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Initial Public Offerings in Scandinavia

An empirical assessment of underpricing and aftermarket performance in the Scandinavian market

Are Scandinavian initial public offerings good investments?

Thea Grepp & Amalie Herrlin Sørensen

Supervisor: Francisco Santos

NORWEGIAN SCHOOL OF ECONOMICS

Abstract

This thesis contributes to the existing academic literature on the initial public offering anomalies by providing findings on underpricing and aftermarket performance in the Scandinavian market between 2007 and 2016. From the analysis, we find clear evidence of underpricing, whereas no unambiguous evidence of long-term underperformance. With an average equally-weighted first-day return of 5.78%, the Scandinavian market experiences lower levels of underpricing compared to other markets such as the U.S. With regards to aftermarket performance of the initial public offering firms, the level of performance varies with the applied methods and metrics. However, when adjusting for risk we find evidence of long-term underperformance in Scandinavia, with a monthly average equally-weighted excess return of -0.7% when applying the Fama-French three-factor model.

We find strong evidence of initial public offerings with cornerstone involvement to have higher first-day returns and superior performance in the aftermarket, which may be related to a potential signaling effect. The findings fill a gap in the existing literature with regards to the effect of cornerstone investors on Scandinavian initial public offerings. Further, we find that initial public offerings issued in a hot market experience significantly higher levels of underpricing. Evidence of the aftermarket performance depending on market conditions at the time of issuance is also presented. We find no clear evidence indicating that prestigious underwriters and private equity firms significantly affect the level of underpricing and aftermarket performance.

Preface

This thesis concludes our Master of Science in Finance at the Norwegian School of Economics. Writing this thesis has been both challenging and time-consuming but above all, it has been a rewarding and interesting process with great learning outcomes.

Our main motivation for studying initial public offerings (IPOs) in Scandinavia is a profound interest in corporate finance, strengthened by attending inspiring finance courses offered at the Norwegian School of Economics. During the writing process, we have developed a deeper understanding of the IPO process and the performance of Scandinavian IPOs. We are certain that we have acquired valuable insights into the Scandinavian IPO market, from which we will benefit in our future careers in finance.

Several individuals have contributed to the making of this thesis who deserves to be acknowledged. Their encouragement, motivating support, and contributions have been essential for our thesis. First of all, we would like to thank our supervisor Francisco Santos for his great support, guidance, and essential input during the writing process. Ole Petter Kjerkreit and Stenshagen Invest also deserve gratitude for the useful input on the various aspects on the Scandinavian IPO market, as well as input on which topics that would be interesting to learn more about from an investors perspective. We would also like to thank Ulf Persson at Nasdaq OMX Nordic for kindly providing us with data on Swedish and Danish IPOs, and the respondents at the Oslo Bors Information Service for their quick and helpful replies.

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List of Abbreviations

BHAR	Buy-and-hold abnormal return
$BHAR^{0d}$	Buy-and-hold abnormal return including the first-day return
$BHAR^{1d}$	Buy-and-hold abnormal return excluding the first-day return
CAR	Cumulative abnormal return
CAR^{0d}	Cumulative abnormal return including the first-day return
CAR^{1d}	Cumulative abnormal return excluding the first-day return
CAPM	Capital Asset Pricing Model
CPI	Consumer price index
EW	Equally-weighted
H0	Null hypothesis
HML	High book-to-market firms minus low book-to-market firms
ICB	Industry Classification Benchmark
IPO	Initial public offering
NHH	Norwegian School of Economics
NS	Non-sponsored
OLS	Ordinary least squares
OSE	Oslo Bors
PE	Private equity
SMB	Small firms minus big firms
VC	Venture capital
VW	Value-weighted
U.S.	United States of America

1. Introduction

This thesis aims to explore potential underpricing and long-term underperformance among initial public offerings (IPOs) in Scandinavia[1] between 2007 and 2016. Scandinavia has been an active listing market in recent years, boosted by escalating equity prices and a stable operating environment. Bloomberg has predicted that the number of stock market listings in Scandinavia in 2017 will surpass historical numbers, driven by a wave of Swedish IPOs (Hoikkala and Magnusson, 2017). The combination of increased importance, growing volume, and limited existing literature on the Scandinavian IPO market has been a motivation for our choice of topic.

An IPO is an important milestone for private firms wishing to go public, as well as representing new financing opportunities. Consequently, there are several studies exploring the effects and mechanisms of IPOs. Previous research has identified three regularities among IPOs. First, the tendency of new issues to be underpriced is perceived as a market anomaly. An offer price lower than the market price results in substantial returns on the first day of trading for investors. Secondly, IPO cyclicality is evident through great variations in both the number of IPOs and the amount raised in these offerings. Lastly, the shares of IPO firms have tended to perform poorly in the aftermarket. (Ibbotson and Ritter, 1995)

Although IPO underpricing and aftermarket performance are widely researched in an international context, there are only a limited number of studies on the Scandinavian market. With this thesis, we, therefore, aim to answer the question of whether Scandinavian IPOs are underpriced and subjects to long-term underperformance. We attempt to answer this research question by investigating 298 Scandinavian IPOs in the period between 2007-2016.

We further aim to uncover if various firm- and deal characteristics affect the potential underpricing and long-term underperformance of Scandinavian IPOs. Especially interesting is the impact of cornerstone investors, an investor who agrees to subscribe for a major fixed monetary amount of shares in an IPO prior to the issue, as this is a relatively new phenomenon in Scandinavia and a quite unexploited subject within the IPO literature. Furthermore, we wish to explore the effects of issuing an IPO in certain market conditions, the effect of prestigious underwriters, and the effect of private equity ownership in the issuing firms.

[1] Scandinavia include the countries Norway, Sweden and Denmark.

With regards to the research question, we uncover an average equally-weighted first-day return of 5.78% among the sample IPOs in the given time frame. Further, we find no unambiguous answers with regards to the aftermarket performance of Scandinavian IPOs, with the results depending heavily on the methods and metrics applied. However, we find an average monthly return of -0.7% after adjusting for risk by applying the Fama-French three-factor model. Our findings thus contribute to the existing academic literature by providing insights on the Scandinavian IPO market.

Further, we find evidence implying that cornerstone involvement significantly increases both the underpricing and the aftermarket performance of the Scandinavian IPOs. This is consistent with the limited existing research on cornerstone investors. Additionally, we find that IPOs issued in hot markets experience a higher level of underpricing than the remaining sample. However, we are unable to find a definite answer on how hot issue markets affect the aftermarket performance. Furthermore, the involvement of prestigious underwriters do not significantly influence the first-day returns of the sample IPOs, and we get conflicting results with regards to the effect of private equity ownership on underpricing. Lastly, the effect of the firm- and deal characteristics on aftermarket performance varies from the methods and metrics applied. Accordingly, the thesis provides insights to which firm- and deal characteristics affect the level of underpricing and aftermarket performance among Scandinavian IPOs.

The structure of the thesis is as follows. A literature review and relevant theories are presented in Chapter 2. Chapter 3 presents the sample selection and data collection processes. Further, Chapter 4 presents the methodology applied measuring underpricing and aftermarket performance, prior to presenting the results of our empirical analysis. Lastly, in Chapter 5, we present our overall conclusion. Take note, that a number of figures and tables are displayed in the appendix, these are denoted with an A in their captions.

2. Literature Review

This chapter presents theories and empirical findings on both IPO underpricing, cyclicality and aftermarket performance.

2.1. Underpricing

IPOs tend to experience a positive return on the first day of trading, indicating that the offering price is set too low relative to the market demand (Berk and DeMarzo, 2014). The first-day return thus depends on the retail demand for an offer, with aftermarket prices deviating from the fundamental value of a firm when demand for the issue is high. In contrary, if the demand is low, the aftermarket price will end up closer to the offer price (Santos, 2017). A common explanation as to why IPOs are associated with underpricing is that issuers need to leave money on the table[1] in order to attract investors (Bergström et al., 2006). The underpricing of IPOs is well-documented in the academic literature. Ritter (2017) uncovers an average first-day return of U.S. IPOs between 1980 and 2016 of 17.9%, leaving substantial profits for investors participating in the offering. Ritter (2017) provides a substantial data library on average first-day returns by country between 1980 and 2016, some of which are displayed in Figure 2.1.

Ibbotson (1975) finds an average first-day return of 11.4% for the U.S. market in the period between 1960-69. The author also reports that the distribution of these returns are both positively skewed and experience fat tails. According to Ibbotson (1975), initial positive returns is a result of one of two things, either the offering price is set too low or the investors systematically overvalue new issues. Westerholm (2006) studies the Nordic IPO market between 1991-2002 and finds that the first-day return varies between 8.5% and 22.0%, with an average of 17.0%. Compared to Westerholm (2006) our thesis offers an empirical analysis of IPOs in the recent years between 2007-2016, also further limiting the scope to the Scandinavian countries. Overall, there is limited research on the Scandinavian market. Our thesis, however, contributes to the existing literature by finding an average equally-weighted first-day return of 5.78%. The level of underpricing is substantially lower than both the average first-day returns uncovered by

[1] Loughran and Ritter (2004) defines money on the table as the initial return times the number of shares issued.

Ritter (2017) and Ibbotson (1975) in the U.S., and the level uncovered in the Nordic region by Westerholm (2006).

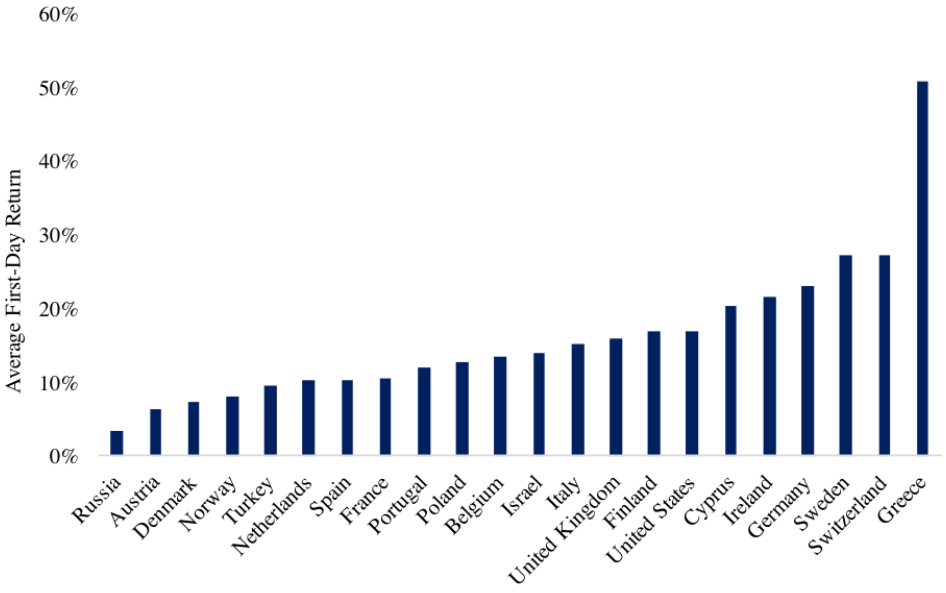

Figure 2.1 – Average First-Day Returns in a Selection of Countries, 1980-2016

The figure illustrates the average first-day return in a number of European countries and the U.S. between 1980 and 2016. The average return varies from 3.3% in Russia to 50.8% i Greece. Denmark, Norway, and Sweden have average returns of 7.4%, 8.1% and 27.2%. Source: Ritter (2017).

2.1.1 Theories Based on Deal Characteristics

A number of explanations for the new issue underpricing anomaly focuses on market conditions and deal characteristics[2]. Many of which, focuses on the occurrence of informational asymmetries between stakeholders participating in the IPO process. The winner's curse hypothesis by Rock (1986) is such a theory. Rock (1986) divides investors into two groups, the informed investors who have perfect information about the realized value of the new issue, and the uninformed investors. Underpricing is thus regarded as compensation for the risk carried by the uninformed investors, due to their informational disadvantage. Hence, the uninformed investors face the winner's curse if they are allocated all the shares of the desired issue. Accordingly, implying that the informed investors are uninterested in participating as they believe the issue to be overpriced. This results in uninformed investors only subscribing to IPOs, if on average the IPOs are underpriced sufficiently to compensate their disadvantage. Issuers must price the

[2]See for instance Ibbotson (1975), Ritter (1984), and Loughran and Ritter (2004).

stocks at a discount to avoid the uninformed investors unwillingness to participate in the IPO. (Rock, 1986)

Further, empirical research states that underwriter reputation is negatively correlated with the first-day returns of new issues[3]. Beatty and Ritter (1986) and Carter and Manaster (1990) state that prestigious underwriters[4] who frequently interact with the capital markets, have significant incentives not to mislead investors by supporting firms that try to go public at excessive valuations. Underwriters have a signaling effect with regards to the true value of a company, thus, if present, reducing information asymmetries. In addition, Loughran and Ritter (2004) and Baron (1982) argue that underwriters may have incentives to deliberately underprice IPOs, either to reduce marketing costs and risk, or to induce investors to participate in future issues.

Private equity (PE)-firms use the IPO market as an exit strategy for their investments. Accordingly, investors may infer that an issuing firm is of high quality if the firm is backed by private equity, as PE-firms stake their reputation by issuing a low-quality firm. Bergström et al. (2006) examine 1,522 IPOs on the London Stock Exchange and the Paris Stock Exchange between 1994 and 2004, finding that PE-backed and non-sponsored IPOs on average exhibit an underpricing of 9.33% and 12.87%, respectively. Additionally, Bergström et al. (2006) argue that PE-backed IPOs on average outperform non-sponsored IPOs over all time horizons. Studying the Nordic market both Anker and Stärk-Johansen (2015), Sevonius and Hertervig (2014), and Mathisen and Camas (2012) find evidence consistent with Bergström et al. (2006), indicating that PE-backed IPOs are less underpriced than non-sponsored IPOs.

Cornerstone investments are a relatively new phenomenon in Europe compared to the Asian market, and in Scandinavia this trend has currently only been observed in Sweden[5]. A cornerstone investment is an agreement by an investor to subscribe for a fixed monetary amount of shares in an IPO (McNaughton et al., 2015). Cornerstone investors are often large institutional or sovereign investors. Normally the cornerstone investors commit to the issue shortly prior to the IPO price range and the prospectus are published. From an investor's perspective, a cornerstone investment brings with it a guaranteed allocation of shares. As opposed to the issuer's perspective. Having one or more cornerstone investors participating has the benefit

[3]See for instance Carter and Manaster (1990).

[4]Carter and Manaster (1990) developed a ranking procedure to determine whether an underwriter is prestigious or not.

[5]Recent examples are Lifco AB in 2014, Dustin Group AB in 2015 and Eltel AB in 2015.

of increasing marketing momentum, especially if a well-known institutional investor publicly attaches its name to the deal (McNaughton et al., 2015). The effect of cornerstone investors on IPOs is a relatively unexploited topic in empirical literature. McGuinness (2012) finds no evidence of underpricing in cornerstone-backed transactions when studying the Chinese IPO market. Further, with regards to long-term performance, McGuinness (2014) reports evidence of positive abnormal return for cornerstone-backed IPOs. McGuinness (2014) points to signaling effects as a possible explanation for the positive performance of IPOs with cornerstone investors, when the presence of cornerstone investors could send positive signals to the market about the quality of the issue. Studying the Swedish IPO market between 2010-17, Negman and Pehrson (2017) discover a higher level of underpricing among cornerstone backed IPOs, with an average first-day return of 14.6% compared to an 5.4% average for IPOs without cornerstone involvement. Additionally, our thesis contributes to the existing literature by presenting an average equally-weighted first-day return of 17.94% for Scandinavian IPOs with cornerstone investors, compared to an average of 4.16% for the IPOs without cornerstone involvement. Our findings are consistent with those of Negman and Pehrson (2017) and shed light on the interesting and unexploited effects of cornerstone involvement on IPOs.

Lastly, Hanley (1993) studies the relationship between the final offer price and the indicative price range set prior to an IPO in situations where the price is decided through a bookbuilding process. Finding an average first-day return of 20.7% for IPOs priced above the price range, whereas an average of 0.6% for issues priced below. Thus, suggesting that issues priced at the top of the price range perform better in the aftermarket. Further, a study conducted by Bakke et al. (2016) finds that first-day returns are smaller in a low-demand state where the offer price is set to the lower end of the offer range, and higher in a high-demand state.

2.1.2 Theories Based on Firm Characteristics

Firms decide to go public at different stages in their life cycle. It is a common assumption that younger firms tend to be riskier, thus investors demand higher returns for such firms due to their uncertain future (Ritter, 1991). Ritter (1984) argues that informed investors require a discount on the price of new issues when a firm's historical data is limited. This is consistent with Beatty and Ritter (1986) who find that the higher the firm age, the lower degree of underpricing. In addition, Ritter (1991) and Loughran and Ritter (1995) argue that investors are periodically overoptimistic about the earnings potential for young growth firms. Several studies have proved

that industry-specific risk, influences the level of underpricing. Ritter (1991) studies 1,526 IPOs belonging to 14 different industries and finds the highest level of first-day returns of 128.2% in the financial institution sector, closely followed by the drug sector at 121.7%. Furthermore, Loughran and Ritter (2004) discovered that during the IT-bubble there was a significant increase of 65.0% in the level of underpricing, while in the post-bubble period it dropped by 12.0%. The authors explain this phenomenon as a result of technology firms likely being younger, thus exposing investors to additional risk which they need to be compensated for.

2.2. IPO Cyclicality

Existing literature on IPOs has uncovered that the frequency rate of initial issues is highly cyclical. These cycles have been identified both in the volume of IPOs in a given year and in the average initial return of IPOs (Ibbotson and Ritter, 1995). Ibbotson and Jaffe (1975) uncovered cyclicality in the U.S. IPO market in the 1960s by finding significant serial correlation and indications of serial dependency between months (Ibbotson and Jaffe, 1975). Hot issue markets are defined as *periods in which the average first-month performance of new issues is abnormally high* (Ibbotson and Jaffe, 1975, p. 1027). Consistent with Ibbotson and Jaffe (1975), Ritter (1984, 1991) finds that IPOs issued in hot issue markets yield higher first-day returns, however, perform poorly in the long-term. Additionally, Ljungqvist et al. (2006) report that investor sentiment increases in hot issue markets.

Ibbotson and Ritter (1995) propose positive feedback strategies as an explanation for hot issue markets, arguing that investors assume positive autocorrelation in an IPO's first-day return. Thus, incentivizing them to bid up the price of the IPO if other previous issues have risen in price (Ibbotson and Ritter, 1995), as a result of the limited rationality of investors. If enough investors follow this strategy autocorrelation may occur, resulting in a hot market (Loughran and Ritter, 1995). Additionally, Ritter (1984) finds that there are more issues with a higher degree of risk in hot markets, thus yielding a higher average first-day return. However, Ritter (1984) states that this high first-day return is not solely explained by a change in the risk composition.

2.3. Long-Term Underperformance

Ritter (1991) was the first to identify the underperformance anomaly among IPOs. From his study of 1,526 IPOs in the U.S. between 1975-84, he finds that IPO firms underperform compared

to a peer group, yielding an average three-year cumulative abnormal return of -29.1%. In addition, Loughran and Ritter (1995) report that IPO firms significantly underperform those of public firms with a similar market capitalization over a period of three and five years. Loughran and Ritter (1995) argue that underperformance is caused by investors being over-optimistic about the future of the IPO firms. In accordance, Loughran (1993) discovers that NASDAQ IPOs yielded significantly lower returns than the CRSP NASDAQ equally-weighted index in the period 1973-88 for the first six years after going public. Consistent with Ritter (1991), Loughran and Ritter (1995) and Loughran (1993), Bergström et al. (2006) report evidence of long-term underperformance of European IPOs between 1994 and 2004. In regards to the Nordic markets between 1991 and 2002, Westerholm (2006) finds that the long-term return is weak in Sweden and Finland and almost identical to the market index return in Denmark. However, the Norwegian IPOs outperform the market index by 3.3% per year. Our thesis contributes to the existing literature on IPO aftermarket performance by presenting findings on the aftermarket performance of Scandinavian IPOs in more recent years. The findings, however, yield no definite answer on the question of underperformance in the Scandinavian aftermarket.

2.3.1 Possible Explanations for IPO Underperformance

Miller (1977) explains IPO long-term underperformance as a result of divergence in the opinions of investors, with higher levels of divergence in the perceived value of an IPO in situations of high uncertainty. As more information is revealed, the marginal investors' valuation converge and the price of the IPO shares drop. In comparison, Shiller (1990) argues that underwriters deliberately underprice IPOs to create an illusion of excess demand in the market and that the IPOs with the highest first-day returns have the lowest subsequent returns. Ritter (1991) partially bases long-term underperformance on the behavioral explanations of risk mismeasurement, bad luck or fads, and overoptimism as possible explanations of underperformance. Further, Schultz (2003) presents the pseudo market timing hypothesis as a possible explanation for IPO underperformance. He argues that firms choose to go public in periods with high share prices, as this implies higher investment opportunities. The result is a higher number of offerings at peak valuations than at lower prices ex-post, which is known as pseudo market timing.

3. Sample Selection and Data Collection

The following sections describe the sample and data selection, as well as our collection process. The variables and data described are constructed with the purpose of answering our research questions. Namely, to identify potential underpricing and underperformance, and uncover variables that significantly affect these anomalies.

3.1. Sample Selection and Issue Characteristics

Our initial sample consists of 298 IPOs issued in Scandinavia[1] in the time period between January 2007 and December 2016. In order to best capture the Scandinavian IPO market, we include the following stock exchanges; Nasdaq OMX Stockholm, Nasdaq OMX Copenhagen, Nasdaq First North, Oslo Bors, and Oslo Axess. The similar economic and institutional characteristics of the Scandinavian countries is the main reason for our choice of geographical delimitation. Additionally, the Scandinavian market as a whole is regarded as transparent with respect of data availability (Shi et al., 2013), which is an advantage in the process of data collection. The nine-year time frame is selected to obtain a sufficiently large sample, to capture varying market conditions, as well as limiting our analysis to recent years. We aim to capture the effect of the closing and reopening of IPO markets related to the Financial Crisis in 2008 by including data from 2007.

The process of retrieving data has been a time-consuming part of our research. We obtained lists of relevant IPOs from Oslo Bors and Oslo Axess from Oslo Bors's website, and Ulf Persson[2] kindly provided us with lists of IPOs from Nasdaq OMX Nordic and First North. In order to isolate the effect of an IPO, we exclude secondary listings, spin-offs, transfers, OTC-listings, and IPOs without available prospectuses. IPO firms which were delisted in the analyzed time period were included in order to avoid survivorship bias. During the process of retrieving our initial sample, we were, however, obligated to remove 41 of the IPOs as none or little information was available. This could potentially bias our results. The sample selection process yielded an initial sample of 298 IPOs, consisting of 13, 93, and 192 IPOs in respectively Denmark, Norway and Sweden. We regard the initial sample as a sufficient sample size in order to obtain significant

[1] Defined as; Denmark, Norway, and Sweden.

[2] Economic and Statistical Researcher at Nasdaq Stockholm.

results, considering the size of the Scandinavian market and the given time frame of nine years. Table 3.1 summarizes the distribution and issue characteristics of the IPOs across the initial sample.

Year	Number of IPOs	Average 1^{st}Day Return	Average Adj.Offer Size (EURm)
2007	55	3.54%	41.6
2008	13	2.88%	6.6
2009	1	1.82%	6.4
2010	19	-1.51%	196.9
2011	13	1.25%	43.7
2012	4	-5.53%	68.7
2013	19	4.07%	81.6
2014	52	0.35%	105.6
2015	68	11.38%	86.0
2016	54	12.09%	114.2
Total	298	5.78%	87.3

Table 3.1 – Distribution and Issue Characteristics of Scandinavian IPOs, 2007-2016

The table displays the distribution and issue characteristics of the 298 Scandinavian IPOs completed between 2007 and 2016, by year. Secondary listings, spin-offs, transfers, OTC-listings and IPOs without available prospectuses are excluded. Reported offer sizes are in millions of euros and are inflation-adjusted.

Figure 3.1 illustrates how the yearly number of IPOs fluctuates over time in the Scandinavian market, with the highest activity found in 2015. We observe that the Scandinavian IPO market is cyclical in terms of volume, which is consistent with previous findings on the IPO cyclicality anomaly by for instance Ibbotson and Jaffe (1975). The low IPO activity in 2008 and 2009 could be a result of the negative market sentiment related to the Financial Crisis, while the Euro Crisis may be a reason for the low level in 2012. Nevertheless, the IPO activity has strengthened in recent years.

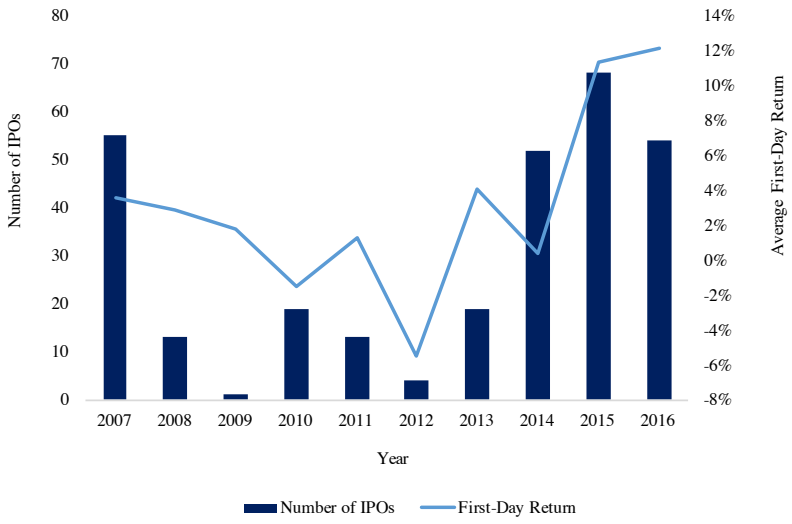

Figure 3.1 – Number of IPOs and Average First-Day Returns by Year in Scandinavia, 2007-2016

The figure displays the distribution of the initial sample of 298 IPOs in Scandinavia, 2007-2016. The average first-day return is given by the line, while the number of IPOs per year is given by the bars. The lowest first-day return is observed in 2012 and equals -5.53%, while the highest is observed in 2016 at 12.09%. The years with the highest IPO volume are 2007 and 2016 with 68 and 55 IPOs, respectively.

3.2. Data- and Variable Characteristics

In order to conduct an empirical analysis of the Scandinavian IPO market, we are highly dependent on retrieving data on historical prices and deal- and firm characteristics. The following subsections describe how these variables were constructed, our underlying assumptions, and the characteristics of the variables.

3.2.1 Offer Price

Reported offer prices are either a result of a book building process, or they are set at a fixed price. To capture the effect of these two processes we constructed the dummy variable BOOK_BUILDING set to one if the offer price was determined by book building and zero otherwise. In the sample, 134 of the offering prices were decided by a book building process. Further, to capture the initial demand for an IPO, we have constructed a proxy for the placement of the final offer price relative to the indicative price range. The proxy is given by the variable, PRICE_A_MP, taking the number one if a price is set above the midpoint of the price range.

The underwriters usually disclose an indicative price range in the prospectus, which made it feasible to uncover. For the remaining price ranges, we applied desktop searches. The range defines the upper and lower limit of the proceeds a company is believed to be able to raise. During the book building period the underwriters get a sense of where to set the final offer price, thus the final price is a result of the market demand. The purpose of the price range variable is to explore if a high or low price relative to the price range has a significant effect on underpricing and aftermarket performance. Several studies distinguish between issues going public with an offer price below, within, or above the price range, see for instance Hanley (1993). However, since only a few of the IPOs in our sample went public with an offer price outside the range, we find it more appropriate to divide the issues into companies going public below and above the price range midpoint. Based on our relatively small sample this twofold distinction is more suitable in light of degrees of freedom. Due to there only being a few instances were the initial price range were updated before the books closed, we do not include a control variable for these instances.

3.2.2 Offer Size

To examine the effect of the offer size on the level of underpricing and underperformance, we construct an offer size variable. For the Norwegian IPOs, the offer size was calculated by multiplying the number of shares issued by the issue price. The remaining offer sizes were obtained directly from the data provided by Nasdaq OMX Nordic and verified by information found in the IPO prospectuses. Further, in order to eliminate currency risk, the offer sizes are converted to euros[3], and as the IPO firms are listed in different years, we inflation-adjust the offer sizes. To obtain real values, the offer sizes are adjusted by a time-varying CPI deflator[4], which is based on the individual countries CPI between 2007-2016 with 2007 as the base year. Due to a limited time-period, the deflation effect was relatively limited. The average adjusted offer size amounts to EUR 87.30 million. Figure 3.2 illustrates the distribution of the inflation-adjusted offer sizes. More than 50 percent of the IPOs raised less than EUR 20 million, indicating that the sample mainly consists of relatively small IPOs.

[3]Daily exchanges rates were conducted from the central banks of the Scandinavian countries.

[4]Country specific and time-varying Consumer Price Index(CPI) was downloaded from The World Bank(TheWorldBank, 2017).

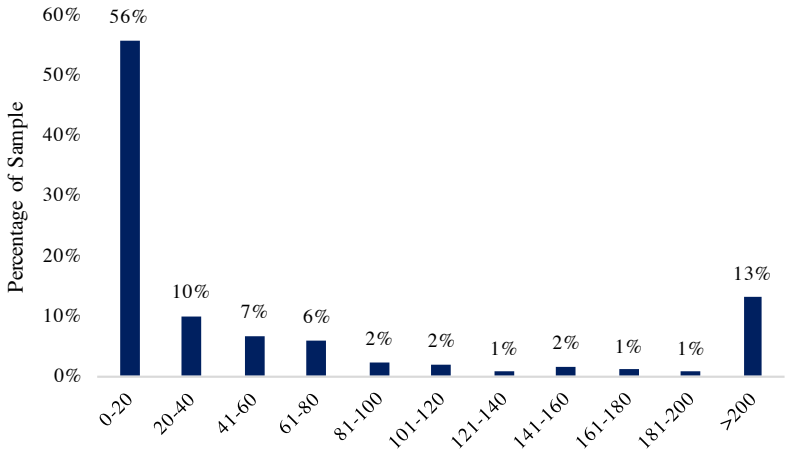

Figure 3.2 – Adjusted Offer Size of Scandinavian IPOs between 2007-2016 in 2007 EURm

The chart plots the distribution of the adjusted offer size in constant 2007 euros as a percentage of the initial sample of 298 IPOs in Scandinavia between 2007 and 2016. The offer size equals the number of shares sold multiplied by the offer price. The offer sizes are adjusted for inflation by the consumer price index for each of the countries and converted to euros using daily exchange rates.

3.2.3 Historical Prices and Accounting Data

Daily historical total return indices for each IPO firm are obtained from Thomson Reuters Datastream (ThomsonReuters, 2017a). Due to challenges with regards to dividends and stock splits being added back to the initial issue of a firm in Datastream, the total return index adjusted for dividends is employed instead of using historical stock prices. For IPO firms missing from Datastream, daily returns are computed using historical stock prices adjusted for dividends obtained from Bloomberg (Bloomberg, 2017) and cross-checked with Yahoo Finance (Finance, 2017)[5].

Furthermore, accounting data for the year prior to the IPO is collected for each firm in the sample[6], thus enabling analysis of possible firm-specific effects on underpricing and underperformance. From the accounting data the variables ADJ_TOT_ASSETS, ADJ_SALES, and ADJ_LT_DEBT are constructed. These variables are both currency and inflation-adjusted in the same way as the offer size[7]. We have also taken the natural logarithm of the three accounting variables in order to remove extreme outliers when running multivariate regressions.

[5]We also verified that these firms did not experience stock splits or buy-backs over the analyzed period.

[6]For instance, if a firm is listed in 2007 and reports by calendar years we have reported 2006 numbers and 2005-2006 numbers if it reports from September to August.

[7]See equation 4.5.

3.2.4 Industry, Market Size, and Firm Age

We apply the Industry Classification Benchmark (ICB)[8] to categorize the IPO firms into 19 different supersectors, with the purpose of analyzing possible industry effects (FTSE, 2012). The ICB was chosen on the basis of its reputation of being an acknowledged classification benchmark, as well as being used by the Nasdaq OMX Nordic (Nasdaq, 2017). Table A1 reports the characteristics of the individual industry segments. Based on the number of IPOs, the top five industry segments in the initial sample are industrial goods & services, health care, technology, oil & gas, and real estate.

Further, to investigate the effect of a firm's market size at the time of the IPO, we have classified the IPO firms into small, mid and large capitalization firms. This is carried out using the same classification standard as used by Nasdaq OMX Nordic[9]. The segmentation results in, 16, 84 and 198 respectively, large-cap, mid-cap, and small-cap firms[10].

Lastly, in order to examine possible age-effects, we construct an age variable. The LISTING_AGE variable is created by subtracting a firm's year of establishing from the year of the IPO. The initial sample has an average age of 18.5 years and a median age of 8.5 years, with the oldest company going public at an age of 211 years and the youngest being listed the same year as established.

3.2.5 Underwriter

Underwriters hold important roles in an IPO process, hence making the characteristics of the underwriters interesting to explore with regards to the effect on underpricing and underperformance. We have identified the underwriters of our sample IPOs and their roles through extensive desktop searches and the IPO prospectuses. The underwriters are separated into bookrunners, global coordinators, and co-managers. Furthermore, we have constructed two dummy variables, the SYNDICATE which indicates if the underwriters have collaborated in a syndicate or not, and the INT_UND variable which distinguishes between Scandinavian and

[8]The ICB is governed by the FTSE Group and consists of 4 levels with 10 industries, 19 supersectors, 41 sectors, and 114 subsectors.

[9]The standard implies that small-cap firms are firms with a market capitalization less than EUR 150 million, mid-cap firms are valued between EUR 150 million and EUR 1 billion, and large-cap firms have a market capitalization that exceeds EUR 1 billion (Nasdaq, 2017).

[10]For the 12 companies Datastream did not provide market values, we computed the market value by multiplying the shares outstanding, downloaded from Bloomberg, times the closing price on the first-day of trading.

international underwriters. An underwriter is defined as Scandinavian if the headquarter of the underwriter is located in Scandinavia and international if not.

Further, we construct a PREST_UND dummy variable which identifies underwriters regarded as prestigious, in hope of identifying possible effects of underwriter name and reputation on IPO underpricing and performance. A scoring procedure based on The Nordic Underwriter Ranking by TNS Sifo (Prospera, 2017) and the Thomson Reuters International Investment Banking Scorecard (ThomsonReuters, 2017b) is developed in order to construct the PREST_UND variable. An underwriter is considered prestigious if one of the bookrunners in the pertinent year and market, was either ranked as number one or two on the Nordic Ranking or ranked among the top ten in the international ranking. The scoring procedure results in 107 IPOs of the total sample having prestigious underwriters. The most active underwriters measured by participation in the number of IPOs are; ABG Sundal Collier, Carnegie, Pareto Securities and SEB Enskilda. Additionally, we constructed the variable LEAD_PREST_UND, which is set equal to one if the lead underwriter is regarded as prestigious and zero otherwise. The variable gives that only 19 of the initial IPOs have prestigious lead underwriters, which is less than the 107 given by the more broadly defined variable of PREST_UND.

3.2.6 Private Equity

Firms with private equity ownership prior to an IPO are especially interesting to examine. These are IPOs put forward by a professional owner, whom which in term might be able to withhold information and thus affect the pricing of an IPO. Buyout-backed firms and firms that have received venture capital (VC) are both defined as having PE-backing. The majority of IPOs with PE-ownership is identified from going through the IPO prospectuses, before being cross-referenced with a database provided by the Argentum Centre for Private Equity (Argentum, 2017). The classification process results in 95 PE-backed IPOs, where 47 are VC-backed and 48 are buyout-backed. The majority of buyout-backed IPOs took place in Sweden, which also was the most active market in terms of VC-backed IPOs for the analyzed period. EQT, Nordic Capital, and Altor were the three most active PE-firms in terms of volume. The BUYOUT and VC dummy variables take the value of one if the IPO firm is respectively buyout-backed or VC-backed, while the PE variable represents the total effect of both buyout and VC. We define a firm as buyout and VC-backed if one of the three largest owners are directly or indirectly PE-firms or venture capitalists. In addition, the dummy variable PE_OWNERSHIP_50% which

we define as one if a PE-firm owns more than 50% of the IPO firm prior to the listing, both indirect or direct, is constructed.

3.2.7 Cornerstone Investors

The effect of cornerstone investors on underpricing and aftermarket performance is fairly undocumented in empirical literature concerning Scandinavia. We aim to investigate this trend by constructing the CORNERSTONE dummy variable, which equals one if there have been cornerstone investors participating in the IPO and zero otherwise. Of the total sample, 35 IPOs have cornerstone involvement, all of which are Swedish IPOs. The first IPO with cornerstone investors in the sample is reported in 2014. The number increases for the year of 2015 and 2016, which demonstrates that this is a relatively new and increasing trend in the Scandinavian IPO market.

3.2.8 Market Conditions

Ibbotson and Jaffe (1975) find that hot issue markets are predictable in the U.S. and highly cyclical, implying that investors can choose which market, either hot or cold, they want to subscribe to IPOs. Further, firms choose to go public when the market conditions are favorable[11]. Based on this several variables are constructed in order to investigate the effect of market conditions on underpricing and underperformance.

As illustrated in Figure 3.1 there are fluctuations in the number of IPOs per year in the given time-period. In addition, the market conditions may vary considerably within a year, thus the number of listings per year does not necessarily provide a precise picture of the true market conditions. Taking this into account, market conditions are measured on a monthly basis which is consistent with Ibbotson and Jaffe (1975). With accordance to prior literature the market is divided into *hot*, *neutral* and *cold* periods based on IPO volume. This is executed by calculating the distribution of the number of IPOs per month during the sample period. If the number of IPOs in a given month is equal to, or higher than the 75^{th} percentile the month is characterized as a high volume month, and low volume month if the number of IPOs is equal to or below the 50^{th} percentile. All remaining months are characterized as neutral. Existing studies, such as Santos (2017), use the 25^{th} percentile as the lower limit, however, due to there being several months without issues in the sample, we find it more appropriate to use the 50^{th} percentile as

[11] Explained in section 2.2 about IPO Cyclicality.

the lower limit. Due to the fact that one specific month of high IPO volume might be driven by outliers, it may not reflect the actual state of the market. We accordingly use the low, neutral and high months to define *hot*, *neutral*, and *cold* periods, with a *hot* period consisting of three or more consecutive high volume months and correspondingly for *low* volume periods. All other periods are defined as *neutral* volume months. The dummy variable HOT_MKT_VOL equals one if a market is either defined as *hot* or *neutral*, and zero otherwise. Additionally, a similar variable defined by the level of first-day return, HOT_MKT_RET, is constructed from a time series of the average monthly initial returns from 2007 to 2016. If a month's underpricing is equal to or higher than the 75^{th} percentile the month is defined as high underpricing and low if the underpricing is equal to or below the 50^{th} percentile. All remaining months are classified as neutral. Compatible with the HOT_MKT_VOL, the *hot* and *neutral* periods are merged, as they both can be regarded as favorable market conditions. Lastly, Figure 3.3 illustrates that *hot*, *neutral*, and *cold* periods in terms of volume and underpricing do not occur simultaneously. In the year 2008 one, for instance, we observe high volume but a neutral level of underpricing.

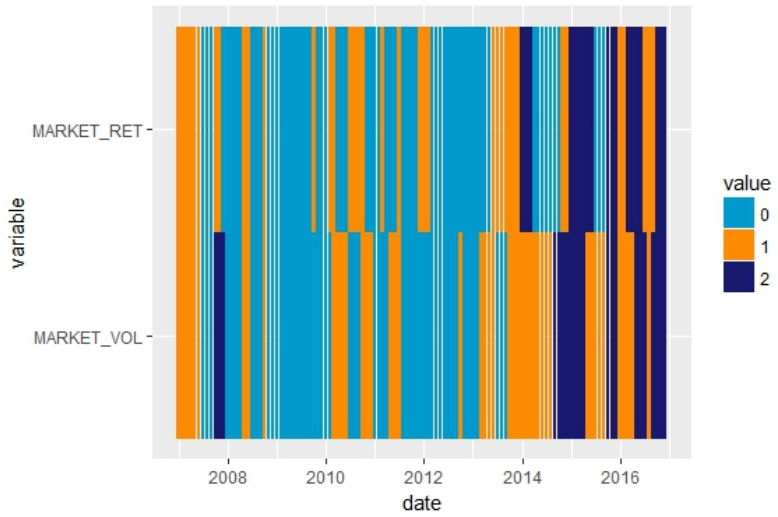

Figure 3.3 – Markets Conditions by the Level of IPO Underpricing and Volume, 2007-2016

The figure illustrates that hot, cold, and neutral periods in terms of volume and underpricing do not occur simultaneously. The sample consist of the 298 IPOs issued in Scandinavia from 2007 to 2016. The value of 0 denotes a cold issue market, while the value of 1 and 2 denotes neutral and hot issue markets, respectively. A high volume period consist of three or more consecutive high volume months, and correspondingly for low volume periods. All other periods are defined as neutral.

3.2.9 Benchmarks and Matching Procedure

Aftermarket performance is measured relative to a benchmark, with the ideal benchmark holding the same exposure to risk as the average IPO firm. Research mainly employ two types of benchmarks when examining IPO returns, a broad equity market index or a benchmark constructed matching the IPO firms against the returns of comparable public firms with similar risk characteristics[12]. The broad market index is easily implemented, however, at the expense of possibly not fully reflecting the unique characteristics of the IPO firms. The matched firm benchmark is more accurate in comparison to the market index, however, the process of identifying matching firms is especially difficult in small markets like the Scandinavian. We choose to employ both types of benchmarks. The MSCI Nordic Total Return Index is chosen as the broad market index. The index captures large and mid-cap firms in Sweden, Denmark, Norway, and Finland and accounts for approximately 85% of the free-float capital in each country (MSCIInc., 2017). Based on this, we believe the MSCI Nordic to be the most appropriate proxy for the Scandinavian IPOs, despite the fact that the index includes Finland.

Additionally, we conduct a matching procedure finding a comparable firm to each of the IPO firms, consistent with Ritter (1991) and Loughran and Ritter (1995). A matching procedure that is sufficiently precise, although does not lead to a severe loss of observations, is desirable. In line with Lie (2001) the IPO firms are matched with publicly traded firms on the basis of similar time periods and stock exchange[13], industry and book value of assets. The book value of assets is retrieved for the year prior to the IPO. In similarity with Santos (2017)[14] a value between 60% and 140% of the IPO firms total asset value is used when matching. The matching criteria were chosen since they might affect the first-day return. Firms that have been listed less than three years prior to a given IPO are excluded as potential matches, when it is undesirable to have recently listed firms accounting for the IPO sample firms[15]. A one-to-one matching procedure is chosen, as the limited scope of the Scandinavian stock markets makes it challenging to find a portfolio of comparable public firms. The matching procedure resulted in a sample of 88 IPOs with a match, which we regard as sufficient.

[12] See for instance Ritter (1991), Loughran and Ritter (1995), and Santos (2017).

[13] With the exception of three firms previously listed on Oslo Axess and later moved to Oslo Bors, where we have used a peer from Oslo Bors.

[14] We find it appropriate to increase the limits of total assets as compared to Santos (2017), due to the Scandinavian IPO market being smaller than the U.S. market.

[15] Research on U.S. IPOs have used a five-year limit, but we found it appropriate to use a three-year limit based on the smaller market size of the Scandinavian market.

4. Empirical Analysis

In the following chapter, we present the applied methodologies before answering the research questions on whether Scandinavian IPOs are underpriced and subjects to long-term underperformance, and if special firm- and deal characteristics have an effect on underpricing and aftermarket performance.

4.1. Methodological Approaches in Measuring Underpricing

In accordance with the majority of existing literature, the IPO underpricing is measured by the initial return of the issue, also known as and later referred to as the first-day return. Ritter and Welch (2002) and Loughran and Ritter (2004) argue that the majority of latter research, in the calculation of initial return, use the closing price of the first day of trading as a mean of measure. In accordance with this, the initial return is defined by Equation 4.1. The initial return of firm i is calculated using the offer price and unadjusted historical closing price in accordance with Beatty and Ritter (1986), who argue that it is unnecessary to adjust the initial return for market movements as these are small compared to the average initial return.

$$IR_i = \frac{ClosingPrice_{i1} - OfferPrice_{i0}}{OfferPrice_{i0}} \tag{4.1}$$

In addition, we calculate the average equally-weighted and average value-weighted first-day returns. Due to small firms getting a higher weight when using the average equally-weighted first-day returns, the returns are in general larger under the equally-weighted scheme than under the value-weighted scheme since several anomalies are more pronounced for smaller firms (Schober, 2008). The average equally-weighted return of the initial sample s is calculated using Equation 4.2, where n_s represent the sample size with the same weights assigned to each return, regardless of the relative market capitalization of each firm.

$$IR_s^{EW} = \frac{1}{n_s} \sum_{i=1}^{n_s} IR_i \tag{4.2}$$

For the sake of detecting the potential effect of underpricing between IPOs of different sizes, the average value-weighted return of sample s is computed using Equation 4.3. The weights

calculated using Equation 4.4 are assigned to the different firms in relation to their relative inflation-adjusted offer size at the time of the offering.

$$IR_s^{VW} = \sum_{i=1}^{n_s} w_i * IR_i \tag{4.3}$$

$$w_i = \frac{Adj.OfferSize_i}{\sum_{i=1}^{n_s} Adj.OfferSize_i} \tag{4.4}$$

We further adjust the offer sizes to euros to eliminate currency risk. In addition, the offer size is inflation-adjusted as the IPOs occur in different years. In order to obtain real values, we adjust the offer size by a time-varying CPI deflator, aligned by 2007 as the base year.

$$OfferSize_{Deflated} = \frac{OfferSize_{Unadjusted}}{1 + CPI_{Deflator}} \tag{4.5}$$

It is noteworthy that the average value-weighted calculation can be problematic since a small number of firms with large offerings may dominate the sample. Fama (1998) discusses this in further detail. To address this problem we calculate a trimmed average value-weighted first-day return, adjusted for extreme offer sizes. Further, we test if the average equally-weighted and value-weighted first-day returns are significantly different from zero. We do not trim the returns of the initial sample, with the exception of a trimmed version of the average value-weighted first-day return. This is done on the basis of keeping the first-day returns unskewed. In the following section the results of the aforementioned metrics are presented.

4.2. Underpricing in the Scandinavian IPO Market

The characteristics of the first-day return are summarized in Table 4.1. The initial sample contains a few extreme values, with the first-day returns ranging from -69.70% to 147.30%. The maximum value of 147.30% first-day return is observed in November 2016, a month characterized as a hot issue market[1]. The minimum value of -69.70% is observed in March 2007, a month characterized as cold[2]. Moreover, the average equally-weighted first-day return is higher than the median, indicating non-normal distributions, which is confirmed by a Shapiro-Wilks test. The distribution of the first-day return is displayed in Figure A1. Of the initial sample, 190 IPO

[1]Hot issue market defined by the level of underpricing.

[2]Cold issue market defined by the level of underpricing.

firms yield a positive first-day return, hence experiencing underpricing. A portion of the issues yields extreme values with 3.7% of the initial sample experiencing a first-day return above 50%.

	First-Day Return
Average (%)	5.78
Median (%)	2.00
Minimum (%)	-69.74
Maximum (%)	147.33
St.Deviation (%)	23.81
Kurtosis	9.25
Skewness	1.94
n	298

Table 4.1 – Summary Statistics of the First-Day Return of Scandinavian IPOs, 2007-2016

The table summarizes the distribution characteristics of the first-day returns for the total initial sample of 298 IPOs in Scandinavia between 2007 and 2016.

The average equally-weighted and value-weighted[3] first-day returns are 5.78% and 7.05%, respectively. The value-weighted average first-day return is however influenced by particularly two large issues in the sample, namely NETS A/S and Dong Energy which are allocated weights of approximately 7.00% each. When excluding these outliers, the value-weighted average first-day return amounts to 7.66%. The equally-weighted, and trimmed and untrimmed value-weighted average first-day returns are all significant at a 1%-level tested by a one sample t-test and one sample Wilcoxon rank test[4]. Furthermore, we find fluctuating first-day returns varying from -5.53% in 2012 to 12.09% in 2016. Such deviations may imply that IPO underpricing is a random phenomenon in the Scandinavian market.

Regardless of the weighting method, we find the sample IPOs to be on average statistically significantly underpriced, and the occurrence of positive first-day returns are consistent with the majority of existing empirical evidence[5]. The level of underpricing, however, is substantially lower than the international level. Comparing the results to earlier empirical findings from the U.S., we find that the average equally-weighted first-day return of 5.78% is substantially lower than the first-day returns observed in the U.S. Ritter (2017) finds an average first-day return of 17.90% between 1980 and 2016. Possible explanations of this deviation may be related

[3]Returns are value-weighted based on the inflation and currency-adjusted offer sizes.

[4]The results of these tests are available at request.

[5]See section 2.1.

to the theories of asymmetric information and divergence in the time-periods examined. The Scandinavian countries are known for a high degree of transparency and easily accessible information, which potentially could diminish the information asymmetry by alleviating the ex-ante uncertainty of investors. The lower level of underpricing may also be related to the high listing requirements of the Scandinavian markets, as proposed by Westerholm (2006).

Furthermore, looking at the Nordic IPO market between 1991-2002, Westerholm (2006) finds an average first-day return of 17.00%, which is more than twice as high as our finding. We find the average first-day return for Denmark, Norway, and Sweden to be respectively 4.81%, 6.03%, and 5.78%. The finding of Norwegian IPOs having a higher average first-day return compared to Swedish IPOs is inconsistent with Ritter (2017), who reports a higher return for Sweden. However, there is no significant difference between each of these countries first-day returns[6]. The average return for Sweden of 5.78% is much lower than the 39.00% reported by Loughran et al. (1994) for Sweden in the period between 1970-91. While the average first-day return found for Norway is higher than the return of 2.41% reported by Ellingsen (2012). Overall, the deviations may be explained by differences in geographical area or time-period. Our time-period does not include the hot issue years around the millennium, whereas it includes the cold issue years around the Financial Crisis of 2008.

We run several multiple regression to investigate which deal- and firm characteristics[7] that significantly affect the first-day return. Table A4 summarizes the results of the regressions. Equation 4.6 illustrates regression (1) in Table A4.

$$\begin{aligned} FirstDayReturn_i = \alpha_i + \beta_i CORNERSTONE_i + \beta_i HOT\_MKT\_RET_i \\ + \beta_i IND\_TECH_i + \beta_i IND\_PERSHOUSE_i + \epsilon_i \end{aligned} \tag{4.6}$$

From regression (1) in Table A4 we find that cornerstone investors have a significant positive effect on the first-day return yielding a 10.00% higher average compared to the total sample. Additionally, we find that the HOT_MKT_RET has a significant positive effect on the first-day return, thus issuing an IPO in a hot issue market[8] on average increases the first-day return. The size of these effects make them particularly interesting and will be analyzed further in Sections 4.2.1 and 4.2.2.

[6]Significance is tested by a two-sample t-test and Wilcoxon rank-sum test.

[7]The independent variables tested are found in Table A2.

[8]Variable based on the first-day returns.

The technology industry dummy (IND_TECH) and the dummy for the industrial goods and services sector (IND_PERSHOUSE) are the only significant industry variables. The significant positive coefficients for these variables indicate that IPOs of firms in these industries are more underpriced than in the other industries. The positive effect of the technology industry is consistent with Loughran and Ritter (2004) and Beatty and Ritter (1986). Beatty and Ritter (1986) argue that the higher the firm age at the time of the issue, the lower degree of underpricing. Firms from the technology industry are characterized by a relatively high degree of uncertainty and asymmetric information related to the relatively young age of technology firms. The average age of the initial sample is 18.5 years, while the average age for the IPO firms in the technology industry is 11.5 years. However, the LISTING_AGE variable which was included as a proxy for the uncertainty regarding an IPO, is not significant in any of the regressions. A possible explanation may be that investors do not regard young firms in general as sufficiently risky, and that the level of asymmetric information is low due to the considered transparency of the Scandinavian market. The dummy variable denoting the offer price relative to the indicative price range[9] is not significant. This is inconsistent with the findings of Hanley (1993), who reports that the variable is a good predictor of first-day returns and that issues priced equal to, or above, the midpoint of the indicative price range have higher returns.

4.2.1 Signaling Effects by Cornerstone Investors

To test whether cornerstone investors have a positive effect on the first-day return, we calculated the average equally-weighted first-day return of the IPO samples with and without cornerstone involvement. These results are displayed in Table 4.2. IPOs with cornerstone investors have an average first-day return of 17.94%, which is substantially and significantly different from the 4.16% average return of the IPOs with no cornerstone involvement. This is an interesting result displaying that IPOs with cornerstone investors yield a more than four times as high first-day return compared to the sample without cornerstone investors.

[9]The dummy variable equals 1 when issues are priced equal to or above the midpoint of the indicative price range.

	Average (%)	Median (%)	Observations	z-value
Cornerstone	17.94	14.69	35	
No cornerstone	4.16	1.25	263	
Diff.	13.78	13.44		4.266***

Table 4.2 – First-Day Return of Scandinavian IPOs with and without Cornerstone Investors, 2007-2016

The table illustrates the average and median first-day returns of the Scandinavian IPOs split into IPOs with and without cornerstone investors. The average first-day returns are equally-weighted averages. The z-value is the result of a two-sample Wilcoxon rank-sum (Mann-Whitney) test with a H0 of equal medians. The significance level is given by *** p<0.01, ** p<0.05, and * p<0.1.

Furthermore, regression (1) displayed in Table A4 shows that cornerstone investors have a significant and positive effect on the first-day returns. In other words, IPOs with cornerstone investors experience a higher degree of underpricing compared to those without cornerstone involvement. The cornerstone variable has a strong and significant effect on the first-day return in regression (1), with cornerstone investors yielding an average equally-weighted first-day return of 15.78%[10]. This finding is consistent with Negman and Pehrson (2017), who study the Swedish IPO market between 2014-2016 and report a higher average first-day return of IPOs backed by cornerstones of 14.6% and 5.4% for those without. A possible explanation of our results is that the presence of cornerstone investors sends positive signals to the market about the quality of an issue, resulting in increased demand for the issue. Cornerstone involvement can then function as insurance for other potential investors since they buy a large portion of the IPO firm pre-issue. The price for this insurance potentially translates into underpricing (Negman and Pehrson, 2017). The increased underpricing of such IPOs may also be related to the principal-agent theory, assuming that an underwriter wants to maintain its relationship with cornerstone investors.

For an investor, our findings indicate that an IPO with cornerstone investors is a significantly better investment than an IPO without cornerstone involvement. Since cornerstone investors in Scandinavian IPOs is a relatively new phenomenon our sample only consists of 35 IPOs with cornerstone investors. Regardless of the limited sample size, we obtain significant results indicating a considerable positive effect of cornerstone investors.

[10] 15.78% =10%+5.78%

4.2.2 The Effect of Market Conditions

The HOT_MKT_RET and HOT_MKT_VOL variables are constructed in order to examine whether market conditions have a significant effect on the first-day returns. Accordingly, IPOs issued in hot issue markets, defined by the first-day return, yield an average first-day return of 9.38% while the IPOs issued in a cold market experienced a negative average first-day return of -5.33%. From Table 4.3 one finds that the two samples are significantly different from each other. IPOs issued in a hot market, defined by the IPO volume in the market, however, do not experience a first-day return that significantly differs from IPOs issued in cold markets. Further, we observe a higher number of IPOs in the periods defined as hot, both based on the first-day return and volume, which is consistent with the findings of Santos (2017). Existing literature suggests that high underpricing reflects a large discount to the fundamental value, while we observe an increase in issues in periods of high-underpricing. Nevertheless, this may be justified if high underpricing coincides with IPO prices that are set above the fundamental value.

	Average (%)	Median (%)	Observations	z-value
Hot issue market, return	9.38	4.76	225	
Cold issue market, return	-5.33	-1.00	73	
Diff.	14.71	5.76		-5.538***
Hot issue market, volume	6.03	2.14	284	
Cold issue market, volume	0.75	0.57	14	
Diff.	5.28	1.57		-0.785

Table 4.3 – The First-Day Returns of Scandinavian IPOs Issued in Hot and Cold Markets, 2007-2016

The table illustrates the average and median first-day returns of the Scandinavian IPOs split into IPOs issued in hot and cold markets, defined by both the first-day return and volume. The average first-day returns are equally-weighted averages. The z-value is the result of a two-sample Wilcoxon rank-sum (Mann-Whitney) test with a H0 of equal medians. The significance level is given by *** p<0.01, ** p<0.05, and * p<0.1.

Regressions (1) and (2) in Table A4 show that IPOs issued in hot issue markets[11] give significantly higher average first-day returns. For an investor, this implies that investing in an IPO issued in a hot market would yield an average first-day return of 18.58%[12], which is more than three times as high as the average first-day return of 5.78%. This is to be regarded as a

[11] Constructed based on the level of first-day return in the market.

[12] 5.75% + 12.8% = 18.58%

considerable effect and an important finding. On the contrary, the HOT_MKT_VOL variable is not significant for any of the regressions on the first-day return. The fact that we find the HOT_MKT_RET variable to be significant and not the HOT_MKT_VOL is consistent with Santos (2017). He reports no significant differences in average underpricing between hot and neutral months based on the volume definition of the variable. A possible explanation for the different results of the apparent similar market variables is that the variable based on the first-day returns is a better proxy for the market sentiment.

Our finding of a higher average first-day return among Scandinavian IPOs issued in hot markets[13] is consistent with the findings of Ibbotson and Jaffe (1975) and Ritter (1984, 1991) from the U.S. IPO market. A possible explanation of the increased underpricing can be related to younger and riskier firms exploiting windows of opportunity during hot issue markets, which results in a positive market sentiment. In term, the increased asymmetric information and uncertainty associated with such firms can result in an increased first-day return and consequently higher levels of underpricing. Another explanation of the increased underpricing in hot issue markets could be that because of the increased market sentiment more retail investors participate in the market, and bids up the share prices on the first-day of trading (Ljungqvist et al., 2006). Overall, our findings indicate that an investor with a short investment horizon should prefer IPOs issued in hot markets when these on average yield significantly higher first-day returns.

4.2.3 Certification Effects by Underwriters

We find no clear evidence of firms taken public by a prestigious underwriter being less underpriced than firms affiliated with a less reputable underwriter. In contrary, we observe effects indicating a higher level of underpricing of IPOs with prestigious underwriters. These findings are reported in Table 4.4. The IPOs with prestigious underwriters taking part in the issue process yield an average first-day return of 7.27% while the remaining IPOs have an average first-day return of 4.95%. The two subgroups of IPOs are significantly different from each other at a 5%-level displayed in Table 4.4.

[13] Defined as hot based on first-day returns.

	Average (%)	Median (%)	Observations	z-value
Prestigious	7.27	3.85	107	
Not Prestigious	4.95	0.27	191	
Diff.	2.32	3.58		-2.853**

Table 4.4 – The First-Day Return of Scandinavian IPOs by Underwriter, 2007-2016

The table illustrates the average and median first-day returns of the Scandinavian IPOs split into IPOs with and without prestigious underwriters. The average first-day returns are equally-weighted averages. The z-value is the result of a two-sample Wilcoxon rank-sum (Mann-Whitney) test with a H0 of equal medians. The significance level is given by *** p<0.01, ** p<0.05, and * p<0.1.

To further investigate the effect of prestigious underwriters with regards to the first-day return, the return is regressed on the prestigious underwriter dummy. From regression (4) in Table A4 we find no evidence of certification from prestigious underwriters having a significant effect on the first-day return. The positive coefficient of PREST_UND denotes a higher first-day return. This is consistent with the findings from Table 4.4, which shows that having a prestigious underwriter leads to more underpricing. However, since the coefficients are not significant at any level, we are unable to draw any inference from these results. The positive effect on the first-day return, however not significant, suggests that firms taken public by prestigious underwriters are more underpriced. This is inconsistent with considerable literature finding that underwriter reputation is negatively related to the initial returns of new stock issues[14]. Our findings are, however, consistent with the arguments presented by Loughran and Ritter (2004) and Baron (1982), who argue that underwriters may have incentives to deliberately underprice an issue to avoid undersubscription. Furthermore, the strength of the certification effect may crucially depend on the reputation of the lead underwriter (Schober, 2008). To explore this we rerun regression (4) with a modified dummy variable for prestigious underwriters, given by regression (5) in Table A4. By isolating the effect of only the lead underwriter being prestigious we find a negative non-significant effect on the first-day return, and such decreasing underpricing when the lead underwriter is prestigious. The negative effect is consistent with Carter and Manaster (1990). Lastly, we test if the four most active prestigious underwriters have an effect on IPO underpricing in our sample, but we find no indications of this.

Overall, we find neither unambiguous nor significant results indicating that the involvement of prestigious underwriters leads to less underpricing. Thus, we are unable to draw any conclusions

[14]See for instance Carter and Manaster (1990).

with regards to prestigious underwriters affecting IPO underpricing in Scandinavia. We do, however, observe significant different first-day returns of IPOs with prestigious underwriters compared to those without, indicating a higher level of underpricing for IPOs taken public by prestigious underwriters.

4.2.4 Certification Effects by Private Equity

Consistent with existing research[15], Table A3 reports positive average first-day returns for the subgroups of buyout-backed, VC-backed and non-sponsored IPOs, thus implying that all groups, on average, are subject to underpricing. We find that PE-backed IPOs yield an average first-day return of 6.07% which is higher than the non-sponsored IPOs average first-day return of 5.64%. However, the difference between the two groups is not significant. The buyout-backed and VC-backed IPOs have an average return of respectively 7.54% and 4.58%. The VC-backed IPOs display lower underpricing than both non-sponsored and buyout-backed IPOs, and the buyout-backed higher than the non-sponsored. Nevertheless, neither of these results are significant. The uncovered findings contradict existing research[16], which finds that PE-backed IPOs display lower underpricing than that of non-sponsored IPOs. Whereas, our results suggest that PE-firms do not contribute to less information asymmetry through their certification role and greater information disclosure, which may be related to investors' fear of PE-firms applying information in their favor.

In addition to comparing non-sponsored IPOs to buyout and VC-backed IPOs, we have conducted three regressions[17] testing the effect of private equity on the first-day return, of which said results are displayed in Table A4. From regressions (1) and (2) we find that the PE_PREV_OWNER coefficient is negative and insignificant in both regressions. The negative coefficient suggests that the presence of PE-firms in IPOs reduce the degree of underpricing, which is consistent with existing literature[18]. The negative effect may be related to the fact that such firms often are highly involved in the listing firms. However, neither coefficients yield significant effects and we are unable to make any definite statements on their effect on the first-day return. In a further attempt to uncover significant effects we distinguish between buyout and VC-backed IPOs in regression (3)[19]. Consistent with the results from testing the different subgroups against

[15] See for instance Schober (2008), Bergström et al. (2006), and Anker and Stärk-Johansen (2015).
[16] See for instance Schober (2008), Bergström et al. (2006), and Anker and Stärk-Johansen (2015).
[17] See regressions (1) to (3).
[18] See for instance Schober (2008), Bergström et al. (2006), and Anker and Stärk-Johansen (2015).
[19] See Table A4.

one another reported in Table A3, the BUYOUT variable has a positive effect on the first-day return, while VC has a negative effect. However, as the results are not significant we cannot draw statistical inferences from them. Additionally, to the variables tested above, we included dummy variables for the three largest buyout-firms and the four largest VC-firms based on volume, whereas none of these show significant effects.

Overall, we find no significant effect of private equity ownership on the first-day return. It follows that we do not have sufficient evidence supporting existing literature reporting that certification by PE-firms reduces underpricing.

4.2.5 Conclusion

In brief, Scandinavian IPOs between 2007 and 2016 are significantly but only moderately underpriced[20], with an average equally-weighted first-day return of 5.78%. The multiple regressions indicate that cornerstone investors and hot issue markets have a significant positive effect on IPO underpricing. Additionally, IPOs of firms in the technology- and personal household goods industries are found to have a positive effect on the first-day return. However, the involvement of prestigious underwriters does not significantly influence the first-day returns of the sample IPOs, while we get mixed signals with regards to the effect of the PE-sponsors. It follows, that investors should aim at investing in IPOs being issued in hot issue markets as well as IPOs backed by cornerstone investors since these yield significantly higher first-day returns. Investors should also prefer firms from the technology and personal household goods industries going public.

4.3. Methodological Approaches in Measuring Aftermarket Performance

Measuring aftermarket performance is sensitive to the calculating procedure employed. Hence, we calculate abnormal returns with different metrics, benchmarks, weighting methods, and approaches to strengthen the robustness of the results. In accordance with existing literature, we employ the cumulative abnormal return (CAR), buy-and-hold abnormal return (BHAR), and wealth relative to measure aftermarket performance. The return metrics are calculated with two different benchmarks, the MSCI Nordic Index and a portfolio of matched firms, in order to get robust results. Further, we calculate the different return metrics both including and excluding the first-day return. The main argument for excluding the initial return from the

[20] In comparison with similar research on the U.S. IPO market.

calculations is that not all investors are allocated shares in the initial issue, and that first-day returns may incorporate effects that do not concern the true value of the issuing firm (Bergström et al., 2006). Excluding the initial return period is consistent with Ritter (1991). In order to avoid survivorship bias, we include IPO firms that were delisted in the analyzed period, 2007-2016. When computing the CAR and BHAR, we set the firm and benchmark return equal to zero following a delisting. As a result, all abnormal returns for delisted companies are zero after delisting. This approach is consistent with Ritter (1991). Lastly, we calculate the risk-adjusted excess return by employing the Capital Asset Pricing Model (CAPM) and the Fama-French three-factor model (Fama and French, 1993).

Aftermarket performance is measured over one week, three and six months, and three and five years, which is consistent with the majority of existing literature (Bergström et al., 2006). The abnormal return after one week is analyzed in order to eliminate the potential effect of stock flippers and is included even though not regarded as long-term. The three and six-month metrics enable us to investigate whether it is profitable to hold IPO stocks over a shorter period of time and explore what happens when overoptimistic investors start reassessing their expectations. The six-month metric is also interesting with regards to the common lock-up (quiet) period of around six months in IPOs. Lastly, the longer time intervals of three and five years allow us to detect abnormal performance and identifying time-varying performance patterns. Further, we explain how the long-term abnormal return metrics are calculated.

4.3.1 Cumulative Abnormal Returns

The daily abnormal return, given by Equation 4.8, is calculated by subtracting the daily return of benchmark b at time t from the daily return of firm i at the same point in time. The abnormal return (AR) is used in the calculation of the CAR.

$$r_{i,t} = \frac{ClosePrice_t - ClosePrice_{t-1}}{ClosePrice_{t-1}} \tag{4.7}$$

$$AR_{i,t} = r_{i,t} - r_{b,t} \tag{4.8}$$

Fama (1998) argues in favor of the use of CAR rather than BHAR since CAR implicitly assumes monthly portfolio rebalancing. The CAR is the sum of the abnormal returns for IPO firm i over event period T, defined by Equation 4.9. We compute CAR^{1d} and CAR^{0d}, which respectively

denotes the CAR excluding and including the first-day return. The calculation for CAR^{0d} is identical to the CAR^{1d}, with the only difference being the inclusion of the first-day return.

$$CAR_{i,T}^{1d} = \sum_{t=1}^{T} AR_{i,t} \tag{4.9}$$

Further, we calculate the average cumulative abnormal returns for the one week, three and six-month, and three and five-year event periods, using both the equally-weighted and value-weighted methods. The average value-weighted CAR is calculated in order to not overweight small offerings. The average equally-weighted CAR (4.10) and value-weighted CAR (4.11) are calculated using the same method as was done with the first-day return averages. The weights w are given by Equation 4.12, and the n_s represent the number of IPOs in sample s.

$$CAR_{T}^{1d,EW} = \frac{1}{n_s} \sum_{i=1}^{n_s} CAR_{i,t-T} \tag{4.10}$$

$$CAR_{T}^{1d,VW} = \sum_{i=1}^{n_s} w_i * CAR_{i,t-T} \tag{4.11}$$

$$w_i = \frac{Adj.OfferSize_i}{\sum_{i=1}^{n_s} Adj.OfferSize_i} \tag{4.12}$$

4.3.2 Buy-and-Hold Abnormal Returns

An alternative measure to the CAR is the BHAR, which assumes that an investor holds a portfolio for a defined time period without a rebalancing scheme. The BHAR measures the total return based on a buy-and-hold strategy, where a stock is purchased at the closing price at the first-day of trading and held until the end of the event period or its delisting. According to Westerholm (2006), an advantage of the BHAR-metric is that it is similar to the return an investor would receive, however, the metric has the disadvantage of being generally more skewed than the CAR. The BHAR is calculated as the compounded daily return for IPO firm i minus the compounded daily return of the benchmark b, over event period T. Equation 4.13 display the calculation of BHAR^{1d} which denotes the BHAR excluding the first-day return. BHAR^{0d}, denoting the BHAR including the first-day return, is calculated identically to the BHAR^{1d},

however, including the first-day return.

$$BHAR_{i,T}^{1d} = \Pi_{t=1}^{T}(1 + r_{i,t}) - \Pi_{t=1}^{T}(1 + r_{b,t}) \tag{4.13}$$

Further, we calculate the average equally-weighted and value-weighted BHAR for the given event periods. These are displayed in Equations 4.14 and 4.15. The weights w are given by Equation 4.12, and the n_s represents the number of IPOs in sample s.

$$BHAR_{T}^{1d,EW} = \frac{1}{n_s}\sum_{i=1}^{n_s} BHAR_{i,t-T} \tag{4.14}$$

$$BHAR_{T}^{1d,VW} = \sum_{i=1}^{n_s} w_i * BHAR_{i,t-T} \tag{4.15}$$

4.3.3 Wealth Relatives

Consistent with Ritter (1991) we compute the wealth relatives using Equation 4.16, to compare the IPO firms return to the returns of the two benchmarks.

$$WR = \frac{1 + Average\ Total\ Return\ of\ IPOs}{1 + Average\ Total\ Return\ of\ Benchmark} \tag{4.16}$$

The wealth relative denotes whether the IPO firms in the sample outperform the benchmark. A wealth relative greater than 1.0 implies that the IPOs perform better relative to the benchmark, whereas a wealth relative less than 1.0 indicates that the IPO firms underperform the benchmark.

4.3.4 The Capital Asset Pricing Model and the Fama-French Three-Factor Model

To enable inferences about the risk-adjusted performance of the IPOs, we apply the CAPM and the Fama-French three-factor model (Fama and French, 1993) to uncover possible excess returns.

The CAPM is widely used for the pricing of risky securities in financial theory. Even though it is simple, it provides a good approximation of the relationship between risk and return. The abnormal return, also known as alpha, excess return or market adjusted return, reflects the return of the IPO firm share that is not explained by general movements in the market portfolio.

The excess return of an IPO firm is calculated as the difference between the monthly return in excess of the risk-free rate and the market premium, given by Equation 4.17. The $r_{p,t}$ represents the average return of the sample portfolio, calculated in calendar time on a monthly basis. For each month between 2007 to 2016, we have constructed an average monthly return from the IPOs present in the given month. These are calculated using both the equally-weighted and value-weighted average monthly returns of the IPOs. The individual firms return is calculated using Equation 4.7. A disadvantage is, however, that the number of IPOs in each calendar month varies, resulting in some months holding more IPOs than others. Furthermore, r_f in Equation 4.17 represents the risk-free rate, and the $r_{m,t}$ the market return. The risk-adjusted aftermarket performance is measured through the intercept, α, when regressing the realized return in excess of the market risk premium. (Bodie et al., 2014)

$$r_{p,t} - r_{f,t} = \alpha + \beta * (r_{m,t} - r_{f,t}) + \epsilon_t \tag{4.17}$$

Further, we apply the Fama-French three-factor model, which includes factors that control for size and value as well as the market factor. The model is displayed in Equation 4.18, where the excess return is represented by α and the market premium by $r_{m,t}$-r_f. The size factor, SMB, represents a portfolio of small-minus-big firms, while the value factor, HML, is a portfolio of high book-to-market firms minus low book-to-market firms. As for the CAPM, the $r_{p,t}$ is calculated both using average equally-weighted returns and average value-weighted returns.

$$r_{p,t} - r_{f,t} = \alpha + \beta(r_{m,t} - r_{f,t}) + s * SMB_t + h * HML_t + \epsilon_t \tag{4.18}$$

The CAPM and the Fama-French model are constructed both using Norwegian and European factors, as we were unable to retrieve factors for Scandinavia. From French (2017) data library, we downloaded monthly market premiums and the SMB- and HML-factors for the European market. While we from Odegaard (2017) obtained the monthly market returns, an approximation of the Norwegian risk-free rate, and the SMB- and HML-factors. Further, we calculated the Norwegian market premium by subtracting the risk-free rate from the market return. We are aware that the Norwegian factors may be too small and the European too big for the Scandinavian market. From using both the Norwegian and the European factors, we aim to obtain an idea of the excess return in the Scandinavian market.

4.3.5 Time Regimes

Our analysis is mainly based on an event time regime, which is consistent with the majority of studies of long-term IPO performance. The event time method calculates the abnormal returns of each IPO for a time regime relative to the IPO issue date, either calculated from the offer price or from the closing price on the first-day of trading. In accordance with Ritter (1991), an event month is defined as 21 trading days. When including the first-day return, the initial return is added to the primary 21 days event period. Since the average abnormal return metrics are calculated for different event periods, we assume that the returns of the IPOs are independent. There could, however, be cross-sectional dependency among IPO firms stocks, which may result in an overstatement of t-statistics. Resulting in inference of statistical evidence when there, in reality, is none (Schober, 2008).

An alternate approach to event time is a calendar time approach. Fama (1998) argues that a calendar time approach is superior to event time when it eliminates cross-sectional dependence and controls for heteroskedasticity. However, it is not without flaws when such an approach may understate an anomaly when events cluster in time, as is the case for IPOs. Consistent with the arguments of Fama (1998), we apply a calendar time approach when constructing the CAPM and the Fama-French three-factor model. The first step of the calendar time approach involves calculating the returns for all firms in each month. This step is then repeated for each calendar time month for which data is available. In the second step, returns for each calendar month is averaged across the sample firms. In order to avoid distortion of the results, delisted firms are dropped from the month of delisting.

4.4. IPO Aftermarket Performance in Scandinavia

In the following section, we present our findings on the aftermarket performance of Scandinavian IPOs. We aim to reveal the actual long-term performance, and which deal- and firm characteristics that impact the performance.

4.4.1 Distribution of Cumulative- and Buy-and-Hold Abnormal Returns

Figures A2 and A3 display the distribution of the three and five-year CAR^{1d} calculated from the MSCI Nordic Index[21]. We observe moderately fat left-hand tails and a skewness of respectively 1.37 and 1.00 for the three and five-year CAR^{1d}. Figures A4 and A5 exhibit the distribution

[21] CAR^{1d} represents the cumulative abnormal return excluding the first-day return

of the three and five-year $BHAR^{1d}$ calculated from the MSCI Nordic Index. The BHARs are truncated on the left-hand side, have fat right-hand tails, and positive skewness. The skewness of the three and five-year $BHAR^{1d}$ are 3.25 and 1.57, respectively. From Figures A4 and A5 we observe severe problems with the normal distribution, and from testing for normality, we conclude that the samples are non-normal, which also was the case for the three and five-year CAR[22]. In general, the distribution of the BHARs are more extreme due to the effect of compounding, which results in greater statistical challenges. Additionally, to the plots displayed, we have examined the distribution of the one-week, three, and six-month CARs and BHARs as well as calculating the CARs and BHARs benchmarked against the self-constructed portfolio of matched firms and including the first-day return. We observe the same trends for these metrics as for the three and five-year metrics with non-normal distributions[23].

4.4.2 Summary Statistics of Cumulative- and Buy-and-Hold Abnormal Returns

Figure 4.1 displays the performance patterns for the Scandinavian IPOs measured from daily abnormal returns. Noticeably, there is a divergence of the median CARs and BHARs with respect to the MSCI Nordic and the portfolio of matched firms. We observe inconsistencies with regards to the aftermarket performance of the sample IPOs, hence the medians of the four metrics give incompatible results. From the second event month, the median BHARs are consistently below the median CARs, when benchmarked against the MSCI Index. The magnitude of the median returns are smaller when benchmarked against the portfolio of matched firms, as opposed to the MSCI Nordic Index, which is in line with the findings of Sevonius and Hertervig (2014). A possible explanation for the reduced magnitude, might be that the self-constructed benchmark of matched firms, is accounting for the higher risk and expected return of some IPOs in a way that the MSCI Nordic Index does not. These observations underline the importance of the choice of benchmark.

[22]The Shapiro-Wilk test was applied to test for normality.

[23]The non-displayed results are available at request.

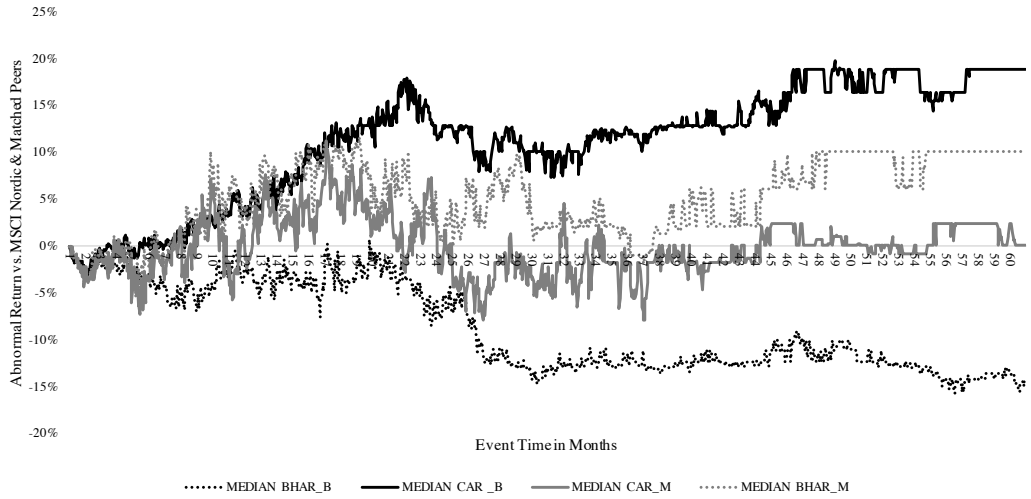

Figure 4.1 – Median Abnormal Returns of Scandinavian IPOs vs. MSCI Nordic Index and Portfolio of Matched Firms in Event Time

The figure displays the median abnormal returns excluding the first-day return for the Scandinavian IPOs between 2007 and 2016. The black solid line represents the median CAR vs MSCI Nordic Index, while the solid grey line gives the CAR vs. the matched firms. As with the CAR, the dashed black line represents the median BHAR vs MSCI Nordic Index, while the dashed grey line gives the BHAR vs the matched firms. The event period extends from one to sixty months.

The average equally-weighted and value-weighted CARs and BHARs are reported in Tables 4.5 and 4.6. Compared to the median abnormal returns, the average equally-weighted CARs and BHARs, as well as value-weighted BHARs, are higher in absolute terms with respect to the MSCI Nordic Index. Similarly to the medians displayed in Figure 4.1, we find no unambiguous sign of underperformance. The sample IPOs benchmarked against the MSCI Nordic Index yield positive CARs for all holding periods when including the first-day return. However, these CARs are not statistically different from zero, with the exception of the one-week CAR^{0d}. The average equally-weighted and value-weighted BHARs are to an extent similar until three months after the initial issue. However, the value-weighted BHARs are consistently higher than the equally-weighted BHARs after six months. This is evident for both the $BHAR^{0d}$ and $BHAR^{1d}$, which indicates a size effect. In addition, the median $BHARs^{0d}$ are lower than the $BHARs^{1d}$ for holding periods longer than six months. However, only the BHARs for three and five-year holding periods benchmarked against the MSCI Nordic Index are significant. In contrast to the unambiguous findings of underperformance in the U.S. market, found by Ritter (1991), Loughran (1993), and Loughran and Ritter (1995), we are unable to find clear signs of underperformance in the Scandinavian IPO market at this stage of the analysis.

Metric	Holding Period				
	1 Week	3 Months	6 Months	3 Years	5 Years
CARs vs. MSCI Nordic Index					
Average equally-weighted CAR^{1d}	0.64%	4.98%	3.72%	3.64%	16.61%
Average equally-weighted CAR^{0d}	6.53%	10.87%	9.60%	5.31%	18.99%
Average value-weighted CAR^{1d}	0.03%	4.08%	3.21%	-0.61%	21.10%
Average value-weighted CAR^{0d}	7.05%	11.10%	10.23%	5.17%	26.09%
Median CAR^{1d}	-1.32%	-0.82%	-0.05%	3.16%	31.17%
z-values from Wilcoxon signed-rank test	-1.967	0.446	-0.294	0.616	0.605
Median CAR^{0d}	1.26%	4.76%	3.66%	4.37%	34.15%
z-values from Wilcoxon signed-rank test	2.98***	2.771	1.862	0.737	0.796
Percentage of firms with positive CAR^{1d}	42.62%	48.99%	50.00%	53.05%	53.40%
Percentage of firms with positive CAR^{0d}	54.70%	56.71%	55.71%	53.66%	55.34%
n	298	298	298	164	103
CARs vs. Portfolio of Matched Firms					
Average equally-weighted CAR^{1d}	1.28%	-0.27%	-0.01%	-21.85%	-29.42%
Average equally-weighted CAR^{0d}	7.00%	5.45%	5.71%	-24.88%	-31.72%
Average value-weighted CAR^{1d}	-4.50%	-3.87%	-8.87%	-33.30%	-35.42%
Average value-weighted CAR^{0d}	2.48%	3.20%	-1.80%	-31.05%	-36.96%
Median CAR^{1d}	-0.05%	-1.11%	-2.61%	-11.76%	-0.31%
z-values from Wilcoxon signed-rank test	-0.682	-0.528	-0.141	-1.194	-0.052
Median CAR^{0d}	2.66%	1.78%	3.27%	-14.03%	-0.01%
z-values from Wilcoxon signed-rank test	2.076**	0.840	0.895	-1.445	-0.052
Percentage of firms with positive CAR^{1d}	48.86%	48.86%	45.86%	41.67%	50.00%
Percentage of firms with positive CAR^{0d}	60.23%	53.41%	53.41%	38.89%	50.00%
n	88	88	88	36	16

Table 4.5 – Cumulative Abnormal Returns of Scandinavian IPOs, 2007-2016

The table displays the CARs of the initial sample of 298 IPOs between 2007 and 2016. The CARs are benchmarked against both the MSCI Nordic Index and the self-constructed portfolio of matching firms. The calculation of the CARs is explained in section 4.3. The CARs are tested if they are significantly different from zero with a one-sample Wilcoxon signed-rank test with an H0 of median equal to 0. The significance level of the z-values are given by *** $p<0.01$, ** $p<0.05$, and * $p<0.1$.

Metric	Holding Period				
	1 Week	3 Months	6 Months	3 Years	5 Years
BHARs vs. MSCI Nordic Index					
Average equally-weighted $BHAR^{1d}$	0.60%	1.83%	-0.98%	-3.90%	-13.31%
Average equally-weighted $BHAR^{0d}$	6.97%	8.13%	5.59%	-1.92%	-11.98%
Average value-weighted $BHAR^{1d}$	-1.23%	1.45%	0.34%	8.58%	59.09%
Average value-weighted $BHAR^{0d}$	5.71%	9.14%	8.07%	13.80%	71.79%
Median $BHAR^{1d}$	-1.31%	-1.89%	-4.55%	-35.71%	-48.64%
z-values from Wilcoxon signed-rank test	-2.224**	-1.155	-2.547	-2.376**	-2.678***
Median $BHAR^{0d}$	1.33%	2.02%	-3.11%	-33.03%	-48.03%
z-values from Wilcoxon signed-rank test	2.607***	1.470	-0.305	-2.225**	-2.477**
Percentage of firms with positive $BHAR^{1d}$	41.95%	44.30%	38.59%	40.24%	37.86%
Percentage of firms with positive $BHAR^{0d}$	53.02%	52.01%	43.62%	31.10%	26.21%
n	298	298	298	164	103
BHARs vs. Portfolio of Matched Firms					
Average equally-weighted $BHAR^{1d}$	1.92%	1.65%	2.97%	-8.64%	8.21%
Average equally-weighted $BHAR^{0d}$	9.70%	9.49%	11.06%	-8.78%	9.46%
Average value-weighted $BHAR^{1d}$	-4.26%	-2.96%	-5.08%	3.63%	50.28%
Average value-weighted $BHAR^{0d}$	2.98%	4.81%	3.54%	5.24%	50.17%
Median $BHAR^{1d}$	0.01%	0.03%	-2.11%	-13.02%	10.62%
z-values from Wilcoxon signed-rank test	-0.599	-0.075	0.399	-0.408	0.672
Median $BHAR^{0d}$	2.46%	1.80%	2.23%	-13.39%	7.43%
z-values from Wilcoxon signed-rank test	2.060**	1.132	1.344	-0.471	0.621
Percentage of firms with positive $BHAR^{1d}$	51.14%	50.00%	48.86%	41.67%	50.00%
Percentage of firms with positive $BHAR^{0d}$	60.23%	52.27%	53.41%	38.89%	50.00%
n	88	88	88	36	16

Table 4.6 – Buy-and-Hold Abnormal Returns of Scandinavian IPOs, 2007-2016

The table displays the BHARs of the initial sample of 298 IPOs between 2007 and 2016. The BHARs are benchmarked against both the MSCI Nordic Index and the self-constructed portfolio of matching firms. The calculation of the BHARs is explained in section 4.3. n represents the number of observations. The BHARs are tested if they are significantly different from zero with a one-sample Wilcoxon signed-rank test with an H0 of median equal to 0. The significance level of the z-values are given by *** $p<0.01$, ** $p<0.05$, and * $p<0.1$.

4.4.3 Regression Results of One-Week Holding Period

Even though a one-week holding period cannot be regarded as long-term, we include the one-week metric in order to examine initial effects in the aftermarket. In order to uncover inferences about the one-week performance and independent variables[24], we have performed several OLS-regressions, for which results are reported in Table A5. The one-week metric excluding the first-day return should be of interest to investors who are not allocated shares in an IPO and are considering to buy shares of the IPO firm in the aftermarket.

From regressions (1) and (2) in Table A5 we observe several significant explanatory variables from regressing one-week CAR^{1d} and $BHAR^{1d}$. However, none of the significant variables from the regressions on the first-day return is significant when excluding the first-day return. The strong positive effect of the HOT_MKT_RET and CORNERSTONE variables are absorbed in the first-day of trading, which could explain the lack of significance. Hence, by excluding the first-day return the effect is still positive for both variables, but not significant. In contrast with the regressions on the first-day return, we find significant year and country variables. The variable denoting the natural logarithm of adjusted sales is also significant at a 1%-level in both regressions. This leads to a unit increase in adjusted sales, resulting in both CAR and BHAR decreasing by 1.1%, hence the higher the sales of a listing firm, the lower the one-week abnormal return. A potential explanation is related to the size and age of the IPO firms since smaller and younger firms normally experience lower sales than more mature firms. Presuming younger firms have lower sales, the negative effect of sales could be a result of a higher level of asymmetric information in the valuation of the smaller IPO firms compared to the more mature firms. Smaller or younger firms often experience a higher return on the first days of trading due to there being uncertainty associated with these IPOs (Ritter, 1991). The offer price of mature firms may, however, reflect the value of the firm more precisely. The lower mispricing and uncertainty results in smaller shifts in the price of such firms in the first days of trading.

Further, regressions on CAR^{0d} and $BHAR^{0d}$ are given by regressions (3) and (4) in Table A5. The one-week CAR and BHAR significantly increases with the HOT_MKT_RET. The CORNERSTONE variable's coefficients are higher[25] when including the first-day return, as well as significant for $BHAR^{0d}$. Hence, indicating strong positive effects of hot markets and

[24] A summary of the independent variables can be found in Table A2.

[25] A CAR^{1d} and $BHAR^{1d}$ of 4.70% and 6.10%, respectively. Compared to the 11.40% CAR^{0d} and 18.40% $BHAR^{0d}$.

cornerstone investors on shorter holding periods. We discover that mid-cap firms have positive effects on one-week returns for CAR^{0d} and $BHAR^{0d}$.

Additionally, we regress CAR_M^{1d} and CAR_M^{0d}, calculated from the self-constructed portfolio of matched firms as the benchmark, on the independent variables[26]. Thus, further exploring the one-week return as well as test the robustness of the aforementioned results[27]. Regressions (5) and (6) in Table A5 display the results. Cornerstone investors have a positive and significant effect on both CAR_M^{1d} and CAR_M^{0d}. Furthermore, the natural logarithm of adjusted sales is still significant at a 5%-level when excluding the first-day return. Additionally, ln_ADJ_ASSETS are significant at a 5%-level. Both accounting variables yield negative coefficients, hence an increase in adjusted sales or adjusted total assets reduce the one-week performance. It follows that the larger a firm is in terms of sales and total assets, the lower is the one-week CAR, when excluding the first-day return. The aforementioned argument about the effect of age and size on asymmetric information in relation to the ln_ADJ_SALES applies.

Valuable insight from the analysis of one-week performance is that investors with a short investment horizon should choose IPOs with cornerstone investors, IPOs issued in a hot market, and smaller firms in terms of assets and sales, in order to obtain the highest possible return.

4.4.4 Regression Results of a Six-Month Holding Period

To investigate if any deal- or firm characteristics affect IPO performance in medium-term periods, we have regressed the six-month metrics on the independent variables. The results are reported in regressions (1)-(4) in Table A6[28]. We find that the effect of cornerstone investors are positive but not significant and that the effect of hot issue markets is only weakly significant for CAR^{1d}. The variable of offer price relative to the price range is significant at a 5%-level for both CAR^{1d} and CAR^{0d}, but not for the BHAR. This points to higher abnormal return in the six-month holding period for issues priced above the midpoint of the price range. Further, we observe negative significant effects of years 2007 and 2014, indicating that IPOs listed in these years significantly underperform compared to the other studied years. The variable for Nasdaq Copenhagen is negative and highly significant, implying that IPOs listed on Nasdaq Copenhagen underperform compared to the IPOs listed on the other stock exchanges. However,

[26]The independent variables are displayed in Table A2.

[27]The one-week $BHAR\_M^{1d}$ and $BHAR\_M^{0d}$ have also been tested. The results are available at request.

[28]We have carried out the same regressions for $BHAR^{0d}$, $CAR\dot{M}^{0d}$, $BHAR\dot{M}^{0d}$, $BHAR\dot{M}^{1d}$, as well as for the three-month event period. Results are available upon request.

Danish IPOs represent only a fraction of the total sample which may skew the results. When regressing on the CAR_M^{1d}, only the price above midpoint variable remains weakly significant, while none of the other variables are significant.

4.4.5 Regression Results of Three and Five-Year Holding Periods

The regressions on the three-year CAR^{1d} and BHAR^{1d}, displayed in Table A6, give neither a significant cornerstone nor hot issue market[29] variable. However, the hot issue market variable based on volume turns slightly significant for the CAR^{1d}. The year and country variables are still negative and significant, as well as the Nasdaq Copenhagen variable. Regression (6) on BHAR^{1d} gives positive and significant industry variables for the personal household goods, basic resources, and telecommunication industries. This implies that IPOs of firms in these industries increase the buy-and-hold return in a three-year perspective.

Further, regressions (7) and (8) in Table A6 present the five-year regressions. We find that the variable for prestigious underwriters turn negative and significant at a 5%-level for the five-year CAR^{1d}, indicating that prestigious underwriters have a negative effect on the long-term performance. This is consistent with Carter and Manaster (1990) who argue that prestigious underwriters are associated with IPOs that have lower aftermarket returns. However, the negative effect is only significant when regressing on the five-year CAR^{1d}. Further, the dummy variable for international underwriters turns highly significant and negative. Resulting in the CAR and BHAR significantly decreasing when the underwriter is defined as international. The international underwriter variable is negative for the six-month and five-year aftermarket periods[30], indicating that IPOs with international underwriters perform worse in the aftermarket. In addition, the LISTING_AGE variable turns significant at a 5%-level when regressing on the BHAR^{1d}, implying that the older the listing firm at the time of the IPO, the higher the five-year BHAR. Ritter (1991) finds that the three-year average abnormal return increases with the age of the IPO firm. His argument is assumed applicable to our results despite our longer time-period. Several industry variables also turn significant, although different industries than for the three-year regressions. The bank industry turns highly significant and negative for both the CAR and BHAR, which is consistent with the findings of Ritter (1991). The variable ln_ADJ_OFFER_SIZE is positive and significant for both metrics, pointing to that a one unit increase in the offer size leads to an 43.50% and 45.00% increase in CAR and BHAR, respec-

[29] Variable defined by first-day return.

[30] Note that this is only when measured against the MSCI Nordic Index.

tively. This is inconsistent with Westerholm (2006), who finds a negative effect of the natural logarithm of the offer size on an equal holding period of five years.

4.4.6 Wealth Relatives

To further explore the aftermarket performance of Scandinavian IPOs, as well as to test the robustness of the abnormal return findings, we calculate the wealth relatives against the two benchmarks[31]. The wealth relative is the ratio of one plus the average IPO return divided by one plus the average return of the benchmark. Calculated by excluding the first-day return. The wealth relatives are displayed in Table 4.7. The average equally-weighted wealth relatives are greater than one, for all holding periods when benchmarked against the MSCI Nordic Index. Implying that the sample IPOs outperform the MSCI Nordic Index. However, the wealth relatives comparing IPO firms to the matched peer group[32] are less than one for the three-year holding period, indicating that the sample IPOs underperform relative to the matched peer group. The deviating results could be a result of one of the two benchmarks better reflecting the level of risk of the sample IPOs. Additionally, the deviation might be caused by the deviating sample sizes of the wealth relatives calculated from the two benchmarks. Unfortunately, none of the wealth relatives displayed in Table 4.7 are significant at any level, thus making it impossible to draw inferences from these findings.

Holding Period	MSCI Nordic Index	n	Matched Firms	n
6 Months	1.03	298	0.99	88
t-statistic	0.913		-0.077	
3 Years	1.03	164	0.81	36
t-statistic	0.3295		-0.960	
5 Years	1.15	103	0.80	16
t-statistic	0.997		-0.522)	

Table 4.7 – Wealth Relatives for the Initial Sample of Scandinavian IPOs, 2007-2016

The table summarizes the wealth relatives calculated for the sample IPOs for holding periods of six-month, three and five-year calculated from the two benchmarks, MSCI Nordic Index and the portfolio of matching firms. The t-statistics reported for the wealth relatives are from a two-sided paired two-sample t-test with a H0 of different means. The standard errors are given in parentheses, while the significance levels are given by *** p<0.01, ** p<0.05, and * p<0.1.

[31]The MSCI Nordic Index and matched firm sample.

[32]A self-constructed benchmark of public firms, matched on industry and book value of assets.

4.4.7 The Capital Asset Pricing Model and the Fama-French Three-Factor Model

A concern with the calculated CARs, BHARs, and wealth relatives are that these metrics might not properly control for risk. Consequently, we examine the aftermarket performance of the sample IPOs by testing the inference for the risk-adjusted performance and performance adjusted for size and value factors by employing the CAPM and the Fama-French three-factor model (Fama and French, 1993). The results of the two regressions are displayed in Table 4.8. The regression intercepts represent the excess return, alpha[33]. From the regression outputs, we observe negative alphas for both models, implicating that the IPOs in our sample underperform relative to the risk-free rate. This with the exception of the average value-weighted monthly return calculated from the Fama-French three-factor model with Norwegian factors, which is not significant.

From regressions (1) and (5) in Table 4.8, we find that the CAPM explains 55.50% and 10.30% of the equally-weighted average monthly returns of the sample IPOs, respectively based on Norwegian and European factors. The alpha is -1.00% and significant in the regression using average equally-weighted monthly returns and Norwegian factors, while -5.40% and significant using European factors. The results based on the average value-weighted monthly returns of the IPO firms, displayed in regressions (2) and (6), are similar and -0.90% and -5.30% for Norwegian and European factors, respectively. Additionally, the coefficient of the excess return of the market (Rm-Rf) is positive and significant at a 1%-level in all CAPM regressions. Summarized, based on the CAPM the sample IPOs appear to have a significant negative excess return in calendar time, hence the IPO firms underperform relative to the market.

[33]Measured as the IPO monthly return in excess of the risk-free rate.

	CAPM		Fama-French Model	
	Avg.EW-Returns	Avg.VW-Returns	Avg.EW-Returns	Avg.VW-Returns
	(1)	(2)	(3)	(4)
Norwegian Factors				
Alpha	-0.010***	-0.009**	-0.007**	-0.004
	(0.003)	(0.005)	(0.003)	(0.004)
Rm-Rf	0.837***	0.995***	0.806***	0.885***
	(0.067)	(0.095)	(0.070)	(0.095)
SMB			-0.173**	-0.405***
			(0.067)	(0.091)
HML			0.037	-0.098
			(0.081)	(0.109)
R^2	0.555	0.468	0.580	0.541
European Factors	(5)	(6)	(7)	(8)
Alpha	-0.054***	-0.053***	-0.055***	-0.053***
	(0.011)	(0.012)	(0.011)	(0.012)
Rm-Rf	0.007***	0.008***	0.007***	0.009***
	(0.002)	(0.002)	(0.002)	(0.002)
SMB			0.017***	0.014**
			(0.006)	(0.006)
HML			-0.05	-0.008
			(0.006)	(0.006)
R^2	0.103	0.119	0.172	0.170

Table 4.8 – CAPM and Fama-French Three-Factor Model Regression Outputs of the Monthly Average Return of Scandinavian IPOs, 2007-2016

The table reports the regression outputs from the CAPM model and Fama-French three-factor model, with alpha representing the excess return of the IPOs for both average equally-weighted and value-weighted monthly IPO returns. The average returns in a calendar month are the average of the monthly share returns of the firms in the portfolio in that month. Excess returns are calculated as the difference between the return of the IPO firms and the risk-free interest rate, measured as the one-month Rf_t. The standard errors are specified in parentheses and the significance level is given by *** p<0.01, ** p<0.05, and * p<0.1.

Further, we control for the size and value factors by applying the Fama-French three-factor model (Fama and French, 1993). The results of these regressions are displayed in regressions (3)-(4) and (7)-(8) in Table 4.8. As expected, the Fama-French regression models have superior explanatory power compared to the CAPM. In the regression based on Norwegian factors, the alpha is -0.70% and significant using average equally-weighted monthly returns, and -0.40% and insignificant for the value-weighted monthly averages. However, based on the European factors we uncover negative and significant alphas, respectively -5.50% and -5.30% for the average equally-weighted and value-weighted monthly returns. In addition, the SMB and HML factors show unequal effects for the regressions based on the Norwegian and European factors. Based on the Norwegian factors, the SMB loading is negative, indicating that the IPO portfolio takes a short position in small firms and a long position in large firms. The HML loading is insignificant. From regressions (7) and (8) based on the European factors, we find that the Rm-Rf and SMB factors are both positive and significant, while the value factor is insignificant. Comparing the Fama-French models using Norwegian factors to the ones using European factors we find that the average monthly returns are better explained by the regressions using Norwegian factors, displayed by the higher explanatory power, R^2. Indicating that the European factors may be inadequate in a Scandinavian context.

Tables A7 and A8 summarize the excess returns for different time-periods, calculated from the CAPM and Fama-French Three-Factor model. The excess returns are all negative, implying underperformance after adjusting for risk in the Scandinavian IPO market. The results are consistently negative using both Norwegian and European factors. Note, that the negative excess return is larger when regressing on European factors, as one would expect since these factors might be too large for the Scandinavian market. In combination with the lower explanatory power of the regressions using European factors, we find it appropriate to only display the results from the Norwegian factors going forward. In addition, the excess returns from the regressions on average value-weighted returns are smaller than from the regressions on equally-weighted returns, which indicates a size effect with regards to the adjusted offer size of the IPOs. Assuming the validity of the Fama-French three-factor model, our sample IPOs appear to have a significant negative excess return in calendar time. Overall, from the CAPM and Fama-French three-factor model, we find that the Scandinavian IPOs underperform the market when adjusting for risk.

4.4.8 Aftermarket Performance of IPOs with Cornerstone Investors

In the preceding analysis, we find that IPOs with cornerstone investors persistently outperform the market. The IPOs with cornerstone investors yield consistent positive abnormal returns for holding periods from one week to six months. The six-month average CAR^{0d} and $BHAR^{0d}$ calculated using the MSCI Nordic Index, are as high as 35.56% and 41.53%, respectively. The medians are somewhat lower, but still 27.01% and 23.97%. This is substantially higher than the total sample averages of respectively, 5.71% and 5.59% for the same time-frame[34]. The regressions in Table A5 show that cornerstone investors have a positive effect on the one-week abnormal returns. However, only significant for the $BHAR^{0d}$, CAR_M^{0d}, and CAR_M^{1d}. Studying the CAR_M^{1d}, IPOs with cornerstone investors increases the metric by adding 17.4% to the total sample average when excluding the first-day return. In comparison when including the first-day return, the amount further increases to level 40.1% at a 5% significance level. We again observe that cornerstone investors have a profound effect on the first-day return, thus investors who are assigned shares in the initial issue will have a higher aftermarket abnormal return the first week of trading. Supporting the argument of cornerstone investors having a positive effect on IPO performance. Despite the fact that not all of the variables are significant, cornerstone involvement indicates a positive effect on IPO aftermarket performance in Scandinavia. For the mid-term time periods of three and six months we find that cornerstone investors have positive effects on the aftermarket performance, however not significant[35].

Furthermore, we have calculated the wealth relatives for the IPOs with cornerstone investors present. The results are reported in Table 4.9. The wealth relatives imply that IPOs with cornerstone investors significantly outperform the MSCI Nordic Index for both three and six months. The cornerstone IPOs also outperform the portfolio of matched firms, however, these results are not significant. Overall, this further strengthens the argument of positive cornerstone effects on the aftermarket performance. Additionally, we find that the cornerstone IPOs yield positive excess return after controlling for risk calculated from the CAPM and the Fama-French three-factor model, as seen in Table 4.10[36]. The results give significant positive alphas of 4.10% and 3.00%, for respectively equally-weighted and value-weighted average monthly returns both

[34]Note that we cannot calculate three and five-year CARs and BHARs for cornerstone involvement when there are no IPOs with cornerstone investors in these sub-samples.

[35]See Table A6 for six-month regressions. The three-month regressions are available at request.

[36]We only display the results from using Norwegian factors. European factors lead to similar results, however not significant.

using the CAPM and the Fama-French model. In comparison to the results of the total sample which yielded negative excess return, see Table 4.8, we observe that IPOs with cornerstone investors significantly outperform the market. A summary of the estimated excess returns for different time-periods are displayed in Tables A9 and A10.

Holding Period	MSCI Nordic Index	Matched Firms
3 Months	1.10	1.11
t-statistic	2.696***	1.61
n	35	20
6 Months	1.16	1.15
t-statistic	2.933***	1.90
n	35	20

Table 4.9 – Wealth Relatives of Scandinavian IPOs with Cornerstone Investors, 2007-2016

The table summarizes the wealth relatives by three and six months, for the IPOs with cornerstone investors relative to the MSCI Nordic and the self-constructed portfolio of matched firms. The wealth relative is the ratio of one plus the average IPO three and six-month holding period return divided by one plus the average return of the benchmark. We exclude the first-day return. The t-statistics reported for wealth relatives are from a two-sided paired two-sample t-test with a H0 of equal means between the samples, and *** $p<0.01$, ** $p<0.05$, and * $p<0.1$ denotes the significance levels.

Overall, the CARs, BHARs, wealth relatives, and asset pricing models all points to that IPOs with cornerstone involvement yield positive aftermarket performance. This opposed to the signs of underperformance in the total IPO sample. Our findings are supported by the arguments of Loughran and Ritter (2004) who argue that the optimal way for underwriters to conduct IPOs is to sell the shares to investors who will not flip them in the aftermarket, which in this relation may be regarded as cornerstone investors. It follows that we have prevailing results of positive aftermarket performance for IPOs with cornerstone investors. Thus, the signals of quality sent by cornerstone investors seem to be justified. Our findings are consistent with McGuinness (2014), who reports evidence of positive abnormal return in the aftermarket for cornerstone-backed IPOs.

	CAPM		Fama-French Model	
	Avg.EW-Returns	Avg.VW-Returns	Avg.EW-Returns	Avg.VW-Returns
	(1)	(2)	(3)	(4)
Norwegian Factors				
Alpha	0.041***	0.030***	0.041***	0.030***
	(0.013)	(0.011)	(0.013)	(0.010)
Rm-Rf	-0.329	-0.158	-0.021	0.169
	(0.350)	(0.293)	(0.455)	(0.363)
SMB			-0.540*	-0.574**
			(0.277)	(0.221)
HML			-0.451	-0.479*
			(0.300)	(0.240)
R^2	0.027	0.010	0.148	0.208

Table 4.10 – CAPM and Fama-French Three-Factor Model Regression Outputs of the Monthly Average Return of Scandinavian IPOs with Cornerstone Investors, 2007-2016

The table reports the regression outputs from the CAPM and the Fama-French three-factor models, with alpha representing the excess return of the IPOs with cornerstone investors. The average returns in a calendar month are the average of the monthly share returns of the firms in the portfolio in that month. Excess returns are calculated as the difference between the return of the IPO firms and the risk-free interest rate, measured as the one-month Rf_t. Standard errors are specified in parentheses and the significance level is given by *** p<0.01, ** p<0.05, and * p<0.1.

4.4.9 The Effect of Market Conditions on Aftermarket Performance

The regressions in Table A5 report that issuing an IPO in a hot issue market, characterized by the level of return, increases the one-week performance for both CAR and BHAR[37] benchmarked against the MSCI Nordic Index. As the holding period increases we observe that the HOT_MKT_RET variable turns less positive. However, the CARs measured both from the MSCI Nordic Index and the portfolio of matched firms have consistent negative coefficients. These results are displayed in Table A6. In contrast, when regressing on long-term BHARs we find that hot issue markets based on return have a positive effect on the aftermarket performance. None of the long-term hot issue markets effects displayed in Table A6 are however significant, and we are unable to draw inferences from these results.

IPOs issued in a hot market defined by volume have a consistently positive effect on abnormal

[37]Including and excluding the first-day return.

return for holding periods from one week to six months measured against both benchmarks [38], but not all significant. These results are displayed in Tables A5 and A6. However, we find a significant negative effect of hot issue markets on the three and five-year CAR^{1d}, with hot issue markets decreasing the average abnormal return by 0.845 and 1.481, respectively. It follows that the effect of hot issue markets defined by volume is positive for the shorter time-periods, and with time, the effect decreases before turning negative. A possible explanation is that the market is still perceived as hot in the shorter time periods and that the share performance profit from the positive market sentiment. For the three and five-year periods the results are contradicting. However, the negative BHARs are consistent with the findings of Ritter (1991), reporting that IPOs issued in a hot market perform poorly in the aftermarket.

	Initial Return		Volume	
	3yrWR	5yrWR	3yrWR	5yrWR
Cold	1.04	1.07	1.32	1.65
t-statistic	0.256	0.205	0.756	1.325
n	70	31	14	10
Hot	1.02	1.19	0.99	1.07
t-statistic	0.167	1.163	-0.000	1.174
n	94	72	150	93
Total	1.03	1.15	1.03	1.15
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				

Table 4.11 – Wealth Relatives for Scandinavian IPOs by Market Conditions, 2007-2016

The table summarizes the wealth relatives for three and five-year holding periods, and are divided into cold and hot market periods defined by the first-day return and volume. The MSCI Nordic Index is used as the benchmark, and the first-day return is excluded. The wealth relative is the ratio of one plus the average IPO three and five-year holding period return divided by one plus the average return of the index or the matching firm. The t-statistics reported for wealth relatives are from a two-sided paired two-sample t-test with a H0 of equal means between the samples.

To further explore the effects of market conditions, we compute the wealth relatives of IPOs issued in hot and cold markets, see Table 4.11. According to the wealth relatives, both IPOs issued in cold and hot markets outperform the MSCI Nordic Index over a three and five-year holding period when excluding the first-day return. The only exception is the wealth relative for IPOs issued in a hot market defined by volume, which underperform the index in a three-

[38]The MSCI Nordic Index and the self-constructed portfolio of matched firms.

year holding period. However, none of these findings are significant which makes us unable to draw inferences from the results. Regardless of the insignificance of the results, they are inconsistent compared to Santos (2017). He reports wealth relatives pointing to underperformance independent of the market conditions for a five-year holding period.

Furthermore, we find negative monthly excess returns for the IPOs issued in hot markets defined by first-day return, when controlling for risk in the CAPM and Fama-French model. These findings[39] are displayed in Table 4.12. The estimated excess returns for the different time-periods are displayed in Tables A9 and A10. The negative and significant alphas show that IPOs issued in hot markets underperform after adjusting for market, size and value effects. When compared with the risk-adjusted excess return for the total sample, displayed in Table 4.8, we observe only minor differences. Overall, employing CARs, BHARs, wealth relatives, and asset pricing models, we find inconsistent evidence of long-term underperformance of firms issued in hot markets.

	CAPM		**Fama-French Model**	
	Avg.EW-Returns	Avg.VW-Returns	Avg.EW-Returns	Avg.VW-Returns
	(1)	(2)	(3)	(4)
Norwegian Factors				
Alpha	-0.009***	-0.010*	-0.007**	-0.004
	(0.003)	(0.005)	(0.003)	(0.005)
Rm-Rf	0.808***	1.059***	0.778***	0.932***
	(0.068)	(0.114)	(0.072)	(0.115)
SMB			-0.158**	-0.452***
			(0.069)	(0.111)
HML			0.026	-0.131
			(0.083)	(0.134)
R^2	0.528	0.406	0.549	0.476

Table 4.12 – CAPM and Fama-French Three-Factor Model Regression Outputs of the Monthly Average Return of Scandinavian IPOs Issued in Hot Markets, 2007-2016

The table reports the CAPM and the Fama-French three-factor model of IPOs issued in hot markets defined by the first-day return. The average returns are the average of the monthly share returns in that month. Excess returns, alphas, are calculated as the difference between the return of the IPO firms and the risk-free interest rate, measured as the one-month Rf_t. Standard errors are specified in parentheses and the significance level is given by *** p<0.01, ** p<0.05, and * p<0.1.

[39]We have chosen to only display the results using Norwegian factors. The results from using European factors are consistent with the displayed results, however, the coefficients are higher as well as more significant.

4.4.10 Conclusion

The analysis of the aftermarket performance yields ambiguous results in regards to the actual performance of the Scandinavian IPOs. We find indications of both outperformance and underperformance. The results are highly affected by the choice of method and benchmark used. We regard our most interesting finding to be the strong positive effect of cornerstone investors on IPO performance. All our findings points in the direction of IPOs with cornerstone investors outperforming the remaining sample, as well as the market. From an investor's perspective, it would be profitable to go long in IPOs with cornerstone investors.

4.5. Robustness of the Results

In order to obtain robust results, we have examined the underpricing and long-term underperformance anomalies with multiple methods, and such to the best of our abilities attempted to report robust results. However, comparing the magnitudes of our empirical results to those reported in earlier research should be conducted with care, as the method applied in the computation of the first-day returns and long-term performance varies between scholars.

4.6. Limitations and Future Research Recommendations

The limited sample size is a considerable limitation in our thesis. Hence, despite obtaining several significant results, we acknowledge that the sub-sample sizes may be insufficient to draw causal effects and relationships. The magnitude of the problem can be reduced by enhancing the size of the sample, for example by increasing the time frame or the geographical area. A larger sample will most likely yield more valid inferences. The OLS-regressions applied in the analysis relies on several assumptions. Among others, there is a requirement of normality in the residuals. We have therefore performed Shapiro-Wilk tests to test the variables and metrics for normality. The tests indicate that the majority of the return metrics are not normally distributed, which may skew the OLS-results.

Further, due to the sample of cornerstone IPOs existing of only 35 IPOs and it being a relatively new phenomena[40] in Scandinavia, we are unable to investigate the effect of cornerstone investors on three and five-year performance. An interesting approach would be to study the performance of these IPOs on longer time-periods, and such enabling comparison to existing studies of underperformance. It would also be interesting to examine if the size of the cornerstone investment

[40] Our first observation of involvement of a cornerstone investor is in 2014.

significantly affects the IPO performance. The last proposition regarding cornerstone investors would be to investigate how valuation multiples are affected by cornerstone involvement. Another interesting topic is the relation between underpricing and aftermarket performance in the Scandinavian IPO market. Moreover, it could be interesting to include a variable for the length of the lock-up period[41]. By including such a variable, one could study market reactions when a lock-up period ends and if it affects the aftermarket performance of an IPO. Lastly, we were unable to obtain CAPM and Fama-French factors for Scandinavia. We believe that such factors for the Scandinavian market could affect the accuracy of our results. An interesting topic of a future thesis would be to calculate these.

[41] Also known as a quiet period.

5. Concluding Remarks

This thesis has aimed to answer the questions of underpricing and underperformance in the Scandinavian IPO market between January 2007 and December 2016, as well as if the selected deal- and firm characteristics affect these anomalies.

We find strong evidence of underpricing in the Scandinavian IPO market consistent with the empirical works of Ibbotson (1975), Ritter (1984), and Loughran and Ritter (2004). We uncover an average underpricing, calculated from the first-day return, of 5.78%. The average first-day return is relatively small compared to existing empirical literature from other markets and time-periods, such as the U.S. and the Nordics[1]. Even though we find significant evidence of underpricing of the IPOs, new issues were not strictly underpriced for all years in our sample. We find first-day returns varying from -5.53% in 2012 to 12.09% in 2016.

We regard the most important findings on IPO underpricing to be that IPOs with cornerstone investors and IPOs issued in hot markets[2] have significantly higher first-day returns compared to the total sample. The size of these effects is to be regarded as highly interesting as cornerstone involvement yields a 6.9% higher average first-day return, and going public in a hot market adds 13.8% to the average first-day return compared to the total sample. It follows that an investor should favor and endeavor to be allocated shares in IPOs going public in hot issue markets, as well as IPOs backed by cornerstone investors. Additionally, we find that IPO firms in the technology and personal household goods industries yield significantly higher first-day returns.

Further, we are unable to uncover unambiguous significant effects on the first-day return by the involvement of prestigious underwriters. We do, however, find significant different first-day returns of IPOs with prestigious underwriters compared to those without. This points to a higher level of underpricing for IPOs taken public by prestigious underwriters, yet this finding is not supported by the regression results. In addition, we find deviant results with regards to the private equity-backed IPOs. Inconsistent with existing research, private equity-backed IPOs do not on average exhibit lower underpricing than non-sponsored IPOs. These results do not enable us to make inference on the effect of these deal characteristics on the first-day return.

[1] See for instance Ritter (1984, 1991) and Westerholm (2006).

[2] Hot markets defined by the level of return.

The analysis of the aftermarket performance of the Scandinavian IPOs finds varying degrees of underperformance, depending on the holding periods examined, the benchmark employed, and the metrics and methods applied. With regards to the risk-adjusted excess returns calculated from the CAPM and the Fama-French three-factor model, we find significant signs of underperformance. Consequently the findings of long-term underperformance are partly consistent with a large body of existing research[3]. However, the results are somewhat conflicting and we are unable to present a definite conclusion to the question of whether Scandinavian IPOs are subjects to underperformance in the aftermarket.

Further, the analysis shows that IPOs with cornerstone investors outperform both the market and the initial sample of IPOs. We also find indications of hot markets positively affecting the short-term performance, however, signs of underperformance in the longer holding periods are discovered. The results on hot issue markets are conflicting and difficult to draw inferences from. With regards to the impact of other deal- and firm characteristics affecting the long-term performance, we find that it vary between the different underperformance metrics and holding periods.

Our research has hopefully given valuable insight and increased transparency in the field of Scandinavian IPOs, especially with regards to the effect of cornerstone investors. We hope investors and other participants in the IPO process have gained additional perspectives from this thesis.

[3]See for instance Ritter (1991), Loughran and Ritter (1995), Loughran (1993), Schultz (2003) and Bergström et al. (2006).

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Appendix

ICB Supersectors	Number of IPOs	DK	NO	SE	Average 1^{st}day Return	Average Age at IPO
Industrial goods and services	57	3	18	57	6.59%	21.8
Health care	50	1	9	40	2.76%	9.7
Technology	34	3	5	26	13.91%	11.5
Oil and gas	33	0	28	5	-0.08%	8.2
Real estate	24	0	6	18	3.97%	11.7
Personal and household goods	19	2	4	13	22.33%	29.1
Food and beverages	13	0	9	4	5.18%	18.3
Retail	11	1	1	9	7.51%	26.2
Financial services	9	0	1	8	2.38%	39.3
Construction and materials	7	0	1	7	9.33%	74.3
Travel and leisure	7	1	0	6	-0.68%	16.9
Banks	5	1	2	2	2.30%	49.6
Basic resources	5	0	3	2	3.46%	6.8
Chemicals	5	0	1	4	-0.14%	29.4
Telecommunications	5	0	1	4	-14.64%	10.6
Automobiles and parts	4	0	0	4	4.59%	37.3
Media	4	0	0	4	3.96%	7.0
Utilities	3	1	1	1	2.17%	5.3
Insurance	3	0	3	0	-2.98%	31.7

Table A1 – Scandinavian IPO Firms by Industry Segments, 2007-2016

The table illustrates the composition of the initial sample of 298 IPOs completed between 2007-2016 with respect to the ICB industry segments, year, and geographical areas. Lines are sorted in a declining order of number of IPOs.

Variable Name	Description
LISTING_AGE	the number of years from founding to listing date
ADJ_OFFER_SIZE	currency and inflation-adjusted offer sizes
ln_ADJ_OFFER_SIZE	the natural logarithm of ADJ_OFFER_SIZE
YEAR_X	the year of issue, 2016 is excluded
COUNTRY	dummy variable for country of issue, Denmark is excluded
EXCHANGE_X	dummy variable for the five stock exchanges, First North is excluded

IND_X	dummy variables for the 19 supersectors of the ICB, insurance is excluded
X_CAP	dummy variable for the size of the IPO firms at the time of IPO, small, mid and large-cap, small-cap is excluded
CORNERSTONE	a dummy variable that equals 1 if there are any cornerstone investors participating in the IPO and 0 otherwise
BOOKRUNNER_LEAD	dummy variable equals 1 if there is a lead bookrunner in the IPO
INT_UND	dummy variable equals 1 if the underwriter is regarded as international, and 0 if regarded as Scandinavian
SYNDICATE	dummy variable equals 1 if underwriters have collaborated in a syndicate
PREST_UND	dummy variable equals 1 if one of the underwriters are regarded as prestigious, see Section 3.2.5 for details
LEAD_PREST_UND	dummy variable equals 1 if the lead underwriter is regarded as prestigious
UNDERWRITER_X	dummy variables for the four most active underwriters
PE_PREV_OWNER	dummy variable set to 1 if the IPO is backed by a PE-firm
VC	dummy variable set to 1 if the IPO is backed by a VC-firm
VC_X	dummies for the most active VC-firms
BUYOUT	dummy variable set to 1 if the IPO is backed by buyout from a PE-firm
PE_OWNERSHIP_50%	dummy defined as 1 if a PE-firm owns more than 50% of the IPO firm prior to the listing, both indirect and direct
BUYOUT_X	dummies for the three most active PE-firms in terms of buyout
HOT_MKT_VOL	dummy equals 1 if the market conditions are characterized as favorable based on volume
HOT_MKT_RET	dummy equals 1 if the market conditions are characterized as favorable based on initial return
PRICE_A_MP	proxy of the placement of the final offer price relative to the indicative price range, equals 1 if the offer price is set above the midpoint and zero below the midpoint
BOOKBUILDING	dummy equals 1 if the offer price is set through bookbuilding
ADJ_TOT_ASSETS	currency and inflation-adjusted total assets
ln_ADJ_TOT_ASSETS	the natural logarithm of ADJ_TOT_ASSETS
ADJ_LT_DEBT	currency and inflation-adjusted long-term debt
ln_ADJ_LT_DEBT	the natural logarithm of ADJ_LT_DEBT
ADJ_SALES	currency and inflation-adjusted sales
ln_ADJ_SALES	the natural logarithm of ADJ_SALES

Table A2 – Description of the Independent Variables

The list explains how the independent variables are constructed. The X in the variable names denotes if there are several versions of a variable.

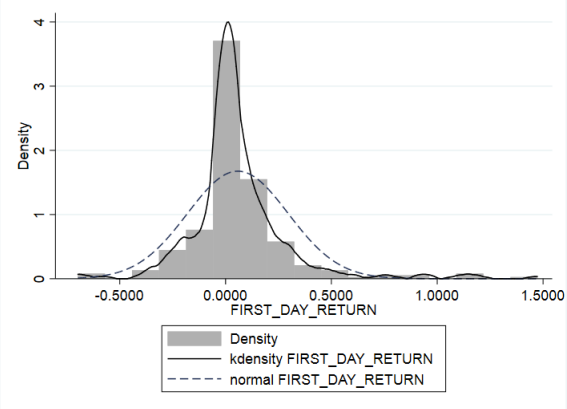

Figure A1 – Distribution of First-Day Returns of Scandinavian IPOs, 2007-2016

The figure displays the distribution of the first-day return. The bars illustrate the distribution of the first-day returns of the initial sample of 298 IPOs in Scandinavia between 2007-2016. The solid line gives the normal density, while the dashed line depicts the estimated kernel density.

	Average (%)	Median (%)	Observations	z-value
Non-sponsored IPOs vs. VC-backed IPOs				
Non-sponsored IPOs	5.64	1.82	203	
VC-backed IPOs	4.58	1.72	47	
Diff.	1.06	0.10		0.581
Non-sponsored IPOs vs. buyout-backed IPOs				
Non-sponsored IPOs	5.64	1.82	203	
Buyout-backed	7.54	6.00	48	
Diff.	-1.90	-4.80		1.550
Non-sponsored IPOs vs. private equity-backed IPOs				
Non-sponsored IPOs	5.64	1.82	203	
Private equity-backed IPOs	6.07	2.83	95	
Diff.	-0.43	-1.01		-0.637
VC-backed IPOs vs. buyout-backed IPOs				
VC-backed IPOs	4.58	1.72	47	
Buyout-backed	7.54	6.00	48	
Diff.	-2.96	-4.28		1.690*

Table A3 – The First-Day Return by Private Equity and Non-Sponsored Scandinavian IPOs, 2007-2016

The figure illustrates the average and median first-day returns of the Scandinavian IPOs split into non-sponsored, buyout-backed, VC-backed and PE-backed IPOs. The average first-day returns are equally-weighted averages. The z-value is the result of a two-sample Wilcoxon rank-sum (Mann-Whitney) test with a H0 of equal medians. The significance level is given by *** p<0.01, ** p<0.05, and * p<0.1.

Variables	(1) 1^{st}day Return	(2) 1^{st}day Return	(3) 1^{st}day Return	(4) 1^{st}day Return	(5) 1^{st}day Return
CORNERSTONE	0.100**	0.069	0.076	0.069	0.069
	(0.042)	(0.062)	(0.063)	(0.062)	(0.062)
HOT_MKT_RET	0.128***	0.138***	0.140***	0.138***	0.138***
	(0.031)	(0.047)	(0.047)	(0.047)	(0.047)
HOT_MKT_VOL	0.009	0.031	0,034	0.031	0.031
	(0.062)	(0.087)	(0.087)	(0.087)	(0.087)
IND_TECH	0.105**	0.112	0.110	0.112	0.112
	(0.041)	(0.188)	(0.188)	(0.188)	(0.188)
IND_PERSHOUSE	0.166***	0.217	0.211	0.217	0.217
	(0.054)	(0.194)	(0.194)	(0.194)	(0.194)
PE_PREV_OWNER	-0.028	-0.006			
	(0.029)	(0.049)			
VC			-0.018		
			(0.053)		
BUYOUT			0.041		
			(0.093)		
PREST_UND				0.043	
				(0.070)	
LEAD_PREST_UND					-0.017
					(0.086)
Constant	-0.073	0.265	0.268	0.265	0.265
	(0.062)	(0.377)	(0.377)	(0.377)	(0.377)
Control	NO	YES	YES	YES	YES
n	298	298	298	298	298
R-squared	0.135	0.209	0.211	0.209	0.209

Table A4 – Regression Outputs of the First-Day Return of Scandinavian IPOs, 2007-2016

The initial sample consists of 298 IPOs completed between 2007 and 2016 in Scandinavia. The first-day return is calculated as the percentage change from the offer price to the closing price on the first trading day. The control row indicates if control variables are included or not. The control variables refers to the variables in Table A2. Standard errors are given in parentheses, and the significance level is given by *** p<0.01, ** p<0.05, and * p<0.1.

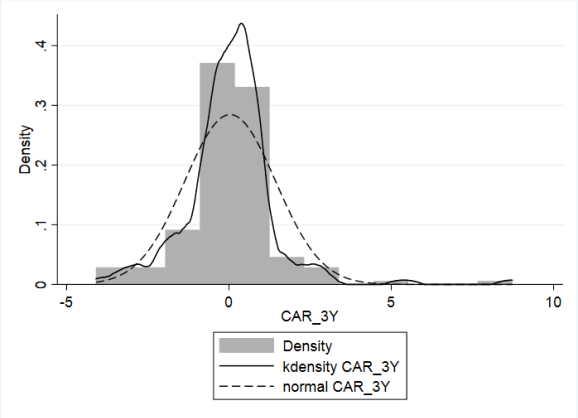

Figure A2 – Distribution of the Three-Year Cumulative Abnormal Return

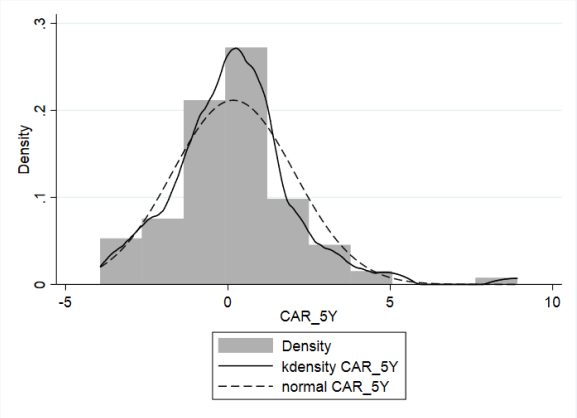

Figure A3 – Distribution of the Five-Year Cumulative Abnormal Return

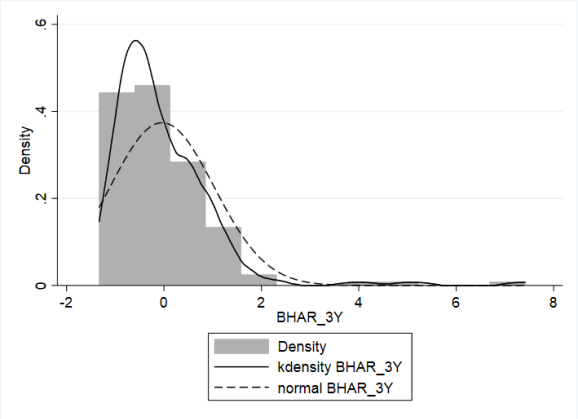

Figure A4 – Distribution of the Three-Year Buy-and-Hold Abnormal Return

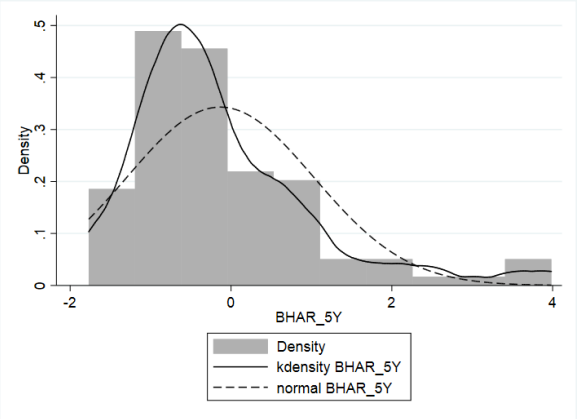

Figure A5 – Distribution of the Five-Year Buy-and-Hold Abnormal Return

Figures A2, A3, A4, and A5 display the distribution of the three and five-year CAR and BHAR for the sample IPOs issued between 2007-2016. The CARs and BHARs are calculated from the IPO firms return indices and the MSCI Nordic Index benchmark. In each panel, the solid line gives the normal density, while the dashed line depicts the estimated kernel density. The bars illustrate the distribution of the abnormal returns. The samples for three and five years are smaller than the initial sample due to a large number of firms being issued after 2011, thus the three-year sample consists of 164 firms and the five-year sample of 103 firms.

	(1)	(2)	(3)	(4)	(5)	(6)
	CAR^{1d}	$BHAR^{1d}$	CAR^{0d}	$BHAR^{0d}$	CAR_M^{1d}	CAR_M^{0d}
Variables	1 Week	1 Week	1 Week	1 Week	1 Week	1 Week
CORNERSTONE	0.047	0.061	0.114	0.184**	0.174*	0.401**
	(0.045)	(0.045)	(0.079)	(0.092)	(0.069)	(0.181)
HOT_MKT_RET	0.033	0.025	0.167***	0.141**	-0.035	0.092
	(0.035)	(0.035)	(0.060)	(0.071)	(0.100)	(0.205)
HOT_MKT_VOL	0.034	0.036	0.065	0.075	0.123	0.285
	(0.065)	(0.064)	(0,112)	(0.131)	(0.169)	(0.347)
PE_PREV_OWNER	0.010	0.017	0.003	0.031	0.050	-0.063
	(0.034)	(0.034)	(0.059)	(0.069)	(0.069)	(0.142)
PREST_UND	-0.043	-0.035	-0.001	-0.005	-0.054	-0.077
	(0.052)	(0.052)	(0.090)	(0.105)	(0.110)	(0.225)
MID_CAP			0.133*	0.169**		
			(0.073)	(0.086)		
2008	-0.133**	-0.113*				
	(0.067)	(0.067)				
2013	-0.102*	-0.085				
	(0.061)	(0.061)				
NO	0.338**	0.319**				
	(0.133)	(0.133)				
SE	0.340***	0.336***				
	(0.118)	(0.118)				
IND_TELE	0.327**	0.273*				
	(0.158)	(0.158)				
NASDAQ_CPH	0.295*	0.264*				
	(0.154)	(0.153)				
ln_ADJ_SALES	-0.011***	-0.011***	-0.01	-0.012*	-0.023**	-0.027
	(0.003)	(0.003)	(0.005)	(0.006)	(0.008)	(0.017)
ln_ADJ_TOT_ASSETS					-0.083**	-0.119
					(0-036)	(0.073)
Constant	-0.347	-0.334	-0.024	0,131	0,751	1.046
	(0.280)	(0,280)	(0.486)	(0,569)	(0,703)	(1.439)
Control	YES	YES	YES	YES	YES	YES
n	298	298	298	298	88	88
R-squared	0.237	0.223	0.231	0.204	0.645	0.565

Table A5 – Regression Outputs of the One-Week Abnormal Returns of Scandinavian IPOs, 2007-2016

Description of **Table A5**. The initial sample consists of 298 Scandinavian IPOs completed between 2007 and 2016. The table reports the coefficients from cross-sectional regressions with one-week (five trading days) CARs and BHARs, both benchmarked against the MSCI Nordic Index and the portfolio of matched firms as the dependent variable. The calculation of the dependent variables CAR and BHAR is explained in detail in Section 4.3. The control row indicates if control variables are included or not. The control variables refer to the variables in Table A2. Standard errors are given in parentheses, and the significance level is given by *** p<0.01, ** p<0.05, and * p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	CAR^{1d}	$BHAR^{1d}$	CAR^{0d}	CAR_M^{1d}	CAR^{1d}	$BHAR^{1d}$	CAR^{1d}	$BHAR^{1d}$
Variables	6m	6m	6m	6m	3y	3y	5y	5y
CORNERSTONE	0.063	0.002	0.130	0.217				
	(0.144)	(0.104)	(0.156)	(0.200)				
HOT_MKT_RET	-0.213*	0.049	-0.079	-0.006	-0.139	0.226	-0.226	0.270
	(0.110)	(0.079)	(0.120)	(0.228)	(0.308)	(0.248)	(0.443)	(0.285)
HOT_MKT_VOL	0.197	0.329**	0.228	-0.272	-0.845*	0.079	-1.481**	-0.406
	(0.205)	(0.148)	(0.222)	(0.385)	(0.480)	(0.387)	(0.669)	(0.431)
PE_PREV_OWNER	-0.123	-0.159**	-0.128	0.116	-0.200	-0.103	-0.803	-0.468
	(0.108)	(0.078)	(0.117)	(0.157)	(0.346)	(0.288)	(0.584)	(0.376)
PREST_UND	-0.126	0.078	-0.084	0.246	-0.371	0.067	-1.450*	0.235
	(0.165)	(0.119)	(0.179)	(0.240)	(0.476)	(0.384)	(0.821)	(0.529)
PRICE_A_MP	0.281**		0.270**	0.396*	0.650*			
	(0.122)		(0.132)	(0.233)	(0.376)			
INT_UND	-0.297*		-0.318*				-2.710***	-1.55***
	(0.167)		(0.181)				(0.861)	(0.554)
LISTING_AGE						0.008**		0.025**
						(0.004)		(0.010)
2007	-0.272***		-0.322*			-1.770*		
	(0.155)		(0.167)			(0.910)		
2010					-1.700**	-1.370**		
					(0.858)	(0.692)		
2013					-1.610*			
					(0.855)			
2014	-0.334**		-0.343**		-1.758**			
	(0.151)		(0.163)		(0.855)			
NO	-2.867***		-2.894***		-5.160***		-8.060***	
	(0.423)		(0.458)		(0.976)		(1.330)	
SE	-2.860***		-2.872***		4.970***		-7.133***	
	(0.375)		(0.406)		(0.857)		(1.020)	

NASDAQ_CPH	-2.738***		-2.790***		-4.640***			3.803***
	(0.487)		(0.528)		(1.250)			(1.227)
LARGE_CAP							-1.480**	
							(0.668)	
MID_CAP		0.173*	0.267*					
		(0.097)	(0.145)					
IND_TRAVEL			-0.903*		-2.645**		-5.713**	
			(0.541)		(1.310)		(2.21)	
IND_PERSH						2.450**		
						(1.195)		
IND_BASIC						2.120**		
						(1.013)		
IND_TELE						3.210***		5.048***
						(1.066)		(1.527)
IND_REALEST							-3.813*	
							(1.990)	
IND_BANKS							-9.705***	-5.655***
							(3.201)	2.067
IND_AUTO							-7.550**	
							(3.250)	
ln_ADJ_OFFER							0.435*	0.450***
							(0.176)	(0.113)
Constant	3.686	-0.629	4.010	1.979	6.539**	-2.880	8.960	-8.048***
	(0.890)	(0.644)	(0.964)	(1.584)	(2.855)	(2.340)	(4.151)	(2.674)
Controls	YES	YES	YES	YES	YES	YES	YES	YES
n	298	298	298	88	164	164	103	103
R-squared	0.322	0.194	0.330	0.656	0.533	0.479	0.802	0.785

Table A6 – Regression Outputs of Six-Month, Three and Five-Year Abnormal Returns of Scandinavian IPOs, 2007-2016

The initial sample consists of 298 IPOs in Scandinavia completed between 2007 and 2016. The calculation of the dependent variables CAR and BHAR is explained in detail in Section 4.3. The table reports the coefficients from the cross-sectional regressions with six-month, three and five-year CARs and BHARs as the dependent variable. The control row indicates if control variables are included or not. The control variables refer to the variables given in Table A2. Standard errors are given in parentheses, and the significance level is given by *** p<0.01, ** p<0.05, and * p<0.1.

	Norwegian Factors		European Factors	
	Avg.EW-Returns	Avg.VW-Returns	Avg.EW-Returns	Avg.VW-Returns
1 Month (n=1)	-0.96%	-0.90%	-5.44%	-5.25%
3 Months (n=3)	-2.88%	-2.69%	-16.32%	-15.74%
6 Months (n=6)	-5.75%	-5.37%	-32.63%	-31.49%
3 Years (n=36)	-34.51%	-32.22%	-195.78%	-188.91%
5 Years (n=60)	-57.51%	-53.70%	-326.30%	-314.85%

Table A7 – Excess Returns Calculated from the Capital Asset Pricing Model

The table displays the excess returns calculated from the CAPM for the sample of Scandinavian IPOs for different time periods, between 2007-2016. Excess returns are calculated as the difference between the monthly return of the IPO firms and the risk-free interest rate. The three and six-month, and three and five-year excess returns are aggregated numbers of the monthly returns.

	Norwegian Factors		European Factors	
	Avg.EW-Returns	Avg.VW-Returns	Avg.EW-Returns	Avg.VW-Returns
1 Month (n=1)	-0.74%	-0.38%	-5.54%	-5.35%
3 Months (n=3)	-2.23%	-1.15%	-16.63%	-16.05%
6 Months (n=6)	-4.46%	-2.30%	-33.27%	-32.09%
3 Years (n=36)	-26.78%	-13.80%	-199.60%	-192-54%
5 Years (n=60)	-44.64%	-23.01%	-332.66%	-320.90%

Table A8 – Excess Returns Calculated from the Fama-French Three-Factor Model

The table displays the excess returns calculated from the Fama-French three-factor model for the sample of Scandinavian IPOs for different time periods, between 2007-2016. Excess returns are calculated as the difference between the monthly return of the IPO firms and the risk-free interest rate. The three and six-month, and three and five-year excess returns are aggregated numbers of the monthly returns.

	Norwegian Factors				European Factors			
	Avg.EW-Returns		Avg.VW-Returns		Avg.EW-Returns		Avg.VW-Returns	
	C.stone	Hot M	C.stone	Hot M	C.stone	Hot M	C.stone	Hot M
1 Month (n=1)	4.08%	-0.88%	3.00%	-0.96%	1.30%	-5.39%	0.66%	-5.26%
3 Months (n=3)	12.25%	-2.65%	8.99%	-2.88%	3.89%	-16.16%	1.99%	-15.79%
6 Months (n=6)	24.50%	-5.30%	19.97%	-5.76%	7.78%	-32.32%	3.98%	-31.58%
3 Years (n=36)	146.97%	-31.79%	107.85%	-34.55%	46.70%	-193.92%	23.86%	-189.47%
5 Years (n=60)	244.95%	-52.99%	179.75%	-57.58%	77.84%	-323.70%	39.77%	-315.78%

Table A9 – Excess Returns Calculated from the Capital Asset Pricing Model for IPOs with Cornerstone Investors and IPOs Issued in Hot Markets

The table displays the excess returns calculated from the CAPM for the sample of Scandinavian IPOs with cornerstone investors (C.stone) and IPOs issued in hot markets (Hot M) for different time periods between 2007-2016. Excess returns are calculated as the difference between the monthly return of the IPO firms and the risk-free interest rate. The three and six-month, and three and five-year excess returns are aggregated numbers of the monthly returns.

	Norwegian Factors				European Factors			
	Avg.EW-Returns		Avg.VW-Returns		Avg.EW-Returns		Avg.VW-Returns	
	C.stone	Hot M	C.stone	Hot M	C.stone	Hot M	C.stone	Hot M
1 Month (n=1)	4.10%	-0.69%	3.01%	-0.39%	0.62%	-5.49%	0.21%	-5.36%
3 Months (n=3)	12.29%	-2.06%	9.03%	-1.16%	1.86%	-16.47%	0.64%	-16.07%
6 Months (n=6)	24.58%	-4.12%	18.07%	-2.33%	3.73%	-32.94%	1.27%	-32.14%
3 Years (n=36)	147.51%	-24.75%	108.42%	-13.98%	22.36%	-197.63%	7.64%	-192.83%
5 Years (n=60)	245.85%	-41.25%	180.70%	-23.30%	37.27%	-329.39%	12.73%	-321.38%

Table A10 – Excess Returns Calculated from the Fama-French Three-Factor Model for IPOs with Cornerstone Investors and IPOs Issued in Hot Markets

The table displays the excess returns calculated from the Fama-French three-factor model for the sample of Scandinavian IPOs with cornerstone investors (C.stone) and IPOs issued in hot markets (Hot M) for different time periods, between 2007-2016. Excess returns are calculated as the difference between the monthly return of the IPO firms and the risk-free interest rate. The three and six-month, and three and five-year excess returns are aggregated numbers of the monthly returns.