is to measure the aftermarket abnormal returns of the average IPO and to serve as point of reference for managers, investors, or researchers, using equal weights of each company in the estimations of the CAARs and BHARs is the appropriate approach (Loughran & Ritter, 2000). Additionally, due to the fact that in general IPOs tend to be smaller companies, the use of value weights would result in biased towards the performance of the larger issues results. To illustrate, let's assume that a sample comprises 10 IPOs, 9 of which have equal capitalizations resulting in a combined market value of 1 billion euro (111.1 million per company). The last company in the sample is much bigger than the others with market capitalization of 1 billion. Each of the smaller companies underperformed its benchmark by 10 percentage points (realized abnormal return of -10%) whereas the large company outperformed by the same amount (abnormal return of 10%). So, if value weights are incorporated, no abnormal performance will be detected. However, the use of equal weights results in an abnormal return of -8% which represents the situation much more realistically.

4 Empirical Results

4.1 Abnormal Returns

4.1.1 Cumulative average abnormal returns

Table 4 reveals the average abnormal returns (AAR_t) and the cumulative average abnormal returns ($CAAR_t$) over the 36-month aftermarket period for the two samples of IPOs issued between January 1992 and the end of June 2012 in Germany, France, Italy, Spain, and Sweden. The results in the left half of the table represent the sample for which the IPO returns are measured relative to matched on size firms, whereas the right half shows the results for the sample matched on book-to-market ratio and size. The latter sample includes much smaller number of observations for two reasons: first, missing book value data for some of the companies, and second, the found matching firm does not meet the size restriction of being smaller or larger than the IPO firm by no more than 25% in terms of market capitalization as described in section 3.2.1. The table also shows that only a small number of companies were delisted by the end of the 36 month holding period.

Consistent with the majority of international evidence, the results indicate that IPOs tend to underperform in the long run when compared to companies with similar size. The average abnormal returns are negative in 25 out of the 36 months following the offering, 11 of which are statistically significant. As can be seen from the table, the IPOs substantially outperformed the matching firms throughout the first month of seasoning. However, as stated in the methodology section, the first month return is estimated from the first available closing price (different from the offer price) to the closing price at the end of the month. Thus, this result should be treated cautiously since the first month following the issues varies in terms of days included in its calculation. The subsequent CAARs indicate that the IPOs outperformed the benchmark companies over the first 10 months in the aftermarket reaching statistically significant 8.63%. Afterwards, the performance begins to deteriorate and the results become insignificant at the 5% level up to month 27 for which the CAAR has a value of -14.7 percent that continues to decrease to -19.23% at the end of the 3-year period. The results also suggest that the IPO market in Continental Europe behaves differently compared to the UK, where the underperformance becomes evident sooner after the offering (Espenlaub et al., 2000; Gregory et al., 2010).

On the other hand, the results in the right half of the table demonstrate the sensitivity of the IPO abnormal performance to the employed benchmark. When the book-to-market effect is considered

Table 4: *Cumulative average abnormal returns over the 3-year aftermarket period*

Average abnormal returns (AAR$_t$) and cumulative average abnormal returns (CAAR$_t$) are computed as described in section 3.2.2. The conventional t-statistic is used for the AARs: $t = \frac{AAR_t}{\sigma AAR_t/\sqrt{n_t}}$. The t-statistics for the CAARs are computed via Brown and Warner's (1980) crude dependence adjustment: $t = \frac{CAAR_t}{\sqrt{t}*\sigma AAR}$. The results at the end of each full year in the aftermarket are presented in bold to ease reading of the table.

Month	Size-matched firms					B/M and size-matched firms				
	IPOs trading	AAR$_t$	t-stat	CAAR$_t$	t-stat	IPOs trading	AAR$_t$	t-stat	CAAR$_t$	t-stat
1	1522	4.04%	(5.15)	4.04%	(2.97)	978	4.50%	(4.91)	4.50%	(3.59)
2	1522	1.85%	(2.63)	5.88%	(3.07)	978	1.26%	(1.44)	5.77%	(3.25)
3	1522	0.96%	(1.59)	6.85%	(2.91)	978	0.37%	(0.58)	6.13%	(2.82)
4	1522	1.39%	(2.17)	8.23%	(3.03)	978	0.44%	(0.71)	6.57%	(2.62)
5	1522	-0.36%	(-0.48)	7.87%	(2.59)	978	-0.52%	(-0.70)	6.05%	(2.16)
6	1520	0.88%	(1.25)	8.75%	(2.63)	977	1.50%	(1.58)	7.55%	(2.46)
7	1520	0.35%	(0.58)	9.10%	(2.53)	977	0.74%	(1.05)	8.30%	(2.50)
8	1518	-0.36%	(-0.54)	8.74%	(2.28)	977	0.07%	(0.10)	8.37%	(2.36)
9	1517	0.40%	(0.67)	9.14%	(2.25)	977	0.80%	(1.05)	9.17%	(2.44)
10	1516	-0.51%	(-0.84)	8.63%	(2.01)	977	0.39%	(0.49)	9.57%	(2.41)
11	1515	0.12%	(0.11)	8.75%	(1.94)	977	0.93%	(1.26)	10.49%	(2.52)
12	**1513**	**-0.12%**	**(-0.17)**	**8.64%**	**(1.84)**	**975**	**0.15%**	**(0.19)**	**10.65%**	**(2.45)**
13	1510	-2.21%	(-3.59)	6.42%	(1.31)	975	-1.78%	(-2.28)	8.87%	(1.96)
14	1507	-2.48%	(-3.84)	3.94%	(0.78)	973	-0.86%	(-1.03)	8.01%	(1.71)
15	1506	-1.82%	(-2.86)	2.12%	(0.40)	973	-0.52%	(-0.77)	7.48%	(1.54)
16	1504	-1.01%	(-1.41)	1.11%	(0.20)	973	-1.30%	(-1.59)	6.19%	(1.23)
17	1501	-1.59%	(-2.56)	-0.48%	(-0.09)	972	-1.56%	(-2.17)	4.62%	(0.89)
18	1498	-0.43%	(-0.74)	-0.91%	(-0.16)	971	-1.10%	(-1.37)	3.53%	(0.66)
19	1495	-1.06%	(-1.68)	-1.97%	(-0.33)	970	-1.12%	(-1.26)	2.41%	(0.44)
20	1491	-0.83%	(-1.20)	-2.80%	(-0.46)	968	-0.95%	(-1.26)	1.46%	(0.26)
21	1485	-1.30%	(-1.81)	-4.10%	(-0.66)	964	-1.14%	(-1.50)	0.32%	(0.06)
22	1481	-2.35%	(-3.91)	-6.46%	(-1.01)	962	-1.20%	(-1.66)	-0.88%	(-0.15)
23	1476	-1.20%	(-1.84)	-7.66%	(-1.18)	960	-0.52%	(-0.69)	-1.39%	(-0.23)
24	**1468**	**-1.67%**	**(-2.84)**	**-9.32%**	**(-1.40)**	**957**	**-2.34%**	**(-3.00)**	**-3.74%**	**(-0.61)**
25	1464	-1.30%	(-2.04)	-10.62%	(-1.57)	955	-1.36%	(-2.01)	-5.09%	(-0.81)
26	1463	-2.10%	(-3.20)	-12.72%	(-1.84)	955	-0.21%	(-0.30)	-5.30%	(-0.83)
27	1454	-1.98%	(-3.10)	-14.70%	(-2.08)	952	-0.78%	(-1.01)	-6.08%	(-0.93)
28	1451	-2.48%	(-3.93)	-17.18%	(-2.39)	950	-1.25%	(-1.42)	-7.33%	(-1.11)
29	1447	-0.71%	(-1.23)	-17.88%	(-2.45)	947	-0.55%	(-0.78)	-7.89%	(-1.17)
30	1440	-1.18%	(-1.90)	-19.07%	(-2.57)	942	-0.31%	(-0.39)	-8.19%	(-1.19)
31	1433	0.42%	(0.59)	-18.64%	(-2.47)	938	-2.21%	(-2.52)	-10.40%	(-1.49)
32	1430	0.05%	(0.06)	-18.59%	(-2.42)	936	0.24%	(0.32)	-10.16%	(-1.43)
33	1426	-0.06%	(-0.03)	-18.65%	(-2.39)	933	-1.85%	(-2.36)	-12.01%	(-1.67)
34	1422	-0.24%	(-0.34)	-18.88%	(-2.39)	930	0.46%	(0.48)	-11.54%	(-1.58)
35	1416	-1.33%	(-2.12)	-20.21%	(-2.52)	928	-0.04%	(-0.06)	-11.58%	(-1.56)
36	**1414**	**0.99%**	**(1.40)**	**-19.23%**	**(-2.36)**	**927**	**0.21%**	**(0.28)**	**-11.37%**	**(-1.51)**

along with the size of the companies, the evidence of long-run underperformance becomes statistically insignificant at the 5% level. But still, the 3-year CAAR is negative, although smaller in magnitude (-11.37%). In fact, the average abnormal returns are significant only for seven out of the 36 months included in the event period.

Over the first year, the cumulative returns are similar in magnitude to the returns of the left side of the table, suggesting that the IPOs have superior performance over that period. Again, there is a high positive abnormal return in the first month of seasoning, which continues to increase to 10.65% by the end of month 12. All of the CAARs for that period are statistically significant at the 5% level. Afterwards, the cumulative performance starts to deteriorate, but this time all of the results after the 13th aftermarket month are insignificantly different from zero at conventional levels, indicating that the reported IPO underperformance relative to similar in terms of size and book-to-market ratio companies should be treated with cautiousness.

4.1.2 Buy-and-hold abnormal returns

Since the use of CAARs does not accurately measure the return for an investor who holds a security for a long post-event period, BHARs for different holding periods are presented in Table 5 as a second measure of abnormal performance. Again, the left side of the table reports the abnormal returns relative to size-matched firms and the right - relative to matching firms with similar book-to-market ratios as well as size. Although the BHARs demonstrate higher values than the CAARs (which can be expected due to the compounding, as stated in section 3.2), there is no difference regarding the qualitative implications drawn from the results. Once more, the IPOs significantly outperform the matched on size firms in the beginning[21], this time, over the first 18 months. The underperformance occurs after the second year, reaching a BHAR of -16.10% at the end of year three. Moreover, the underperformance is highly significant.

Similarly to the results in Table 4, the right side of the table shows that once book-to-market together with size effects are controlled for, both the magnitude of the underperformance and its significance decline. The highest performance is reached by the end of the first year and afterwards it starts to deteriorate becoming negative after year two. But unlike the 3-year CAAR measured against the book-to-market matched companies, this time the negative abnormal return is significant at the 10% level. Additionally, the columns to the right show the share of the companies that have

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[21] Schuster (2003b) also reports that the IPOs outperform all of his four benchmarks over the first twelve months (Table III).

underperformed their benchmarks over the different investment horizons. They suggest that over the first aftermarket year it is equally likely for an IPO to under- or outperform. However, as the holding period increases, more and more IPOs tend to underperform, regardless of the benchmark.

Table 5: *Buy-and-hold abnormal returns over the 3-year aftermarket period*

Average buy-and-hold abnormal returns (BHAR$_t$) over different horizons are estimated as defined in section 3.2.2. Due to the presence of some extreme winners (and sometimes even unrealistic buy-and-hold returns suggesting errors in the price data) the returns for both the IPOs and the matching firms are winsorized at the 1st and 99th percentile for each of the measuring horizons. A summary of the BHARs which demonstrates the relevance of the employed winsorizing can be found in Appendix A. T-statistics are estimated for the average BHARs using the conventional method: $t = \dfrac{\overline{BHAR}t}{\sigma BHARt/\sqrt{nt}}$. The Negative BHARs column presents the share of IPOs which have underperformed their benchmarks out of the total number of new issues trading in each investment period.

	Size-matched firms				B/M and size-matched firms				
Month	IPOs trading	BHAR$_t$	t-stat	Negative BHARs	Month	IPOs trading	BHAR$_t$	t-stat	Negative BHARs
6	1520	14.32%	(6.86)	50.20%	6	977	10.61%	(4.97)	50.77%
12	1513	18.82%	(5.96)	51.22%	12	975	16.76%	(5.10)	48.00%
18	1498	10.76%	(2.95)	56.81%	18	971	13.62%	(3.14)	51.91%
24	1468	0.05%	(0.01)	57.90%	24	957	4.11%	(1.00)	53.29%
30	1440	-10.18%	(-3.18)	61.60%	30	942	-3.35%	(-0.92)	55.31%
36	1414	-16.10%	(-4.76)	62.94%	36	927	-6.49%	(-1.74)	57.39%

To summarize, the results provide evidence of IPO underperformance over the long-run. However, they should be interpreted cautiously. When the performance is measured relative to companies that more closely match the characteristics of the issuing firms, the abnormal returns lose their statistical significance or register it at lower confidence level (10% when the BHAR methodology is employed). Regardless of the return metric or the used benchmark, the results suggest IPO outperformance over shorter aftermarket horizons, reaching the highest abnormal returns around the end of the first year. Afterwards, the abnormal performance starts to deteriorate. It might be the case that the turning point in the performance coincides with the expiration of the lock-up periods of the IPOs. During these periods insiders are obliged to not sell their holdings in order to not push down the price of the company's stock in the beginning, which will result due to the high supply or to the potential perception as a bad signal (selling by insiders might be interpreted as lack of confidence in the future prospects of the company even when they just want to cash in the long-anticipated profits). In their Table 4, Gajewski & Gresse (2006) provide a survey of the listing requirements on some of the European markets. The table shows that there are no lock-up requirements on the main markets of the five countries included in this thesis but there are requirements on their new market

segments[22]. For instance, in France the compulsory lock-up period varied between 6 months and 3 years during the existence of the new segment, in Germany it was 6 months, and in Italy – 1 year. However, the lock-up period is usually requested by the companies or by their underwriters, regardless if it is a listing requirement or not, and is company specific. In the US for example, the period typically lasts 90 to 180 days after the IPO. If the lock-up periods have similar lengths across the sample firms, their expiration should be reflected in large drops in some of the monthly average abnormal returns from Table 4. Month 13 demonstrates larger and statistically significant negative abnormal returns for both of the samples, which might be indicating an average lock-up period of the sample of 12 months.

In order to gain further insights on the long-run IPO performance and to identify which factors could serve as an indicator of its direction, as stated in the methodology chapter, the following section examines the long-run IPO returns by different issue characteristics. This approach has become a standard in the long-run initial public offerings literature following the early studies of Aggarwal & Rivoli (1990) and Ritter (1991).

4.2 Cross-Sectional Patterns

4.2.1 Long-run performance categorized by company's size

Table 6 illustrates the distribution and long-run performance of the companies, both absolute (BHR) and abnormal (BHAR), across seven size groups where size is defined as the market capitalization of the company estimated at the time of issue (using the offer price). Not surprisingly, the second column of Panel A reveals that more than half of the IPO sample is concentrated in the first three groups comprising companies with market value smaller than 100 million. On the other hand, the significant number of larger IPOs is another typical characteristic of the IPO market of Continental Europe.

Regarding the share price performance of the IPOs included in the sample, a closer inspection of Panel A reveals that the largest companies have the highest average 3-year buy-and-hold return of 4.53%. Furthermore, only one more group has a positive BHR over the period – the smaller companies with values between 10 and 50 million euro.

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[22] Markets opened specifically for high growth companies in the late 1990s which were all closed during the next decade.

Table 6: *Long-run performance categorized by company's size*

Average three-year buy-and-hold returns (BHRs) are estimated for both the IPOs and the matching firms and winsorized at the 1st and 99th percentile due to the presence of several extreme winners. The BHRs for each size group are calculated as: BHR$_{36}$ = $\frac{1}{n}$ $\sum_{i=1}^{n}$[$\prod_{t=1}^{36}(1 + r_{it}) - 1$]. The summary of the BHRs which demonstrates the relevance of winsorizing the returns can be found in Appendix B. The BHAR then is simply the difference between the IPO BHR and its matching firm BHR. T-statistics are estimated for the average BHARs using the conventional method: $t = \frac{\overline{BHARt}}{\sigma BHARt/\sqrt{nt}}$. The Negative BHARs column presents the share of IPOs which have underperformed their benchmarks. All of the IPO sizes are in nominal value and are estimated as the total number of shares outstanding multiplied by the offer price in euro. The two panels include 1414 and 927 IPOs respectively.

Size group, million euro	IPOs in the group	Matching firms 3-year BHR	IPOs 3-year BHR	BHAR	Negative BHARs
Panel A: Size matched firms					
size < 10	133	0.87%	-4.07%	-4.94%	53.38%
10 ≤ size < 50	416	10.67%	2.93%	-7.74%	61.54%
50 ≤ size < 100	252	5.74%	-23.05%	-28.79%	67.46%
100 ≤ size < 250	285	7.88%	-19.69%	-27.57%	68.07%
250 ≤ size < 500	129	-8.71%	-33.52%	-24.81%	71.32%
500 ≤ size < 1000	88	-2.34%	-5.80%	-3.46%	55.68%
size >1000	111	7.00%	4.53%	-2.47%	52.25%
Panel B: Book-to-market and size matched firms					
size < 10	56	-5.41%	-8.64%	-3.22%	55.36%
10 ≤ size < 50	251	-0.28%	-11.52%	-11.24%	56.97%
50 ≤ size < 100	184	-20.26%	-21.33%	-1.07%	54.89%
100 ≤ size < 250	190	-7.00%	-8.31%	-1.31%	57.37%
250 ≤ size < 500	92	-10.31%	-28.32%	-18.00%	64.13%
500 ≤ size < 1000	70	9.05%	-6.12%	-15.18%	65.71%
size >1000	84	-0.25%	1.60%	1.84%	51.19%

In terms of relative performance, the BHARs have negative values in 13 out of the 14 groupings in the two panels indicating a general underperformance, regardless of the size of the issue. Panel B reveals that the results are sensitive to the book-to-market factor, albeit part of the change may be caused by sample differences. Nevertheless, the magnitude of underperformance is lower than when the returns are measured relative to only size-matched companies. In fact, the results for three of the groups indicate considerably close performance between the IPOs and the matching firms.

Contrary to the findings in the IPO literature about North America and the UK, and regardless of the benchmark employed, it is not the smallest companies (i.e., the first size group) that realise the poorest 3-year abnormal performance. For instance, Brav & Gompers (1997) provide evidence that the smallest in terms of market capitalization IPOs realize the worst aftermarket performance and suggest several explanations of these findings. They state it is the smallest companies that are more likely to be subject of fads and investor sentiment, since these issues are held primarily by

individuals. Institutional investors might avoid the smallest issues due to regulatory reasons coming with the risk of becoming a large shareholder of the firms. Also, the absolute amount of the potential return is limited by the firm's size and the small firms generally receive less analyst coverage, which are additional reasons why these issues are not attractive to institutions. On the other hand, the BHAR column of Table 6 slightly supports the majority of evidence about Continental Europe that smaller companies perform better in the long run, compared to larger firms[23]. Moreover, the final column of the table also indicates that the share of the IPOs that underperform increases with the size of the company, with the exception of the last group. It should be emphasized that it is exactly the billion euro IPOs that show the best performance, both in absolute and relative terms, irrespective of the chosen benchmark. In fact, these companies managed to outperform the matched on size and book-to-market firms. Although not reported in the table, this group has a moderate initial return of 8-9%, suggesting that the large IPOs are fairly priced which could partly explain their good long-run performance. This relation (between the initial pricing and the long-run performance) is studied in the following section.

4.2.2 Long-run performance categorized by initial returns

Table 7 shows the average 3-year buy-and-hold returns for the IPOs and their matching firms, as well as the average buy-and-hold abnormal return, segmented by initial return quintiles. The poor long run performance of the two groups can be attributed to the fact that the majority of the studied issues were held during the dot-com bubble and prior the 2007-2008 financial crisis.

Contrary to the findings of Schuster (2003b) about the Continental European IPO market, Panel A reveals that there is a tendency for the firms with the highest initial returns to perform the worst in the long run. Companies that have negative initial returns (from the first quintile) also underperform severely. The results for quintiles 2 to 5 demonstrate a pronounced negative relation between initial returns and the aftermarket performance. On the other hand, Panel B shows that when the book-to-market value is incorporated in the matching procedure, this relation is not clearly defined. But again, the most under-priced IPOs and those with negative initial returns realize the poorest long-run abnormal returns. Interestingly, the results from the 4th quintile indicate a severe outperformance of the IPOs, slightly supporting the signalling theories of Allen & Faulhaber (1989) and Grinblatt & Hwang (1989). In general, there is some evidence[24] supporting these hypotheses for the IPO markets of Germany, France, and Spain (Bessler & Thies, 2007; Leleux & Muzyka, 1998; Alvarez & Gonzalez,

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[23] This can be more cleanly seen in Panel B with the exception of the largest size group.
[24] The results are not always statistically significant.

2005). However, the results in Table 7 are also in line with the fads notion implying a temporary overvaluation caused by investor over-optimism. As stated in Aggarwal & Rivoli (1990), "the fad literature suggests that fads are most likely to occur in securities where estimating intrinsic value is more difficult, in riskier securities, and in markets dominated by more speculative investors", which is the case for the IPO market. And more importantly, as an evident example of investor over-optimism, the Internet bubble of the late 1990s comprises a large portion of the issues in the sample.

Table 7: *Long-run performance categorized by initial return quintiles*

The average three-year buy-and-hold returns (BHRs) of the IPOs and their matching firms and the BHARs are estimated in five groups defined by the initial return quintiles. The BHRs are winsorized at the 1st and 99th percentile due to the presence of several extreme winners. The initial returns are calculated as the raw return from the offer price to the first available closing price which is different from the offer price. The BHRs for each IR quintile are calculated as: $BHR_{36} = \frac{1}{n}\sum_{i=1}^{n}[\prod_{t=1}^{36}(1 + r_{it}) - 1]$. The column to the right presents the share of IPOs which have underperformed their benchmarks out of the total number of IPOs in each quintile. The two panels include 1412 and 927 IPOs respectively. The sample in Panel A includes 2 observations less than the full sample used by far due to extremely high and unrealistic initial returns (the two excluded companies have initial returns of 2684% and 5099%; keeping them produces similar results).

Initial returns quintiles			Matching firms 3-year BHR	IPOs 3-year BHR	BHAR	*Negative BHARs*
Panel A: Size matched firms						
-93.53%	< IR <	-0.21%	4.70%	-19.74%	-24.44%	66.43%
-0.15%	< IR <	0.40%	11.05%	12.69%	1.64%	56.74%
0.40%	< IR <	6.67%	-0.24%	-6.77%	-6.53%	56.10%
6.72%	< IR <	21.91%	12.57%	2.82%	-9.75%	61.15%
22.03%	< IR <	692%	-0.65%	-43.64%	-42.99%	74.82%
Panel B: Book-to-market and size matched firms						
-93.53%	< IR <	-0.67%	-7.04%	-20.64%	-13.60%	58.60%
-0.65%	< IR <	0.23%	4.80%	3.61%	-1.19%	56.76%
0.23%	< IR <	5.86%	4.90%	-8.35%	-13.25%	53.23%
5.88%	< IR <	20.90%	-15.15%	-4.98%	10.17%	55.68%
20.99%	< IR <	433.33%	-18.67%	-33.15%	-14.49%	62.70%

In summary, regardless of the underlying theory or the matching criteria, the results suggest two important implications. Companies with highly negative initial returns as well as companies which are highly under-priced at the time of the IPO tend to underperform by the greatest extent at the three-year horizon. Furthermore, the last column of the table indicates that the share of underperforming IPOs is much higher for the highest initial return quintile. Hence, the results suggest that the initially inflated by the overoptimistic investors prices get corrected in the aftermarket leading to the reported long-run underperformance.

4.2.3 Long-run performance categorized by year of issuance

Table 8 summarizes the 3-year performance of the IPOs by their year of issuance. The results on the right side of the table again demonstrate the impact of the book-to-market factor – in general, its consideration results in higher values of the BHARs. Furthermore, the results provide evidence that the aftermarket performance is time dependent. For both of the samples, the underperformance occurs for companies issued in 12 out of the 21 years of study. Consistent with the IPO literature, the table clearly demonstrates that the issues bunch in time, forming periods of high (referred as "hot") and low (referred as "cold") IPO activity. Over the first "cold" period (1992-1997), the IPOs severely outperform the matching firms. To illustrate, the companies issued in 1995 realise abnormal returns of 50.58% against the similar size companies and 97.56% against the other benchmark. The outperformance during that period sheds light on the difference between the findings of this study and the results of Schuster (2003b) who reports positive abnormal returns over the 3-year horizon. His sample covers the period 1988-1998 and thus his findings are heavily affected by the strong IPO performance during the aforementioned "cold" period.

Further inspection of Table 8 reveals that the IPOs issued during the following "hot" period covering the years 1998 till 2000 underperform over the long-run. It should be noted that this period also coincides with the Internet bubble of that time. Thus, the underperformance of the companies issued in these years does not come as a surprise considering the collapse of the bubble. Interestingly, the following low issue ("cold") years are also characterized by long-run IPO underperformance. It might be the case that the burst of the bubble affected adversely the popular IPO sectors in the following several years or that the investors were still overoptimistic about the new issues. However, the final two years of this second "cold" period demonstrate again the much better performance of the IPOs which actually manage to realize higher returns than the benchmark firms.

The next "hot" period comprises the years 2006 and 2007 which is just before the beginning of the 2007-2008 crisis. As expected, the crisis had a negative effect not only on the performance of the IPOs, but also on the benchmark companies. Once more however, the newly listed companies underperform their matching counterparts, indicating a negative relation between yearly IPO volume (in terms of number of issues) and aftermarket performance. The subsequent 5 years[25] form another "cold" market and consistent with the findings for the previous periods of low IPO activity, the IPOs

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[25] The results for 2012 are based only on issues held by the end of June.

tend to outperform the matching firms over the major part of the period. Moreover, the discussed patterns persist among the two samples, although with differences in the magnitude.

Table 8: *Long-run performance categorized by year of issuance*

Once more, the 3-year BHRs are winsorized at the 1st and 99th percentile due to the presence of several extreme winners and are calculated as: $BHR_{36} = \frac{1}{n} \sum_{i=1}^{n} [\prod_{t=1}^{36}(1 + r_{it}) - 1]$. The BHAR is simply the difference between the returns of the two groups. The two samples comprise 1414 and 927 IPOs respectively. To ease reading of the table, starting from 1995, every fifth year is presented in bold.

		Size-matched firms				*B/M and size-matched firms*		
Year	IPOs held	Matching firm BHR	IPO BHR	BHAR	IPOs held	Matching firm BHR	IPO BHR	BHAR
1992	11	4.07%	-17.49%	-21.57%	7	-2.90%	-10.58%	-7.69%
1993	18	12.64%	14.18%	1.54%	14	1.39%	14.24%	12.85%
1994	47	26.45%	49.07%	22.61%	33	15.33%	56.35%	41.01%
1995	**32**	**68.75%**	**119.33%**	**50.58%**	**19**	**30.28%**	**127.84%**	**97.56%**
1996	46	52.15%	50.63%	-1.52%	24	22.48%	-7.75%	-30.23%
1997	81	45.31%	74.63%	29.32%	53	12.19%	49.30%	37.11%
1998	166	-0.20%	3.35%	3.54%	108	1.21%	-11.15%	-12.36%
1999	249	-0.18%	-29.41%	-29.23%	128	-11.58%	-26.82%	-15.23%
2000	**256**	**-14.70%**	**-63.04%**	**-48.33%**	**147**	**-35.20%**	**-59.55%**	**-24.35%**
2001	81	7.54%	-25.75%	-33.30%	57	-9.63%	-28.28%	-18.65%
2002	37	41.90%	14.53%	-27.37%	26	23.03%	8.47%	-14.55%
2003	9	191.83%	42.24%	-149.59%	6	84.65%	46.19%	-38.45%
2004	36	83.11%	78.24%	-4.87%	33	83.96%	88.41%	4.45%
2005	**52**	**-4.28%**	**-0.64%**	**3.63%**	**48**	**-13.02%**	**-1.57%**	**11.45%**
2006	120	-25.40%	-42.71%	-17.31%	111	-18.36%	-41.51%	-23.15%
2007	81	-26.70%	-44.41%	-17.71%	65	-32.96%	-43.61%	-10.65%
2008	19	10.51%	-22.54%	-33.05%	7	18.79%	-30.84%	-49.63%
2009	16	-28.73%	-9.71%	19.02%	8	-11.81%	-12.06%	-0.25%
2010	**31**	**-1.08%**	**24.95%**	**26.03%**	**15**	**-8.60%**	**43.32%**	**51.92%**
2011	18	12.90%	-10.82%	-23.72%	13	-4.32%	-1.56%	2.76%
2012	8	46.37%	48.06%	1.69%	5	23.60%	33.55%	9.94%

To summarize, with some exceptions in the early 2000s, the results in Table 8 suggest a negative relation between the annual issuing volume and the aftermarket performance for the IPO market of Continental Europe. This is the opposite of the findings of Schuster (2003b), who reports that IPOs issued in "cold" markets underperform in the long-run, whereas those issued in "hot" markets realize superior returns. However, he uses the median values of initial under-pricing and market return to define the "hot" and "cold" periods[26]. Combined with the earlier and shorter period of his sample,

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[26] The "hot" market literature reports that the annual volume of issues and the level of initial underpricing are related – high volume years are accompanied by high initial returns and vice versa.

this results in discrepancy with the defined periods of this study – some of his "hot" periods are actually "cold" in the broader sample that is used here. On the other hand, the negative relation between the annual issuing volume and the long-run IPO performance evident from Table 8 is consistent with the market timing and fads hypotheses. It looks that managers in Continental Europe are able to time the initial public offering of their companies when investors are overoptimistic about the future growth prospects of the firms and therefore are willing to pay high price multiples (i.e., price-to-earnings ratios). Derrien (2005) provides one of the few studies focusing on "hot" markets for a European country. His findings are in support of the latter notion demonstrating that IPOs occurring in high volume years in France tend to be overpriced in the long-run.

4.2.4 Long-run performance categorized by industry

In Table 9, the three-year aftermarket performance is segmented by industry sectors as provided by the Thomson One database which classifies the IPOs based on their Standard Industrial Classification (SIC) codes. As can be seen, the IPOs underperform their matching firms in all but 3 and 4 out of the 12 industry groups, respectively in Panel A and Panel B. As can be expected, the IPOs were not evenly distributed among the industries. The high technology, healthcare, and media and entertainment sectors are heavily present, as well as more traditional industries like industrials, financials, and consumer products and services. A closer inspection of the first column in Panel A reveals that nearly half of the sample is concentrated in the New Economy industries following the classification of Schuster (2003b)[27]. Thus, the industry representation indicates capital flowing into more modern (as indicated by the average age of the firms within the sectors) growth industries. On the other hand, the real estate sector demonstrates the lowest IPO activity.

Focusing on the abnormal performance, the results presented in Panel B should be more relevant, since matching only on size does not control for industry factors. And since this section studies the performance by industries in which companies went public, these factors are of substantial importance and the book-to-market ratio should consider them by a greater extent. The four sectors in which the newly listed firms show positive abnormal performance are energy and power, industrials, retail, and telecommunications (the retail IPOs underperform when the book-to-market effect is not considered). These results are interesting – usually the literature reports that IPOs from the oil and gas industry underperform the most which should affect adversely the whole energy sector.

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[27] He groups the high technology, healthcare, telecommunications, and media and entertainment sectors into one New Economy sector. The average age column in Table 9 is consistent with this classification.

Table 9: *Long-run performance categorized by industry*

BHRs are winsorized at the 1st and 99th percentile due to the presence of several extreme winners and are calculated as: $BHR_{36} = \frac{1}{n}\sum_{i=1}^{n}[\prod_{t=1}^{36}(1 + r_{it}) - 1]$. The average BHAR is simply the difference between the BHRs of the IPOs and their matching firms. The two Panels comprise 1414 and 927 IPOs respectively. The age of an IPO is defined as the difference between the issue date and the year of founding of the company. The average age within an industry might be based on fewer firms than the reported in the second column of the table due to missing data on the founding years for some companies. The industry classification is based on the SIC codes of the IPOs as provided by Thomson One.

	IPOs in the group	Average age	Matching firms 3-year BHR	IPOs 3-year BHR	BHAR	*Negative BHARs*
Panel A: Size matched firms						
Consumer Products and Services	136	23	19.59%	5.70%	-13.89%	63.97%
Consumer Staples	80	34	25.95%	1.02%	-24.93%	65.00%
Energy and Power	61	30	-11.73%	-1.10%	10.62%	45.90%
Financials	114	38	0.68%	-11.78%	-12.46%	57.02%
Healthcare	100	14	11.23%	-13.91%	-25.14%	60.00%
High Technology	392	12	-1.54%	-29.94%	-28.39%	69.64%
Industrials	192	35	4.19%	9.64%	5.44%	52.60%
Materials	65	39	2.78%	-3.41%	-6.20%	61.54%
Media and Entertainment	120	17	2.39%	-27.51%	-29.90%	65.83%
Real Estate	40	23	34.14%	-5.47%	-39.61%	75.00%
Retail	57	27	16.76%	-3.81%	-20.58%	66.67%
Telecommunications	57	9	-9.06%	12.57%	21.63%	64.91%
Panel B: Book-to-market and size matched firms						
Consumer Products and Services	82	28	-6.43%	-11.87%	-5.44%	63.41%
Consumer Staples	56	37	5.94%	-0.38%	-6.33%	57.14%
Energy and Power	43	30	-5.29%	-3.32%	1.97%	53.49%
Financials	85	35	-7.78%	-18.10%	-10.33%	52.94%
Healthcare	66	16	0.29%	-22.64%	-22.93%	54.55%
High Technology	232	14	-12.40%	-26.43%	-14.04%	62.07%
Industrials	138	38	-7.22%	12.06%	19.28%	45.65%
Materials	42	42	10.24%	-18.05%	-28.28%	69.05%
Media and Entertainment	72	18	-10.14%	-33.02%	-22.88%	63.89%
Real Estate	36	23	14.65%	-6.30%	-20.95%	55.56%
Retail	37	30	-5.41%	6.79%	12.20%	56.76%
Telecommunications	38	10	-22.58%	-0.76%	21.82%	55.26%

Also, in contrast to the findings of Schuster (2003b), the New Economy IPOs do not outperform their benchmarks, nor do they show superior performance relative to the more traditional industries.The only exception is for the telecommunication issues demonstrating the highest and impressive average abnormal return of 21.82% over the 3-year holding period. This is also the industry with the youngest companies. A quick check reveals that the high value is driven by the outstanding performance of several companies. Excluding them from the calculation actually makes the

telecommunications sector to underperform. High positive abnormal returns are realized also by the industrial IPOs and moreover, this is the only sector in which there are more IPOs that outperform their benchmarks than IPOs that underperform. The differences between the findings reported here and the prior literature could be attributed to the different sampling periods and the accompanying economic conditions. The return estimates in this section should be interpreted with cautiousness. Ideally, the matching firms would have been from the same industry as the IPOs and second, as can be seen from the telecommunications example, the industries comprising a lower number of observations are strongly affected by the presence of more extreme performers. Nevertheless, the results suggest a general long-run IPO underperformance across almost all of the sectors.

4.2.5 Long-run performance categorized by age

Table 10 presents the long-run performance of the IPOs, segmented by the age of the company at the time of issue. Prior studies have found that the age of the company is another good proxy for risk. Due to lack of data about the year of founding which is used to estimate the age of the firm, the samples used in this section have reduced sizes.

Panel A of the table reveals that there is a tendency for the older, more established firms to realize higher buy-and-hold returns over the 3-year investment horizon. The IPOs from the oldest group outperform the youngest companies by the considerable 55.56 percentage points. This magnitude remains similar when looking at the abnormal performance which indicates a tendency to increase with the age of the companies. The relation becomes perfectly pronounced in panel B, where the abnormal performance is estimated relative to companies with similar book-to-market ratios and size. Once more, the difference between the aftermarket performance of the youngest and the oldest IPOs has a significant magnitude both in absolute and abnormal terms (53.33 and 47.55 percentage points respectively). Furthermore, the final column of Table 10 shows that the share of underperforming IPOs among the youngest group is much higher than the share of underperforming companies in the most established group. Thus, the results indicate that the age of the firm at the time of going public serves as a really good proxy for risk. The youngest group in Table 10 comprises a lot of New Economy companies[28] and start-ups which are probably unable to meet the high growth expectations and as a consequence the market corrects their prices in a negative direction.

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[28] For instance, 72 of the youngest companies in Panel A are high technology firms, followed by 26 media and communications companies.

Table 10: *Long-run performance categorized by age of the firm at the time of the IPO*

The three-year BHRs are winsorized at the 1st and 99th percentile due to the presence of several extreme winners. The age of an IPO at the time of issuing is defined as the difference between the issue date and the year of founding of the company. Due to data availability regarding the year of founding the two panels include fewer firms - 1091 and 716 IPOs respectively. The age intervals are determined by the quintile break points of the IPO age. However, the number of firms in each group is not equal since many companies have the same age at the time of going public and therefore they belong to the same group.

Age in years	IPOs in the group	Matching firm BHR	IPO BHR	BHAR	Negative BHARs
Panel A: Size matched firms					
0 - 5	264	4.35%	-41.08%	-45.43%	71.97%
6 - 9	183	-0.04%	0.22%	0.26%	56.83%
10 - 15	212	11.97%	1.35%	-10.62%	61.79%
16 - 33	215	6.43%	-0.62%	-7.05%	63.72%
34 - 527	217	6.03%	14.48%	8.45%	51.15%
Panel B: Book-to-market and size matched firms					
0 - 5	163	-10.05%	-36.02%	-25.97%	66.26%
6 - 10	141	-7.04%	-20.61%	-13.58%	53.19%
11 - 17	141	-2.90%	-10.98%	-8.08%	56.03%
18 - 37	128	-9.86%	3.90%	13.77%	53.13%
38 - 527	143	-4.28%	17.31%	21.58%	47.55%

Interestingly, these results are in a strong contrast with the findings of Schuster (2003a, 2003b) who reports a negative relation between firm age at the time of issue and the long-run performance for Germany, France, and Spain in the case of the first article, and the same relation for his pooled sample in the second. However, in these two studies, the sample ends in 1998. This suggests that the relation between age and performance changes its direction after that year which does not come as a surprise considering that a large portion of the IPOs studied in this thesis are issued during the Internet bubble covering the years 1998 till early 2000s. Thus, the poor long-run performance of the younger companies reported here can be interpreted as evidence of fads and investor over optimism on the IPO market of Continental Europe, especially after the late 90s.

4.2.6 Long-run performance categorized by type of investor/ownership structure

In Table 11, the aftermarket performance of the IPOs held in the five countries of study is presented in three different groups indicating whether stock was available to institutional investors at the time of the IPO, or whether the companies were backed by a private equity or a venture capital firm. For instance, Brav & Gompers (1997) were the first to investigate the long-run IPO performance dividing the issues into venture-backed and non-venture backed. Contrary to their findings, the results in

Table 11 indicate that venture-backed firms perform worse than IPOs which lack venture capital support. Regardless of the benchmark employed, the two groups demonstrate negative abnormal returns with the venture-backed IPOs realizing -29.49% and -14.4% in Panels A and B respectively, whereas the non-backed firms show much lower underperformance of -15.27% and -5.84%. Thus, these results suggest that venture capitalists might be able to successfully exploit investor sentiment in their favour (Coakley et al., 2008).

The table also reveals the difference between the performance of private-equity-backed IPOs and non-backed issues. As discussed in Bergström et al. (2006), "investment banks and various articles in the financial press provide positive pictures of European private equity". Consistent with their findings, Panel A reveals that the new issues backed by private equity perform better than the non-backed companies, although the long-run IPO underperformance is present among the two groups. However, when the book-to-market factor is considered in the matching procedure the results do not show difference in the magnitude of abnormal performance. But as in Panel A, the private-equity backed IPOs realize positive buy-and-hold returns and demonstrate lower share of companies that underperform their benchmarks, suggesting a positive effect of the private equity firms.

The different effects on the long-run share price performance that private equity and venture capital firms have can be partly explained by the different working mechanisms of the two sources of financing. Usually, private equity acquires a substantial share of a company and then restructures it to optimize its operating performance. On the hand, the venture capital's approach is gentler, providing mostly advisory and monitoring services (by having representatives in the board of directors of the backed firm). So, the optimization made by the private equity could be still present even after the exit of the PE, whereas the exit of the VC would lead to the loss of its advisory function which could worsen the firm's performance. Furthermore, the academic literature provides evidence that the venture capitalists' reputation is an important factor in determining the long-run performance of the backed companies. Krishnan et al. (2011) report that "more reputable VCs provide more valuable advisory and monitoring services to their portfolio firms, in addition to initially selecting better-quality portfolio firms to invest in." Their evidence suggests that the high-reputation venture capital firms hold higher proportion of the shares and have more representatives in the board of directors of the backed IPO firms during the 3 post-issue years which is assosiated with superior firm performance. Moreover, Gompers (1996) shows that IPOs backed by younger venture capital firms are usually young and realize higher initial returns than more established ones, which is a premise for poor share price performance in the long-run.

Lastly, Table 11 shows the long-run returns of the companies segmented by the type of investors the offering is being available to – institutional, individual, or both. It should be noted, that the ownership structure is related to the other groups presented in Table 11 - Megginson & Weiss (1991) report that institutional ownership in IPOs is higher for venture-backed than for non-backed companies. Not surprisingly, Field & Lowry (2009) find that IPOs with higher institutional ownership

Table 11: *Long-run performance categorized by type of investor*
The buy-and-hold returns are winsorized at the 1st and 99th percentile and presented in three different groups indicating whether the companies were backed by a venture capital or a private equity firm, or whether stock was available to institutional investors at the time of the IPO. The total number of companies in each group in Panel A is 1414 and 927 in Panel B.

Categories	IPOs in the group	Matching firm BHR	IPO BHR	BHAR	Negative BHARs
Panel A: Size matched firms					
VC backed	83	-1.35%	-30.84%	-29.49%	69.88%
Non-VC-backed	1331	5.87%	-9.40%	-15.27%	62.51%
PE backed	58	3.96%	2.57%	-1.39%	56.90%
Non-PE-backed	1356	5.51%	-11.23%	-16.73%	63.20%
Institutional	413	2.28%	-11.21%	-13.49%	63.92%
Institutional and individual	705	6.72%	-19.24%	-25.96%	65.39%
Individual	296	6.82%	10.55%	3.72%	55.74%
Panel B: Book-to-market and size matched firms					
VC backed	70	-15.51%	-29.91%	-14.40%	60.00%
VC non-backed	857	-5.46%	-11.30%	-5.84%	57.18%
PE backed	55	12.69%	6.05%	-6.63%	52.73%
PE non-backed	872	-7.41%	-13.89%	-6.48%	57.68%
Institutional	280	-6.56%	-14.49%	-7.93%	59.64%
Institutional and individual	434	-7.38%	-22.92%	-15.55%	60.37%
Individual	213	-3.43%	10.45%	13.88%	48.36%

perform better than those with high individual holdings. As stated by the authors, "institutions have connections to venture capitalists and underwriters, and they are invited to road shows where they can obtain firm- and offer-specific information." It should be emphasized, that they study only IPOs that had large portion of institutional holdings at least a month after the issue in order to avoid investments meant to be flipped[29] in the initial aftermarket. Interestingly, Table 11 shows that

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[29] Flipping refers to buying the shares at the offer price and selling them in the immediate aftermarket to benefit from the higher price.

irrespective of the benchmark, IPOs that were available only to individual investors do not only perform better than the other two groups, but manage to realize positive abnormal returns – 3.72% against the size-matched firms and 13.88% for the other sample. The last column of the table also supports the finding that firms offered only to individuals perform better by indicating a lower share of underperforming companies for this group. While the reported outperformance of the IPOs available only to individual investors remains puzzling, the long-run underperformance is evident in all of the other groups, although with differences in the magnitude.

4.2.7 Regression results

To conclude, Table 13 presents the results of the following multiple regression:

$$\text{BHR}_i = \alpha + \beta_1 lnSize_i + \beta_2 IR_i + \beta_3 lnAge_i + \beta_4 Volume_i + \beta_5 PE_i + \beta_6 VC_i + \beta_7 Institution_i + \beta_8 NewEconomy_i + \varepsilon_i \,,$$

where BHR_i is the 3-year buy-and-hold return of IPO i, $lnSize_i$ is the natural logarithm of the market value at the time of the issue, IR_i is the initial return, $lnAge_i$ is the natural logarithm of 1 + the age of the company at the time of the issue, and Volume indicates the number of IPOs held in the year of issue of company i. PE, VC, Institution, and NewEconomy are dummy variables taking value of 1 if the IPO is private-equity- or venture-capital-backed, the issue is available to institutional investors, and it belongs to the high technology, healthcare, media and entertainment, and telecommunications sectors, or 0 otherwise. The regression does not cover the full number of companies included in the sample due to several reasons. First, not all of the IPOs stayed listed for the full 3-year period. Additionally, the year of founding needed for the estimate of the company's age at the time of going public was missing in the two databases used (Thomson One and Datastream). Finally, two companies are excluded from the regression due to unrealistic estimates of their initial returns[30]. Thus, the total number of IPOs included in the regression is reduced to 1089. A summary of the expected signs of the regression coefficients is presented in Table 12. It should be noted that the expectations are based on the findings of this study, not on the overall IPO literature.

The R-squared of the regression, as reported in Table 13, indicates that only around 10% of the variability of the 3-year buy-and-hold return is explained by the 8 independent variables. In general, the results are in support of the implications from the tables presented in the previous sections of

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[30] The two companies have initial returns of 2684% and 5099%. These values are considered to be caused by data mismatches.

this chapter. Size of the company, initial return, annual volume of issuance, venture-capital-backing, availability to institutional investors are factors which demonstrate a negative relation with the long-run share price performance of the IPOs. Additionally, firms from the new economy sector also report a negative relation with the aftermarket returns. However, not all of these coefficients are

Table 12: *Regression coefficients expectations*

The expected signs of the independent variables are based on the cross-sectional patterns reported by far in this study.

Variable	Expected sign	Hypothesis
$lnSize_i$	-	With the exception of the largest IPOs in terms of market capitalization at time of issuing, the well-known small firm anomaly seems to be also present on the IPO market of Continental Europe and suggests a negative relation between company size and its long-run performance.
IR_i	-	Consistent with the fads hypothesis, the high initial returns caused by investor overoptimism are corrected buy the market in the long-run, resulting in the negative relation between the initial under-pricing and the 3-year performance.
$lnAge_i$	+	More mature companies have reliable business models, generating stable cash flows which in turn should result in a fair offer price. Moreover, these companies should not be affected by fads, further contributing to the positive relation between the IPO's age and its long-run return.
$Volume_i$	-	According to the "hot" markets literature, high issue years are characterized by high initial returns and generally higher stock prices on the markets. On the other hand, the market timing (windows of opportunity) hypothesis suggests that managers time the IPOs of their companies when investors are willing to pay higher prices as it is the case during the "hot" periods. Later, these higher prices get corrected in the aftermarket, resulting in a negative relation between the yearly number of IPOs and the long-run performance.
PE_i	+	Private-equity firms have a positive effect on the overall business of the backed companies which is reflected in their share prices, resulting in a positive relation between the aftermarket performance and the presence of private equity in the issuing firm.
VC_i	-	Venture capitalists might be able to successfully exploit investor sentiment by timing the backed IPOs in times when the market is overvalued, resulting in a negative relation between the venture-capital-backing and the long-run returns.
$Institution_i$	-	Institutions might initially invest in IPOs just to flip them in the aftermarket. The IPO flipping should be more profitable in times of high valuations which explains the negative relation between the long-run IPO performance and its availability to institutional investors.
$NewEconomy_i$	-	The New Economy sectors comprise younger, high growth companies, which are easily affected by fads. The failure to meet the overoptimistic initial expectations about these firms affects adversely their share prices, resulting in a negative relation with the long-run performance.

significant at the 5% level[31]. Only the initial return, annual volume of issuance, and VC-backing are significantly and negatively related to the 3-year BHR. For instance, the results indicate that the venture-backed IPOs are expected to underperform the non-venture issues by 27 percentage points. In Appendix C, the volume variable is replaced by a dummy indicating whether the IPO was held in a "hot" year as defined in section 4.2.3. The coefficient is again statistically significant and shows a severe underperformance of the companies issued in "hot" years relative to IPOs held in low issue years.

Table 13: *Regression results*

$$\text{BHR}_i = \alpha + \beta_1 lnSize_i + \beta_2 IR_i + \beta_3 lnAge_i + \beta_4 Volume_i + \beta_5 PE_i + \beta_6 VC_i + \beta_7 Institution_i$$
$$+ \beta_8 NewEconomy_i + \varepsilon_i,$$

where the dependent variable is winsorized at the 1st and 99th percentile and the independent variables are the natural logarithm of the market value at the time of the issue, the initial return, the natural logarithm of 1 plus the age at time of the issue, the number of IPOs held in the year of issue of company i, and dummy variables indicating if the IPO is backed by a private equity or venture capital firm, if the issue is available to institutional investors and if it belongs to the high technology, healthcare, media and entertainment, and telecommunications sectors. Robust t-statistics are provided in parenthesis following the procedure of White (1980).

				Panel A: Coefficients					
Intercept	*lnSize*	*IR*	*lnAge*	*Volume*	*PE*	*VC*	*Institution*	*NewEconomy*	*R^2*
0.530	-0.029	-0.160	0.101	-0.003	0.096	-0.270	-0.053	-0.106	0.102
(2.46)	(-1.67)	(-4.41)	(3.70)	(-6.26)	(0.74)	(-2.69)	(-0.52)	(-1.46)	

	Panel B: Summary statistics		
Variables	*Mean*	*Median*	*Standard deviation*
BHR$_i$	-0.107	-0.435	1.094
lnSize	11.382	11.268	1.711
IR	0.178	0.030	0.489
lnAge	2.582	2.565	1.107
Volume	143.130	120	90.885
PE	0.041	0	0.198
VC	0.059	0	0.235
Institution	0.791	1	0.407
NewEconomy	0.473	0	0.499

On the other hand, the age of the company at the time of issue and the private-equity-backing have a positive effect on the long-run performance, even though the latter coefficient is not statistically significant. Therefore, the results indicate that the long-run aftermarket performance increases with the age of the firm, confirming the clear pattern reported in Table 10. A correlation matrix is

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[31] The presented t-statistics are corrected for heteroskedasticity using the method of White (1980).

provided in the appendix to shed some further light on the relationships between the studied variables.

5 Conclusion

This thesis examines the long-run IPO performance in Continental Europe. To do so, the performance is measured using two different return metrics over different investment horizons, the longest of which is 36 months, and the Continental European market is represented by the markets of France, Germany, Italy, Spain, and Sweden. The IPO returns are estimated against two different benchmarks: similar size matching firms and matching firms with similar size as well as book-to-market ratio, in order to provide more reliable results. Furthermore, the thesis identifies several offer characteristics which are able to indicate the 3-year performance of the IPOs. Instead of focusing on individual countries, this study provides a general picture of the market of Continental Europe – a topic on which the current academic literature is limited.

The empirical analysis is based on 1522 IPOs held on the markets of the aforementioned five European countries over the period January 1992 – June 2012. However, the sample which is based on size and book-to-market matching includes fewer observations (978) due to missing data about the book value of equity and the lack of appropriate matching firms. The number of observations in the cross-sectional and regression analysis is further slightly reduced due to delisting of some of the IPOs before the end of the third year in the aftermarket. Due to the lack of the year of founding of some IPO companies, the observations in the regression analysis are further reduced to 1089.

Consistent with the long-run initial public offerings literature, the 3-year abnormal returns indicate that when purchased at the closing price of the first day of trading, the IPOs underperform their benchmarks irrespective of the return metric. The cumulative average abnormal return has a value of -19.23% against the size-matched firms and -11.37% against the similar size and book-to-market companies. The estimates for the buy-and-hold abnormal returns are -16.1% and -6.49% respectively. However, the results should be interpreted with cautiousness since when the book-to-market effect is considered together with the size of the company they become significant only at the 10% or lower (in the case of the CAAR) level. On the other hand, all of the results demonstrate that the IPOs tend to realize superior returns over the first year, after which the performance starts to deteriorate. So, holding IPOs over shorter horizons might result in a profitable strategy.

Next, the 3-year IPO performance was studied by different offer characteristics including: the size (market capitalization) of the company at the time of the IPO, realized initial return, firm age at the time of going public, IPO activity during the issuing year, firm's industry, private-equity- and venture-capital-backing, and availability of the offer to institutional investors. The results indicate a

marginally significant negative relation between firm size and the long run performance. However, the largest group of IPOs which comprises firms with market values exceeding one billion euro at the time of the offer is an exception of that notion by realizing the best returns over the 3-year investment horizon compared to the other six size groups.

Highly significant negative relations with the long run share price performance of the IPOs are reported with the initial return, the yearly IPO activity, and the presence of venture capital in the firm's structure. The companies with the highest initial returns, measured from the offer price to the closing price of the first day of trading, tend to fare the worst over the long-run. The results also reveal clearly defined "hot" and "cold" periods on the IPO market of Continental Europe. The reported long-run underperformance seems to be driven by the high volume years, whereas the IPOs issued during "cold" markets in general realize positive abnormal returns. In general, venture capital seems to have a negative effect on the long-run share price performance. Although still underperforming, the non-backed companies have outperformed the backed firms by a substantial amount.

The only factor with statistically significant positive effect on the 3-year IPO performance is the age of the company. Moreover, the most mature companies in the sample have realized highly positive abnormal returns demonstrating superior performance over their benchmarks. Thus, together with the foregoing three relationships, the empirical evidence of this study is consistent with the presence of fads on the IPO market of Continental Europe caused by the overoptimistic investor expectations about the growth prospects of the issuing firms. Later, the inflated by these expectations prices get corrected in the aftermarket, resulting in the reported underperformance. In line with the market timing/windows of opportunity hypothesis, it seem that managers (and venture capitalists) are successfully able to time the IPOs of their companies in periods when investors are willing to pay high price multiples.

The study has also reported some interesting patterns which require additional examination. First, as Table 8 clearly demonstrates that in the majority of the cases IPOs issued in low issue periods realize positive abnormal returns, it would be worthwhile to further study whether investing in "cold" period IPOs is a reliable strategy of generating positive abnormal returns. The fact that IPOs which are available exclusively to individual investors not only outperform the ones which are available to institutions, but also realize positive abnormal returns is another puzzle, requiring further attention. Furthermore, the thesis is limited by the included variables. For instance, another factor that can serve as an indicator of long-run IPO performance is the underwriter quality.

To conclude, it should be not forgotten that the presented return estimates are about the average IPO, meaning that some companies underperform over the long-run whereas others realize positive abnormal returns. A thorough analysis of each company should be able to give much more insights about its future prospects and the findings of this thesis provide useful insights in that direction.

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APPENDIX A: Descriptive statistics for the average buy-and-hold abnormal returns (BHARs) over different horizons

The following tables are directly extracted from Stata13. The outputs show different percentiles, the four largest values, the four smallest values and some additional statistics. As can be clearly seen, winsorizing comes as necessity to deal with the extreme outliers. Therefore, the BHARs in the results section of the study are estimated via winsorized buy-and-hold returns of the IPOs and their matching firms (the BHAR is the difference between the BHRs of the two groups). The presented tables are about the sample with the matched on size firms serving as benchmark. The situation with the sample with the second benchmark is similar.

6-month BHAR				
	Percentiles	Smallest		
1%	-1.419	-6.944		
5%	-0.702	-4.370		
10%	-0.532	-2.973		
25%	-0.267	-2.749	Obs.	1520
50%	0.000		Mean	0.154
		Largest	Std. Dev.	0.972
75%	0.302	7.253		
90%	0.903	7.649		
95%	1.635	8.972		
99%	3.980	10.421		

12-month BHAR				
	Percentiles	Smallest		
1%	-2.530	-5.429		
5%	-1.070	-4.799		
10%	-0.825	-4.108		
25%	-0.412	-3.501	Obs.	1513
50%	-0.018		Mean	0.236
		Largest	Std. Dev.	1.753
75%	0.429	14.066		
90%	1.190	19.832		
95%	2.372	26.165		
99%	6.490	28.985		

18-month BHAR				
	Percentiles	Smallest		
1%	-2.817	-7.408		
5%	-1.357	-5.707		
10%	-0.996	-5.453		
25%	-0.555	-4.475	Obs.	1498
50%	-0.112		Mean	0.205
		Largest	Std. Dev.	2.933
75%	0.378	19.287		
90%	1.201	30.819		
95%	2.276	34.658		
99%	8.819	82.861		

24-month BHAR				
	Percentiles	Smallest		
1%	-3.287	-11.476		
5%	-1.605	-7.562		
10%	-1.152	-5.951		
25%	-0.644	-5.060	Obs.	1468
50%	-0.146		Mean	0.105
		Largest	Std. Dev.	3.348
75%	0.353	13.242		
90%	1.176	21.132		
95%	2.458	41.328		
99%	6.490	105.635		

30-month BHAR				
	Percentiles	Smallest		
1%	-3.513	-8.765		
5%	-1.698	-8.193		
10%	-1.250	-6.721	Obs.	1440
25%	-0.686	-5.878		
50%	-0.194		Mean	0.074
		Largest	Std. Dev.	6.087
75%	0.290	16.001		
90%	0.980	20.710		
95%	1.950	26.423		
99%	5.511	222.386		

36-month BHAR				
	Percentiles	Smallest		
1%	-3.915	-15.164		
5%	-1.809	-7.472		
10%	-1.295	-6.648	Obs.	1414
25%	-0.801	-6.365		
50%	-0.238		Mean	0.003
		Largest	Std. Dev.	4.644
75%	0.245	19.933		
90%	1.047	23.376		
95%	1.992	55.656		
99%	4.885	153.086		

APPENDIX B: Descriptive statistics for the average 3-year buy-and-hold returns (BHRs) of the IPOs and their matching firms

Again, the presented tables are about the sample with the matched on size firms serving as benchmark. The situation with the sample with the second benchmark is similar.

3-year BHR of the size-matched firms				
	Percentiles	Smallest		
1%	-0.986	-1.000		
5%	-0.881	-0.999		
10%	-0.777	-0.999	Obs.	1414
25%	-0.485	-0.998		
50%	-0.110		Mean	0.074
		Largest	Std. Dev.	0.965
75%	0.345	5.836		
90%	0.987	7.151		
95%	1.646	7.347		
99%	3.722	15.280		

3-year IPO BHR				
	Percentiles	Smallest		
1%	-0.996	-1.000		
5%	-0.975	-1.000		
10%	-0.938	-0.999	Obs.	1414
25%	-0.792	-0.999		
50%	-0.435		Mean	0.077
		Largest	Std. Dev.	4.610
75%	0.123	20.205		
90%	0.981	22.925		
95%	2.085	55.579		
99%	5.711	154.923		

APPENDIX C: Re-estimated regression from section 4.2.7 using a dummy variable indicating whether the IPO was held during a "hot" year instead of the actual number of companies that went public during the year

Regression results

$$\text{BHR}_i = \alpha + \beta_1 lnSize_i + \beta_2 IR_i + \beta_3 lnAge_i + \beta_4 Hot_i + \beta_5 PE_i + \beta_6 VC_i + \beta_7 Institution_i$$
$$+ \beta_8 NewEconomy_i + \varepsilon_i,$$

where the dependent variable is winsorized at the 1st and 99th percentile and the independent variables are the natural logarithm of the market value at the time of the issue, the initial return, the natural logarithm of 1 plus the age at time of the issue, and dummy variables indicating if the IPO is held during one of the "hot" years in the sample period, if it is backed by a private equity or venture capital firm, if the issue is available to institutional investors, and if it belongs to the high technology, healthcare, media and entertainment, and telecommunications sectors. Robust t-statistics are provided in parenthesis following the procedure of White (1980).

				Panel A: Coefficients					
Intercept	**lnSize**	**IR**	**lnAge**	**Hot**	**PE**	**VC**	**Institution**	**NewEconomy**	**R^2**
0.58	-0.03	-0.18	0.09	-0.49	0.16	-0.16	-0.13	-0.15	0.109
(2.73)	(-1.89)	(-4.70)	(3.26)	(-6.62)	(1.31)	(-1.73)	(-1.36)	(-2.19)	

APPENDIX D: Correlation matrix of the independent variables from section 4.2.7.

Correlation matrix of the independent variables used in the regression from section 4.2.7.

	lnSize	**IR**	**lnAge**	**Hot**	**PE**	**VC**	**Institution**	**NewEconomy**
lnSize	1							
IR	0.005	1						
lnAge	0.174	-0.137	1					
Volume	0.100	0.217	-0.173	1				
PE	0.131	-0.039	0.072	-0.107	1			
VC	0.033	-0.041	-0.061	-0.091	0.067	1.000		
Institution	0.041	0.084	-0.140	0.416	-0.024	0.020	1	
NewEconomy	-0.074	0.094	-0.276	0.246	-0.020	0.118	0.140	1