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The long-run underperformance of Initial Public Offerings

Author: Boy van Reede
Student number: 387096

Supervisor: Dr. Maurizio Montone

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Preface and Acknowledgement

I would like to thank my supervisor Dr. Maurizio Montone, for his time, valuable suggestions, and comments.

Abstract

This thesis examines the long-run performance of initial public offerings in the US and the Netherlands market. I provide results using the same IPOs for both, event- and calendar-time long-run performance. Moreover, the results are from periods that are more recent. I conclude that there is a long-run underperformance of IPOs relative to their matched firms of -41.51% for a 5-year holding period in 2000-2011 using cumulative average adjusted returns. For IPOs in the Netherlands, the underperformance is -28.80% for a 3-year holding period. Although, this result is not conclusive. The United States buy-and-hold abnormal returns provide evidence that support the fads and overoptimistic investors as explanations for the long-run underperformance of IPOs. The calendar time abnormal returns give results that support the market timing hypothesis as an explanation for the long-run underperformance of IPOs. Moreover, matching on industry and size or industry and book-to-market both result in an underperformance of IPOs.

Keywords: Initial Public Offerings, long-run performance, long-run event studies, sentiment

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1. Introduction

The long-run underperformance of Initial Public Offerings (IPOs) is a well-documented phenomenon during the last decades. Researchers like, Ritter (1991), Loughran and Ritter (1995) and Carter, Dark and Singh (1998) reports this phenomenon. Numerous published articles are based upon on the results found by those researchers, talking about the danger of buy-and-hold investing in IPOs. The articles stated before, use data from IPOs in the United States, but there are also researchers, like Levis (1993), Loughran, Ritter and Rydqvist (1994), Lee, Taylor and Walter (1996) and Stehle, Ehrhardt and Przyborowsky (2000), who find evidence of an international long-run underperformance of IPOs.

However, there are also researchers who criticize the conclusion of a long-run underperformance of IPOs. For example, Brav and Gompers (1997) and Corwin and Schultz (2003). Brav and Gompers show that the stock of firms that go public perform the same or even better as their benchmark matched firms based on size and book-to-market ratio. In addition, Corwin and Schultz argues that event-time return analyses may not be the correct way to analyze the long-run performance of IPOs. The aforementioned articles often use event-time long-run returns.

This means that there is still a debate is about the long-run stock (under)performance of initial public offerings, both in the US and non-US market. Therefore, in this paper, I analyze the long-run performance of initial public offerings in the US and the Netherlands market.

If the stock market is efficient, there should be a neutral abnormal performance of stocks after firm-specific events, like an IPO, once the event-related activities have been fully completed (Stehle, Ehrhardt and Przyborowsky, 2000). This is why there should be no under- or outperformance of IPOs at all.

Nevertheless, to clarify if there really is a long-run underperformance of initial public offerings, I examine IPOs during 1975-1984 and 2000-2011 on the US market and 1990-2011 for the Netherlands market. I use two different long-run event study approaches. Namely, the event-calendar-time long-run performance. The event-time is divided into the cumulative average adjusted returns and the buy-and-hold abnormal returns. For the calendar-time approach, I use the calendar-time abnormal returns to make different regression. For the event-time approach, I compute different lengths of the event, a 3- and 5-year event study. Moreover, I calculate the returns using different matched firm samples. I compute the samples by matching on industry and size, and industry and book-to-market.

This thesis will contribute to existing literature. Although this study of the long-run performance of IPOs is not providing a new methodology, nor a new theory. I will examine a new,

more recent time-period and use the same sample of IPOs to calculate two different long-run performance approaches. In addition, I hope to find conclusive results for the Netherlands IPO long-run performance. Van Gelderen & Huij (2014) states that it is important that empirical evidence withstand a significant number of attempts of falsification before investment strategies are engineered that incorporate this knowledge. Thus, an additional study of the long-run performance of initial public offerings will add to the robustness of the prior studies.

The results this thesis finds provide evidence for a long-run underperformance of initial public offerings in the United States and the Netherlands. However, the findings of the Netherlands are not conclusive results. A strategy of investing in US-traded IPOs at the end of the first day of public trading and holding them for 5 years would have left the investor with only 76 cents relative to a dollar invested in a group of matched firms in the period 1975-1984 using buy-and-hold abnormal returns. Moreover, I find a wealth relative of 0.902 for the period 2000-2011, suggesting that the investor only got 90 cents relative to a dollar invested in a group of matched firms. The matched firms are this case matches on industry and size. The industry and book-to-market matched firm cumulative average adjusted return is -27.41% and -23.49% for the periods 1975-1984 and 2000-2011, respectively. Concluding that both matching firm characteristics provide evidence for a long-run underperformance of IPOs. Moreover, the calendar-time abnormal returns provide me with a significant negative alpha for an equally-weighted risk free-adjusted IPO portfolio of -6.335% for the period 1976-1987 and the same portfolio during 2000-2010 provide me with an alpha of -1.524%, which adds to the robustness of the results found using event-time long-run returns.

The structure of this thesis is as follows. The academic literature part provides a review of previous studies about the long-run performance of IPOs. Thereafter, I describe the data and methodology used in this research. The results part discusses the results and draw conclusions using these results. Finally, I give the conclusion and suggestions for further research about the long-run performance of IPOs.

2. Literature review

2.1 The long-run performance of IPOs in the United States

Ibbotson (1975) is one of the earliest studies about the initial return and long-run performance of initial public offerings (measured by risk-adjusted returns) on the stock market during the 1960s. Nowadays, studies show that the aftermarket stock performance does not support the efficient market hypothesis, Ibbotson finds results that are generally consistent with aftermarket efficiency.

However, there are some interesting patterns in his findings. He selects one offering at random for each month during January 1960 through December 1969 from the universe of unseasoned SEC registered offerings. The aftermarket performance is estimated for a period up to sixty months after the IPO. His results for both one and six-month holding periods[1] reports in the first year a positive stock price performance, in the next three years his results show a negative aftermarket performance. The last year of his research, the fifth year, reports again a positive performance of initial public offerings in the aftermarket. These results are generally insignificant due to the high standard errors of his estimates. Only the first year gives significant different results from zero. Although, including the initial return to the aftermarket performance, gives only positive performance for a holding period up to five years.

Aggarwal and Rivoli (1990) is one of the first studies that reports a significant aftermarket underperformance of IPOs relative to the NASDAQ index for the period 1977 to 1987 for 1598 IPOs. However, they examine only a 1-year long-run performance. The average NASDAQ-adjusted return is estimated at -13.71% and -5.45% for investing at first day closing price and at the offer price, respectively. This shows that their results support underpricing for the short-run performance and suggests that the long-run performance might be explained by the presence of 'fads' on the IPO stock market. Due to temporary overvaluation caused by over-optimistic investors there is a short-run underpricing of IPOs, shortly after this the overvaluation is corrected and the long-run returns become negative.

One year later, Ritter (1991) reports a 3-year underperformance of IPOs relative to a matched firm sample on industry and size, for the period 1975 through 1984. The cumulative average adjusted return of 1526 IPOs is -29.13%, whereas he also adjusted to different benchmarks. These benchmark-adjusted returns differ quite some, showing that choosing the benchmark is an important task is in long-run performance studies. The underperformance is also present when buy-and-hold abnormal returns are calculated. As Aggrawal and Rivoli (1990), the results of Ritter show support for the fads explanations of the long-run underperformance of IPOs. Moreover, his empirical findings provide support for two other possible explanations of the long-run underperformance, overreaction and the market timing hypotheses. The market timing hypothesis explains the negative relation between the aftermarket performance and the number of issues per year. Thus, a high volume of issues in a year suggests a lower aftermarket performance than a year with a low number of IPO issues.

[1] One-month holding period refers to any month between 1 and 60. Whereas six-month holding period is 1 – 6, 7 – 12, etc.

Loughran and Ritter (1995) documents a 5-year underperformance of 4753 IPOs during 1970 to 1990. The annual performance shows consistency with the findings of Ibbotson (1975), the underperformance decrease in the fifth year and is statistically not significantly different from zero. The results also support the market timing hypothesis, where companies issue equity when the market is willing to pay higher prices.

Carter, Dark and Singh (1998) find that the underperformance of IPOs relative to the market over a 3-year holding period is less severe for IPOs handled by underwriters that are more prestigious. This is the first academic work that documents the relation between the long-run performance of IPOs and underwriter reputation.

Nevertheless, there are studies that criticize the long-run underperformance of initial public offerings. Brav and Gompers (1997) and Brav, Geczy and Gompers (2000) provide evidence that the aftermarket underperformance of IPOs is not solely created by the fact that it is an IPO. Another explanation for the underperformance could be the fact that most IPO firms have low book-to-market ratios. The findings of the two studies show that the returns, adjusted with a portfolio of matched firms on size and book-to-market ratio, are positive, suggesting an outperformance of the IPO portfolio relative to the benchmark. Furthermore, the findings show that the value-weighted portfolio returns are lower in magnitude of possible under- or outperformance, indicating that the results are sensitive to the selected weighting method.

Another reason to criticize the long-run underperformance of IPOs is the used long-run event-time study approach in most aforementioned studies. Mitchell and Stafford (2000) and Lyon, Barber and Tsai (1999) advocate to use the calendar-time approach to examine the long-run performance of event studies. I discuss the advantages and disadvantages of this approach later on in the thesis.

2.2 The long-run performance of IPOs on international markets

Finn and Higham (1988) is one of the first international studies on long-run performance of IPOs. They find a positive initial return followed by an aftermarket underperformance on the Australian market. The study examines the joint process of initial-issue-cum-listing of 93 issues during the period 1966 to 1978. The one-year aftermarket market-adjusted return results in a significant mean return of -6.52%.

Levis (1993) documents the long-run performance of IPOs on the United Kingdom market during 1980 to 1988. He finds significant negative cumulative abnormal returns for a 3-year holding period excluding the first month of trading. The returns are adjusted using three different benchmarks. The FTA benchmark-adjusted return is -11.38%. However, including the first month,

show findings that the IPOs outperform two out of three used benchmarks; only the all share benchmark-adjusted long-run performance stays negative. The results suggest a relation between the initial return and the aftermarket performance. These findings are consistent with the overreaction or over optimism of investors at the time of offering. The aftermarket performance is the worst for firms that have the highest initial returns.

In 1993, there was another study published about the long-run performance of IPOs on international markets. Aggarwal, Leal and Hernandez (1993) observe the aftermarket performance of IPOs on the market of Brazil, Chile and Mexico during the 1980s. However, the authors note that the results should be interpreted with caution due to the small size of the samples and because they are emerging markets. Nevertheless, the findings support evidence for a long-run underperformance phenomenon across the three countries relative to local market indices. Moreover, the results in Brazil suggest the presence of overoptimistic investors, because the IPO firms that have the highest initial return perform the worst in the end.

Loughran, Ritter and Rydqvist (1994) discuss findings of short- and long-run performance of companies going public in many countries. They report results that provide evidence for a relation between market timing and long-run performance of IPOs. In 14 of the 15 countries examined, they find evidence of this. Periods of high volume of IPO issues seem to be associated with lower long-run performance. However, the conclusions are tentative in nature. For the Netherlands during 1982-1991, they only report an initial return of 7.2%. This initial return is one of the lowest initial returns found in their study.

A study geographically close to the Netherlands about the long-run performance of IPOs is one of Stehle, Ehrhardt and Przyborowsky (2000). They estimate the long-run stock performance of IPOs and seasoned equity offerings in Germany. The average buy-and-hold return of an IPO or SEO underperforms a matched firm sample, on size, by 6% in three years. This is considerably less than the underperformance reported by previous studies. A possible explanation for this could be the portfolio of both IPO and SEO firms. Additionally, they conclude that size portfolio and matched firms are better benchmarks than market indices for measuring the long-run performance of IPOs.

There is also evidence for a long-run underperformance of IPOs on the French stock market. Leleux and Muzyka (1998) report a 3-year cumulative abnormal return of -29.2% for 56 IPOs during 1987-1993.

3. Data and methodology

The section data and methodology, describes the data and methods used to draw conclusions about the long-run performance of initial public offerings.

I use three samples: two US market samples of different periods and a sample of the Netherlands market. The United States samples are divided into the periods: 1975-1984 (which is in accordance with Ritter (1991), because I extend Ritter's 3-year holding period to a 5-year holding period) and 2000-2011. The sample of the Netherlands comprise the period: 1990-2011, this period is longer than the US sample because there are less IPOs in the Dutch market. I extend the period to get a greater amount of observations of IPOs in the Netherlands.

An US IPO needs to meet the following criteria to get into the sample. First, an offer price of $1.00 per share or more. Second, the amount of gross proceeds, measured in terms of 1984 and 2011 purchasing power, needs to be more than $1,000,000. Moreover, the public states before going public is private. Additionally, the company is listed within 6 months on the CRSP daily AMEX-NYSE or NASDAQ. Finally, the offering technique is firm commitment or best efforts. Firm commitment means that an underwriter purchases the entire IPO issue from the firm with the intention of selling it to investors. Best efforts is an agreement with the underwriter to provide its 'best efforts' to sell between some prespecified minimum and maximum number of shares. Both techniques involve an underwriter managing the IPO.

Table 1: Distribution of Initial Public Offerings by Year in the United States, 1975-1984
The total sample of 1,065 IPOs that meet the criteria. Gross proceeds calculations is based upon the amount sold in the United States and calculated through using the offer price and total amount of shares offered at the initial public offering. The 836 sample is a sample with IPOs of which the year of founding available is. The founding years are collected from Ritter's website. No price-level adjustments made in this table.

	Total of 1,065 IPOs sample		836 IPOs sample		1,065 sample	
Year	No. of IPOs	Aggregate gross proceeds, $ millions	No. of IPOs	Aggregate gross proceeds, $ millions	No. of IPOs %	Aggregate gross proceeds %
1975	2	37.1	2	37.1	100	100
1976	21	179.9	19	167.7	90.5	93.2
1977	21	128.2	17	120.3	81.0	93.8
1978	18	152.2	18	152.2	100	100
1979	42	303.4	37	275.4	88.1	90.8
1980	80	837.0	51	666.7	63.8	80.0
1981	197	1,839.6	129	1,416.5	65.5	77.0
1982	69	913.3	51	726.1	73.9	79.5
1983	414	6,785.4	359	6,505.8	86.7	95.9
1984	201	1,786.2	153	1,521.9	76.1	85.2
Total	1,065	12,962.3	836	11,589.7	78.5	89.4

The initial public offerings in the Netherlands matches the following criteria: first, an offer price of €1.00 per share or more. Moreover, the amount of gross proceeds, measured in terms of 2011 purchasing power, needs to be more than €1,000,000. Furthermore, the firm public states before going public is private. Lastly, the company listed within 6 months on the Euronext Amsterdam.

As Table 1 and 2, this leads to a sample of 1,065 and 1,439 IPOs during the period 1975-1984 and 2000-2011, respectively. In addition, in the Dutch market, 49 IPOs meet the criteria described before; see Table 3 for the distribution per year. I gather the IPO firms from the ThomsonOne database.

Table 2: Distribution of Initial Public Offerings by Year in the United States, 2000-2011

The total sample of 1,439 IPOs meet the criteria. Gross proceeds calculation is based upon the amount sold in the United States and calculated through using the offer price and total amount of shares offered at the initial public offering. The 1,086 sample is a sample with IPOs of which the year of founding available is. The founding years are collected from Ritter's website. No price-level adjustments made in this table.

	Total of 1,439 IPOs sample		1,086 IPOs sample		Percentage of 1,439 sample	
Year	No. of IPOs	Aggregate gross proceeds, $ millions	No. of IPOs	Aggregate gross proceeds, $ millions	No. of IPOs %	Aggregate gross proceeds %
2000	238	23,860	234	23,660	98.3	99.2
2001	83	15,370	49	8,274	59.0	53.8
2002	122	21,010	50	6,333	41.0	30.1
2003	80	25,680	55	9,156	68.8	35.7
2004	183	36,150	126	16,150	68.9	44.7
2005	157	34,320	112	17,970	71.3	52.4
2006	147	29,050	123	20,030	83.7	69.9
2007	173	51,660	129	26,140	74.6	50.6
2008	21	23,620	17	22,800	81.0	96.5
2009	45	12,300	35	10,330	77.8	84.0
2010	97	16,370	83	13,180	85.6	80.5
2011	93	25,680	73	22,290	78.5	86.8
Total	1,439	315,070	1,086	196,313	75.5	62.3

To examine the long-run performance of initial public offerings in the different samples, three measures are used: (1) 3- and 5-year buy-and-hold returns for both the IPOs and matching firms, the procedure to get the matched firms is explained later on. The buy and hold returns are event-time returns, this technique weighs months equally, even though offerings cluster in time. (2) 3- and 5- year cumulative average adjusted returns with event-time returns using the matched firm returns as benchmark. (3) A calendar-time portfolio approach that tracks the performance of an event portfolio in calendar time relative to explicit an asset-pricing model. In addition, a

sentiment variable will control for investor's sentiment, and possibly for the offer clustering in time.

Table 3: Distribution of Initial Public Offerings by Year in the Netherlands, 1990-2011
The total sample of 49 IPOs meet the criteria's. Gross proceeds calculation is based upon the amount sold in the Netherlands and calculated through using the offer price and total amount of shares offered at the initial public offering. No price-level adjustments made in this table.

Year	No. of IPOs	Aggregate gross proceeds, € millions
1994	1	100.0
1995	3	1,482.5
1996	3	1,648.3
1997	2	664.3
1998	12	1,367.8
1999	7	501.9
2000	7	1,106.0
2005	3	777.6
2006	5	1,384.4
2007	4	524.8
2008	1	1,100.6
2011	1	264.9
Total	49	10,923.1

To examine the long-run performance of initial public offerings in the different samples, three measures are used: (1) 3- and 5-year buy-and-hold returns for both the IPOs and matching firms, the procedure to get the matched firms is explained later on. The buy and hold returns are event-time returns, this technique weighs months equally, even though offerings cluster in time. (2) 3- and 5- year cumulative average adjusted returns with event-time returns using the matched firm returns as benchmark. (3) A calendar-time portfolio approach that tracks the performance of an event portfolio in calendar time relative to explicit an asset-pricing model. In addition, a sentiment variable will control for investor's sentiment, and possibly for the offer clustering in time.

For the first two measures, I use two intervals to compute the returns: the initial period and the aftermarket period. The initial period defines the offering date to the first trading price listed on the CRSP or Datastream daily return data; this period is typically 1 day. For the aftermarket period, the buy-and-hold returns are calculated using Ritter (1991) approach of aftermarket returns.

The aftermarket period defines the 3 or 5 years after the IPO exclusive the initial return period. This means an event-study of 36 or 60 months relative to the IPO date. A month is determined by 21-trading-day periods corresponding to the IPO date. Thus, if the initial period is 1 day, month 1 consists of event days 2-22 and month 2 consists of event days 23-43, etc. If the initial period is greater than 1 day, month 1 is abridged. For example, the initial period of the IPO is 10 days, this means that month 1 is event days 11-22 and month 2 consists again of event days

23-43. The aftermarket period also cuts short, if the IPO delists before its 3- or 5-year anniversary, the cumulative average adjusted or buy-and-hold return then ends with the last listing date.

3.1 Event-time long-run performance

3.1.1 Buy-and-Hold Abnormal Returns (BHARs)

Buy-and-hold abnormal returns measures the average multiyear return from a strategy of investing in all firms that complete an event, like an IPO, until the end of a 3 or 5-year holding period versus a comparable strategy using similar characteristics nonevent firms.

The formula to calculate the BHARs is:

$$\text{BHAR}_i = \prod_{t=1}^{T}(1 + R_{ipo,t}) - \prod_{t=1}^{T}(1 + R_{matched\ firm,t}) \quad (1)$$

Where ipo, stands for the IPO firm, T represents the total number of months (36 or 60 months), t states the event month and R is the return in a specific month.

Another way to compare the returns of the IPO firm and the matched firm is computing a performance measure, the *wealth relative*, which is defined as

$$WR = \frac{1 + \text{average buy and hold return on IPOs}}{1 + \text{average buy and hold return on matched firms}} \quad (2)$$

When the *wealth relative* is greater than 1.00, the variable interprets the IPOs outperforming a portfolio of matched firms. A *wealth relative* of smaller than 1.00 interpret the portfolio of IPOs underperforming the portfolio of matched firms.

Matching procedure

I need matched firms returns to calculate the buy-and-hold abnormal returns, as formula (1) shows. This paragraph explains the matching procedure. The two US samples match on industry and size and industry and book-to-market, and the Dutch sample matches only on size.

For explaining the procedure, I use the matching on industry and size and the period 1975-1984. To select the matched firms, I employ the following procedure: the first step is excluding all IPO firms for 1972 to 1987 (1970-1989) from all firms in the CRSP database. Then the market values of all firms, excluded the IPO firms, of the whole CRSP database are calculated for the dates: December 31st 1974, December 30th 1980 and December 31st 1983. This first step creates a control group from which I select the matched firm. Thereafter, the match starts by matching on the three-digit sic-code of firms going public during 1975-1980 to the control group. Then the firm with the closest market value (December 31st 1974) is the matched firm. A matched firm is only

used once until the IPO firm delist or until the 3 (5) years passes. If there is no match possible on three-digit sic-code, the match is on two-digit sic-code or if necessary on one-digit sic-code, to get a matched firm. For IPOs in the years 1981-1983, the market value on December 30th 1980 controls for size and the market value on December 31st 1983 for matching IPOs in 1984. There is also a possibility that there is a second matched firm needed. This is the situation if the first matched firm delist before the 3- (5-) year anniversary, or before the IPO delist. If necessary, this process is repeated until we have matched firm data for 3 (5) years or until the IPO firm delist. Matching in this way avoids "survivorship bias", regardless of the delist date of the matched firm (even if it is 1 week after matching) it matches to the IPO firm. The matching on industry and book-to-market uses the same method as described before.

For finding the matched firms for the 2000-2011 US IPOs, I use almost the same procedure. Only the dates of controlling for size are different. The IPOs between 2000 and 2002 are controlled by the market value on December 31st 1999, for IPOs from 2003 to 2005 the market value on December 31st 2002 controls for the size. During 2006 through 2008, the market value on December 30th 2005 is of importance and lastly the market value on December 31st 2008 controls for the IPOs between 2009 and 2011.

The procedure of matching the IPOs on the Dutch market is different. Due to the low amount of IPOs and control firms, the match is only done on market size and not on industry. Often, there are only a few publicly traded companies in certain industries. The number of publicly traded Dutch companies is already low; therefore, there is no matching on industry. Ritter and Lourghan (1995) state, firms in an industry can time their offers to take advantage of industry-wide misvaluations. By matching on industry, there is a control on industry effects, which will reduce the ability to identify abnormal performance. Therefore, the Dutch market matches the IPO firms with control firms only on the market value of the firms.

3.1.2 Cumulative Average Adjusted Returns (CARs)

To get the cumulative average adjusted returns (CARs) I need to calculate the monthly-adjusted returns. The raw returns of the IPO firms adjust with the relative matched firms' 21-trading-day period; this is the way to calculate the monthly-adjusted returns. The formula for the matched firm-adjusted returns is:

$$ar_{it} = r_{it} - r_{matched\ firm,t} \quad (3)$$

Where i represents the IPO firms and t, the event month.

The average matched firm-adjusted return on a portfolio of traded IPO stocks (n) is calculated using the following formula:

$$\mathrm{AR}_t = \frac{1}{n}\sum_{i=1}^{n} ar_{it} \tag{4}$$

This is the equally weighted average of the matched firm-adjusted returns.

Finally, I get the cumulative matched firm-adjusted returns from event month k to event month p from aggregating the average matched firm-adjusted returns, which leads to the formula:

$$\mathrm{CAR}_{k,p} = \sum_{t=k}^{p} \mathrm{AR}_t \tag{5}$$

When an IPO firm delists, the return for both the IPO and matched firm includes just the days of the month in which the IPO is still listed. The event-time periods for the CARs are month 1 to 36 and 1 to 60.

3.2 Calendar-time long-run performance

3.2.1 Calendar-Time Abnormal Returns (CTARs)

The Calendar-Time Portfolio Approach is a methodology that accounts for the dependence of event-firm abnormal returns. Fama (1998) and Mitchell and Stafford (2000) strongly advocated this approach. I assemble the portfolio by including all event firms (IPOs) that have completed the event within the prior 36 months and form equally- and value-weighted portfolio for two different periods.

The portfolios rebalance monthly and drop all firms that reach their 3 anniversary and add all firms that completes an initial public offering in the month before creating the portfolio. The portfolio excess returns are regressed on three-factor model of Fama and French (1993) (6), the Carhart (1997) four-factor model (7).

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_p\left(R_{m,t} - R_{f,t}\right) + s_p\mathrm{SMB}_t + h_p\mathrm{HML}_t + e_{p,t} \tag{6}$$

In the Fama and French three-factor model, the variable of interest is: the intercept, α_p. This variable measures the average monthly excess return on the portfolio of event firms adjusted by the risk free rate, which is zero under the null hypothesis of no excess return. Where SMB is the difference between a portfolio of 'small' stocks and 'big' stocks. HML is the difference between a portfolio of 'high' BE/ME stocks and 'low' BE/ME stocks. In addition, $\left(R_{m,t} - R_{f,t}\right)$ is the market risk premium.

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_p\left(R_{m,t} - R_{f,t}\right) + s_p \mathrm{SMB}_t + h_p \mathrm{HML}_t + u_p \mathrm{UMD}_t + e_{p,t} \qquad (7)$$

This Carhart four-factor model is the Fama and French three-factor model plus a momentum variable, UMD, the monthly premium on 'winners' minus 'losers'. In this model the intercept, α_p measures the average monthly excess return and is the variable of interest.

Lastly, the Carhart four-factor model (7) is re-estimated for different states of the Baker and Wurgler's investor sentiment index. The sentiment index is a state-variable, when the average sentiment is high (sentiment >0) or low (sentiment <0) at the beginning of the month, the regressions are re-estimated. The sentiment variable is an average variable of the Baker and Wurgler (2006) variable, of one year prior to the IPO to three years after the portfolio month. This will lead to an average perception of the stock market before and during the issue and holding of an initial public offering stock. Furthermore, this way of using the sentiment variable leads to interpreting the alphas still as risk-adjusted returns.

Stingler (1964) and Ritter (1991) concluded that a manager of a company time their IPO offer to a time of positive perspective of investors. The sentiment index captures the perspective of investors on the market. Controlling for this may lead to different results, and therefore a different conclusion about the long-run performance of IPOs.

The sentiment variable comes from the Baker and Wurgler (2006) article 'investor sentiment and the cross-section of stock returns'. Baker and Wurgler calculate their sentiment variable using different sentiment proxies. These proxies are closed-end fund discount, NYSE share turnover, number of IPOs, average first-day return of IPOs, the share of equity issues in total equity and debt issues and the last proxies for sentiment is the dividend premium. The closed-end fund discount is the average difference between the net asset values (NAV) of closed-end funds shares and their market prices. Previous research suggests that the closed-end fund discount relates inversely to sentiment. Baker and Stein (2004) suggest that turnover can serve as a sentiment index, high turnover suggest an overvaluation. As stated before the IPO market is sensitive to sentiment and that is why the number and average first-day returns on IPOs are included in calculating the sentiment variable. Baker and Wurgler (2000) conclude that high values of the equity share predict low market returns, thus including the share of equity issues gives a better explanation of the sentiment of investors. Finally, the dividend premium is included, because it is a proxy for relative investor demand for dividend-paying stocks. It may be a proxy for the relative demand of a correlated bundle of characteristics: larger, more profitable firms with weaker growth opportunities (Fama and French, (2001))

Table 4 reports the correlation between the coefficients of the regressions. The correlation between the dependent variable: the risk free-adjusted IPO returns and the independent variable is high. Looking at the correlation between the independent variables, it shows that the correlation is lower. The correlation between the independent variables is, of course, the same in the two panels.

Table 4: Correlation Coefficients

Panel A contains equally-weighted portfolios and panel B reports the value-weighted portfolios. $R_{p,t} - R_{f,t}$, is the risk free-adjusted IPO returns. $R_{m,t} - R_{f,t}$ stands for the market risk premium. Where SMB is a size-control variable, the difference between a portfolio of 'small' stocks and 'big' stocks. HML is a book-to-market-control variable, the difference between a portfolio of 'high' BE/ME stocks and 'low' BE/ME stocks. Moreover, UMD is the momentum variable, the monthly premium on 'winners' minus 'losers'. All data is collected from Kenneth-French data's library. The correlation coefficients without parentheses are for the period 1 January 1976 to 31 December 1987. The correlation coefficient in the parentheses are for the period 1 January 2000 to 31 December 2010.

	$R_{p,t} - R_{f,t}$	$R_{m,t} - R_{f,t}$	SMB_t	HML_t
Panel A: equally-weighted portfolios				
$R_{m,t} - R_{f,t}$	0.808*			
	(0.726*)			
SMB_t	0.616*	0.342*		
	(0.617*)	(0.253*)		
HML_t	-0.537*	-0.451*	-0.141	
	(-0.457*)	(-0.075)	(-0.362*)	
UMD_t	0.390*	0.336*	-0.251*	-0.259*
	(-0.267*)	(-0.395*)	(0.154)	(-0.129)
Panel B: value-weighted portfolios				
$R_{m,t} - R_{f,t}$	0.839*			
	(0.770*)			
SMB_t	0.573*	0.342*		
	(0.493*)	(0.253*)		
HML_t	-0.545*	-0.451*	-0.141	
	(-0.394*)	(-0.075)	(-0.362*)	
UMD_t	0.352*	0.336*	0.251*	-0.259*
	(-0.329*)	(-0.395*)	(0.154)	(-0.129)

Significant by 5 percent level is indicated by 1 asterisks

Table 5 reports the summary statistics of the variables used in the regression for the two periods. These variables are the equally- and value-weighted risk free adjusted IPO portfolios, Carhart four factors and the sentiment index from Baker and Wurgler (2006). The IPO portfolios show negative average risk free-adjusted returns (excluding the value-weighted IPO portfolio of panel B) and a positive risk free market premium, suggesting a long-run underperformance of the IPO portfolio to the market. However, the other variables could influence this relation, so the regression could result in different suggestions. No extreme outliers are detected that can lead to wrong conclusions, therefore there is no correction needed.

Table 5: Summary coefficients

Panel B contains the variables for the period 1 January 1976 to 31 December 1987 and Panel B gives the summary statistics of variables for the period 1 January 2000 to 31 December 2010. EW stands for equally-weighted portfolio and VW for the value-weighted portfolio. $R_{p,t} - R_{f,t}$, is the risk free-adjusted IPO returns. $R_{m,t} - R_{f,t}$ stands for the market risk premium. Where SMB is a size-control variable, the difference between a portfolio of 'small' stocks and 'big' stocks. HML is a book-to-market-control variable, the difference between a portfolio of 'high' BE/ME stocks and 'low' BE/ME stocks. Moreover, UMD is the momentum variable, the monthly premium on 'winners' minus 'losers'. All data is collected from Kenneth-French data's library.

Variables	Mean	Standard error	Minimum	Maximum
Panel A: 1 January 1976 to 31 December 1987				
EW $R_{p,t} - R_{f,t}$	-5.384	8.369	-37.786	13.785
VW $R_{p,t} - R_{f,t}$	-3.527	9.824	-38.818	20.702
$R_{m,t} - R_{f,t}$	0.578	4.890	-23.140	12.470
SMB_t	0.504	2.531	-9.900	7.040
HML_t	0.528	2.759	-8.340	8.570
UMD_t	0.896	3.457	-9.580	15.240
$\mathrm{SENTIMENT}_t$	0.332	0.918	-1.731	1.429
Panel B: 1 January 2000 to 31 December 2010				
EW $R_{p,t} - R_{f,t}$	-1.451	10.481	-37.750	34.351
VW $R_{p,t} - R_{f,t}$	0.590	9.878	-33.035	46.559
$R_{m,t} - R_{f,t}$	0.002	4.894	-17.230	10.190
SMB_t	0.528	3.907	-17.170	22.080
HML_t	0.564	3.715	-11.250	12.910
UMD_t	0.115	6.562	-34.580	18.380
$\mathrm{SENTIMENT}_t$	0.184	0.659	-0.795	2.072

4. Results

The results discuss the findings of this thesis. First, I display and discuss the cumulative average adjusted returns. After that, I examine the buy-and-hold abnormal returns and possible explanations for the long-run performance of IPOs. To control for the robustness of my conclusions, I also look at the results from the calendar-time abnormal returns, whether I can draw the same conclusions from this type of long-run performance measure.

4.1 Cumulative Average Adjusted Returns (CARs)

Figure 1 plots the cumulative average matched firm-adjusted returns for the 36 months after the offering date in the United States for 1,065 IPOs in 1975-1984 and for 1,439 IPOs during 2000 to 2011. When I look at month 0, the initial return period of the IPOs, the average initial return for IPOs in 1975-1984 is 8.91%. For IPOs in 2000-2011, the initial return is even higher: 15.59%. These initial returns support many studies that have documented the short-run underpricing of IPOs and the 'hot issue' market phenomenon, like Ibbotson and Jaffe (1975) and Ritter (1984).

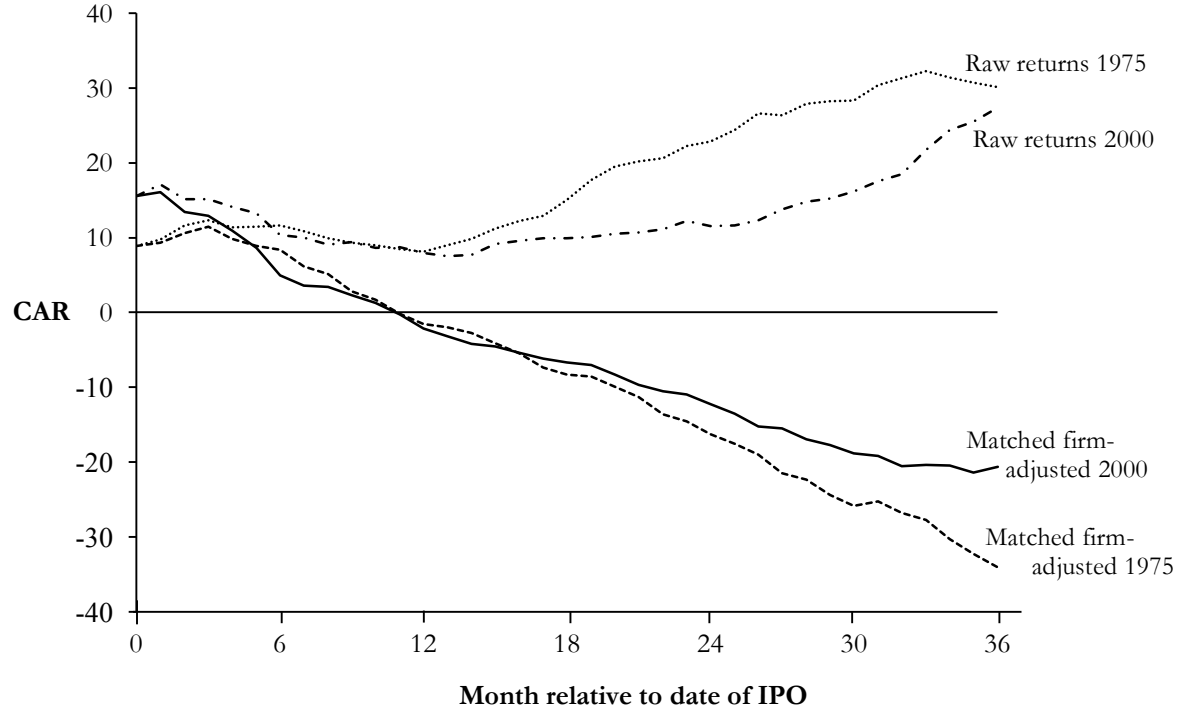
Looking at both of the raw returns, the conclusion could be that the IPO firms have a positive cumulative average return for 36 months using event-time methods. With peaks of 32.26% in month 33 and 27.38% in month 36 for the periods: 1975-1984 and 2000-2011, respectively. However, looking only at the raw returns, will not lead to the proper conclusions, because after controlling with matched firms returns the long-run performance becomes negative. The 3-year cumulative average matched firm-adjusted return for the period 1975-1984 is -34.06%. Which means that IPO firms underperform when I compare it with matched firms on industry and size.

The results for the period 1975-1984 are consistent with Ritter (1991) results. The sign of the line is same as Ritter's study, only the magnitude differs, but this could be because I used a smaller sample of IPOs. I replicate this time-period because I wanted to extend the three-year results to five-year results. Because the last months of Ritter's study documents, significant negative abnormal returns at a 5% significance level.

Table 6 reports the abnormal return for IPO in 1975-1984 by month, the table shows the numbers used to plot Figure 1. In addition, it also reports the significance level of each month's under- or outperformance.

Figure 1: Cumulative average matched firm-adjusted returns (CAR) for an equally weighted portfolio of different IPOs in the United States, 1975-1984 and 2000-2011, with monthly rebalancing, using the 3-year matching on industry and size data

Four CAR series are plotted for the 36 months after the IPO date: 1) raw returns in the period 1975-1984, 2) raw returns in the period 2000-2011, 3) matched firm-adjusted returns in the period 2000-2011, and 4) matched firm-adjusted return in the period 1975-1984. Month 0 is the initial return period.

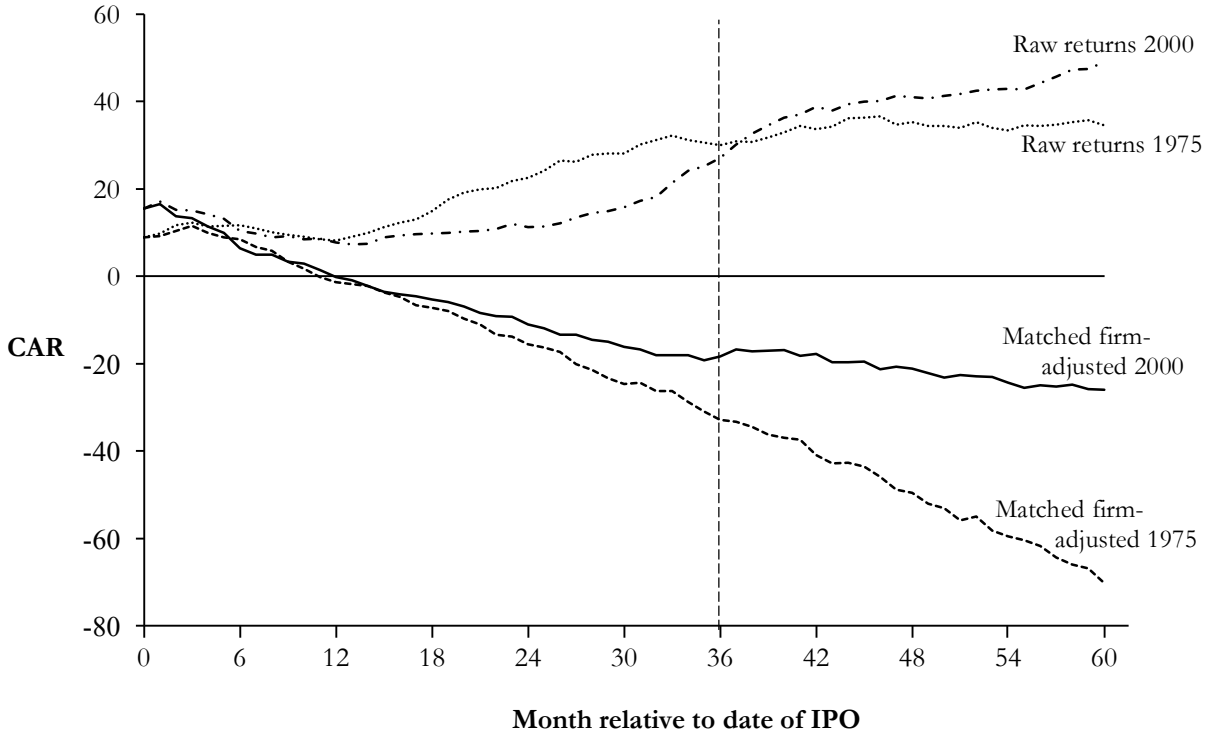


Moreover, by extending the results to five-year results, I can draw conclusions about a longer aftermarket performance of IPOs. Whether the underperformance ends, continues, or stays at the same level. I describe the conclusion about the five-year results later.

The conclusion about the 3-year performance of IPO firms for the period 2000-2011 is uniform with the conclusion for the period 1975-1984. Looking at only the raw returns, Figure 1 shows a lower magnitude of raw returns in the period 2000-2011, but the direction of the line is the same. The matched firm-adjusted returns follow the same path as the matched firm-adjusted returns in 1975-1984, but after 18 months relative to the IPO, the adjusted returns in 2000-2011 follow a less steep negative line and the 3-year cumulative average matched firm-adjusted return is higher than the CAR in 1975-1984. Nevertheless, the 3-year matched firm-adjusted return for 2000-2011 stays negative: -20.65%. The fact that, the raw returns in the most recent period are less positive than the period of 1975-1984 and that the cumulative average matched firm-adjusted return for the months 18-36 are less negative, could suggest that the underperformance of IPO has become less.

Figure 2: Cumulative average matched firm-adjusted returns (CAR) for an equally weighted portfolio of different IPOs in the United States, 1975-1984 and 2000-2011, with monthly rebalancing, using the 5-year matching on industry and size data

Four CAR series are plotted for the 60 months after the IPO date: 1) raw returns in the period 2000-2011, 2) raw returns in the period 1975-1984, 3) matched firm-adjusted returns in the period 2000-2011, and 4) matched firm-adjusted return in the period 1975-1984. Month 0 is the initial return period.



When looking at the Table 1 in the appendix, I see that the abnormal returns for the period 2000-2011, for the same months, have a higher significance, because the t-statistics are more negative in comparison with the t-statistics for the period 1975-1984. This means that according the abnormal returns, without the initial return, the IPO underperformance is more significant for the period 2000-2011.

Concluding, in both periods the IPO firms have a 3-year underperformance when the returns adjust by matched firms. The underperformance is less negative for the 2000-2011 period.

Figure 2 reports that the underperformance stays for the months 37-60 relative to the offer date of an IPO. The cumulative average matched firm-adjusted returns become even more negative for the months after the 3-year anniversary of the IPO.

These results are computed from a different matched sample, however, the returns in the first 3-year are not significantly different from the first sample. Mostly, the difference is in the decimals. Therefore, I can compare two samples with each other.

The raw returns in the period 1975-1984 after the 3-year anniversary of the IPOs have a small increase and then stay around 35%. The matched firm-adjusted returns keep decreasing, which means that the underperformance of IPOs is getting more negative in the months after the 3-year anniversary. The raw returns stay around 35%, this suggests that the average IPO firm returns are around 0% during month 37-60 and that the matched firms perform better than the IPO firms.

The raw returns in 2000-2011 keep increasing after the 3-year anniversary to a peak in month 60 of 49.12%. The matched firm-adjusted returns keep decreasing but with a lower magnitude than that of Ritter's period.

From these results, I can conclude that the underperformance of IPO firms remains when the event-time period extends from 3- to 5-years. This is not consistent with Ibbotson (1975); Ibbotson finds no underperformance in the fifth year after going public. Although, the underperformance for the period 2000-2011 appear to be not of a great magnitude. Table 3 (appendix) shows that, after extending the period to 5 years, only 5 of the 24 months have significant negative returns at a 5%-level. This could suggest that the 5-year underperformance is decreasing, the underperformance is still significantly in the 1975-1984 period, nevertheless, when I look at the most recent results, the underperformance is still available, but mostly not significant anymore. This is consistent with the results that Jay Ritter displays on his website, where he provided much information about IPOs post-performance.

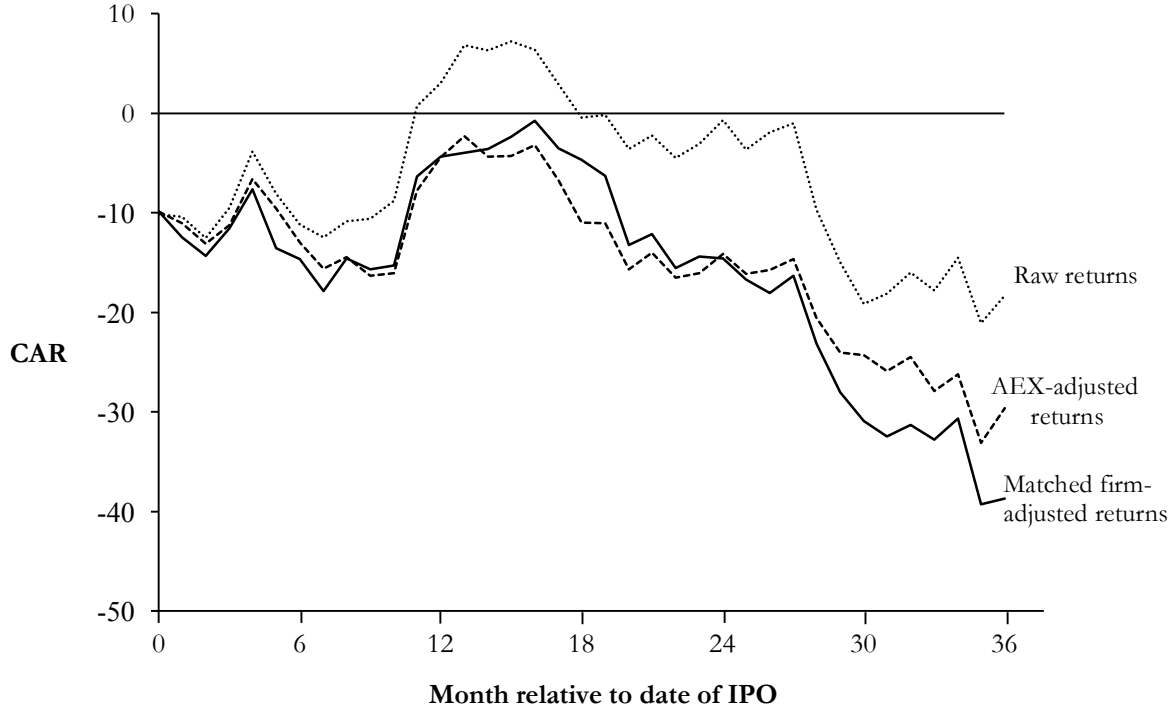
Figure 3 exhibits the Dutch cumulative average adjusted returns (CARs) for the period 1990-2011. I gather these results after excluding three IPOs with exceptionally high initial returns,

otherwise the average initial return is 960%. The initial return, after excluding the three IPOs, is -9.90%. Loughran, Ritter and Rydqvist (1994) find an initial return of 7.20% for 72 IPOs in the period 1982-1991. My sample only consists of 46 included IPOs, this number of IPOs is too low to draw conclusions about the possible overpricing of Dutch IPOs during the period 1990-2011.

The results advocate a 3-year underperformance of the Netherlands IPOs during 1990-2011. The cumulative matched firm- and AEX index-adjusted return, excluding the initial return, are -28.80% and -19.74%, respectively. The Dutch IPO firms underperform to the Netherlands market index and the matched firms. Nonetheless, due to the low number of IPOs in the sample it is hard to draw conclusions from the results. Although, there seem to be an underperformance of the Netherlands IPO firms to the market and matched firms.

Figure 3: Cumulative average adjusted returns (CAR) for an equally weighted portfolio of different IPOs in the Netherlands, 1990-2011, with monthly rebalancing, using the 3-year matching on size data

Three CAR series are plotted for the 36 months after the IPO date: 1) raw returns in the period, 2) AEX index-adjusted returns in the period, and 3) matched firm-adjusted returns in the period. Month 0 is the initial return period.



All the samples show a long-run underperformance of IPO firms in comparison to their matched-firms sample. Therefore, I can conclude that the findings provide evidence for a long-run underperformance of IPO firms. With a remark to the Netherlands sample, this sample needs to be extended with more IPO firms to get a good view of the Netherlands IPO short- and long-run performance.

Table 6: Abnormal Returns for IPOs in the United States, 1975-1984

Average matched firm-adjusted returns (AR_t), matched on industry and size, and cumulative average returns ($\mathrm{CAR}_{1,t}$), in percent, with associated t-statistics for the 36 months after going public, excluding the initial return. The number of IPOs trading is less than 1,065 because some firms have a greater delay than one month, before becoming listed. $\mathrm{AR_t} = 1/n_\mathrm{t} \sum_{i=1}^{n_t}(r_{\mathrm{ipo},it} - r_{\mathrm{matched},it})$ where $r_{\mathrm{ipo},it}$ is the total return on initial public offering firm i in event month t, and $r_{\mathrm{match},it}$ is the total return on the corresponding matching firm. The *t*-statistics for the average adjusted return is computed for each month as $\mathrm{AR_t} * \sqrt{n_\mathrm{t}}/sd_\mathrm{t}$, where $\mathrm{AR_t}$ is the average matching firm-adjusted return for month t, n_t is the number of observations in month t, and sd_t is the cross-sectional standard deviation of the adjusted returns for month t. The *t*-statistics for the cumulative average adjusted return in month t, $\mathrm{CAR}_{1,\mathrm{t}}$, is computed as $\mathrm{CAR}_{1,\mathrm{t}} * \sqrt{n_\mathrm{t}}/csd_\mathrm{t}$, where n_t is the number of firms trading in each month, and csd_t is computed as $csd_\mathrm{t} = [\mathrm{t} * \mathrm{var} + 2 * (\mathrm{t}-1) * \mathrm{cov}]^{1/2}$, where t is the event month, var is the average (over 36 month) cross-sectional variance, and cov is the first-order autocovariance of the $\mathrm{AR_t}$ series.

Month of seasoning	Number of IPOs trading	AR_t %	t-stat	$\mathrm{CAR}_{k,p}$ %	t-stat
1	1000	0.36	0.51	0.36	0.52
2	1023	1.31	2.02	1.67	1.54
3	1029	0.87	1.31	2.54	1.86
4	1042	-1.59	-2.54	0.95	0.60
5	1043	-1.00	-1.54	-0.05	-0.03
6	1043	-0.49	-0.72	-0.54	-0.27
7	1043	-2.21	-3.64	-2.75	-1.28
8	1037	-1.00	-1.47	-3.76	-1.63
9	1033	-2.36	-3.69	-6.11	-2.49
10	1031	-1.08	-1.54	-7.19	-2.77
11	1022	-1.90	-2.92	-9.09	-3.32
12	1022	-1.38	-2.03	-10.47	-3.66
13	1021	-0.38	-0.57	-10.86	-3.64
14	1019	-0.84	-1.16	-11.70	-3.77
15	1013	-1.34	-1.89	-13.01	-4.04
16	1005	-1.32	-1.73	-14.36	-4.29
17	997	-1.95	-2.77	-16.31	-4.71
18	985	-0.91	-1.26	-17.23	-4.80
19	975	-0.27	-0.38	-17.51	-4.72
20	969	-1.38	-1.93	-18.89	-4.94
21	962	-1.36	-1.98	-20.25	-5.15
22	951	-2.29	-3.40	-22.53	-5.57
23	943	-0.92	-1.24	-23.46	-5.64
24	935	-1.73	-2.41	-25.19	-5.90
25	924	-1.24	-1.71	-26.43	-6.03
26	917	-1.46	-1.97	-27.89	-6.21
27	905	-2.50	-3.54	-30.39	-6.60
28	902	-0.89	-1.26	-31.28	-6.66
29	887	-2.08	-3.00	-33.36	-6.92
30	879	-1.44	-2.01	-34.80	-7.06
31	873	0.66	0.71	-34.14	-6.79
32	866	-1.54	-1.97	-35.69	-6.96
33	851	-0.98	-1.26	-36.67	-6.98
34	840	-2.55	-3.51	-39.22	-7.31
35	830	-1.98	-2.83	-41.20	-7.52
36	825	-1.77	-2.29	-42.97	-7.08

4.2 Buy-and-Hold Abnormal Returns (BHARs)

In this section, I use the buy-and-hold abnormal returns (BHARs) to explore possible explanations for the long-run underperformance of IPOs. The section reports several cross-sectional and time-series patterns of the different samples.

4.2.1 Buy-and-hold returns categorized by initial returns

Table 7 displays the 3-year buy-and-hold performance classified by its initial return quintiles for the 1,065 IPOs in 1975-1984. Ritter (1991) finds that the offerings with the highest initial return do the worst in the long-run performance. In addition, DeBondt and Thaler (1987) find a negative relationship between past and subsequent abnormal returns on stocks using a holding period for at least a year. At first sight, this does not hold for my sample, however after excluding two extreme buy-and-hold IPO returns from the second quintile, the average IPO holding period return for the second quintile drop to 23.58%. These results are more consistent with Ritter's findings, and the relation that Debondt and Thaler describe. Although the quintile IPO returns do not go up evenly, they appear to increase when the initial return decreases.

Table 7: Performance of 3-year buy-and-hold returns categorized by initial return quintiles, 1975-1984, using matching on industry and size data

All IPOs sample consist of the 1,065 IPOs and the segmented by age sample consist of 836 IPOs. 7 years is the median age for the 836 IPOs. The wealth relative is a ratio of (1 + average IPO holding period total return (not in percent)) divided by (1 + average matched firm holding period total return (not in percent)), excluding the initial return.

	All IPOs			Segmented by age of the issuing firm			
	Excluding initial returns			Age <=7 years 'young'		Age > 7 years 'old'	
	Average holding period total return						
Matched firm-adjusted initial return quintile %	IPOs %	Matched firms %	*Wealth relative*	*Wealth relative*	Sample size	*Wealth relative*	Sample size
19.17 < IR < 227.70	21.38	43.14	0.848	0.779	111	1.074	65
6.44 < IR < 19.17	43.88*	45.67	0.988	1.146	72	1.023	103
1.25 < IR < 6.44	20.40	67.23	0.720	0.772	92	0.763	99
-3.45 < IR < 1.25	32.26	47.74	0.895	0.857	93	0.976	87
-90.66 < IR < -3.45	29.49	39.70	0.927	0.870	51	0.940	65

* After excluding the two highest IPO holding period return (Enzo Biochem, 2,417% and Tie Communications, 1,956%) the average IPO holding period total return drop to 23.58%.

Looking at the results that are segmented by age of the issuing firm, propose the 'young' firm perform worse than the 'older' firm, I will look more deeply into this later on. Something else that stands out is the assessment of the wealth relatives. When I look at the different wealth relatives, I find a similar pattern between the whole sample of IPOs and the 'young' IPOs. However, the 'old' IPO firms show a different pattern, there is an outperformance for the 'old' IPOs with a high initial return and an average underperformance for the 'old' IPO firms with a negative or low initial return. This suggests that the initial return is a possible indicator for the long-run performance of 'old' firms. The wealth relative's show that a high initial return for an 'old' IPO

firm could indicate an outperformance of firm in the same industry with a comparable market capitalization.

The results from the 5-year buy-and-hold returns (Appendix, Table 4) show that for every quintile, the IPOs underperform relative to the matched firms. The relation between the initial return and the aftermarket performance partially still exist, only the lowest quintile does not follow the relation. Moreover, the older IPOs have a lower underperformance or even outperformance of the matched firms. This shows the possible importance of the age of a firm when going public.

Table 8 reports the 3-year buy-and-hold returns categorized by initial return quintiles for the period 2000-2011. The average IPO holding returns support the finding from the period 1975-1984. The IPO holding returns increases when the initial return quintiles values decreases, with the only exception of going from the fourth quintile to the fifth quintile.

Noteworthy is the negative average holding period return for both IPO and matched firms in the first quintile. This is probably due to the high percentage of IPOs in the year 2000 in this quintile. 42% of the firms going public with an initial return in the highest quintile went public in the year 2000. This is at the end of the dot-com bubble, which ended in 2001. Ljungqvist and Wilhelm (2003) documents an average initial return of 58% for 366 IPOs in 2000. The average matched firm-adjusted initial return in my sample is 56,03% for 238 IPOs in 2000. However, the

Table 8: Performance of 3-year buy-and-hold returns categorized by initial return quintiles, 2000-2011, using matching on industry and size data

All IPOs sample consist of the 1,439 IPOs and the segmented by age sample consist of 1,086 IPOs. 8 years is the median age for the 1,086 IPOs. The wealth relative is a ratio of (1 + average IPO holding period total return (not in percent)) divided by (1 + average matched firm holding period total return (not in percent)), excluding the initial return.

	All IPOs			Segmented by age of the issuing firm			
	Excluding initial returns			Age <=8 years 'young'		Age > 8 years 'old'	
	Average holding period total return						
Matched firm-adjusted initial return quintile %	IPOs %	Matched firms %	*Wealth relative*	*Wealth relative*	Sample size	*Wealth relative*	Sample size
24.17 < IR < 510.26	-27.13	-7.13	0.785	0.656	168	0.931	155
7.64 < IR < 24.17	7.75	22.38	0.880	0.968	129	0.865	139
0.47 < IR < 7.64	15.22	27.32	0.905	0.755	103	1.002	102
-1.59 < IR < 0.47	29.96	30.84	0.993	1.155	55	1.158	43
-70.98 < IR < -1.59	14.69	26.87	0.904	0.913	143	0.778	87

average holding period total returns for the highest quintile are negative, this shows that the IPOs and matched firms with a high initial return perform worst in the aftermarket. Moreover, the IPOs in 2000 have a high influence on this result.

The 5-year buy-and-hold IPO returns per initial return quintile show the same results as all previously discussed results; see Table 5 in the appendix for the results. I find evidence for a negative relation between the initial return of an IPO and the aftermarket performance. Once again are the wealth relative's of the 'young' IPOs lower than the 'old' IPO firms, showing the possible importance of the age of the IPO for the long-run performance after going public.

Summarizing, I find evidence for a potential negative relation between the matched firm-adjusted initial return and the long-run performance of an IPO. I find this relation in every sample that I have conducted.

4.2.2 Buy-and-hold returns categorized by industry

Ritter (1991) shows that the long-run performance of IPOs in different industries varies widely. For example, financial institutions performed very well, through the large drop in interest rates in 1985-1986. Moreover, the oil prices declined considerably during 1981-1983, whereby the oil and gas firms performed worse, due to the great amount of oil and gas firms that went public in 1980 and 1981. My 3-year buy-and-hold returns for the period 1975-1984 are consistent with Ritter's in his research. Table 6 of the appendix reports the long-run (3- and 5-year) performance categorized by industry[2] for the period 1975-1984. I base the industry groups upon the three-digit Standard Industrial Classification (SIC) codes. The 5-year long run returns show no noteworthy remarks, only that the IPO and matched firms returns mostly get higher, meaning that positive 3-year returns get higher and negative 3-year returns get less negative.

Table 9 shows the 3- and 5-year buy-and-hold returns categorized by industry for IPOs during 2000-2011. The industries of communication and electronic equipment, and computer services have the worst long-run performance. However, the initial return for those industries is the highest. The dot-com bubble is a good explanation for this. The number of firms that went public in these industries during the dot-com bubble is 39 out of the 84 communication and electronic equipment firms and 101 out of the 191 for computer services firms. These firms have a significant effect on the performance of the industry, because after removing the IPOs in 2000 and 2001, the initial return drops to 12.16% and 19.39% for the communication and electronic equipment, and computer services industries, respectively. The 3-year buy-and-hold return of both, IPOs and the matched firms, become positive.

[2] 81% of the matched firms are in the same three-digit industry as the IPOs, this could mean that the control for industry is imperfect. I looked at a sample with only three-digit matched firms and found an average wealth relative of 0.859 as contrasted with 0.872 for the entire sample. Therefore, I can interpret the entire sample results as industry controlled. The other sample show the same results.

Table 9: Performance categorized by industry, 2000-2011, using matching on industry and size data

Panel A includes the 3-year buy-and-hold returns of the 1,439 IPOs. Panel B includes the 5-year buy-and-hold returns of the 1,439 IPOs. The different industries have a minimum of 20 IPOs. The wealth relative is a ratio of (1 + average IPO holding period total return (not in percent)) divided by (1 + average matched firm holding period total return (not in percent)), excluding the initial return.

		Excluding initial returns		
		Average holding period total returns		
Industry	Average matched firm-adjusted initial return %	IPOs %	Matched firms %	*Wealth relative*
Panel A: 3-year buy-and-hold returns				
Electronic equipment	43.37	-28.44	-19.22	0.886
Oil and gas	2.13	12.31	42.56	0.788
Financial institutions	1.90	19.95	22.29	0.981
Computer services	41.89	-21.99	2.30	0.763
Scientific instruments	17.44	-14.89	13.38	0.751
Retailers	23.68	27.22	32.23	0.962
Wholesalers	6.79	15.81	12.50	1.029
Health care	14.64	29.45	39.61	0.927
Drugs	6.41	19.84	24.38	0.963
Miscellaneous business	32.25	-16.60	0.64	0.829
Insurance	7.51	68.95	42.18	1.188
All other firms	16.33	12.99	27.20	0.888
All firms	15.47	8.10	20.01	0.901
Panel B: 5-year buy-and-hold returns				
Electronic equipment	43.64	-26.67	-10.98	0.824
Oil and gas	2.18	36.69	55.08	0.881
Financial institutions	1.89	19.10	34.77	0.884
Computer services	41.50	-6.34	15.48	0.811
Scientific instruments	17.46	-10.97	22.43	0.727
Retailers	23.76	28.31	28.13	1.001
Wholesalers	6.79	20.47	49.95	0.803
Health care	14.64	49.02	102.71	0.735
Drugs	6.78	39.31	5.16	1.325
Miscellaneous business	32.27	6.00	13.00	0.938
Insurance	7.51	75.54	94.80	0.901
All other firms	16.54	14.12	24.36	0.918
All firms	15.51	15.30	27.81	0.902

However, the matched firm-adjusted buy-and-hold returns show an underperformance of IPO firms in 10 of the 12 industries. The oil and gas industry has a wealth relative of 0.788 of the 3-year results; this implies that an investor would have had to invest 21.2% more in each IPO in the oil and gas industry, then in each corresponding matched firm to achieve the same wealth after 3 years of public trading. The high number of industries with IPOs long-run underperformance implies more evidence for the 'fads' explanation of Ritter (1991). The explanation suggests that the negative aftermarket performance is due to irrationally overoptimistic forecasts.

4.2.3 Buy-and-hold returns categorized by age of the IPO firm

Hensler, Rutherford and Springer (1997) find evidence for an increase in survival of IPOs in the aftermarket when the age of the IPO firm at offering date is higher. In addition, Carroll (1983) finds nearly widespread harmony that mortality monotonically decreases with firm age. Prolonged existence brings solidity; firms founded a specified minimum number of years before the IPO offer an adequate number of historical data on which investors can assess the risk and value of the firm. Therefore, age is a proxy for risk.

Table 10: Performance categorized by the age of the IPO firm, 1975-1984, using matching on industry and size data

Panel A includes the 3-year buy-and-hold returns of the 836 IPOs. Panel B includes the 5-year buy-and-hold returns of the 836 IPOs. The wealth relative is a ratio of (1 + average IPO holding period total return (not in percent)) divided by (1 + average matched firm holding period total return (not in percent)), excluding the initial return.

			Excluding initial returns		
			Average holding period total returns		
Age in years	Sample size	Average matched firm-adjusted initial return %	IPOs %	Matched firms %	*Wealth relative*
Panel A: 3-year buy-and-hold returns					
0 – 2	144	13.85	0.68	29.26	0.779
3 – 5	181	13.20	23.88	31.76	0.940
6 – 10	190	10.58	45.77*	42.18	1.025
11 – 17	157	8.87	26.34	58.01	0.800
18 – up	163	5.36	66.84	75.87	0.949
Panel B: 5-year buy-and-hold returns					
0 – 2	144	14.11	-12.88	45.02	0.601
3 – 5	181	13.20	23.55	53.51	0.805
6 – 10	190	10.79	45.40	61.70	0.899
11 – 17	157	8.46	30.27	78.11	0.731
18 – up	163	5.35	76.88	103.11	0.871

* After excluding the highest IPO holding period return (Tie Communications, 1,956%) the average IPO holding period total return drop to 35.71%.

Table 10 presents the aftermarket performance of IPO firms and their matched firms categorized by the age of the IPO firm at the offer during 1975 to 1984. The results support the fact that age is a proxy for risk, risky IPOs require higher average initial returns. Moreover, the aftermarket performance follows the appropriate direction of possible longer survival of IPOs, meaning that the older IPOs perform better. The 5-year buy-and-hold returns show even more pronounced evidence for the importance of the age at an initial public offering.

Table 11 reports the 3-year buy-and-hold returns of the entire sample and a sample without the dot-com bubble year IPOs, categorized by age of the IPO firm at the time of offering for the period 2000-2011. With panel A's results I can conclude mostly the same as described before, only the initial return for the first quintile is not the highest, as you should expect. However, the year

2000 has results that are not consistent with the other years in the sample, mostly due to the dot-com bubble.

Table 11: Performance categorized by the age of the IPO firm, 2000-2011, using matching on industry and size data

Panel A includes the 3-year buy-and-hold returns of the 1,086 IPOs. Panel B reports the 3-year buy-and-hold returns excluding the IPOs in the year 2000, leading to a sample of the 801 IPOs. The wealth relative is a ratio of (1 + average IPO holding period total return (not in percent)) divided by (1 + average matched firm holding period total return (not in percent)), excluding the initial return.

			Excluding initial returns		
			Average holding period total returns		
Age in years	Sample size	Average matched firm-adjusted initial return %	IPOs %	Matched firms %	*Wealth relative*
Panel A: 3-year buy-and-hold returns					
0 – 3	209	18.26	-0.34	13.72	0.876
4 – 6	235	32.53	-16.51	17.52	0.710
7 – 9	207	20.45	11.45	0.72	1.107
10 – 19	223	19.43	3.82	14.91	0.903
20 – up	212	11.52	25.61	42.15	0.884
Panel B: Excluding the IPOs in the years 2000					
0 – 3	152	2.05	28.07	34.40	0.953
4 – 6	156	12.26	11.77	41.74	0.786
7 – 9	169	14.79	27.62	6.49	1.198
10 – 19	185	12.44	19.55	25.72	0.951
20 – up	188	9.95	31.19	45.49	0.902

The sample size in panel B shows relatively more young 'firms' went public during the year 2000. The results in panel B do not support the assumption that age is a proxy for risk. Because the lowest age has the lowest initial return. Moreover, the buy-and-hold returns for IPOs do not follow a specific path, which you should expect if age is a proxy for risk. Consequently, the pattern present in panel A is not present in panel B, meaning that the year 2000 has quite some influence on the results in the sample of 2000-2011.

The matched firm-adjusted buy-and-hold returns stay about the same for all the quintiles in panel B, the results show an underperformance in 4 out of 5 quintiles. The outperformance quintile is the same as in the period 1975-1984, suggested that investors should invest in IPOs with an age between 7 to 9 years to outperform a portfolio of matched firms.

In the first period 1975-1984, the results are consistent with the results you would expect when age is a proxy for risk. Although, returns in 2000-2011 do not follow the same path when excluding the year 2000. Thus, for that period I cannot conclude that age is a proxy for risk. This could suggest that in more recent times, age cannot be seen as a proxy for risk. However, there

needs to be more research for this to make a correct conclusion about age as a proxy for risk in recent times.

Table 12: Performance categorized by year of issuance for IPOs in 1975-1984, using matching on industry and size data

The *wealth relative* is a ratio of (1 + average IPO holding period total return (not in percent)) divided by (1 + average matched firm holding period total return (not in percent)), excluding the initial return.

		3-year buy-and-hold				5-year buy-and-hold			
			Excluding initial returns				Excluding initial returns		
			Average holding period total return				Average holding period total return		
Year	No. of IPOs	Average Matched firm-adjusted initial return %	IPOs %	Matched firms %	*Wealth relative*	Average Matched firm-adjusted initial return %	IPOs %	Matched firms %	*Wealth relative*
1975	2	1.99	37.70	259.87	0.383	1.99	28.12	197.76	0.430
1976	21	5.50	175.68	113.04	1.294	5.37	373.60	258.11	1.322
1977	21	5.24	161.22	53.15	1.706	5.21	195.65	93.84	1.525
1978	18	21.56	172.92	117.61	1.250	21.83	331.46	228.81	1.312
1979	42	7.66	101.95	78.42	1.132	7.92	100.52	139.36	0.838
1980	80	27.58	51.05	86.24	0.811	27.74	-5.70	101.87	0.467
1981	197	6.00	8.57	40.55	0.772	6.20	9.21	68.22	0.649
1982	69	12.63	-5.30	67.20	0.566	12.60	16.82	105.84	0.568
1983	414	9.64	17.23	34.07	0.874	9.88	3.25	42.46	0.725
1984	201	1.99	22.09	43.07	0.853	1.53	27.65	50.41	0.849
All	1,065	9.01	29.60	48.55	0.872	9.08	29.68	69.82	0.764

4.2.4 Buy-and-hold returns categorized by year of issuance

Ritter (1991) documents that the long-run underperformance of IPOs is not a general phenomenon, implicating that the long-run underperformance is not yearly available. Table 12 and Table 13 show the long-run performance categorized by year of issuance for IPOs in 1975-1984 and 2000-2011, respectively.

The tables show results that support the evidence that Ritter found. In 1975-1984, six out of ten 3-year matched firm-adjusted buy-and-hold returns show underperformance of the IPOs, for the 5-year returns it is seven out of ten years. In the period 2000-2011, the underperformance is more frequently available for the 3-year matched firm-adjusted BHARs, with only 2 out of 12 wealth relative above one. However, extending the BHARs to a 5-year period results in 5 out of 12 wealth relative above one. Hence, the underperformance still is a phenomenon that does not generally exist.

The 5-year buy-and-hold returns strengthen or weaken the results depending on the results in the years after the 3-year returns. It shows that the condition of the market in previous years appear to be of importance.

Table 13: Performance categorized by year of issuance for IPOs in 2000-2011, using matching on industry and size data

The *wealth relative* is a ratio of (1 + average IPO holding period total return (not in percent)) divided by (1 + average matched firm holding period total return (not in percent)), excluding the initial return.

		3-year buy-and-hold				5-year buy-and-hold			
			Excluding initial returns				Excluding initial returns		
			Average holding period total return				Average holding period total return		
Year	No. of IPOs	Average Matched firm-adjusted initial return %	IPOs %	Matched firms %	*Wealth relative*	Average Matched firm-adjusted initial return %	IPOs %	Matched firms %	*Wealth relative*
2000	238	56.03	-65.54	-29.10	0.486	56.25	-57.43	-6.86	0.457
2001	83	7.11	46.55	59.85	0.917	6.55	79.18	56.80	1.143
2002	122	2.69	52.30	54.05	0.989	2.79	75.46	102.40	0.867
2003	80	7.53	38.74	67.13	0.830	7.18	9.83	41.47	0.776
2004	183	9.71	41.75	46.76	0.966	9.46	0.86	12.33	0.898
2005	157	6.91	12.81	22.87	0.918	6.91	13.49	24.99	0.908
2006	147	8.52	-24.75	-20.76	0.949	8.46	4.16	3.16	1.010
2007	173	8.74	-14.84	-16.59	1.021	8.87	14.57	-8.92	1.258
2008	21	6.29	38.77	14.36	1.213	6.69	74.16	30.19	1.338
2009	45	7.45	31.84	70.17	0.775	7.70	57.79	118.93	0.721
2010	97	5.09	41.67	42.78	0.992	5.73	68.94	48.73	1.137
2011	93	8.92	44.98	53.35	0.945	9.13	30.92	57.33	0.832
All	1,439	15.47	8.12	20.06	0.901	15.51	15.34	27.87	0.902

In the sample of 2000-2011, the negative relation between annual volume of IPOs and the aftermarket performance is still present, suggesting that Ritter's (1991) scenario of: market timing of firms to go public, when investors are willing to pay high multiples (price-earnings or market-to-book) reflecting optimistic assessments of the net present value of growth opportunities. Nevertheless, the aftermarket performance is negative in comparison to a matched firm or market portfolio, due to the disappointing realizations of the subsequent net cash flows. This could just be bad luck, but the investors could also make irrational overoptimistic forecasts of the cash flows.

Thus, the view of investors on the status of the market appear to be important to the timing of IPOs and on the long-run stock market performance. Baker and Wurgler (2006) support this suggestion, they find that investor sentiment, in contrast to classical finance theory, does play a role in the cross-section of stock prices, realized returns, or expected returns.

I use the investor sentiment in the calendar-time returns of IPOs and make different regression for different values of the sentiment index. This is my way of controlling for the sentiment of investors.

Summarizing, the 3- and 5-year matched firm-adjusted BHARs commonly gives the same results and shows that the underperformance still is not a phenomenon that has been documented widely.

The results of the buy-and-hold abnormal returns show an underperformance of IPOs adjusted by their matched firms for all the used samples. After categorizing these results, I find some interesting observations and possible identifiers or reasons for the underperformance.

4.3 Book-to-market versus market capitalization matching

In the section, BHARs results, I use results gathered through matching on industry and size of the firms. The IPO firms matches on size because I want to find a comparable firm and see what the non-IPO returns are on the market in comparison to the IPO firm. However, I can use different firm characteristics to find a comparable firm in the market for the control group. Fama and French (1995) find that size and book-to-market are good proxies for the risk of investing in a specific firm. Thus, I also conduct a sample by matching on industry and book-to-market to find a comparable firm for the IPO firm.

Table 14 reports the distribution of the two samples that I use to compare the results of book-to-market and size matching. The table shows that the book-to-market value takes on higher average values in times that are more recent. The book values are coming closer to the market values. Figure 4 displays the Cumulative average matched firm-adjusted returns for the period: 2000-2011, using two different ways of matching, on industry and book-to-market and on industry and size. I compute the results using a portfolio of 1,090 IPOs that have book value data on Compustat. The industry and size-portfolio consist of the same sample of 1,090 IPOs. The matched firm-adjusted lines are the same for the first two years after the IPO date. In the third year, the book-to-market-adjusted returns have a less steep line as the size-adjusted returns. Nevertheless, both lines show a significant underperformance of IPOs to their matched firms.

Table 14: Distribution of Initial Public Offerings by year in the United States for the book-to-market sample

Panel A consists of 785 IPOs during 1975-1984 with a fiscal end book value. Panel B consists of 1,090 IPOs during 2000-2011 with a fiscal end book value. I collect the fiscal end book value from Compustat. The book-to-market variable is computed using the following formula: $\frac{B}{M} = \frac{fiscal\ end\ book\ value_{t-1}}{market\ value_t}$

Year	No. of IPOs	Book-to market variable
Panel A: 785 IPOs during 1975-1984		
1975	1	2.548
1976	18	0.524
1977	13	0.577
1978	10	0.404
1979	27	0.388
1980	57	0.385
1981	154	0.328
1982	52	0.356
1983	303	0.332
1984	150	0.342
Total	785	0.353
Panel B: 1,090 IPOs during 2000-2011		
2000	216	0.292
2001	45	0.419
2002	48	0.609
2003	53	0.570
2004	142	0.432
2005	115	0.550
2006	124	0.412
2007	138	0.425
2008	18	0.482
2009	34	0.659
2010	80	0.707
2011	77	0.679
Total	1,090	0.473

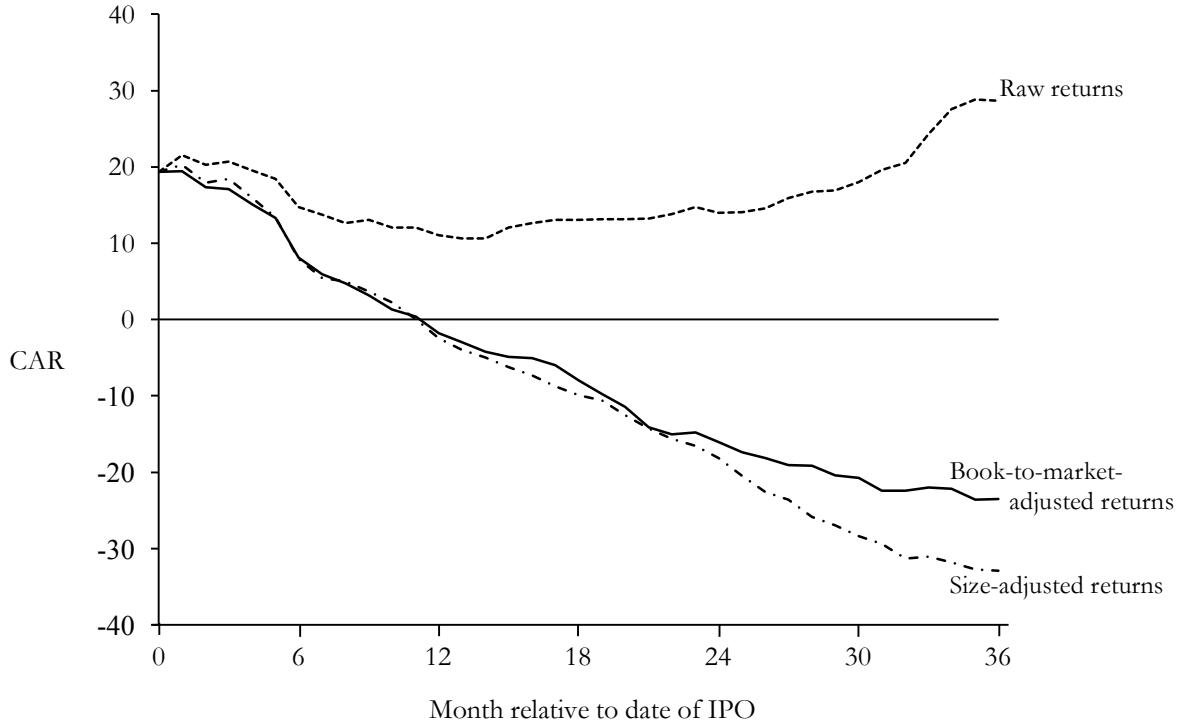
Figure 1 in the appendix plots the cumulative average matched firm-adjusted returns (CAR) in the period 1975-1984 using the two different ways of matching. The matched firm-adjusted lines are generally the same, with a maximum difference of 5.61% in month 36. However, the average difference between the lines is 1.35%. Hence, matching on book-to-market or size gives both a 3-year buy-and-hold underperformance of the IPO firm to their matched firm. In addition, the lines follow almost the same path, but again in the third year the line of the book-to-market-adjusted return is less steep, causing a less negative 3-year CAR.

Matching on book-to-market instead of size appear to have a less negative effect on the 3-year underperformance of IPOs, which is created in the third year after the IPO date.

Table 7 to Table 12 in the appendix; report the 3-year buy-and-hold returns categorized by initial return quintile, year of issuance and industry using different matching characteristics: industry and book-to-market, or industry and size.

Figure 4: Cumulative average matched firm-adjusted returns (CAR) for an equally weighted portfolio of different IPOs in the United States, 2000-2011, with monthly rebalancing, using the 3-year matching on industry and size/book-to-market data

Three CAR series are plotted for the 36 months after the IPO date for 1,090 IPOs: 1) raw returns, 2) book-to-market matched firm-adjusted returns, and 3) size matched firm-adjusted returns. Month 0 is the initial return period.



The results in the tables show an average underperformance for both the samples. The matched firms average holding period total returns are generally higher for the matching on book-to-market, this is consistent with the lower CAR results. The results are often the same, only different in the magnitude of the wealth relative. Nevertheless, there are also some wealth relative that are higher than one in the book-to-market and lower than one in the size sample, and vice versa. This could lead to different conclusions about the long-run underperformance of IPOs.

Thus, it is important to make a justifiable decision about the chosen firm characteristics to create a matched firm sample. Most articles about long-run performance of IPOs choose to use industry and size to match the IPO firms. The matching on industry is reasonable because the matched firm is affected by the same industry risks as the IPO firms. The reason for size as a second firm characteristic is logical, due to the difference in risk between small and big firms, explained by Fama and French (1995). Therefore, a similar size control firm is adjusted for the risk on the stock market returns.

Nonetheless, computing different matched firm samples using different firm characteristics to check the robustness of the drawn conclusions using the industry and size matched firm sample will give more authority to the articles and maybe lead to different conclusions.

4.4 Calendar-Time Abnormal Returns (CTARs)

In this section, I discuss the Calendar-Time Abnormal Returns (CTARs) of IPOs during two time-periods. The CTARs explain the aftermarket performance of IPOs, using a calendar-time approach to gather the long-run returns of the IPOs.

I calculate BHARs and CTARs, because there is still no preferred approach. The BHAR results categorized by year of issuance provide evidence for managers' timing decisions. Lougran and Ritter (2000) supports the BHARs approach, because the approach put enough weight on managers' market timing decisions of corporate events. On the other hand, the CTARs approach is potentially bias to find results consistent with market efficiency, due to the low weight on the same market timing decisions.

Baker and Wurgler (2002 and 2004) discuss the fact that the managers of a company time certain corporate events, like an IPO. They partially exploit misvaluations varying over time in the capital market. When the prices are high, the managers issue certain corporate events to feat these misvaluations. The discovery of the misvaluation leads to a drop of the stock prices. Therefore, a possible explanation of a negative performance of IPOs is the market timing of managers.

The CTARs approach possibly puts not enough weight on the market timing, because each time period weights similarly. It could be harder to identify abnormal returns when managers time their corporate events.

However, there are also several financial economists advocating the CTARs approach. Most reasons are that the CTARs gives better robust statistical inference. Mitchell and Stafford (2000) gather evidence that the distribution of the risk-adjusted returns is well-approximated by the normal distribution.

Furthermore, Fama (1998) argues that the control for cross-sectional correlation among individuals is not sufficient with the BHAR approach, accordingly the test statistics can be overstated. Mitchell and Stafford (2000) show proof for the overstated test statistics. Moreover, the overstated test statistics may lead to less trustworthy results, and improper conclusions about the long-run performance of returns.

Lyon, Barber and Tsai (1999) provide evidence for the third statistical advantage of the CTAR approach. Namely, the use of time-series of portfolio returns; it eliminates the problem of cross-sectional dependence. The use of time-series of portfolios returns contributes the benefit that the portfolio variance embraces the cross-correlations of firm abnormal returns, which removes the problem.

Fama (1998) also comes with a solution for Loughran and Ritter's (2000) criticism about the use of CTARs. Fama suggests using weighting calendar months, which depends on the sample

size of each monthly portfolio. Using this weighting calendar months leads with the market timing of managers and still leads to robust statistical inference.

Hence, I use both methods of calculating long-run event studies, to get a robust conclusion about the long-run performance of IPOs.

4.4.1 Results of regressions

Table 14 report the results for the Ordinary Least Squared regressions of the risk free-adjusted IPO returns for 1,061 IPOs issued from January 1, 1976 through December 31, 1987. The results give evidence for a risk-adjusted underperformance of IPOs in comparison to the market returns. The R-squared indicates that the models are good explanations of the risk free-adjusted IPO portfolios.

The Carhart four-factor model gives a significant excess return of an equally-weighted IPO portfolio of -6.34%. This result rejects the hypothesis of an excess return that is equal to zero. Which means that the equally-weighted portfolio of IPOs performed on average 6.34% worse than the market, after adjusting for size, book-to-market and momentum. The value-weighted portfolio performs better, but there is still a significant negative excess return.

The different sentiment model suggests support for the market timing of IPO, where after the prices will drop and the returns are negative. The high sentiment regression has a more negative excess returns, suggesting higher underperformance in periods of high sentiment. In addition, the excess return during months with low sentiment suggests less underperformance of the IPO portfolios. This holds for both, the equally- and value-weighted risk free-adjusted IPO portfolios.

A possible explanation for this is the market timing of managers. During periods of high sentiment, a manager wants to exploit the misvaluation of stock prices and does an initial public offering. After the market corrects for the misvaluations the prices will drop. Moreover, IPOs during periods of high sentiment perform worse than IPOs during low sentiment periods. Because in low sentiment periods the prices have less misvaluations and are closer to the intrinsic value of the firm. This is a behavioral finance explanation of the negative excess return of stock market returns.

Table 15 shows the results for the Ordinary least squared regressions of the risk free-adjusted IPO returns for 1,346 IPOs issued from January 1, 2000 through December 31, 2010. The sentiment index is only available until 2010, so the last year estimate the sentiment variable using a lower number of sentiment index observations. The excess returns of the equally-weighted monthly IPO portfolios is less negative than the 1976-1987 period. However, they are still significantly negative in four out of five models, only the model with low sentiment still has a

negative excess return, but it is not significant anymore. This is consistent with the results found in the BHAR part, where the underperformance, also smaller, is in the more recent period. The high sentiment portfolios perform again worse than the low sentiment portfolio, which strengthen the possible behavioral explanation of market timing by managers.

Table 14: Ordinary least squared regressions of the risk free-adjusted IPO returns for 1,061 IPOs issued from January 1, 1976 through December 31, 1987

Panel A: returns calculated using equally-weighted monthly portfolios. Panel B: returns calculated using value-weighted monthly portfolios. The IPO returns are included into the portfolio when it has done the offer until the 3-year anniversary of the IPO. The dependent variable is the risk free-adjusted IPO returns. Where α_p is the excess return and the coefficient of interest. β_p is the coefficient for the market risk premium. s_p is coefficient for the difference between a portfolio of 'small' stocks and 'big' stocks. h_p is the coefficient for the difference between a portfolio of 'high' BE/ME stocks and 'low' BE/ME stocks. Moreover, u_p is the coefficient for the monthly premium on 'winners' minus 'losers'. The sentiment control variable is the average sentiment of the previous month, current month and three future months. The sentiment is high when its higher than 0 and low when its lower than 0. For most standard errors there was no correction needed, only for the standard errors of model (4) of the equally-weighted portfolios, where I needed to correct for heteroscedasticity at a 5% significant level. Tests for multicollinearity are rejected.

Variables	(1) Market risk premium	(2) 3-factor model	(3) 4-factor model	(4) High sentiment	(5) Low sentiment
Panel A: equally-weighted monthly portfolios					
β_p	1.383***	0.983***	0.965***	1.107***	0.795***
	(0.085)	(0.071)	(0.073)	(0.075)	(0.137)
s_p		1.282***	1.257***	1.313***	0.890***
		(0.125)	(0.126)	(0.132)	(0.258)
h_p		-0.678***	-0.658***	-0.432***	-1.018***
		(0.121)	(0.121)	(0.124)	(0.234)
u_p			0.119	0.120	0.649
			(0.093)	(0.097)	(0.314)
α_p	-6.183***	-6.241***	-6.335***	-7.312***	-4.186***
	(0.415)	(0.313)	(0.321)	(0.377)	(0.595)
Observations	144	144	144	105	39
R-squared	0.653	0.823	0.826	0.836	0.896
Panel B: value-weighted monthly portfolios					
β_p	1.644***	1.193***	1.183***	1.288***	0.979***
	(0.106)	(0.089)	(0.091)	(0.087)	(0.246)
s_p		1.109***	1.095***	0.943***	1.049***
		(0.155)	(0.157)	(0.153)	(0.463)
h_p		-1.003***	-0.991***	-0.811***	-1.604***
		(0.150)	(0.151)	(0.142)	(0.420)
u_p			0.066	0.018	0.612
			(0.116)	(0.094)	(0.564)
α_p	-4.477***	-4.246***	-4.298***	-5.244***	-2.005***
	(0.459)	(0.388)	(0.400)	(0.365)	(1.069)
Observations	144	144	144	105	39
R-squared	0.670	0.803	0.803	0.861	0.797

(Robust) standard errors in parentheses, *** 1% significance, ** 5%, * 10%.

Table 15: Ordinary least squared regressions of the risk free-adjusted IPO returns for 1,346 IPOs Issued from January 1, 2000 through December 31, 2010

Panel A: returns calculated using equally-weighted monthly portfolios. Panel B: returns calculated using value-weighted monthly portfolios. The IPO returns are included into the portfolio when it has done the offer until the 3-year anniversary of the IPO. The dependent variable is the risk free-adjusted IPO returns. Where α_p is the excess return and the coefficient of interest. β_p is the coefficient for the market risk premium. s_p is coefficient for the difference between a portfolio of 'small' stocks and 'big' stocks. h_p is the coefficient for the difference between a portfolio of 'high' BE/ME stocks and 'low' BE/ME stocks. Moreover, u_p is the coefficient for the monthly premium on 'winners' minus 'losers'. The sentiment control variable is the average sentiment of the previous month, current month and three future months. The sentiment is high when it is higher than 0 and low when it is lower than 0. For the standard errors there was no correction needed at a 5% significant level. Tests for multicollinearity are rejected.

Variables	(1) Market risk premium	(2) 3-factor model	(3) 4-factor model	(4) High sentiment	(5) Low sentiment
Panel A: equally-weighted monthly portfolios					
β_p	1.554***	1.314***	1.163***	1.305***	0.808***
	(0.129)	(0.088)	(0.095)	(0.172)	(0.093)
s_p		0.968***	1.068***	1.124***	0.790***
		(0.118)	(0.117)	(0.188)	(0.137)
h_p		-0.792***	-0.824***	-0.796***	-0.303**
		(0.121)	(0.116)	(0.219)	(0.126)
u_p			-0.243***	-0.171***	-0.352***
			(0.070)	(0.120)	(0.060)
α_p	-1.453**	-1.518***	-1.524***	-2.166***	-0.418
	(0.630)	(0.430)	(0.413)	(0.787)	(0.341)
Observations	132	132	132	63	69
R-squared	0.526	0.796	0.814	0.820	0.834
Panel B: value-weighted monthly portfolios					
β_p	1.355***	1.103***	1.124***	1.414***	0.789***
	(0.147)	(0.090)	(0.101)	(0.187)	(0.078)
s_p		1.050***	1.036***	1.115***	0.682***
		(0.120)	(0.124)	(0.206)	(0.114)
h_p		-0.722***	-0.718***	-0.612**	-0.391***
		(0.123)	(0.123)	(0.241)	(0.104)
u_p			0.033	0.166	-0.195***
			(0.074)	(0.131)	(0.050)
α_p	0.588	0.441	0.442	1.073	0.304
	(0.639)	(0.437)	(0.438)	(0.863)	(0.283)
Observations	132	132	132	63	69
R-squared	0.451	0.763	0.763	0.786	0.835

Standard errors in parentheses, *** 1% significance, ** 5%, * 10%.

The value-weighted IPO portfolios have a positive excess return. Suggesting that there is an outperformance of the market where computing value-weighted IPO portfolio with a holding period of 3-year. Nevertheless, this possible outperformance is not significant, not even at a 10% level.

The high sentiment model reports a higher excess return in comparison to the low sentiment model. Value-weighted portfolio puts more emphasis on the firms with high market

capitalizations. These firms carry less risk on the stock market; this could be a possible explanation for the change in outcome when using the value-weighted IPO portfolios.

From these findings, I can conclude that the underperformance also exists when using a calendar-time approach on calculating the long-run performance of IPO firms. The different sentiment portfolios give support for the behavioral finance explanation of long-run underperformance of corporate events, like an IPO, on the market.

5. Conclusion and discussion

This thesis, studies the long-run performance of initial public offerings in the United States and the Netherlands using different periods and long-run event study approaches to answer the research question and draw a conclusion about the long-run performance of IPOs. Therefore, is there really a long-run underperformance of initial public offerings?

To answer this question, I use different samples of IPOs. For the United States, I gather two different periods: 1975 to 1984 and 2000 to 2011 and for the Netherlands the time-period is 1990-2011. To come to a matched firm sample for all those periods, I have matched on industry and size, industry and book-to-market, and size. The sample for the Netherlands only matches on size, whereas I use the other two firm characteristics for the United States samples. I gather 3- and 5-year long-run performance to check if an extension of the event period leads to different conclusions. Lastly, I make regressions using calendar-time long-run returns to check the robustness of the results found with the event-time cumulative average adjusted and buy-and-hold abnormal returns.

I use the cumulative average matched firm-adjusted return to show the development of the average abnormal returns during the three and five years after the offer date of an IPO. Looking at only the raw returns of the IPO would suggest a positive return of investing in IPOs. However, after adjusting with matched firms on industry and size, the returns are significantly negative for all samples used. With these results, I can conclude that there is a long-run underperformance of initial public offerings in the United States and the Netherlands. However, the IPO sample for the Netherlands is too small to be conclusive and there needs to be more research done to come to conclusive results about the long-run performance on the Netherlands stock market.

The buy-and-hold abnormal returns give some possible explanations for the long-run underperformance of IPOs. I found evidence for a negative relation between the matched firm-adjusted initial return and the long-run performance of an IPO. The buy-and-hold abnormal returns categorized by industry show that the long-run performance varies widely by industry. Still most industries had a wealth relative below one, which gives more evidence for the 'fads'

explanation of Ritter (1991). Moreover, the results in 1975-1984 are consistent with the results you should expect when you use age as a proxy for risk, the higher the age of a firm when going public results in a higher average holding period IPO return. Nonetheless, the 2000-2011 period does not gives me the same results, suggesting that age is not a proxy for risk. To draw a correct conclusion about this, there needs to be more research about this. The last conclusion drawn from the buy-and-hold returns is that the underperformance is not a phenomenon that has been documented widely. In both periods, there are years where the IPOs outperform their matched firms. The results categorized by year of issuance also gives me support for a possible explanation of the underperformance of IPOs, the manager market timing of taking a firm public.

Furthermore, I compute the CARs and BHARs using different firm matching characteristics, the adjusted returns using a matched sample on industry and book-to-market also show an underperformance of IPOs to their matched firms. Nevertheless, it is important to make a justifiable decision about the chosen firm characteristics to create a matched firm sample, because it can influence your conclusions about possible explanations for the long-run performance of IPOs or other events.

Additionally, the cumulative average adjusted returns and buy-and-hold abnormal returns are event-time long-run returns. To check for the robustness of the results found with those returns I also used calendar-time abnormal returns to see if there is a long-run underperformance of IPOs. The alphas provide evidence that the underperformance also exists when using a calendar-time approach on calculating the long-run performance of IPOs. In addition, the different sentiment portfolios give support for the manager market timing explanation of the long-run underperformance of IPOs.

Therefore, I can conclude that there really is an underperformance of initial public offerings.

There are some limitations to my research. I did not take into account if, both IPO and matched, firms issued seasoned equity or bonds during my 3- or 5-year event study. Spiess and Affleck-Graves (1995) and Jegadeesh (2000) document that firms that do a seasoned equity offering underperformed to firms that did not do this. Thus taking into account if a firm also issues seasoned equity or bonds can influence the results found in my research. Moreover, there could be a further extension of the 5-year holding period. Lastly, the conclusion about long-run performance of the Netherlands IPO is not conclusive. The IPO sample needs to extend or even look at a Western-Europe sample to come to conclusive results about the long-run performance of initial public offerings outside the United States.

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7. Appendix

Table 1: Abnormal return for IPOs in the United States, 2000-2011

Average matched firm-adjusted returns (AR_t) and cumulative average returns ($\mathrm{CAR}_{1,t}$), in percent, with associated t-statistics for the 36 months after going public, excluding the initial return. The number of IPOs trading is less than 1,439 because some firms have a greater delay than one month, before becoming listed. $\mathrm{AR_t} = 1/n_t \sum_{i=1}^{n_t}(r_{\mathrm{ipo},it} - r_{\mathrm{match},it})$ where $r_{\mathrm{ipo},it}$ is the total return on initial public offering firm i in event month t, and $r_{\mathrm{match},it}$ is the total return on the corresponding matching firm. The *t*-statistics for the average adjusted return is computed for each month as $\mathrm{AR_t} * \sqrt{n_t}/sd_t$, where $\mathrm{AR_t}$ is the average matching firm-adjusted return for month t, n_t is the number of observations in month t, and sd_t is the cross-sectional standard deviation of the adjusted returns for month t. The *t*-statistics for the cumulative average adjusted return in month t, $\mathrm{CAR}_{1,t}$, is computed as $\mathrm{CAR}_{1,t} * \sqrt{n_t}/csd_t$, where n_t is the number of firms trading in each month, and csd_t is computed as $csd_t = [t * \mathrm{var} + 2 * (t-1) * \mathrm{cov}]^{1/2}$, where t is the event month, var is the average (over 36 month) cross-sectional variance, and cov is the first-order autocovariance of the $\mathrm{AR_t}$ series.

Month of seasoning	Number of IPOs trading	AR_t %	t-stat	$\mathrm{CAR}_{k,p}$ %	t-stat
1	1400	0.47	0.78	0.47	0.79
2	1419	-2.64	-4.41	-2.17	-2.48
3	1427	-0.46	-0.76	-2.63	-2.43
4	1425	-2.01	-3.74	-4.65	-3.69
5	1424	-2.29	-4.09	-6.94	-4.91
6	1423	-3.68	-6.29	-10.62	-6.84
7	1421	-1.32	-2.20	-11.94	-7.11
8	1416	-0.23	-0.32	-12.17	-6.76
9	1411	-1.12	-1.88	-13.30	-6.94
10	1411	-0.99	-1.65	-14.29	-7.07
11	1404	-1.57	-2.71	-15.86	-7.45
12	1401	-1.82	-3.04	-17.69	-7.95
13	1395	-1.09	-1.84	-18.77	-8.08
14	1383	-1.02	-1.71	-19.80	-8.17
15	1375	-0.35	-0.57	-20.14	-8.01
16	1367	-0.87	-1.28	-21.01	-8.06
17	1361	-0.72	-1.21	-21.73	-8.07
18	1346	-0.55	-0.89	-22.28	-7.99
19	1341	-0.33	-0.50	-22.61	-7.88
20	1332	-1.25	-1.98	-23.85	-8.07
21	1326	-1.42	-2.52	-25.27	-8.33
22	1322	-0.85	-1.45	-26.12	-8.40
23	1312	-0.40	-0.68	-26.52	-8.31
24	1305	-1.27	-2.21	-27.80	-8.50
25	1288	-1.32	-2.34	-29.12	-8.66
26	1265	-1.67	-2.98	-30.79	-8.90
27	1250	-0.27	-0.44	-31.06	-8.76
28	1240	-1.50	-2.40	-32.57	-8.98
29	1228	-0.71	-1.08	-33.28	-8.97
30	1213	-1.14	-1.73	-34.42	-9.07
31	1205	-0.36	-0.61	-34.78	-8.98
32	1194	-1.35	-2.27	-36.13	-9.14
33	1181	0.22	0.32	-35.91	-8.90
34	1172	-0.11	-0.19	-36.02	-8.76
35	1164	-0.93	-1.55	-36.96	-8.83
36	1152	0.74	0.89	-36.22	-8.48

Table 2: Abnormal return for IPOs in the United States using 5-year results, 1975-1984

Average matched firm-adjusted returns (AR_t) and cumulative average returns ($\mathrm{CAR}_{1,t}$), in percent, with associated t-statistics for the 60 months after going public, excluding the initial return. The number of IPOs trading is less than 1,065 because some firms have a greater delay than one month, before becoming listed. $\mathrm{AR_t} = 1/n_\mathrm{t} \sum_{i=1}^{n_t}(r_{\mathrm{ipo},it} - r_{\mathrm{match},it})$ where $r_{\mathrm{ipo},it}$ is the total return on initial public offering firm i in event month t, and $r_{\mathrm{match},it}$ is the total return on the corresponding matching firm. The *t*-statistics for the average adjusted return is computed for each month as $\mathrm{AR_t} * \sqrt{n_\mathrm{t}}/sd_\mathrm{t}$, where $\mathrm{AR_t}$ is the average matching firm-adjusted return for month t, n_t is the number of observations in month t, and sd_t is the cross-sectional standard deviation of the adjusted returns for month t. The *t*-statistics for the cumulative average adjusted return in month t, $\mathrm{CAR}_{1,\mathrm{t}}$, is computed as $\mathrm{CAR}_{1,\mathrm{t}} * \sqrt{n_\mathrm{t}}/csd_\mathrm{t}$, where n_t is the number of firms trading in each month, and csd_t is computed as $csd_\mathrm{t} = [\mathrm{t} * \mathrm{var} + 2 * (\mathrm{t}-1) * \mathrm{cov}]^{1/2}$, where t is the event month, var is the average (over 36 month) cross-sectional variance, and cov is the first-order autocovariance of the $\mathrm{AR_t}$ series.

Month of seasoning	Number of IPOs trading	AR_t %	t-stat	$\mathrm{CAR}_{k,p}$ %	t-stat
1	998	0.24	0.35	0.24	0.34
2	1021	1.19	1.81	1.43	1.50
3	1028	1.22	1.81	2.66	2.30
4	1039	-1.62	-2.62	1.03	0.78
5	1039	-0.95	-1.45	0.08	0.06
6	1037	-0.49	-0.75	-0.40	-0.25
7	1036	-1.51	-2.94	-2.21	-1.27
8	1029	-0.80	-1.14	-3.01	-1.62
9	1025	-2.49	-3.75	-5.50	-2.78
10	1023	-1.65	-2.32	-7.15	-3.43
11	1016	-1.93	-2.92	-9.08	-4.14
12	1016	-1.17	-1.69	-10.25	-4.48
13	1015	-0.44	-0.65	-10.69	-4.49
14	1010	-0.41	-0.56	-11.09	-4.48
15	1004	-1.52	-2.23	-12.62	-4.91
16	997	-1.06	-1.40	-13.67	-5.13
17	992	-1.82	-2.54	-15.50	-5.63
18	979	-0.63	-0.85	-16.12	-5.66
19	969	-0.70	-0.94	-16.82	-5.72
20	962	-1.80	-2.54	-18.62	-6.15
21	953	-1.30	-1.83	-19.91	-6.39
22	939	-2.27	-3.39	-22.18	-6.90
23	929	-0.47	-0.61	-22.65	-6.86
24	920	-1.78	-2.45	-24.44	-7.21
25	907	-0.69	-0.90	-25.13	-7.21
26	899	-1.15	-1.54	-26.28	-7.36
27	889	-2.70	-3.82	-28.98	-7.92
28	881	-1.27	-1.76	-30.25	-8.09
29	868	-2.00	-2.83	-32.25	-8.41
30	858	-1.32	-1.85	-33.57	-8.56
31	851	0.33	0.36	-33.24	-8.30
32	844	-1.85	-2.38	-35.08	-8.59
33	830	-0.11	-0.14	-35.19	-8.41
34	817	-2.51	-3.33	-37.70	-8.81
35	806	-2.13	-2.91	-39.83	-9.11
36	801	-1.90	-2.39	-41.73	-9.38
37	795	-0.47	-0.57	-42.20	-9.33
38	793	-1.16	-1.61	-43.36	-9.44
39	785	-1.68	-1.84	-45.05	-9.64
40	774	-0.75	-0.97	-45.80	-9.61
41	767	-0.49	-0.61	-46.28	-9.54
42	760	-3.58	-4.68	-49.86	-10.11
43	756	-1.81	-2.17	-51.68	-10.33
44	747	0.07	0.08	-51.61	-10.14
45	739	-0.89	-1.14	-52.49	-10.15
46	733	-2.33	-2.86	-54.82	-10.44
47	724	-2.84	-3.23	-57.66	-10.79
48	716	-0.78	-0.93	-58.44	-10.77

49	711	-2.50	-3.28	-60.94	-11.07
50	699	-1.05	-0.93	-62.00	-11.06
51	695	-2.69	-3.11	-64.68	-11.39
52	688	0.78	0.90	-63.90	-11.09
53	681	-3.18	-4.26	-67.08	-11.47
54	672	-1.31	-1.38	-68.39	-11.51
55	668	-0.91	-1.00	-69.30	-11.52
56	661	-1.23	-1.57	-70.53	-11.56
57	661	-2.72	-3.16	-73.25	-11.91
58	656	-1.58	-1.77	-74.83	-12.01
59	646	-0.87	-0.92	-75.71	-11.95
60	642	-3.42	-4.54	-79.13	-12.35

Table 3: Abnormal returns for IPOs in the United States using 5-year results, 2000-2011

Average matched firm-adjusted returns (AR_t) and cumulative average returns ($\mathrm{CAR}_{1,t}$), in percent, with associated t-statistics for the 36 months after going public, excluding the initial return. The number of IPOs trading is less than 1,439 because some firms have a greater delay than one month, before becoming listed. $\mathrm{AR_t} = 1/n_\mathrm{t} \sum_{i=1}^{n_t}(r_{\mathrm{ipo},i\mathrm{t}} - r_{\mathrm{match},i\mathrm{t}})$ where $r_{\mathrm{ipo},i\mathrm{t}}$ is the total return on initial public offering firm i in event month t, and $r_{\mathrm{match},i\mathrm{t}}$ is the total return on the corresponding matching firm. The *t*-statistics for the average adjusted return is computed for each month as $\mathrm{AR_t} * \sqrt{n_\mathrm{t}}/sd_\mathrm{t}$, where $\mathrm{AR_t}$ is the average matching firm-adjusted return for month t, n_t is the number of observations in month t, and sd_t is the cross-sectional standard deviation of the adjusted returns for month t. The *t*-statistics for the cumulative average adjusted return in month t, $\mathrm{CAR_{1,t}}$, is computed as $\mathrm{CAR_{1,t}} * \sqrt{n_\mathrm{t}}/csd_\mathrm{t}$, where n_t is the number of firms trading in each month, and csd_t is computed as $csd_\mathrm{t} = [\mathrm{t} * \mathrm{var} + 2 * (\mathrm{t}-1) * \mathrm{cov}]^{1/2}$, where t is the event month, var is the average (over 36 month) cross-sectional variance, and cov is the first-order autocovariance of the $\mathrm{AR_t}$ series.

Month of seasoning	Number of IPOs trading	AR_t %	t-stat	$\mathrm{CAR}_{k,p}$ %	t-stat
1	1400	0.92	1.43	0.92	1.60
2	1418	-2.68	-4.60	-1.76	-2.19
3	1425	-0.44	-0.73	-2.21	-2.25
4	1422	-1.88	-3.48	-4.09	-3.62
5	1420	-1.58	-2.74	-5.67	-4.49
6	1418	-3.52	-5.94	-9.19	-6.64
7	1415	-1.43	-2.45	-10.62	-7.10
8	1411	0.02	0.03	-10.60	-6.62
9	1407	-1.56	-2.61	-12.16	-7.15
10	1407	-0.51	-0.86	-12.67	-7.07
11	1401	-1.44	-2.38	-14.11	-7.49
12	1398	-1.62	-2.66	-15.73	-7.99
13	1392	-0.66	-1.05	-16.38	-7.98
14	1380	-1.43	-2.44	-17.81	-8.32
15	1373	-1.22	-2.17	-19.04	-8.57
16	1364	-0.70	-1.07	-19.74	-8.58
17	1356	-0.38	-0.65	-20.11	-8.45
18	1343	-0.77	-1.25	-20.88	-8.49
19	1338	-0.58	-0.86	-21.46	-8.48
20	1329	-0.98	-1.55	-22.44	-8.61
21	1326	-1.48	-2.59	-23.91	-8.95
22	1323	-0.77	-1.31	-24.68	-9.01
23	1311	-0.13	-0.22	-24.81	-8.82
24	1305	-1.77	-2.94	-26.58	-9.23
25	1288	-0.89	-1.56	-27.47	-9.28
26	1263	-1.40	-2.52	-28.87	-9.47
27	1247	-0.03	-0.05	-28.90	-9.25
28	1237	-1.17	-1.91	-30.07	-9.41
29	1223	-0.52	-0.81	-30.58	-9.35
30	1207	-1.04	-1.52	-31.63	-9.45
31	1201	-0.59	-1.00	-32.22	-9.44
32	1190	-1.38	-2.63	-33.60	-9.65
33	1177	-0.01	-0.02	-33.62	-9.45

34	1170	-0.05	-0.09	-33.67	-9.30
35	1162	-1.14	-1.89	-34.82	-9.45
36	1150	0.96	1.23	-33.86	-9.01
37	1145	1.58	1.74	-32.28	-8.46
38	1136	-0.51	-0.92	-32.79	-8.44
39	1128	0.15	0.26	-32.64	-8.27
40	1119	0.18	0.28	-32.46	-8.08
41	1110	-1.34	-2.52	-33.80	-8.28
42	1100	0.46	0.71	-33.33	-8.03
43	1093	-1.93	-3.61	-35.27	-8.37
44	1088	0.08	0.13	-35.18	-8.24
45	1078	0.15	0.26	-35.03	-8.07
46	1068	-1.83	-3.80	-36.86	-8.37
47	1060	0.58	0.96	-36.28	-8.11
48	1053	-0.35	-0.62	-36.63	-8.08
49	1048	-1.04	-1.75	-37.67	-8.20
50	1039	-1.01	-1.82	-38.67	-8.30
51	1036	0.51	0.75	-38.16	-8.10
52	1028	-0.29	-0.50	-38.45	-8.05
53	1016	-0.19	-0.32	-38.65	-7.97
54	1007	-1.22	-2.03	-39.87	-8.11
55	1003	-1.26	-1.96	-41.12	-8.27
56	997	0.69	1.04	-40.43	-8.04
57	984	-0.30	-0.44	-40.73	-7.97
58	974	0.33	0.38	-40.39	-7.80
59	967	-0.93	-1.40	-41.32	-7.88
60	957	-0.19	-0.32	-41.51	-7.81

Table 4: Performance of 5-year buy-and-hold returns categorized by initial return quintiles, 1975-1984, using matching on industry and size data

All IPOs sample consist of the 1,065 IPOs and the segmented by age sample consist of 836 IPOs. 7 years is the median age for the 836 IPOs. The wealth relative is a ratio of (1 + average IPO holding period total return (not in percent)) divided by (1 + average matched firm holding period total return (not in percent)), excluding the initial return.

	All IPOs			Segmented by age of the issuing firm			
	Excluding initial returns			Age <=7 years 'young'		Age > 7 years 'old'	
	Average holding period total return						
Matched firm-adjusted initial return quintile %	IPOs %	Matched firms %	*Wealth relative*	*Wealth relative*	Sample size	*Wealth relative*	Sample size
19.17 < IR < 227.70	20.98	71.49	0.705	0.668	111	0.904	65
6.26 < IR < 19.17	25.41	65.26	0.756	0.861	74	0.823	99
1.14 < IR < 6.26	23.70	92.80	0.641	0.647	93	0.671	92
-3.14 < IR < 1.14	54.85	64.06	0.944	0.896	92	0.945	94
-88.15 < IR < -3.14	23.91	56.59	0.791	0.562	49	1.092	65

Table 5: Performance of 5-year buy-and-hold returns categorized by initial return quintiles, 2000-2011, using matching on industry and size data

All IPOs sample consist of the 1,439 IPOs and the segmented by age sample consist of 836 IPOs. 8 years is the median age for the 1,086 IPOs. The wealth relative is a ratio of (1 + average IPO holding period total return (not in percent)) divided by (1 + average matched firm holding period total return (not in percent)), excluding the initial return.

	All IPOs			Segmented by age of the issuing firm			
	Excluding initial returns			Age <=8 years 'young'		Age > 8 years 'old'	
	Average holding period total return						
Matched firm-adjusted initial return quintile %	IPOs %	Matched firms %	*Wealth relative*	*Wealth relative*	Sample size	*Wealth relative*	Sample size
24.17 < IR < 509.93	-22.49	0.91	0.768	0.686	164	0.856	119
7.55 < IR < 24.17	20.43	28.34	0.938	0.833	133	1.040	135
0.49 < IR < 7.55	23.09	36.76	0.900	0.853	102	0.992	107
-1.49 < IR < 0.49	21.39	33.48	0.909	1.034	57	0.997	38
-70.98 < IR < -1.49	34.18	39.92	0.959	1.000	142	1.108	87

Table 6: Performance categorized by industry, 1975-1984, using matching on industry and size data

Panel A includes the 3-year buy-and-hold returns of the 1,065 IPOs. Panel B includes the 5-year buy-and-hold returns of the 1,065 IPOs. The different industries have a minimum of 20 IPOs. The wealth relative is a ratio of (1 + average IPO holding period total return (not in percent)) divided by (1 + average matched firm holding period total return (not in percent)), excluding the initial return.

		Excluding initial returns		
		Average holding period total returns		
Industry	Average matched firm-adjusted initial return %	IPOs %	Matched firms %	*Wealth relative*
Panel A: 3-year buy-and-hold returns				
Computer	14.14	29.51	13.75	1.139
Electronic equipment	14.70	43.89	44.53	0.996
Oil and gas	12.86	-44.34	-26.13	0.753
Financial institutions	3.05	117.02	118.81	0.992
Computer services	10.00	-2.29	31.75	0.741
Scientific instruments	17.31	21.08	22.62	0.987
Retailers	9.39	30.43	54.00	0.847
Wholesalers	14.14	-1.99	22.13	0.802
Restaurants	9.98	-25.47	46.37	0.509
Health care	3.05	28.97	129.55	0.562
Drugs	9.23	124.75	52.73	1.472
Airlines	-1.63	-19.66	33.82	0.853
All other firms	4.92	32.29	63.51	0.809
All firms	9.01	29.60	48.55	0.872
Panel B: 5-year buy-and-hold returns				
Computer	13.68	35.65	32.25	1.026
Electronic equipment	14.80	19.22	81.75	0.656
Oil and gas	12.76	-25.00	-26.65	1.022
Financial institutions	2.81	100.67	135.47	0.852
Computer services	11.22	10.46	51.57	0.729
Scientific instruments	17.62	25.77	40.30	0.896
Retailers	9.51	23.78	67.35	0.740
Wholesalers	14.19	-14.23	72.52	0.497
Restaurants	9.65	-41.31	39.81	0.420
Health care	3.40	54.87	117.11	0.713
Drugs	8.02	136.55	83.15	1.292
Airlines	-1.63	6.54	98.41	0.537
All other firms	4.98	32.16	86.70	0.708
All firms	9.08	29.69	69.82	0.764

Figure 1: Cumulative average matched firm-adjusted returns (CAR) for an equally weighted portfolio of different IPOs in the United States, 1975-1984, with monthly rebalancing, using the 3-year matching on industry and size/book-to-market data

Three CAR series are plotted for the 36 months after the IPO date for 785 IPOs: 1) raw returns, 2) book-to-market matched firm-adjusted returns, and 3) size matched firm-adjusted returns. Month 0 is the initial return period.

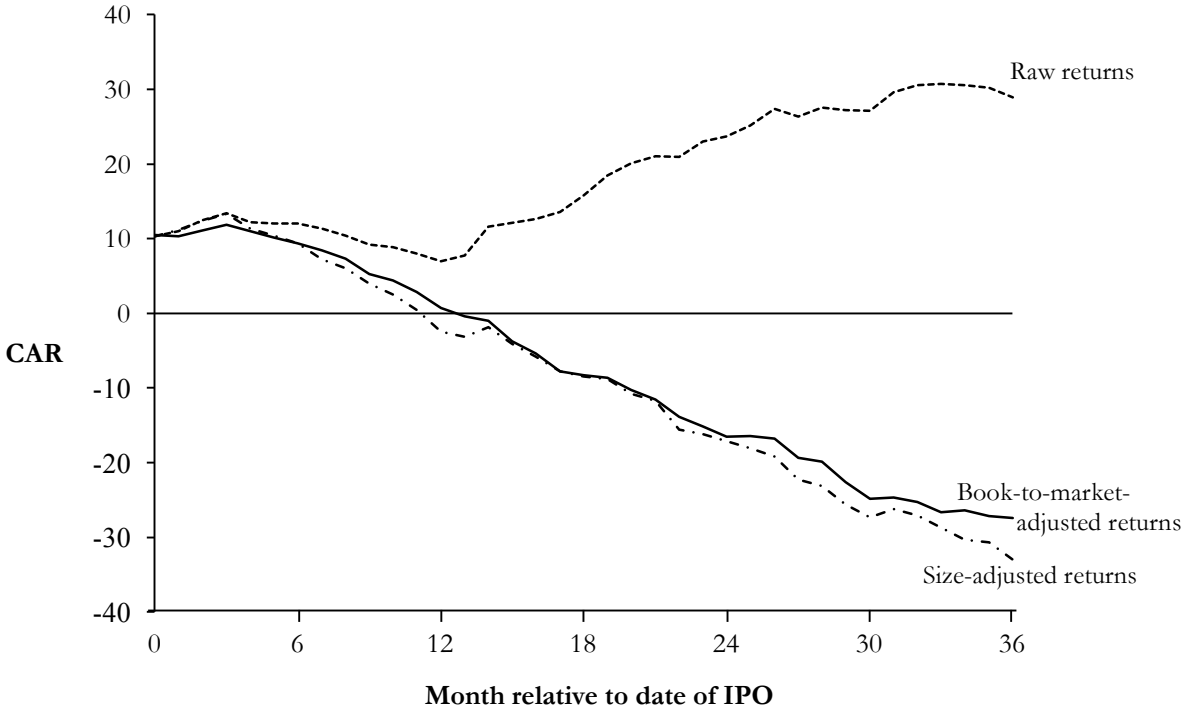

Table 7: Performance of 3-year buy-and-hold returns categorized by initial return quintiles, 1975-1984, using different matching characteristics

Panel A has 777 IPOs with matched firms on industry and size. Panel B consist of the same 777 IPOs, only matched on industry and size. The wealth relative is a ratio of (1 + average IPO holding period total return (not in percent)) divided by (1 + average matched firm holding period total return (not in percent)), excluding the initial return.

	Excluding initial return		
	Average holding period total return		
Matched firm-adjusted initial return quintile	IPO %	Matched firm %	*Wealth relative*
Panel A: Book-to-market matching			
20.54 < IR < 224.78	22.59	32.73	0.924
6.94 < IR < 20.54	47.74	85.73	0.795
1.60 < IR < 6.94	24.88	103.25	0.614
-3.00 < IR < 1.60	24.43	41.63	0.879
-88.15 < IR < -3.00	68.52	94.71	0.865
Panel B: Size matching			
21.84 < IR < 227.70	22.36	44.58	0.846
7.26 < IR < 21.84	63.14	34.45	1.213
1.67 < IR < 7.26	11.19	67.13	0.665
-3.21 < IR < 1.67	25.98	31.82	0.956
-90.66 < IR < -3.21	65.77	39.71	1.187

Table 8: Performance categorized by year of issuance for IPOs in 1975-1984, using different matching characteristics

Panel A has 777 IPOs with matched firms on industry and size. Panel B consist of the same 777 IPOs, only matched on industry and size. The *wealth relative* is a ratio of (1 + average IPO holding period total return (not in percent)) divided by (1 + average matched firm holding period total return (not in percent)), excluding the initial return.

			Excluding initial return		
			Average holding period total return		
Year	No. of IPOs	Average matched firm-adjusted initial return %	IPO %	Matched firm %	*Wealth relative*
Panel A: Book-to-market matching					
1975	1	6.26	44.80	362.25	0.313
1976	18	3.98	153.21	58.14	1.601
1977	14	6.48	256.39	63.68	2.177
1978	10	29.67	286.42	67.45	2.308
1979	26	7.05	129.08	121.87	1.032
1980	57	29.92	54.34	85.15	0.834
1981	153	7.93	59.71	59.09	1.004
1982	51	14.29	-7.93	61.03	0.572
1983	299	11.63	5.21	84.50	0.570
1984	148	1.69	22.01	47.81	0.825
Total	777	10.33	37.65	71.42	0.803
Panel B: Size matching					
1975	1	4.38	44.80	408.99	0.284
1976	18	4.97	153.21	111.18	1.199
1977	14	4.89	256.39	68.05	2.120
1978	10	29.93	286.42	140.81	1.605
1979	26	8.02	129.08	78.09	1.286
1980	57	29.96	54.34	88.40	0.819
1981	153	7.90	59.71	32.93	1.201
1982	51	15.07	-7.93	80.41	0.510
1983	299	11.69	5.21	26.42	0.832
1984	148	2.18	22.01	33.50	0.914
Total	777	10.52	37.65	43.55	0.959

Table 9: Performance categorized by industry, 1975-1984, using different matching characteristics

Panel A has 777 IPOs with matched firms on industry and size. Panel B consist of the same 777 IPOs, only matched on industry and size. The *wealth relative* is a ratio of (1 + average IPO holding period total return (not in percent)) divided by (1 + average matched firm holding period total return (not in percent)), excluding the initial return.

			Excluding initial return		
			Average holding period total return		
Industry	No. of IPOs	Average matched firm-adjusted initial return %	IPO %	Matched firm %	*Wealth relative*
Panel A: Book-to-market matching					
Airlines	17	5.06	414.59	230.64	1.556
Electronic Eq.	78	14.11	48.94	35.34	1.100
Computer	85	13.36	19.22	3.61	1.151
Computer ser.	82	11.94	-0.50	97.66	0.503
Drugs	29	10.66	136.04	190.93	0.811
Health care	19	3.14	32.14	95.70	0.675
Oil and gas	35	13.33	-42.13	-11.10	0.651
Scientific instr.	65	18.36	11.03	25.33	0.886
Restaurants	27	12.38	-6.09	54.80	0.601
Retailers	40	12.07	32.10	46.61	0.901
Wholesalers	27	10.18	1.21	50.91	0.671
All other firms	273	5.87	43.39	99.52	0.719
All firms	777	10.33	37.65	71.42	0.803
Panel B: Size matching					
Airlines	17	3.25	414.59	41.77	3.630
Electronic Eq.	78	14.86	48.94	37.23	1.085
Computer	85	13.92	19.22	12.11	0.984
Computer ser.	82	11.46	-0.50	38.75	0.717
Drugs	29	10.45	136.04	66.66	1.416
Health care	19	4.95	32.14	130.20	0.574
Oil and gas	35	13.76	-42.13	-32.67	0.859
Scientific instr.	65	19.04	11.03	21.03	0.917
Restaurants	27	12.61	-6.09	65.99	0.561
Retailers	40	11.88	32.10	57.31	0.840
Wholesalers	27	11.54	1.21	33.41	0.759
All other firms	273	5.82	43.39	60.08	0.896
All firms	777	10.52	37.65	43.55	0.959

Table 10: Performance of 3-year buy-and-hold returns categorized by initial return quintiles, 2000-2011, using different matching characteristics

Panel A has 1,077 IPOs with matched firms on industry and size. Panel B consist of the same 1,077 IPOs, only matched on industry and size. The wealth relative is a ratio of (1 + average IPO holding period total return (not in percent)) divided by (1 + average matched firm holding period total return (not in percent)), excluding the initial return.

	Excluding initial return		
	Average holding period total return		
Matched firm-adjusted initial return quintile	IPO %	Matched firm %	*Wealth relative*
Panel A: Book-to-market matching			
29.87 < IR < 513.54	-38.83	21.36	0.504
13.58 < IR < 29.87	20.64	65.94	0.727
2.78 < IR < 13.58	8.19	0.76	1.073
-2.83 < IR < 2.78	33.78	28.44	1.042
-71.31 < IR < -2.83	14.48	21.45	0.943
Panel B: Size matching			
28.83 < IR < 506.43	-35.50	-10.66	0.722
13.05 < IR < 28.83	11.21	27.40	0.873
2.90 < IR < 13.05	12.89	19.72	0.943
-2.81 < IR < 2.90	37.36	38.25	0.994
-70.45 < IR < -2.81	12.16	10.05	1.019

Table 11: Performance categorized by year of issuance for IPOs in 2000-2011, using different matching characteristics

Panel A has 1,077 IPOs with matched firms on industry and size. Panel B consist of the same 1,077 IPOs, only matched on industry and size. The *wealth relative* is a ratio of (1 + average IPO holding period total return (not in percent)) divided by (1 + average matched firm holding period total return (not in percent)), excluding the initial return.

			Excluding initial return		
			Average holding period total return		
Year	No. of IPOs	Average matched firm-adjusted initial return %	IPO %	Matched firm %	*Wealth relative*
Panel A: Book-to-market matching					
2000	210	57.31	-66.85	-24.97	0.442
2001	45	15.27	18.91	42.30	0.836
2002	48	6.52	85.85	99.81	0.930
2003	53	10.83	48.65	13.66	1.308
2004	140	11.58	44.21	33.00	1.084
2005	115	8.47	15.86	6.92	1.084
2006	120	10.62	-9.69	110.33	0.429
2007	137	10.63	-12.95	-4.13	0.908
2008	18	7.01	45.04	14.25	1.269
2009	34	11.11	31.91	86.08	0.709
2010	79	6.22	47.88	40.88	1.050
2011	77	10.11	53.78	39.76	1.100
Total	1,077	19.25	7.75	27.59	0.845
Panel B: Size matching					
2000	210	56.60	-66.85	-27.68	0.458
2001	45	14.85	18.91	36.01	0.874
2002	48	7.34	85.85	81.28	1.025
2003	53	11.47	48.65	66.32	0.894
2004	140	11.56	44.21	50.34	0.959
2005	115	8.20	15.86	25.14	0.926
2006	120	10.17	-9.69	-23.59	1.182
2007	137	10.58	-12.95	-19.67	1.084
2008	18	7.68	45.04	18.36	1.225
2009	34	10.21	31.91	67.93	0.786
2010	79	6.32	47.88	44.77	1.021
2011	77	6.70	53.78	59.41	0.965
Total	1,077	19.03	7.75	17.05	0.920

Table 12: Performance categorized by industry, 2000-2011, using different matching characteristics

Panel A has 1,077 IPOs with matched firms on industry and size. Panel B consist of the same 1,077 IPOs, only matched on industry and size. The *wealth relative* is a ratio of (1 + average IPO holding period total return (not in percent)) divided by (1 + average matched firm holding period total return (not in percent)), excluding the initial return.

			Excluding initial return		
			Average holding period total return		
Industry	No. of IPOs	Average matched firm-adjusted initial return %	IPO %	Matched firm %	*Wealth relative*
Panel A: Book-to-market matching					
Electronic Eq.	80	43.55	-28.55	-26.71	0.975
Computer ser.	178	43.50	-21.19	1.06	0.780
Drugs	116	6.25	32.78	110.60	0.630
Financial Inst.	126	5.70	39.19	71.10	0.814
Health care	20	14.65	29.45	60.41	0.807
Insurance	32	8.02	69.12	52.78	1.107
Miscellaneous	31	35.72	-13.76	-2.79	0.887
Oil and gas	111	1.27	15.54	22.27	0.945
Scientific instr.	73	18.60	-17.29	7.46	0.770
Retailers	30	22.32	39.59	34.18	1.040
Wholesalers	12	7.50	13.52	29.77	0.875
All other firms	268	15.59	5.49	10.04	0.959
All firms	1,077	19.25	7.75	27.59	0.845
Panel B: Size matching					
Electronic Eq.	17	42.76	-28.55	-20.54	0.899
Computer ser.	78	42.39	-21.19	4.65	0.753
Drugs	85	6.61	32.78	27.63	1.040
Financial Inst.	82	6.40	39.19	13.67	1.225
Health care	29	14.46	29.45	40.49	0.921
Insurance	19	9.58	69.12	45.80	1.160
Miscellaneous	35	32.04	-13.76	-1.22	0.861
Oil and gas	65	1.41	15.54	44.42	0.800
Scientific instr.	27	18.16	-17.29	13.41	0.729
Retailers	40	20.96	39.59	38.34	1.009
Wholesalers	27	6.95	13.52	28.32	0.885
All other firms	273	15.50	5.49	17.21	0.900
All firms	1,077	19.03	7.75	17.05	0.921