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Initial Public Offerings

An empirical study of how the IPOs on Oslo Stock Exchange are priced relative to the indicative price range

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NORGES HANDELSHØYSKOLE

Summary

This thesis investigates Initial Public Offerings (IPO) on Oslo Stock Exchange between 2006 and 2011. The analyses examine how the IPOs are priced relative to the indicative price range, and how this affects the performance. In addition, the effect of a previous listing in the OTC-market, issue size and the use of a Green Shoe Option (GSO) have been examined.

Based on my analyses I find the average market adjusted initial return to be marginally positive, and it seems to decline in the longer run.

When investigating how the IPOs were priced relative to the indicative price range I find the majority to be priced in the lower part of the range. I also observe that small bookbuilt IPOs and IPOs sold without a GSO more frequently were priced below the midpoint of the range. The analysis indicates that IPOs priced in the upper part of the range perform better in the aftermarket. The regression analyses suggest that both private and public information are only partially incorporated into the issue price.

My results indicate that companies previously listed in the OTC-market and large issues experience less fluctuation after the introduction. Furthermore, every IPO using fixed-price was characterized as small. Finally, I find that fixed-price was more often used among former OTC-listed companies.

Preface

This Master thesis is written as a part of the Master of Science program at the Norwegian School of Economics (NHH) and marks the end of five years of higher education.

Working with this thesis has been both challenging and time consuming, but above all it has been an interesting process with great learning outcomes.

There are a number of people I would like to acknowledge. First of all I would like to thank my advisor, Tore Leite, who has provided me with constructive feedback and academic advice along the way. Secondly, I would like to thank Kristian Fyksen from DNB Markets. Thank you for suggesting an interesting topic as well as useful inputs throughout the process. I also wish to thank DNB Markets for providing me with valuable statistics. Finally, a special thank you to Per Kristian Ellingsen and Christina Heskestad Pedersen for proofreading and support.

Norwegian School of Economics

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Birgitte Heskestad Ellingsen

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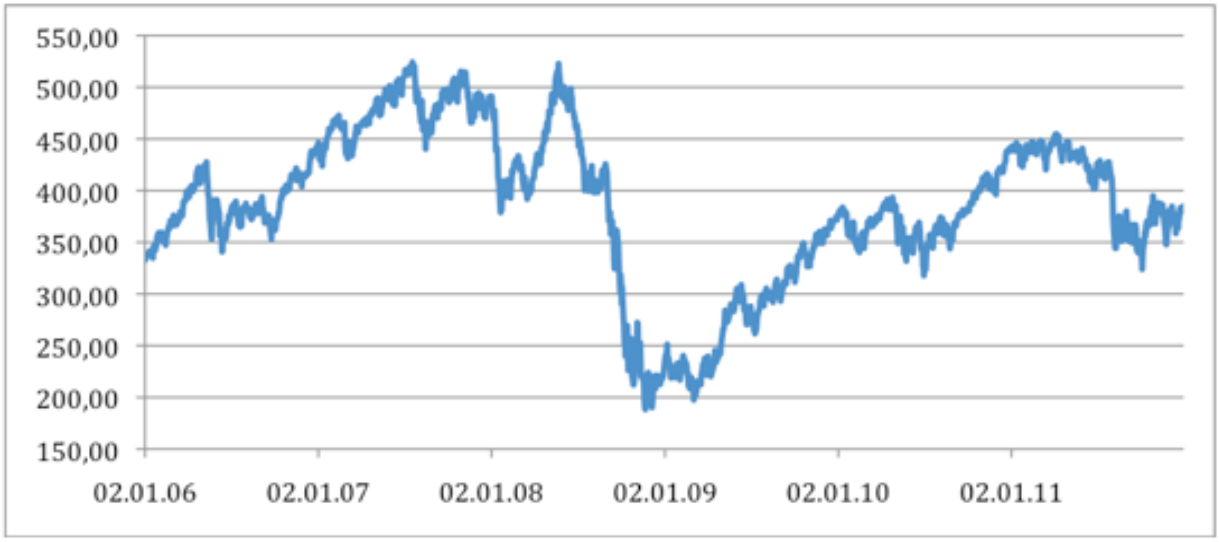
1. Introduction

An initial public offering (IPO) is when a company for the first time offers shares to the public through a listing on a stock exchange. Therefore, few events during a company's lifetime are as major in scale and consequences as an IPO.

In recent years the world has been exposed to, and is still recovering from, a global financial crisis, which influenced the IPO market to a large extent. From September 01, 2008 to December 31, 2011, 40 companies decided to go public in Norway. This is a relatively low number of IPOs compared to the period between January 01, 2006 and August 31, 2008 when 102 firms completed an IPO in the Norwegian market. The crisis was triggered by valuation and liquidity problems in the U.S. banking system, and these problems resulted in the collapse of large financial institutions and downturns in the stock markets worldwide during autumn 2008. Out of the 16 IPOs completed in 2008, only three took place after August. In addition, between October 31, 2008 and September 30, 2009 there was no IPO activity in the Norwegian IPO market. Based on these statistics it might be of interest to compare these two periods in the light of IPO activity. Figure 1 shows how Oslo Børs Benchmark Index (OSEBX) responded to the global financial crisis, and highlights the distinction between the two periods.

Figure 1: OSEBX 2006 - 2011[1]



[1] Statistics from Oslo Stock Exchange (May 23, 2012)

Most of previous research, both Norwegian and international, on IPOs have focused on the underpricing puzzle. Another interesting area is the relationship between the indicative price range established in the pre-IPO market and the final offer price and how this affects the performance in the aftermarket. This thesis will take a closer look at this area.

1.1 Problem

The purpose of this thesis is to see how the IPOs on Oslo Stock Exchange are priced relative to their indicative price range and see how this might be linked to their performance in the aftermarket, both on short and long term. I wish to compare the period January 01, 2006 – August 31, 2008 to September 01, 2008 – December 31, 2011, as these two periods represent two different market conditions.

In addition, I will examine whether there are any differences between companies that have been traded in the Over-The-Counter (OTC)-market prior to the listing on Oslo Stock Exchange and companies that are traded for the first time on a market place. In Norway we observe large variations between IPOs when it comes to issue size, and it might be of interest to investigate if the size of the issue affects the IPO in the aftermarket. Finally, the issuing firm can stabilize their initial share price by using a green shoe option (GSO), and it might also be of interest to investigate to what extent this will affect the IPO and its performance.

The overall problem will however be:

"How was the Initial Public Offerings (IPO) between September 01, 2008 and December 31, 2011 priced relative to the initial price range compared to January 01, 2006 – August 31, 2008, and how was the return after one trading day, after a week and after six months in the two periods? In addition, does a previous listing in the OTC-market, the size of the issue and the use of a green shoe option influence the share price development?"

1.2 Structure

In chapter 2, the relevant theory and earlier studies concerning price setting of IPOs will be presented. It will also include a short explanation of the IPO process. The theory part is mainly based on the Benveniste and Spindt (1989) framework.

The next chapter, chapter 3, will include the empirical analysis of the share price development, both on short and long term. This chapter will be divided into three sections, first a presentation of the data, followed by an explanation of the methodology and finally the findings will be presented and discussed.

Chapter 4 will include regression analyses, and will consist of three sections. The first section will present the variables, explanatory and control, as well as the regression model. The next section will present the findings of the various regressions followed by a critical discussion.

Finally, the thesis ends with a conclusion in chapter 5.

2. Theory

This section of the thesis will concentrate on theory, earlier empirical evidence and studies that exist on the area, including the marketing phase, the final pricing of the IPO and share price returns in the aftermarket. The theory will mainly be based on the Benveniste and Spindt model from 1989.

2.1 Preparing for the IPO

Going public is a time-consuming process that demands careful preparation. The process begins already many months prior to the actual offer date, and can be seen as a process consisting of five phases (Gretland, 1994). The first phase deals with organizing and indentifying motives and goals for going public. The next phase is preparation and analysis including due diligence, valuation and the development of the prospectus. An important part of the preparations is hiring the necessary advisors: an underwriter, auditor and legal counsel. The most important one is the underwriter that has the role as intermediary between the issuing firm and the investors (Draho, 2004). After analyzing and preparing the IPO, the marketing and price setting process begins, which is the central phase in this thesis and will be explained in more detail later. The two last phases is the listing on a stock exchange and monitoring in the secondary market (Gretland, 1994).

In Norway the issuer can choose between two different marketplaces for the listing: Oslo Børs and Oslo Axess. The final choice between the two markets will in most cases be determined by the requirement differences for admission to listing. Oslo Axess has less detailed requirements than Oslo Børs and is therefore an attractive alternative for younger and smaller companies with less than three years' history that still wishes a listing on a regulated marketplace (www.oslobors.no). Oslo Axess was established in 2007 and filled the gap between Oslo Børs and the "grey market" list, OTC.

2.2 Pricing of IPOs

When determining the price of an IPO there are three different methods one can use: fixed-price, auctions and bookbuilding.

When using the fixed-price method, the final offer price is set before investors announce their bids, and is included in the preliminary prospectus. The underwriter distributes the prospectus to different investors and collects bids from them. Finally, the underwriter allocates the shares based on the investors' orders. Fixed-price is not so frequently used in Norway today, but is used occasionally and was a popular method earlier.

The auction method is based on bids from the investors indicating how much and to what price they are willing to buy. The price can both be set at the point where supply equals demand, or it could be set based on the overall demand so that the allocation is rationed (Biais and Faugeron-Crouzet, 2002). The auction method has almost never been seen in practice in the Norwegian market.

Finally, with bookbuilding the final offer price is set after a marketing phase towards potential investors. As it is the most commonly used method, bookbuilding will be described in more detail below.

According to Cornelli and Goldreich (2000) bookbuilding has become increasingly common in recent years, while Jenkinson and Ljungqvist (2001) state that bookbuilding is the dominant method in the world, including Norway. Also, when given choices, issuers, underwriters and institutional investors seem to favor bookbuilding rather than fixed-price or auctions (Draho, 2004). In my sample, containing 69 IPOs in the Norwegian market, 70 % of the firms going public used bookbuilding, while the rest used fixed-price. The sample also shows that fixed-price was more often used in the period January 01 2006 – August 31, 2008, where nearly 35 % of the IPOs used this method in order to determine the price, than between September 01, 2008 – December 31, 2011, where only 17 % of the companies going public used fixed-price.

The pricing of an IPO can be seen as a three-stage process (Lowry and Schwert, 2003). First the indicative price range is established, and the final offer price is expected to be within this range. In order for the underwriter to set a reasonable price range it is necessary to work closely with the issuing firm. The underwriter uses valuation techniques, like discounted cash flow analysis or by using comparables. Both techniques are normally used, but when these two methods come up with different results, the underwriter normally relies on comparables based on recent IPOs (Berk and DeMarzo, 2011). Secondly, the offer price is

set, which is the price offered to the public. Finally, one can observe the market's evaluation of the firm value as the issue starts trading.

The marketing of the issue is an important part of the price setting, and IPOs are in general marketed in two phases, pre-marketing and bookbuilding (Jenkinson and Jones, 2002).

2.2.1 Pre-marketing

The first phase is the pre-marketing phase, which lasts for about a week. European bankers tend to spend more time pre-marketing IPOs than they do in the USA. European pre-marketing can be divided into two sub-categories: Pilot Fishing and Anchor Marketing (Financial News, 25.02.2008).

Pilot Fishing involves testing investor sentiment in order to predict how the market is likely to respond to the issue. Pilot fishing can be productive, and is an opportunity for the investors to get to know the company in an early phase. In addition, they learn about the model, the management and the firm's strategy, and create relationship with the issuing firm (IFR – IPO Roundtable, December 2011).

The second, Anchor Marketing, is based on obtaining a degree of commitment from key investors before a float is launched (Financial News, 25.02.2008). During this pre-marketing phase research analysts provide institutional investors with information about the offering, and this way they are able to test the enthusiasm for the offering, which can be useful when setting the indicative price range. The price range indicates where the investment bank expects to set the final offer price, but the range is only indicative and the final price may be set outside the range (Cornelli and Goldreich, 2001).

2.2.2 Bookbuilding

The second phase starts with the publication of the preliminary prospectus, including the indicative price range, expected offer size and expected number of shares, and is known as the bookbuilding period. This phase will normally last about two weeks where the management of the issuing firm and the underwriter go on a "road show" to promote the investment case directly towards the investors of interest (Jenkinson and Jones, 2002). During the "road show" the issuing firm and the underwriter has two objectives. They want to market the issue to investors, but at the same time they seek new and private information

from the investors. New information learned during the "road show" may be incorporated into the final offer price, and thus result in a more accurate pricing. The price update is the percentage change between the midpoint of the indicative price range in the prospectus and the offer price (Lowry and Schwert, 2001). The presentations during the "road show" are based on the information in the prospectus, and if new information is found relevant, the prospectus may have to be revised (Draho, 2004).

Prior to setting the final offer price for the IPO, the investment bank collects non-binding bids from investors during the bookbuilding period. Investors observe private signals along with public signals, and their bids are submitted by reporting their private signal to the underwriter. The objective of the bookbuilding process is to reveal the private information from investors. The bids are divided into "high" and "low", which is signaling either a positive or a negative signal to the issue (Bakke, Leite and Thorburn, 2011). There are three different types of bids. A "strike bid" is a bid for a specific number of shares or amount regardless of what the final offer price will be. A "limit bid" on the other hand is a bid that specifies a maximum price for the shares. Finally, in a "step bid" the investor submits a demand schedule as a step function (Cornelli and Goldreich, 2000). The investment bank uses the information from the bids to construct a demand curve (Cornelli and Goldreich, 2001). The offer price is however not set at the point where supply equals demand, but on a general level where demand exceeds supply. Any amendment in the final offer price from the expected price in the indicative price range presented in the prospectus will to some extent reflect new information from investors during the "road show" (Bakke, Leite and Thorburn, 2011).

After the price is set, the shares are allocated to the investors at the discretion of the investment bank (Cornelli and Goldreich, 2000). The allocation of shares to the investor can both depend on the signal from that particular investor and on signals from the other investors invited to participate in the issue (Sherman and Titman, 2000). Investor demand for allocations will depend on their private information, thus, the better the private signal, the higher demand for shares. It seems like in markets with positive public information, investors tend to have positive private signals. This means that the better the private information is, the more likely it is that the issue has a positive first-day return (Bakke, Leite and Thorburn, 2011).

As stated earlier, bookbuilding has become increasingly popular. As an explanation, several theories state that the bookbuilding method is designed to better extract information from the investors and thus price the issue more accurately and in turn reduce underpricing. This theory is consistent with international evidence that shows that countries using the fixed-price method rather than bookbuilding seem to have more underpricing than countries using bookbuilding (Loughran, Ritter and Rydqvist, 1994, referred to in Ritter 2003, page 4). Underpricing will however never be eliminated completely (Cornelli and Goldreich, 2000). On the other hand, Ranjan and Madhusoodanan (2004) find evidence in their study that underpricing is less dependent on the pricing mechanism, and more dependent on the size of the issue. The study suggests that issues can be underpriced whether they use fixed-price or bookbuilding, but that large issues tend to be less underpriced than small issues. Issues using bookbuilding are in general large issues, while fixed-price is used on smaller issues, and they state that this is the reason why bookbuilding yields less underpricing. It is however important to note that there are few studies on this area.

2.3 Benveniste & Spindt (1989)

Shares in an offering are proven to be rationed and prices seem to only partially adjust to new information collected (Hanley, 1993). Benveniste and Spindt explain why this is the case in their study from 1989. They state that any changes in the final offer price from the filing of the preliminary prospectus are a product of information from investors to underwriters. Good information leads to a final offer price that exceeds the expected price in the indicative price range, whereas bad information leads to an offer price below the expected price. Investors with negative information have no incentive to not give a truthful signal, as by giving a positive signal the investor is awarded with an allocation of the issue at a price that is higher than the aftermarket value implied by their private information. The incentive for untruthful signaling is however higher for investors with positive information, as a negative signal may result in a lower issue price (Bakke, Leite and Thorburn, 2011).

Benveniste and Spindt developed a model in 1989 of rules regarding pricing and allocation that are used by underwriters of IPOs in order to induce investors to reveal their true private information (Hanley, 1993). The optimal rule for allocation favors investors who give a positive signal. An investor who holds positive information can deflate the IPO price by report a negative signal rather than a positive signal, but at the same time the investor risks

being left with no allocation (Bakke, Leite and Thorburn 2011). In order for investors to be willing to reveal good information to the underwriter they must expect to receive greater profits than if they falsely reveal bad information. Benveniste and Spindt's model states that underwriters give preference in allocating shares to investors who reveal positive information, which means that investors who decide to falsely give negative information may experience a reduction in the allocation of shares, or no allocation (Hanley, 1993). According to a model provided by Bakke, Leite and Thorburn (2011), investors are less willing to truthfully reveal their private information in bear markets than in bull markets. The reason for this is the fact that the probability of being awarded with underpricing after giving false information is higher when the public information is negative.

The high level of initial return associated with IPOs with positive revisions in the final issue price is known as the "partial adjustment" phenomenon, a term introduced by Ibbotson, Sindelar and Ritter (1988, referred to in Hanley 1993, page 232). The underwriter do not fully incorporate positive information learned during bookbuilding when setting the final offer price, and the price is therefore only partially adjusted upwards instead of raised to the market value.

Benveniste and Spindt (1989) explain why prices only partially adjust to demand. They state that the changes in the final offer price from the filing of the indicative price range to the offer date are a product of information learned from investors during the pre-IPO period. They claim that the underwriter only partially incorporates positive information learned from investors into the final offer price, and in that way grants the investors with compensation in form of higher initial return. Thus, positive revisions are usually followed by positive first-day returns. In other words, the underwriters underprice the IPO (Hanley, 1993). On the other hand, negative information is fully incorporated into the price as both underwriters and investors want to avoid losses on overpriced issues. In addition, under this partial adjustment theory, private information from investors should only be partially incorporated into the price, while public information on the other hand should be fully incorporated.

Loughran and Ritter (2000) find in their study that both public and private information are only partially incorporated into the final offer price (Lowry and Schwert, 2001). Bakke, Leite and Thorburn (2011) present a model that helps explain the relationship between public information and initial returns. Their study builds on the Benveniste and Spindt (1989) model explained above. They prove that publicly available information is related to

IPO underpricing through two different mechanisms: The demand effect and the incentive effect.

As mentioned earlier, the expected profit from hiding favorable positive information is higher in "downmarkets" when the public outlook is negative, thus, investors require a higher compensation in form of underpricing in order to reveal positive information. This is known as the incentive effect. Further, the study shows that public and private signals are unconditionally correlated. As investors are more likely to have good information about an issue in an "upmarket", the probability for underpricing is higher when the public outlook is positive. This is what they call the demand effect. When the demand effect dominates, the final offer price will only partially adjust to public information, which indicates a positive relation between public information and underpricing.

The paper offers an indirect test of the Benveniste and Spindt (1989) argument by examining how public information affects investors' incentives to reveal private information, as implied by the incentive effect.

An important prediction in this model put forth by Benveniste and Spindt is the fact that underpricing is related to the level of interest in the pre-IPO phase. This prediction suggests that issues priced in the upper part of the indicative price range are likely to be more underpriced than other issues (Giudici and Roosenboom, 2002).

2.3.1 Empirical Evidence

This thesis investigates among other things the relationship between the indicative price range presented in the preliminary prospectus and the final offer price, and how this can be linked to the performance in the aftermarket. There are some earlier studies that have examined the link between the pre-issue period and the final offer price; six of them are presented below.

Hanley (1993) looks at the relationship between the final offer price and the indicative price range, and her results suggest that issues priced at the top of the price range tend to perform better in the aftermarket – the partial adjustment phenomenon. The study divides the issues into three different categories of where the final offer price is set relative to the indicative price range: above, below and within the price range. The findings show that the mean initial return for IPOs priced above the range is 20,70 %, whereas for issues priced below the range

the initial return is only 0,60 %. According to the study, the initial return for the issues priced within the price range is 10,00 %. These findings suggest that there are no underpricing in issues priced below the price range, which is consistent with the model presented by Benveniste and Wilhelm (1990, referred to in Gondat-Larralde and James, 2008). This model combines the analysis presented by Rock (1986) and Benveniste and Spindt (1989), and predicts that when investors give negative signals in the pre-IPO market, the issue will most likely not be underpriced.

Ritter (2009) provides an overview over IPOs between 1980-2008, and investigates the link between the offer price and the indicative price range. In addition to look at the overall relationship, he divides the time period into four different periods in order to highlight differences. As Hanley (1993), he divides the IPOs into below, within and above the price range. In his study he both investigates how many IPOs that are priced below, within and above the range in the four different periods and the period as a whole, and how this affects the initial return. The results are presented in the tables below.

Table 1: Percentage of IPOs relative to indicative price range

	Below	Within	Above
1980-1989	30 %	57 %	13 %
1990-1998	27 %	49 %	24 %
1999-2000	18 %	38 %	44 %
2001-2008	34 %	44 %	22 %
1980-2008	**28 %**	**49 %**	**23 %**

Table 2: Average first-day returns relative to indicative price range

	Below	Within	Above
1980-1989	0,00 %	6,00 %	20,00 %
1990-1998	4,00 %	11,00 %	32,00 %
1999-2000	8,00 %	26,00 %	121,00 %
2001-2008	3,00 %	10,00 %	30,00 %
1980-2008	**3,00 %**	**11,00 %**	**39,00 %**

Lowry and Schwert (2001) have also provided a study, and through their study they show that the relationship between the offer price and the price range is related to information available at the time the preliminary prospectus is presented. The price range presented in the prospectus is as mentioned earlier only indicative, and the final offer price can be set

outside the range. They conclude that underwriters are more willing to fully incorporate negative information learned during the bookbuilding than positive information.

Bakke, Leite and Thorburn (2011) present three dummy variables in their study that indicate if the final offer price is set within the price range or outside (above or below). The first dummy variable is the high-demand state (HDS) and captures IPOs priced on or above the upper part of the price range. The low-demand state (LDS) represents issues priced on or below the lower end of the range. Finally, the last dummy variable is medium demand state (MDS) and indicates a final offer price set somewhere within the indicative price range. The findings show that the initial return varies across the three different demand states. Consistent with the findings of Hanley (1993) and Ritter (2009), the first-day return seems to be lowest in LDS and highest in the HDS. The study also suggests that the level of underpricing is affected by whether the private information is good or bad. When private information is bad, which indicates that the price revision (PU) is less than 0, the average level of underpricing is relatively small, with initial return equal to 4 % and 5 % in "downmarkets" and "upmarkets" respectively. In addition, consistent with Benveniste and Spindt (1989), they find a higher level of underpricing when PU is higher than 0. Furthermore, they find that investors require a higher level of underpricing in order for them to reveal good information in "downmarkets" than in "upmarkets". On the other hand, investors are more likely to have positive information in "upmarkets", and hence, the probability for underpricing is higher when the public outlook is positive.

Bakke (2012) investigates why more than a third of the 5000 IPOs in his sample between 1981 and 2008 accept prices on or below the minimum of the initial price range. He argues that issuers are only willing to accept these worst-case prices if the expected returns in the aftermarket make up for the foregone assets-in-place. In his study he documents significant and robust abnormal returns up towards 5 % during the first months of trading for "cold" IPOs. On the other hand, his study finds that "hot" IPOs underperform in the same period. The evidence here is however not as strong.[2]

Finally, Cornelli and Goldreich (2001) find that out of their sample the average size of the price range, as percentage of its midpoint, is 16 %. After the price range is set, the

[2] Cold IPOs: Low demand state. Hot IPOs: High demand state

investment banker collects bids from investors during the bookbuilding, before they set the final offer price. Their study shows that on average, the IPO price is 50 % of the way from the bottom to the top of the range. In addition, they find that five IPOs out of their sample are priced outside the range, four below the minimum price and only once above the maximum price. This finding is consistent with Lowry and Schwert's study from 2001 presented above, where they find that underwriters tend to incorporate negative information more fully than positive information. Further, the study shows that the price is set exactly at the bottom of the range in two of the cases, and nine times exactly at the opposite end of the range.

2.4 Share Price Returns

This thesis examines how the IPOs on Oslo Stock Exchange between 2006 and 2011 perform after the introduction. Earlier empirical evidence, both Norwegian and international, suggest that IPOs have a relatively high initial return, whereas the return on longer term has a tendency to be poorer. This chapter will first define underpricing and overpricing before presenting theories that try to explain why both underpricing and overpricing exist. Finally, earlier empirical findings on the area will be introduced.

2.4.1 Underpricing

Most research on IPOs have been linked to underpricing. Underpricing is reflected as the positive initial return, and has been one of the most enduring puzzles within financial economics. Underpricing can also be measured as the amount of "money left on the table". This is the difference between the price after the first day of trading and the final offer price, multiplied with the total number of shares sold at the IPO (Ljunqvist, 2004). According to Loughran and Ritter (2002a; 2002b, referred to in Draho, 2004, page 241), as much as $27billion was "left on the table" in USA during 1990-1998.

The term underpricing indicates that the existing owners of the issuing firm have gotten a lower price for their shares than what they could have, and researches have investigated potential reasons for this phenomenon. The partial adjustment theory has already been presented as one explanation, but this is only one of many theories trying to explain the phenomenon. According to this theory the largest amount of money left on the table will occur when the final offer price is set high in relation to the indicative price range. The

extensive research has led to several theories, but because multiple factors pull in different directions, no single theory can explain underpricing. The remaining theories can be grouped into three categories: Institutional explanations, issuer objectives and behavioral explanations. This thesis will focus on the main theories within each category.

2.4.1.1 Institutional Explanations

These theories are based on imperfections in the IPO market. It is stated that there are informational asymmetries between the different parties participating in the issue, and underpricing is therefore an unavoidable cost of going public. This category includes among other theories informational rent and winner's curse. *Informational rent* states that underwriters must underprice bookbuilt IPOs when demand is strong in order to get the investors to truthfully reveal information. Benveniste and Spindt (1989) and Benveniste and Wilhelm (1990) note that there is an economic motivation for underpricing IPOs. In order for the investment bank to effectively extract the information needed from the investors, they need to underprice the IPO.

The winner's curse model (Rock, 1986) on the other hand believes that underpricing is a necessary tool to make sure that uninformed investors choose to participate. Rock argues that there are two types of investors, informed and uninformed. The informed are perfectly informed about the true value of the IPO. The Rock model explains that underpricing can be seen as compensation to the uninformed for receiving disproportionately large allocations in overpriced offerings because the informed selectively choose the underpriced (Leite, 2007).

2.4.1.2 Issuer Objectives

An IPO is a major one-time event for a firm, and plays an important role in a firms' lifecycle (Chemmanur, He and Nandy, 2009). Therefore, the issuing firm could have other motives with the IPO that can cause additional underpricing. Underpricing can be used to signal firm quality, as firms that are less solid cannot afford to underprice (Welch 1989, referred to in Chemmanur, He and Nandy, 2009). Underpricing will in most cases give high initial return that leads the company to build goodwill in the market, which they can benefit from in the future (Welch, 1989, referred to in Chemmanur, He and Nany, 2009). There are also financial incentives, like taxes, that have made CEOs more tolerant to underpricing. Another reason worth mentioning is the marketing argument. An IPO is an important branding event for the issuing firm, and underpricing can be used instead of traditional marketing

techniques, and has proven to be effective for example through attracting traffic to company websites (Demers and Lewellen, 2001). Finally, Shiller (1990) introduced the impresario hypothesis as an explanation for underpricing. This hypothesis argues that the IPO market is subject to "fads" and suggests that IPOs are underpriced in order to create the appearance of excess demand (Ritter, 1998).

2.4.1.3 Behavioral Explanations

Behavioral explanations for underpricing put focus towards why the final offer price was too low or why the price at the end of the first day of trading was too high. According to Loughran and Ritter (2002), *prospect theory*, presented by Kahneman and Tversky in 1982, can help explain why the offer price of IPOs is too low. This theory states that individuals tend to care more about their level of wealth relative to the anchored level than they do about the absolute amount. In other words, when the offer price is set low and attracts investors, the price will increase and the CEO will focus on the positive unexpected wealth and forget the money left on the table. In theory, a rational CEO would hope for less underpricing. The price at the end of the first day of trading should, according to theory, be an unbiased estimate of the share's intrinsic value, but one can observe prices that are optimistically biased. Speculation among retail investors can be a reason why market prices increase to irrational levels.

2.4.2 Overpricing – Long term return

The positive initial return explained above is often followed by a poor long-run performance (Ritter, 1991). This may indicate that companies listed through an IPO are overpriced relative to their long-term fundamental value. Several theories have been presented in order to explain why IPOs seem to be overpriced in the long run. This thesis will focus on three theories: divergence of opinion hypothesis, impresario hypothesis and windows of opportunity.

2.4.2.1 Divergence of Opinion Hypothesis

According to Miller (1977), the price of a firm facing short sales constraints are determined by the beliefs of the most optimistic investors. This leads to high return on short term, while the expected return will fall on a longer term. This is known as the Miller effect. The initial overvaluation by optimistic investors is corrected in the years after the listing as the

uncertainty of IPO-firms subdue. After the listing, more information is available because of transparency requirements and analyst coverage, and optimistic and pessimistic investors share the opinion of the value of the company to a larger extent (Dong and Michel, 2009).

2.4.2.2 Impresario Hypothesis

The impresario hypothesis was mentioned as one of the theories used to explain underpricing, but can also help understanding the poor return in the long run. This hypothesis states that the companies with the highest first-day return tend to have the lowest subsequent returns. According to Shiller (1990), underpricing will lead to increased interest for the issue, and in turn lead to high positive initial return. This will however be adjusted in the secondary market through negative market-adjusted return in the period after the listing.

2.4.2.3 Windows of Opportunity

This hypothesis predicts that firms that choose to go public in high volume periods are more likely to experience overvaluation compared to other IPOs. High-volume periods should be associated with the lowest long-term returns, and there is evidence that this pattern exists (Ritter, 1998).

2.4.3 Stabilization activity

Earlier studies present several examples of large underpricing, while large overpricing on the first day of trading is rather rare. This can be explained by what is known as stabilization activity, where the underwriter initially takes a short position by exercising an overallotment option. This might occur through exercising a green shoe option (GSO). A GSO can prevent huge price fluctuations, for example caused by "stock flippers", and can therefore save investors from potential loss. "Stock flippers" subscribe to the issue, but they immediately re-sell their shares. This way they can create an artificial demand for an IPO that overstates the true demand. The short covering in the aftermarket is what prevents a large negative initial return on the first day of trading (de Carvalho and Pinheiro, 2008).

A GSO is according to de Carvalho and Pinheiro (2008) a covenant that gives the underwriter the option to buy a complementary number of shares from the issuer at the offer price. The underwriter can buy up to an additional 15 % of company shares at the final offer price. The issuing firm shall appoint one of the book runners as the *stabilization agent*, and this agent is responsible for the price stabilization process. When the aftermarket price is

higher than the offer price, the underwriter will cover the short position by exercising the option. On the other hand, when the aftermarket price is below the offer price, the covering is made at the market price lower than the offer price. Losses are however possible, and this will be the case when the overallotment is larger than the GSO. When this is the case, the underwriter must normally repurchase shares to a higher price than the final offer price.

2.4.4 Empirical Evidence

Underpricing leads to an abnormal high first-day return. Bakke, Leite and Thorburn (2011) find evidence for underpricing in their study. Their final dataset consisted of 5.093 U.S. IPOs from 1981 to 2008, and they find an average initial return equal to 19,2 %. In addition, they find that the initial return varies over time.

Loughran, Ritter and Rydqvist (2008) have compiled studies from 45 different countries worldwide, and their findings are a consistently positive initial return. Their study also noted that the positive initial return varies between the different markets. Ljunqvist (2004) also finds evidence of underpricing in his study. Consistent with the findings of Loughran, Ritter and Rydqvist (2008) and Bakke, Leite and Thorburn (2011) he also finds that underpricing varies both over time and across different markets.

As mentioned earlier, bookbuilding has become popular in recent years, and many countries have moved from fixed-price to bookbuilding. The reason behind this change of method is expected to be that bookbuilding give a more accurate pricing of the issue, which result in less underpricing. Ritter (1998) finds evidence for this explanation. Earlier studies of the Norwegian IPO market, like Nærland (1994), find underpricing of around 12 % over the two first trading days, while more recent studies like Samuelsen and Tveter (2006), find a significantly reduced underpricing equal to 2,21 %. This may be related to the fact that bookbuilding has replaced the fixed-price method. Ritter (1998) also finds underpricing in his study, and also that underpricing varies between different countries. In addition, he finds that this variation was related to the method used. However, as mentioned earlier, Ranjan and Madhusoodanan (2004) find that underpricing is not dependent on the mechanism used to set the price, but rather the size of the issue.

The second interesting pattern associated with IPOs presented in this thesis is the poor share price performance in the long run. Ritter (1998) presents evidence of the long-run performance of IPOs. Companies going public between 1970 and 1993 had an average return

of 7,9 % per year for the five years after the offering took place. Compared to a control group of non-issuing firms (matched by market capitalization) with average annual returns of 13,1 %, the IPOs underperform by 5,2 % per year. The study also presents international evidence on long-run performance of IPOs and can be viewed in the table below.

Table 3: International evidence on long-run performance of IPOs

Country	Authors	Number of IPOs	Issuing Years	Total Abnormal Return
Australia	Lee, Taylor & Walter	266	1976-89	-46.5%
Austria	Aussenegg	57	1965-93	-27.3%
Brazil	Aggarwal, Leal & Hernandez	62	1980-90	-47.0%
Canada	Jog and Srivistava	216	1972-93	-17.9%
Chile	Aggarwal, Leal & Hernandez	28	1982-90	-23.7%
Finland	Keloharju	79	1984-89	-21.1%
Germany	Ljungqvist	145	1970-90	-12.1%
Japan	Cai & Wei	172	1971-90	-27.0%
Korea	Kim, Krinsky & Lee	99	1985-88	+2.0%
Singapore	Hin & Mahmood	45	1976-84	-9.2%
Sweden	Loughran, Ritter & Rydqvist	162	1980-90	+1.2%
U.K	Levis	712	1980-88	-8.1%
U.S	Loughran & Ritter	4,753	1970-90	-20.0%

IPO literature divides the market into “hot” and “cold” issue markets. “Hot” issue markets are recognized as periods where the average aftermarket performance of IPOs is abnormally high (Ibbtson and Jaffe, 1975). In a “cold” market, rational investors set the prices as no exuberant investors exist, which result in no underpricing or long run underperformance (Ljunqvist, Nanda and Singh, 2003). Ritter (1991) has also studied “hot” issue markets and shows that IPOs in the “hot” market of the early 1980s both experienced high underpricing in the short run as well as poor performance in the long run. In addition, Loughran and Ritter (2000) find strong evidence that IPOs in high-volume periods are more likely to perform badly on long term than IPOs in low volume periods (Ljunqvist, Nanda and Singh, 2003).

There is little empirical literature available on price stabilization in IPOs, as there is little available data. De Carvalho and Pinheiro (2008) have however studied stabilization activity and find among other things that the intensity of stabilization is negatively related to the issue size, while the price range presents a positive relation. However, it is important to note that the variables have marginal statistical significance. Boreiko and Lombardo (2009)

provided a study of the stabilization activity in the Italian market, and find that stabilized IPOs have a low level of initial underpricing after the first day of trading (median equal to -0,30 %). Non-stabilized IPOs, on the other hand, perform significantly better.

2.5 “Grey” Markets

”Grey” markets can be described as a market place where a company’s shares are traded unofficially. It is an over-the-counter (OTC) market where a dealer can complete orders for their customers and also give support to an issue before it is listed (Kristhnamurti, Thong and Vishwanath, 2011). In many cases this happens before an IPO. In this pre-IPO market, investors can speculate on future stock prices to companies planning to go public (Cornelli, Goldreich and Ljungqvist, 2005). The price in the OTC market is determined by supply and demand, and is the price investors are willing to buy or sell in the “grey” market (Krishnamurti, Thong and Vishwanath, 2011). In Norway, trading in “grey” markets can occur through the Norwegian OTC-market (NOTC).

Cornelli, Goldreich and Ljungqvist (2005) study the interaction between the “grey” market and bookbuilding in terms of determining the offer price. The study is based on data collected from a number of European IPOs from 1995 to 2002. As mentioned earlier, the underwriter collects information from investors during the bookbuilding period. At the same time as this takes place, investors can trade the shares in the “grey” market. The study finds that when the prices in the “grey” market are high, they are strongly correlated with the prices established in the aftermarket. This can be explained by the fact that when investors are overoptimistic, they are willing to pay a price above the true value. On the other hand, when they are more pessimistic they price the shares out of the market, and there should be no bias to the aftermarket price.

The prices in the “grey” market are publicly available, and the underwriter can use these prices to stipulate the issue price. It is therefore expected to be easier to set a price close to market price. Thus, the width of the price range presented in the prospectus is expected to be narrower as there is less uncertainty. The width of the price range may indicate the level of uncertainty related to an IPO, and one expects a wider range to represent more uncertainty.

3. Analysis

This thesis analyzes the relationship between the final offer price and the initial price range established in the pre-IPO phase and the share price performance of companies introduced on Oslo Stock Exchange between January 01, 2006 and December 31, 2011. I wish to investigate the performance both on short term as well as on longer term, and I will therefore analyze the initial return, the return after one week (five trading days) and finally the return after six months (129 trading days). By looking at the return after five trading days, one might eliminate the effect of potential "stock flippers."

The first part of the chapter will present the underlying data, sources and the criteria behind the selection. Further, I will explain the method used to calculate abnormal returns, before the analysis is presented. In addition to investigate how the IPOs are priced relative to the indicative price range and how this affects the performance in the aftermarket, I also wish to investigate three factors and how they influence the pricing as well as the performance on the short and long term. The analysis has therefore been divided into four sections:

1) Final offer price relative to the indicative price range
2) OTC-market
3) Size of Issue
4) Green shoe option

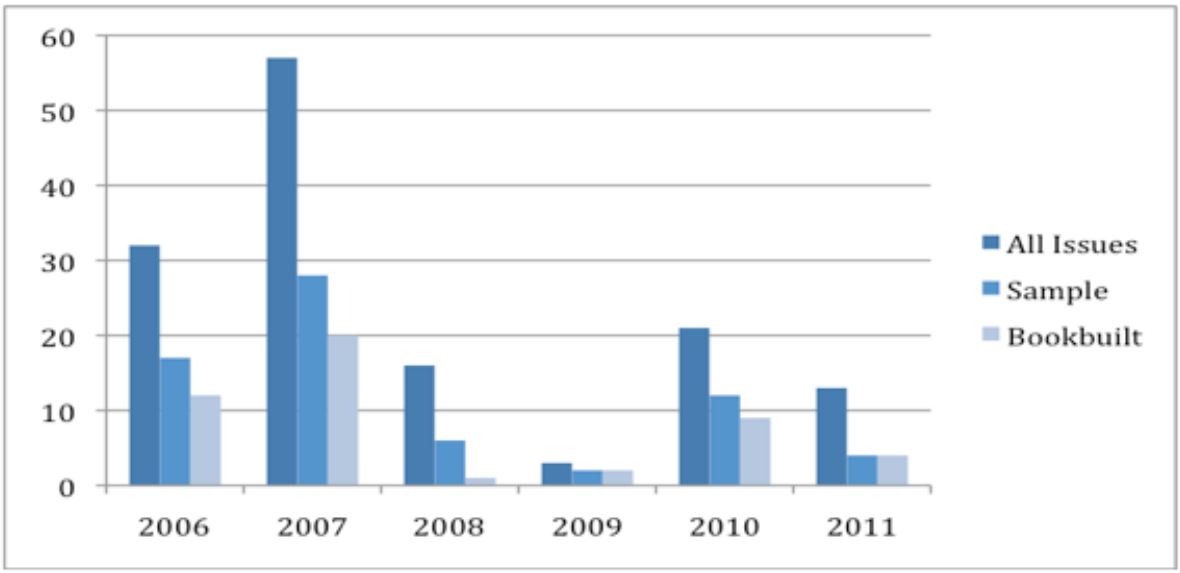
The results will be presented, commented and compared to previous studies mentioned earlier in the thesis.

3.1 Data

The analysis includes companies that have been introduced on Oslo Stock Exchange between 2006 and 2011. According to statistics from Oslo Stock Exchange, 102 companies were introduced in the period between January 01, 2006 and August 31, 2008, whereas only 40 companies were introduced between September 01, 2008 and December 31, 2011, which amounts to a total of 142 companies. The final sample includes only those companies that were introduced on a stock exchange for the first time and at the same time made an increase in share capital or offered a public sale of shares. These limitations reduce the final sample to 69 companies, 51 between January 01, 2006 and August 31, 2008 and 18 between

September 01, 2008 and December 31, 2011. In addition, the main part of the analysis will concentrate on the 48 bookbuilt IPOs in the sample. The chart below presents an overview over the data used in the analysis.

Figure 2: Overview of data (X-axis = Year introduced, Y-axis = Number of IPOs introduced)



The data collection for this thesis has been time consuming. However, DNB Markets has provided me with useful data, which have saved me valuable time. The remaining data has been collected from prospectuses published in connection with the IPO, Yahoo! Finance, Netfonds and statistics obtained from Oslo Stock Exchange. The data received from DNB Markets has been checked to make sure that the final data material is correct. I have therefore been able to collect all data needed in order to perform the various analyses.

In this thesis I have chosen to use the share price at the end of the first trading day when estimating the initial return. When estimating the return on longer term I have used the price after five and 129 trading days. The prices after the first day of trading, five and 129 trading days have been obtained from Yahoo! Finance and Netfonds. In the few cases where there was no price on the given day I have used the price closest prior to the date. Further on, in the analysis of the share price performance, I have used the last subscription date as a measure of when an investor buys shares. Information about the last subscription date has mainly been taken from the prospectuses. In those cases where the prospectus was not available, the information needed could be found in Netfonds' news archive or in Newsweb, provided by Oslo Stock Exchange. In addition, the final offer price was obtained from issue statistics provided by Oslo Stock Exchange.

In order to analyze the share price performance and determine whether there have been any abnormal high or low returns, it is necessary to identify the normal return. This thesis uses Oslo Stock Exchange Benchmark Index (OSEBX) as a measure of normal return. According to Oslo Stock Exchange, OSEBX is an investible index that comprises the most traded shares listed on the stock exchange. It is revised semiannually and is adjusted for dividend payments. The historical prices of OSEBX are collected from Yahoo! Finance.

Information about the indicative price range, deal size and green shoe option were mainly obtained from prospectuses, and when the prospectus was not available, the information was taken from Netfonds' news archive or Newsweb. Information whether a green shoe option was offered or not proved to be more difficult to find, and I only managed to find information about the use of an over-allotment option in 40 of the 48 bookbuilt IPOs in the sample. Whether a company was traded in the NOTC-market prior to the listing on Oslo Stock Exchange or not could also be found in the listing prospectuses. In addition, the Norwegian Securities Dealers Association and Netfonds news archive provided the necessary information.

3.2 Method

To estimate the abnormal return, both on short and long term, I have used the following equation:

$$r_i = (P_{i1} - P_{i0})/P_{i0} - (I_{i1} - I_{i0})/I_{i0}$$

Where:

r_i = Abnormal return

P_{i1} = Stock price at the end of the first day (closing price after five and 129 trading days)

P_{i0} = Final offer price

I_{i1} = OSEBX on the day of listing (price after five and 129 trading days)

I_{i0} = OSEBX on the last subscription date

The expressions abnormal and market adjusted return are used synonymous throughout the analysis. I will also calculate the return without adjusting for market development in order to investigate whether there are any significant differences between these two methods.

3.2.1 Price relative to indicative price range

As mentioned earlier, previous studies like Hanley (1993) and Bakke, Leite and Thorburn (2011) divided the IPOs into three categories based on where the final offer price was set relative to the indicative price range: above, below and within the price range. After the issues are categorized, one can see if there are any significant differences in stock price return between the various groups.

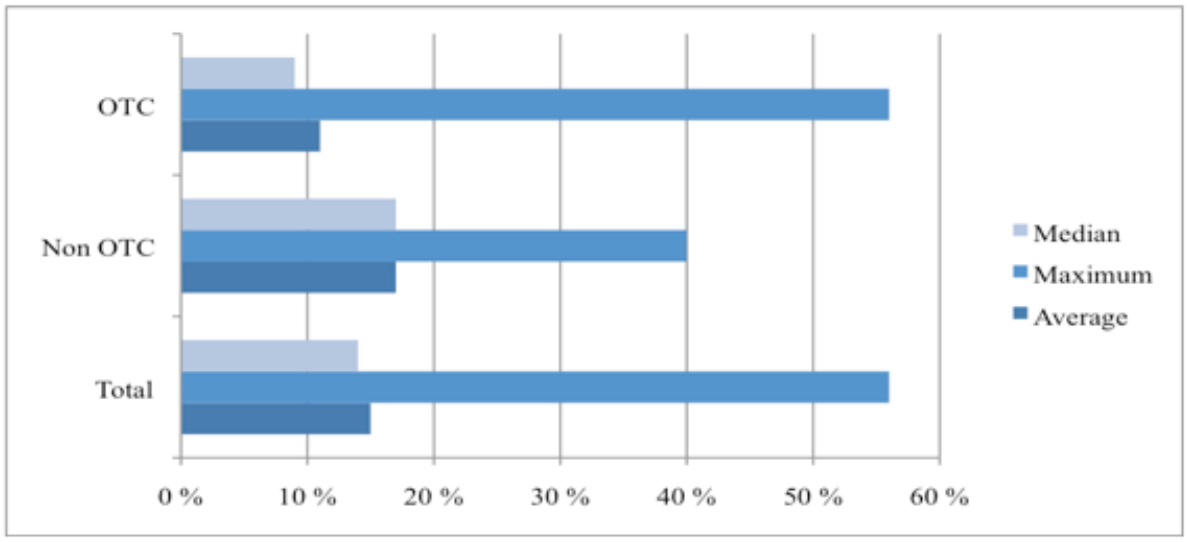
However, in my sample only a few issues ended up with the final offer price outside the price range, and in those few cases, amended price ranges were made. I have therefore used the same method as Samuelsen and Tveter (2006). Instead of three categories, they divided their sample into two: below the midpoint of the indicative price range and equal to or above the midpoint. In the issues where fixed-price were used they used the indicated price from the prospectus instead of the midpoint of the range. In my sample the final offer price was set equal to the indicated price in every issue using fixed-price, and I have therefore chosen to concentrate on the issues using bookbuilding only, which leads to 48 IPOs. This is done in order to investigate whether there is any relationship between where the final offer price is set relative to the indicative price range and the performance in the aftermarket.

Hypothesis 1: I expect issues priced in the upper half of the range to perform better in the short term and poorer in the long run than issues priced below the midpoint of the price range.

3.2.2 OTC-market

The second part of my analysis will investigate how the width of the price range affects the share price performance. As stated earlier, one expects the price range to be narrower for companies that have been traded in the OTC-market than for those who have not. This is also the case in this sample.

Figure 3: Differences between OTC and Non-OTC IPOs (X-axis = Width of range in percentage)



The average width of the price range for the whole sample was 15 %, whereas the width for the OTC-listed and non-OTC-listed was 11 % and 17 % respectively. However, the widest range, 56 %, is among the OTC-listed. Despite this, I will in this part of the analysis concentrate only on whether or not a company has been listed in the OTC-market.

A general assumption is that companies previously traded in the OTC-market have less asymmetric information and hence less uncertainty, which leads to a more accurate pricing. In order to investigate this, I will calculate the average abnormal return using the formula presented earlier for the two different groups, OTC-listed and non-OTC-listed. Further, I will look at the relationship between a previous listing on the OTC-list and the method used to set the price. I will expect that a larger proportion of the OTC-listed IPOs used fixed-price.

Hypothesis 2: Companies previously traded in the OTC-market experience more accurate pricing than companies who have not been traded in this market.

3.2.3 Size

The size of the issues varies considerably throughout the final sample of 69 IPOs. The size varies from approximately 5 million NOK to nearly 11 billion NOK. It is expected that large issues are more accurately priced, and thus yield less abnormal returns. Large issues tend to use the bookbuilding method to set the final offer price, and earlier studies find evidence for more accurate pricing when using bookbuilding rather than fixed-price. Ranjan and Madhusoodanan (2004) find evidence in their study that larger issues used bookbuilding

while smaller issues used fixed-price, and according to them, this is why one finds less underpricing among bookbuilt IPOs.

The sample will be divided into two groups representing large and small issues, and the abnormal return will be calculated for each group. The sample is right-skewed, which means that the majority of the issues are characterized as small issues. Further, I will investigate if there is any relationship between the size and where the final offer price is set relative to the indicative price range. Finally, I will investigate whether abnormal returns are explained by the size of the issue or the method used to set the price.

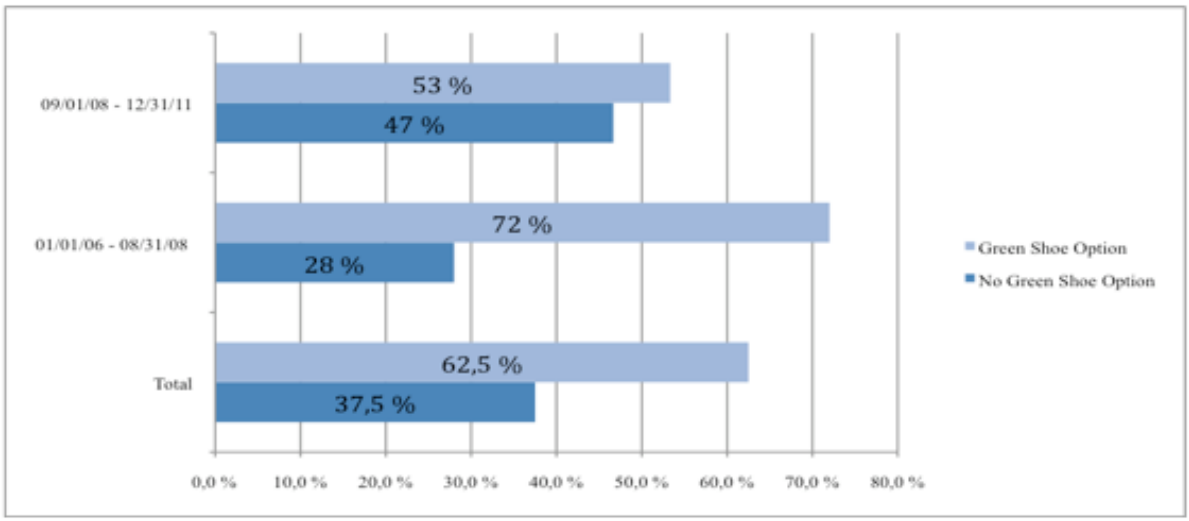
Hypothesis 3: Large issues are more accurately priced than small issues.

3.2.4 Green Shoe Option

The GSO allows the underwriter to keep fluctuations in post-IPO prices to a minimum. "Stock flippers", who buy a *hot IPO* with the intent to re-sell immediately to gain profit, might cause these price fluctuations. As a tool used to keep the price close to the final offer price, one will expect the use of a GSO to lead to a more accurately pricing of the IPO, thus less over- and underpricing. Use of a GSO indicates that the IPO was sold with a GSO.

As mentioned earlier, I only managed to find the necessary information about 40 of the 48 bookbuilt IPOs in the sample. These 40 will be divided into two groups representing whether the IPO was sold with or without a GSO. In addition, the relation between the use of a GSO and where in the price range the final offer price is set will also be investigated.

Figure 4: Overview of the use of Green Shoe Option (X-axis = number of issues measured in terms of percent)



Hypothesis 4: The use of a GSO will cause more accurate pricing and thus less abnormal returns.

3.3 Results

The formula presented above is used to estimate the abnormal return for the three different time horizons, initial return and return after five and 129 trading days. The abnormal return is both estimated for each of the two time periods separately and for the sample as a whole. The results are presented in the table below.

Table 4: Average market adjusted return

Initial Return	**2006-Aug 2008**	**Sept 2008-2011**	**Total**
Number of Issues	51	18	69
Abnormal Return	3,68 %*	-0,97 %	2,41 %
Return after 1 week	**2006-2007**	**2009-2011**	**Total**
Number of Issues	50	18	68
Abnormal Return	1,07 %	-4,60 %*	-1,06 %
Return after 6 months	**2006-2007**	**2009-2011**	**Total**
Number of Issues	50	16	66
Abnormal Return	2,36 %	-4,08 %	-0,02 %

Table 4 indicates that the average abnormal initial return for the 69 companies in the sample is equal to 2,41 %. The abnormal initial return is higher in the first period, and is estimated to 3,68 %. The second period is actually slightly overpriced on an average basis, and the abnormal return is calculated to -0,97 %. However, it is important to note that the estimated return for the period between September 01, 2008 and December 31, 2011 is not statistically significant, and it might therefore be likely that the results occurred by chance. The sample size is also relatively small, containing only 18 IPOs.

Further, table 4 shows the average market adjusted return after five trading days. For the final sample, here including 68 companies due to missing data, the average abnormal return is calculated to -1,06 %. The period between January 01, 2006 and August 31, 2008 has an abnormal return equal to 1,07 %, while the period September 01, 2008 - December 31, 2011 shows another picture with an abnormal return equal to -4,60 %. According to the t-statistic, only the second period is statistically significant, with a t-value equal to 2,11.

Finally, the table shows the average abnormal return on a longer term, here after six months of trading on Oslo Stock Exchange. The sample as a whole, now 66 companies, has an

average market adjusted return estimated to -0,02 %. The first time period still has a positive abnormal return, 2,36 %, whereas the second has a negative return, -4,08 %. The t-values for both periods were low, and according to a simple t-test, none of the estimated returns were statistically significant.

In addition to calculating the market adjusted return for the different IPOs on short and long term, I have also calculated returns without adjusting for market development. The results are presented in Appendix 2. Also here I find the same pattern, and the results indicate that there are marginal differences between the two methods. Further in this thesis, I will only use the market adjusted return.

A more detailed statistical analysis for the sample as a whole as well as for the bookbuilt IPOs has been performed for a closer look at the performance of the IPOs.

Table 5: Descriptive Statistics (whole sample)

Total	1 day	1 week	6 months
Average return	2,41 %	-1,06 %	-0,02 %
Maximum	29,25 %	30,79 %	91,92 %
Median	1,63 %	-0,93 %	-9,21 %
Minimum	-25,14 %	-46,02 %	-68,31 %
Skewness	0,55	-0,45	0,64
Standard Deviation	8,73 %	11,21 %	34,45 %
Number of Observations	69	68	66
Alpha	0,05	0,05	0,05
Confidence	0,021	0,027	0,083
95 % Confidence Interval	(0,35% , 4,47 %)	(-3,72% , 1,60%)	(-8,33% , 8,29%)
Degrees of Freedom (n-1)	68	67	65
T-Value	2,29*	-0,78	0,00
Critical Value	2,00	2,00	2,00

The arithmetic mean (average) gives equal weights to each observation and might therefore give a wrong picture of the return. Median can provide a more accurate picture. Median is defined as the numerical value separating the higher half of the sample from the lower half. A median lower than the arithmetic mean and a positive skewness indicates that the sample is right-biased.

The 95 % confidence interval indicates that one with high confidence can say that the initial return are positive, and the results are, according to a simple t-test, statistically significant. On the other hand, the results for return after one week and after six months are statistically insignificant, and the 95 % confidence interval indicates that returns might be negative as

well as positive. In theory, standard deviation is an indication of probability, while in practice the term has limitations, as returns do not follow a classic "normal distribution." In addition, the standard deviation after six months of trading is high, indicating that the individual values are widely spread around the mean value, and leads to a wider confidence interval and low t-values (Gujarati and Porter, 2009). The distribution is somewhat skewed, and the t-values must be interpreted with this in mind.

Table 6: Descriptive Statistics (bookbuilt IPOs)

Bookbuilt	1 day	1 week	6 months
Average return	3,38 %	-0,26 %	6,39 %
Median	1,73 %	-1,13 %	-3,18 %
Skewness	1,11	0,83	0,62
Standard Deviation	8,90 %	10,46 %	35,9
Number of Observations	48	48	45
Alpha	0,05	0,05	0,05
Degrees of Freedom (n-1)	47	47	44
T-Value	2,63*	-0,17	0,01
Critical Value	2,02	2,02	2,02

The bookbuilt IPOs have a higher average initial return than what was calculated for the whole sample, which is inconsistent with previous research that state that bookbuilding leads to a more accurately pricing, hence less underpricing. The t-statistic indicates that the results are statistically significant only for the initial return.

Further, I have divided the initial return, return after one week and after 6 months into ten intervals to provide an overview of how the IPOs are distributed.

Figure 5: Distribution of initial return in percent (X-axis = Various intervals, Y-axis = Number of observations)

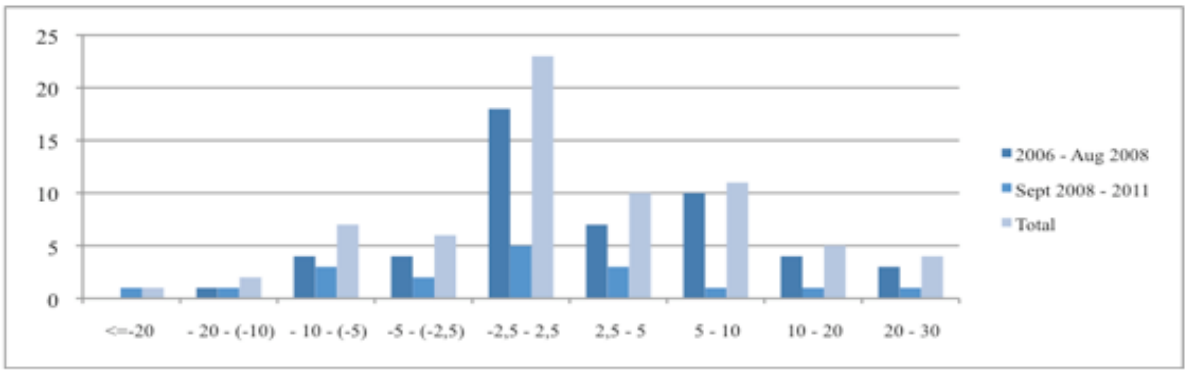
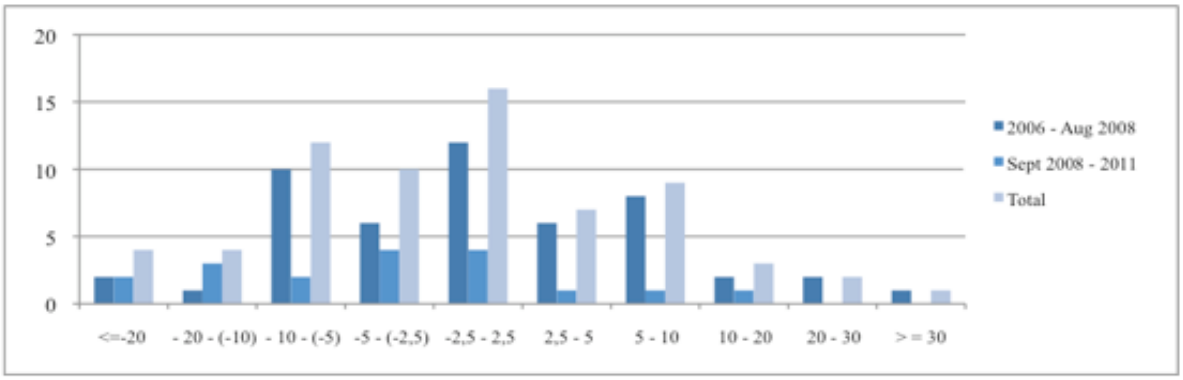


Figure 4 shows that the majority of the IPOs have a positive abnormal initial return, and there are no significant differences between the two time periods. Both periods have a high

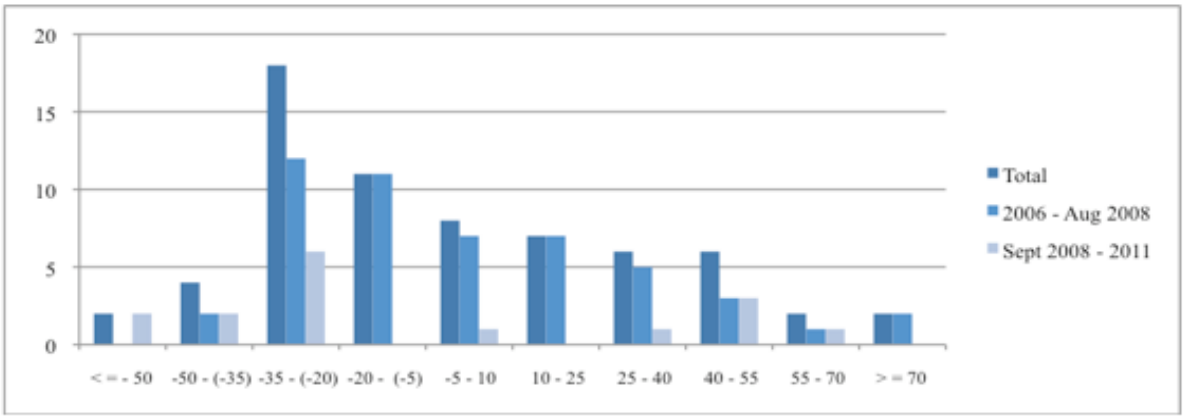
proportion of IPOs within the interval between -2,5 % and 2,5 %, but the companies introduced between January 2006 and August 2008 experience more underpricing than those introduced between September 2008 and December 2011.

Figure 6: Distribution of return after one week (X-axis = Various intervals, Y-axis = Number of observations)



The majority for both time periods is still centered around zero and between the interval -2,5 % - 2,5 % after five trading days. The distribution has however moved more to the left, and the IPOs between January 2006 and August 2008 experience less underpricing after five days of trading than what they did after the first day.

Figure 7: Distribution of return after six months (X-axis = Various intervals, Y-axis = Number of observations)



After 129 trading days the distribution has been moved even further to the left and the majority of the IPOs have a negative abnormal return. However, IPOs in the first time period still have a rather high proportion of positive abnormal returns.

I observe a positive average market adjusted initial return for the IPOs introduced between 2006 and 2011, which is consistent with previous studies. However, the return is lower than earlier observations, and more in line with studies conducted in the recent past. The fact that

underpricing is more or less non-existent today has been explained by previous papers to be caused by the increasing popularity of bookbuilding, a method that will provide a more accurately pricing of an IPO. The majority of the IPOs in my sample used bookbuilding when determining the final offer price. However, my results indicate the opposite, that bookbuilding does not provide a more accurately pricing of IPOs.

The positive average returns seem to decline in the longer run, and move towards zero. The median after 6 months of trading is calculated to -9,21 %, which means that 50 % of the sample has a long term return lower than this. This finding is in line with Ritter (1991), who explained that the positive initial return often is followed by a poor performance in the longer run. As stated earlier, this might indicate overpricing relative to their true value on long-term.

When comparing January 2006 – August 2008 to September 2008 – December 2011 one can see that the IPOs introduced in the first period seem to perform better both on short and long term. In addition, the second period seem more vulnerable to fluctuations, and can be linked to a higher level of uncertainty. According to Bakke, Leite and Thorburn (2011), the probability of a positive initial return is higher when public markets are doing well, as investors are more likely to have positive information in good times. This is in line with the findings in this analysis. In addition, Ljunqvist, Nanda and Singh (2003) stated that in "cold" markets, market rational investors set the prices, and hence no underpricing. This can explain why underpricing in the second period is non-existent.

3.3.1 Price relative to indicative price range

I have investigated whether there is any relation between where the final offer price is set relative to the indicative price range and the share price performance in the aftermarket, as earlier studies suggest. The sample was divided into two groups, one where the offer price was set equal to or higher than the midpoint of the price range, and one where the offer price was set below the midpoint of the range. The differences in the mean values of the two groups are greater than what would be expected by chance, thus, there is a statistically significant difference between the two groups (t-values equal to 2,56, 2,42 and 3,64). Only the 48 IPOs that used bookbuilding to set the final offer price were included in this analysis, and the findings are presented in the table below.

Table 7: Price relative to indicative price range and performance in the aftermarket

Total	N	Initial Return	Return after 1 week	Return after 6 months
Offer price ≥ Midpoint	17	5,51 %	2,10 %	18,51 %
Offer price < Midpoint	31	2,22 %	-1,55 %	-0,97 %
2006 – Aug 2008	N	Initial Return	Return after 1 week	Return after 6 months
Offer price ≥ Midpoint	14	5,54 %	1,18 %	16,00 %
Offer price < Midpoint	19	3,43 %	0,83 %	-1,22 %
Sept 2008 - 2011	N	Initial Return	Return after 1 week	Return after 6 months
Offer price ≥ Midpoint	3	5,36 %	6,37 %	30,20 %*
Offer price < Midpoint	12	0,26 %	-5,31 %*	-0,51 %

The results indicate that the return might be affected by where the final offer price is set. Issues where the offer price was set on or above the midpoint of the range seem to perform better in the aftermarket, both on short and long term. The two periods both show the same pattern. It is however important to bear in mind that when looking at the two periods separately, the sample size is substantially reduced, and according to a simple t-test I find low t-values and few statistically significant results. The statistically significant results are marked with a star and can be viewed in table 7.

The table also shows that the majority of the IPOs end up with an offer price below the midpoint of the range, and this applies particularly for the issues between September 2008 and December 2011 where 12 out of 15 IPOs ended up with an offer price below the midpoint. The global financial crisis resulted in a high level of uncertainty in the IPO-market, and several of the issues completed during the recession needed to amend the price range when more information became available during the bookbuilding period. Despite the fact that the price range is not legally binding, none of the IPOs ended up with a price outside the indicative price range (amended price range). Pricing outside the price range is rare in the European markets (Derrien, 2005).

In addition, I find that 18 of the 48 bookbuilt IPOs ended up with a final offer price exactly at the bottom of the range, while eight ended up with a price exactly at the opposite end. Out of the 18 issues priced at the bottom of the range, nine took place between September 01, 2008 and December 31, 2011, while only one of the eight IPOs priced at the top of the range took place in this period.

A more detailed statistical analysis shows the same results. Apart from initial return for issues priced in the upper part of the range, the results are not statistically significant. A simple t-test indicates that the results are not significantly different from zero. The t-values must be interpreted with caution, as the sample size is small and the distribution is skewed.

Table 8: Descriptive statistics – Offer price ≥ Midpoint

	Offer price ≥ Midpoint		
Total	**Initial Return**	**Return after 1 week**	**Return after 6 months**
Arithmetic Mean	5,51	2,10	18,51
Max	29,25	30,79	91,92
Median	4,28	0,08	19,41
Min	-8,29	-25,01	-38,93
Skewness	1,11	0,21	0,17
SD	9,37	11,21	36,09
Number of Observations	17	17	17
Degrees of Freedom (n-1)	16	16	16
T-Value	2,42*	0,77	2,11
Critical Value	+/-2,12	+/-2,12	+/-2,12

Table 9: Descriptive Statistics – Offer price < Midpoint

	Offer price < Midpoint		
Total	**Initial Return**	**Return after 1 week**	**Return after 6 months**
Arithmetic Mean	2,22	-1,55	-0,97
Max	25,49	27,13	82,23
Median	0,14	-3,20	-13,35
Min	-12,95	-21,78	-42,74
Skewness	1,20	1,29	1,01
SD	8,57	9,99	34,35
Number of Observations	31	31	28
Degrees of Freedom (n-1)	30	30	27
T-Value	1,44	-0,97	0,01
Critical Value	+/-2,042	+/-2,042	+/-2,052

The fact that issues priced equal to or above the midpoint of the indicative price range perform better on short term than issues priced below the midpoint of the range is in accordance with Hanley (1993) and hypothesis 1. This might indicate that the underwriter has not been able to adjust the issue price high enough relative to the demand of the most sought after IPOs. This is known as the "partial adjustment" phenomenon. Negative information, on the other hand, is fully incorporated into the offer price as underwriters as well as investors want to avoid possible losses on overpriced issues. The issues priced below the midpoint of the price range remain more or less constant after the introduction to Oslo

Stock Exchange, both on short and long term. On the other hand, issues priced in the upper part of the range seem to perform better than issues priced in the opposite end also in the longer run. This finding is inconsistent with previous literature, and hypothesis 1, that states that "cold" IPOs outperform the benchmark in the medium-run (Bakke, 2012).

The majority of the issues ended up with an offer price below the midpoint of the price range, and this might explain why I find less underpricing than previous studies. Also the fact that 80 % of the IPOs introduced between September 01, 2008 and December 31, 2011 were priced in the lower end of the range can help explain why I find less underpricing during the recession than in the period between January 01, 2006 and August 31, 2008, where 58 % of the IPOs ended up with a price below the midpoint of the price range.

3.3.2 OTC-market

When investigating the effect of the OTC-market and the width of the price range, I divided the sample into two groups representing whether they have been listed in the "grey" market or not. However, I find low t-values and no statistically significant difference between the two sample groups. This is no surprise as the difference between them is relatively small.

Table 10: Descriptive Statistics – OTC

	OTC		
Total	**Initial Return**	**Return after 1 week**	**Return after 6 months**
Arithmetic Mean	2,88	-0,56	4,20
Median	2,68	-0,40	-9,81
Skewness	0,08	-0,01	0,54
SD	6,15	7,40	40,83
Number of Observations	26	25	25
Degrees of Freedom (n-1)	25	24	24
T-Value	2,39*	-0,38	0,51
Critical Value	2,06	2,06	2,06

	Non-OTC		
Total	**Initial Return**	**Return after 1 week**	**Return after 6 months**
Arithmetic Mean	2,12	-1,36	-2,59
Median	0,13	-1,16	-8,62
Skewness	0,64	-0,42	0,58
SD	10,03	13,00	30,17
Number of Observations	43	43	41
Degrees of Freedom (n-1)	42	42	40
T-Value	1,39	-0,68	-0,55
Critical Value	2,02	2,02	2,02

The results indicate that the arithmetic mean is more or less equal for both groups. However, the non-OTC issues have a higher standard deviation on short term, which indicates that the returns are spread out over a large range of values. A low standard deviation on the other hand means that the returns tend to be closer to the mean, and this is the case for the OTC-issues on short term. The fact that there is less fluctuation among the OTC-traded IPOs is more in line with hypothesis 2. An IPO that has been traded in the "grey" market prior to the listing on a stock exchange has been able to establish a price, and therefore one would expect less uncertainty around the pricing. Except from initial return for OTC-listed IPOs, none of the results are statistically significant.

When investigating the relationship between the OTC-listed IPOs and the method used to set the IPO price, I find that 53 % of the IPOs using fixed-price have previously been traded in the OTC marked, while only 31 % of the bookbuilt IPOs have been traded in this market. Among those using bookbuilding, I found no relation between a previously listing in the "grey" market and where in the price range the final offer price was set.

3.3.3 Size

Since the IPOs on Oslo Stock Exchange varies substantially in size it might be of interest to investigate whether this has any influence on the price setting and the performance in the aftermarket. The sample has been divided into large and small issues. However, a simple t-test suggests that small and large issues are not statistically different from each other. Dividing the sample was relatively difficult, and this can help explain why I find no significant difference between the two groups. Small issues dominate the Norwegian IPO-market; hence, the group with small issues is larger in scale.

Table 11: Descriptive Statistics – Issue Size

Total	Large		
	Initial Return	Return after 1 week	Return after 6 months
Arithmetic Mean	2,19	-1,37	7,14
Median	1,08	-0,39	13,99
Skewness	0,84	-0,92	0,39
SD	7,06	8,48	37,55
Number of Observations	23	23	22
Degrees of Freedom (n-1)	22	22	21
T-Value	1,49	-0,78	0,89
Critical Value	2,07	2,07	2,07

	Small		
	Initial Return	Return after 1 week	Return after 6 months
Arithmetic Mean	2,52	-0,90	-3,60
Median	1,73	-2,10	-11,37
Skewness	0,47	-0,39	0,77
SD	9,53	12,46	32,65
Number of Observations	46	45	44
Degrees of Freedom (n-1)	45	44	43
T-Value	1,79	-0,48	-0,73
Critical Value	2,02	2,02	2,02

The statistical analysis indicates that the large issues have lower standard deviation than the small issues on short term, which might be a sign of a more accurately pricing of large issues and thus less fluctuation in the price after the introduction. This is consistent with hypothesis 3. Nevertheless, as the table suggests, there are no statistically significant results on a 5 % significance level.

When looking at the relationship between the issue size and the position of the offer price in the indicative price range, I find that small issues are more frequently priced below the midpoint of the range than large issues.

In order to investigate whether abnormal returns are explained by the size or the pricing method, I calculated abnormal returns for fixed-price IPOs, and compared the results to the bookbuilt IPOs from table 6. IPOs using bookbuilding seem to be significantly different from those using fixed-price.

Table 12: Abnormal Return for Fixed-Price IPOs

Fixed-Priced	1 day	1 week	6 months
Average return	0,18	-3,00	-13,74
Median	1,16	0,02	-15,00
Skewness	-1,39	-2,11	-0,05
Standard Deviation	8,08	12,92	27,03
Number of Observations	21,00	20,00	21,00
Alpha	0,05	0,05	0,05
Degrees of Freedom (n-1)	20,00	19,00	20,00
T-Value	0,10	-1,04	-2,33*
Critical Value	2,09	2,09	2,09

Table 6 and 12 imply that bookbuilt IPOs experience more fluctuations both on short and long term than fixed-price IPOs, which is inconsistent with previous research that states that bookbuilding results in more accurate pricing. Nevertheless, few of the results are statistically significant. Every IPO in the sample using fixed-price is characterized as a small issue, whereas the bookbuilt IPOs are more or less equally divided between small and large issues. This finding is consistent with Ranjan and Madhusoodanan (2004) who stated that small issues have a tendency to use fixed-price. Large bookbuilt IPOs seem to be more accurately priced than small bookbuilt IPOs.

Overall, the bookbuilt IPOs in this sample are not more accurately priced than the fixed-price IPOs, hence, this does not give an explanation for less underpricing today. The size of the issue, on the other hand, seems to have a greater impact on the performance in the aftermarket.

3.3.4 Green Shoe Option

A green shoe option is a tool that can provide additional price stability as it gives the underwriter the right to increase supply and in that way smooth out price fluctuations if demand surges. In order to examine whether the GSO works as a stabilizer I have divided the sample into two groups and calculated the abnormal return for each group both on short and long term. The results are presented in table 13. When investigating the difference between the two groups I find relatively low t-values suggesting that there is no statistically significant difference.

Table 13: Descriptive Statistics – Green Shoe Option

Total	GSO		
	Initial Return	Return after 1 week	Return after 6 months
Arithmetic Mean	3,71	1,30	10,80
Median	2,34	-0,35	9,80
Skewness	1,45	0,82	0,49
SD	8,72	10,77	34,37
Number of Observations	25	25	25
Degrees of Freedom (n-1)	24	24	24
T-Value	2,13*	0,60	1,57
Critical Value	2,06	2,06	2,06

Total	No-GSO		
	Initial Return	Return after 1 week	Return after 6 months
Arithmetic Mean	3,21	-3,68	1,32
Median	0,73	-2,69	-20,25
Skewness	0,83	-0,80	0,98
SD	10,86	7,74	41,84
Number of Observations	15	15	13
Degrees of Freedom (n-1)	14	14	12
T-Value	1,14	-1,84	0,11
Critical Value	2,15	2,15	2,18

The results indicate that there is no clear relation between whether the IPO was sold with or without a GSO and the performance in the aftermarket as hypothesis 4 suggested.

These results are interesting and also somewhat surprising. An IPO sold with a GSO can only start the stabilization process after the stock starts trading on the stock exchange, and the stabilizing agent will decide whether to exercise the option or not based on demand in the market. When demand is high, and the aftermarket price is higher than the offer price, the underwriter will exercise the option. When demand is low the option will not be exercised. Based on this discussion, one would expect to see a more stable price development in IPOs sold with a GSO.

It is important to note that the results, except from initial return for IPOs sold with a GSO, are not statistically significant. The sample size is relatively small, containing only 40 bookbuilt IPOs.

The IPOs that were sold without a GSO tend to be more frequently priced below the midpoint of the indicative price range, and as many as 87 % of the IPOs with no GSO were priced in the lower half of the range. This might be explained by the fact that more IPOs

were sold without a GSO between September 01, 2008 and December 31, 2011 when the IPO market was filled with uncertainty due to the global financial crisis. The IPOs sold with a GSO was priced equal to or above the price range in 56 % of the cases. I have divided the GSO IPOs into two groups representing where in the range the final offer price was set in order to examine the performance in the aftermarket.

Table 14: Descriptive Statistics – Price relative to price range among IPOs sold with a GSO

	GSO		
Offer price ≥ Midpoint	**Initial Return**	**Return after 1 week**	**Return after 6 months**
Arithmetic Mean	4,48	2,08	19,12
Median	3,58	1,72	23,85
Skewness	1,36	0,20	0,13
SD	9,19	12,31	38,44
Number of Observations	14	14	14
Degrees of Freedom (n-1)	13	13	13
T-Value	1,82	0,63	1,86
Critical Value	2,16	2,16	2,16

	GSO		
Offer price < Midpoint	**Initial Return**	**Return after 1 week**	**Return after 6 months**
Arithmetic Mean	2,74	0,31	0,20
Median	-1,40	-3,12	-5,35
Skewness	1,79	2,47	0,81
SD	8,87	9,56	28,49
Number of Observations	11	11	11
Degrees of Freedom (n-1)	10	10	10
T-Value	1,02	0,11	0,02
Critical Value	2,23	2,23	2,23

Again, one can see that the IPOs including a GSO priced equal to or above the midpoint of the indicative price range perform better, both on short and long term, than those priced below the midpoint. The results are not statistically significant according to the t-statistics.

4 Regression Analysis

This thesis examines the relationship between the indicative price range established in the pre-IPO phase and the final offer price. In this chapter I will take a closer look on how the pricing of IPOs relative to the indicative price range prior to the listing (hypothesis 1) can help explain their performance on Oslo Stock Exchange between 2006 and 2011. This is done using regression analysis. Regression analysis analyses several variables, and the focus is the relationship between a dependent variable and one or more independent variables. I will first describe the variables I found most suitable to examine the hypothesis before a few regression models are presented. The findings will be commented. The chapter ends with a critical review of the regression models.

4.1 Variables

I have chosen to use two explanatory variables. One that states whether the offer price was set equal to or above the midpoint of the indicative price range, and one that takes into account the price revision. I have also included nine control variables. In order to investigate the relationship between each of these factors and the share price performance, I have chosen a variable that I find suitable for this purpose.

I have chosen to use "Ordinary Least Squares" (OLS) as an analytical tool. This method minimizes the sum of squared vertical distances between the observed responses in the sample and the responses predicted by the linear approximation. Four assumptions need to be hold in order for the regressions to be "Best Linear Unbiased Estimators", BLUE, with the smallest variance among the class of alternative linear unbiased estimators.

1: The errors have zero mean, $E(u_i) = 0$

2: The variance of the errors is constant and finite over all values of X_i: $Var(u_i) = \sigma^2 < \infty$ (homoscedasticity)

3: The errors are statistically independent of one another: $Cov(u_i,u_j) = 0$ for $i \neq j$ (no autocorrelation)

4: There is no relationship between the error and the corresponding X variate: $Cov(u_i,X_i) = 0$

(Gujarati and Porter, 2009).

Violation of the second assumption is called heteroscedasticity, and the OLS estimators will no longer be efficient, or the "best". When heteroscedasticity is present, the OLS estimators remain unbiased and consistent. Violation of assumption number three is known as Autocorrelation, and the consequence of this is equal to heteroscedasticity, which means that OLS no longer provides the best estimate. The OLS estimate remains unbiased. Violation of the last assumption creates more severe consequences as the estimates provided by OLS get biased (Gujarati and Porter, 2009).

Next, I will present the response variables, the two explanatory variables, followed by a short presentation of the control variables. Unless otherwise stated, a significance level of 5 % ($\alpha = 0,05$) will be used.

4.1.1 Abnormal Returns

Market adjusted returns are calculated using the formula from chapter 3.2, and the variable is called *abnormal return*. The returns are log adjusted in order to fulfill the normal distribution to a greater extent.

4.1.2 Price relative to indicative price range

The first hypothesis examines the relationship between where the final offer price is set in the indicative price range and the share price performance. I expect to find that IPOs priced equal to or above the midpoint of the range perform better in the aftermarket than IPOs priced below the midpoint of the range. Bakke, Leite and Thorburn (2011) introduced three dummy variables that indicated whether the final offer price was set within the price range or outside (above or below). In my case I will only use one dummy variable that indicates whether the final offer price was set equal to or above the midpoint of the range (1) or below the midpoint (0). I have called the dummy variable *PriceRangehds* (high demand state). Only the bookbuilt IPOs are included in this analysis.

4.1.3 Percentage change in issue price

To take into account the "Partial Adjustment" phenomenon (see chapter 2.3) a *PriceRevision* variable has been included. This variable is defined as the percentage difference between the final offer price P_0 and the expected issue price, P_E (midpoint of the indicative price range).

Formula: $(P_0 - P_E) / P_E$

This variable can be seen as a proxy for the private information that the underwriter obtains during the bookbuilding period prior to the listing. I will expect to find that the final offer price is only partially adjusted relative to private information learned during the bookbuilding. Again, only the bookbuilt IPOs are included.

4.1.4 Control Variables

Here follows a brief review of the nine control variables that are included in the regression analysis in order to distinguish possible effects that might influence the performance in the aftermarket.

1. Underwriter: Earlier studies have documented differences in how an issue performs in the aftermarket between IPOs that have used different underwriters. I have therefore included six dummy variables each representing an investment bank. I have chosen the six investment banks with the most IPOs in the period: DNB Markets, First Securities, Pareto Securities, SEB Enskilda, ABG Sundal Collier and Carnegie. The variables are named the following: *DNB, First, Pareto, SEB, ABG* and *Carnegie*.

2. Age: Another factor that has proven to affect share price performance is the age of the company at the time of introduction to a stock exchange (Loughran and Ritter, 2002). Companies that have lasted longer might be easier to value as more information is available. I will use the variable *Age,* which represents the number of years between the founding of the company and the IPO.

3. Periodical trends: Since the time periods in the sample (2006 – August 2008 and September 2008 – 2011) represent two different market conditions it might be appropriate to introduce variables that take periodical trends into account. One indicator variable, *listed06_aug08*, is therefore introduced.

4. Market Return: Previous studies indicate that the market return prior to the listing has a positive impact on the IPO returns. I have therefore added a control variable that takes the return on OSEBX during the 30 trading days prior to the listing into account. This variable can be seen as a proxy for the publicly available information.

4.1.5 Presentation of the Regression Model

I will perform four different regression analyses. The first only takes into account the first explanatory variable, *PriceRangehds*, whereas the second in addition includes the control variables that provide the strongest explanatory power. The third analysis examines the PriceRevision variable, while the fourth, and final analysis, includes the suitable control variables.

$$Abnormal\ return = \beta_0 + \beta_1 PriceRangehds + \beta_2 PriceRevision + \beta_3 DNB + \beta_4 First + \beta_5 Pareto + \beta_6 SEB + \beta_7 ABG + \beta_8 Carnegie + \beta_9 Age + \beta_{10} Listed06\_aug08 + \beta_{11} LogMarketReturn + e_i$$

Where

β_0: A constant amount

X: Explanatory variables

β_i: The effect on IPO return (the coefficient of the variable X)

e_i: The "noise" term reflecting other factors that influence the return

4.2 Results

4.2.1 Regression 1

This first regression model was performed with only *PriceRangehds* as an explanatory variable. This gave the following model:

$$Abnormal\ return = \beta_0 + \beta_1 PriceRangehds + e_i$$

Table 15: Results obtained from regression 1

Abnormal Return	b_0	PriceRangehds	R^2	N
Initial Return	0,0081	0,014	3,33 %	48
	(t = 1,26)	(t = 1,26)		
Return after five days	-0,01	0,015	2,75 %	48
	(t = -1,10)	(t = 1,14)		
Return after six months	-0,03	0,08	7,49 %	45
	(t = -1,02)	(t = 1,87)**		

Coefficient presented above, t-value below - * 5 % ** 10 % *** 15 % (significant) - All returns are log adjusted

The table shows that when I only include *PriceRangehds* as an explanatory variable the t-value is equal to 1,26, 1,14 and 1,87 for the three time horizons respectively. The coefficient β_1 is equal to 0,014, 0,015 and 0,08 respectively, and indicates the effect on IPO return of a price set equal to or above the midpoint of the indicative price range. This coefficient measures the change in the mean value of *abnormal return* per unit change in *PriceRangehds*, holding everything else constant. The coefficient is positive for each of the time horizons, and indicates that when the offer price is set in the upper part of the range, the IPO perform better both on short and longer term. In addition, the results show that if everything else is held constant, the average return will decline with time. As discussed earlier, that IPOs priced equal to or above the midpoint of the initial price range perform better on short term are in line with previous studies. The fact that they also perform better in the longer run are inconsistent with earlier empirical findings.

The R^2 values are relatively low (3,33 %, 2,75 % and 7,49 % respectively). R^2 is a statistical term saying how good one term is at predicting another. There are however problems with this term, and one important weakness is the fact that R^2 rise as more variables are added to the regression. When adding more variables to the model one may also increase the variance of forecast error (Gujarati and Porter, 2009). R^2 is therefore not a very good measure of how good a regression model is, and it is more interesting to take a closer look at statistically significance and the coefficient. Only the return after six months of trading is significant on a 10 % significance level, which can be explained by the fact that the sample size is relatively small.

4.2.2 Regression 2

In this section I have tried various combinations of the explanatory variable, PriceRangehds, and the various control variables. Two variables, age and listed06_aug08, contributed to a limited extent, and were thus omitted. This gave the following model:

$$Abnormal\ return = \beta_0 + \beta_1 PriceRangehds + \beta_2 DNB + \beta_3 First + 5_4 Pareto + \beta_5 SEB + \beta_6 ABG + \beta_7 Carnegie + \beta_8 LogMarketReturn + e_i$$

Table 16: Results obtained from regression 2 (Four different combinations of the explanatory variable and the nine control variables)

Regressions	I	II	III	IV
Constant	0,008 (t = 1,26)	0,023 (t = 1,87)**	0,007 (t = 1,16)	0,024 (t =1,88)**
	-0,010 (t =-1,10)	-0,008 (-0,47)	- 0,010 (t = -1,25)	-0,007 (t = -0,45)
	-0,030 (t = -1,02)	-0,011 (t = -0,20)	-0,028 (t = 1,34)	-0,006 (t = -0,11)
PriceRangehds	0,014 (t = 1,26)	0,013 (t = 1,08)	0,009 (t = 0,85)	0,008 (t = 0,63)
	0,015 (t = 1,14)	0,019 (t = 1,21)	0,009 (t = 0,66)	0,010 (t = 0,60)
	0,080 (t = 1,87)***	0,110 (t = 2,23)*	0,059 (t = 1,57)***	0,080 (t = 1,49)***
Underwriter[5]	NO	YES	NO	YES
Logmarketreturn	NO	NO	0,243 (t = 1,36)	0,182 (t = 0,92)
			0,367 (t = 1,67)**	0,334 (t = 1,34)
			1,110 (t = 1,57)	0,996 (t = 1,27)
R^2	3,33%,2,75%,7,49%	18,4%,12,21%,23,27%	7,16 %, 8,45%,12,59%	20,15%,16,07%,26,65%
N	48,48,45	48,48,45	48,48,45	48,48,45
Initial return, return after one week and return after six months are presented chronological in the table. *5% ** 10% ***15 % (significant) All returns are log adjusted				

The model with the highest R^2 (20,15 %, 16,07 % and 26,65 % respectively) is, naturally, the one where both the six indicator variables representing different underwriters and the log adjusted market return are included. There are few significant results. The explanatory variable, PriceRangehds, is statistically significant after six months of trading on 15 % (and 5 %) significance level in every regression presented above. In addition, the control variable, Logmarketreturn, is significant on a 10 % significance level after five days of trading in the third regression. This indicates that the underwriter does not take the performance of the market prior to the listing fully into account when pricing the issue. This finding is consistent with Loughran and Ritter (2000, referred to in Lowry and Schwert 2001) who find that both private and public information are only partially incorporated into the final issue price. In addition, Bakke, Leite and Thorburn (2011) find in their study that this finding also is in line with Benveniste and Spindt (1989), as explained in chapter 2.3. The three different parameter estimates in the table represent the three different time horizons, the return after one, five and 129 trading days.

The two coefficients, β_1 and β_8, have positive values in every regression as well as for each of the time horizons. Out of the six different underwriters, only First Securities and DNB Markets seem to contribute with significant explanatory power (p-values below 0,10 in most cases).

4.2.3 Regression 3

The third analysis was performed with only the variable PriceRevision, which gave the following model:

$$Abnormal\ return = \beta_0 + \beta_1 PriceRevision + e_i$$

Table 17: Results obtained from regression 3

Abnormal Return	b_0	PriceRevision	R^2	N
Initial Return	0,017	0,062	5,48 %	48
	(t = 2,98)*	(t = 1,63)**		
Coefficient presented above, t-value below - * 5 % ** 10 % *** 15 % (significant) - All returns are log adjusted.				

In the table above one can see that PriceRevision has a positive coefficient and a t-value equal to 1,63, which indicates that the result is significant on a 10 % significance level. This may suggest that a change in the issue price relative to the expected issue price to a certain degree can predict the initial return. The regression indicates a positive correlation between a price revision and the initial return of an IPO. According to the results, if the final offer price is set 10 % higher than the expected offer price, the initial return will be 0,62 % higher. These findings are in line with earlier studies presented above that state that positive revisions are usually followed by a positive first-day return. This can be explained by the fact that the underwriter only partially incorporates the positive private information learned during the bookbuilding period when they decide on the final offer price.

4.2.4 Regression 4

The fourth and final part contains various combinations of the PriceRevision variable and the nine different control variables presented above.

$$Abnormal\ return = \beta_0 + +\beta_1 PriceRevision + \beta_2 DNB + \beta_3 First + 5_4 Pareto + \beta_5 SEB + \beta_6 ABG + \beta_7 Carnegie + \beta_8 Age + \beta_9 Listed06\_aug08 + \beta_{10} LogMarketReturn + e_i$$

The results are presented in the table below.

Table 18: Results obtained from regression 4 (Four different combinations of the explanatory variable and the nine control variables)

Regressions	I	II	III	IV
Constant	0,031	0,027	0,029	0,029
	(t = 1,63)***	(t = 2,35)*	(t = 2,41)*	(t = 2,44)*
PriceRevision	0,043	0,039	0,050	0,050
	(t = 0,88)	(t = 0,85)	(t = 1,10)	(t = 1,14)
Underwriter[6]	YES	YES	YES	YES
Logmarketreturn	0,199	0,197		
	(t = 1,05)	(t = 1,05)		
Listed06_aug08	YES	NO	NO	NO
Age	0,000	0,000	0,000	
	(t = -0,03)	(t = 0,11)	(t = 0,07)	
R^2	21,11 %	20,95 %	18,66 %	18,65 %
N	48	48	48	48
Coefficient presented above, t-value below. * 5 % ** 10 % *** 15 % (significant) All returns are log adjusted.				

The variable listed06_aug08 contributed only to a limited extent, and was therefore omitted. The indicator variables representing each of the six underwriters seemed to have the largest impact on the regression. The coefficient for age is equal to zero, and indicates neither a positive nor negative effect on the return. However, the inclusion of this variable influenced the other variables to a large extent, and was therefore kept in the model.

There are few statistically significant results in the various models, and only the constant (β_0) seems to be statistically significant on a 5 % (15 %) significance level. The coefficients are still positive and suggest a positive effect on the initial returns. Among the six underwriters, DNB Markets seems to be the only one to contribute with significant explanatory power with p-values below 0,10 in every case.

4.3 Critical Review

As mentioned earlier, the OLS model relies on several assumptions. This section will discuss whether my regression models satisfy these assumptions. The various test results can be viewed in Appendix 3.

When using OLS there is a requirement of normality in the residuals, and I have therefore performed a Shapiro-Wilk (SW) normality test. According to the SW-test the log adjusted returns after one and five trading days are not normally distributed. The p-values were equal

to 0,003 and 0,000 respectively, which indicates that the null hypotheses (the data are normally distributed) are rejected.

Another assumption in the OLS model is that the disturbance u_i appearing in the regression function is homoscestatic, which means that they all have the same variance. There are several reasons to why the variances may be variable (heteroscedasticity). One reason is the presence of outliers, which is an observation that much differs in relation to other observations in the sample. Other reasons are measurement errors and skewness in variables. When heteroscedasticity is present, the confidence interval becomes wider. The consequence may be that significant results become insignificant due to low t-values (Gujarati and Porter, 2009). There are several tests that can help detect heteroscedasticity, and in this thesis I have used White's test, which involves regressing the squared error term from the OLS regression on the independent variables in the regression. As the Chi-square value obtained from the test, in most cases, exceeds the critical Chi-square value at a 5 % significance level, it seems like heteroscedasticity is present.

Autocorrelation is defined as a violation of the assumption that the errors in the regression are uncorrelated and independent. Reasons for autocorrelation might for example be model misspecification or data manipulation. The problems associated with autocorrelation are similar to those caused by heteroscedasticity. The simplest test for autocorrelation is the Durbin-Watson (DW) test. A two-sided test with 5 % significance level suggests that I might have problems with *positive* autocorrelation in some of the regressions.

Multicollinearity is a statistical phenomenon where two or more variables in a regression model are highly correlated. This might cause dramatic changes in the coefficient in response to small changes in the model or the data material. Perfect multicollinearity will never be an issue in real life data, however one might experience near perfect multicollinearity. An often-used measure to detect this problem is the Variance Inflation Factor (VIF). It is however important to note that the VIF-value is not a test, but an *indicator* of multicollinearity. A rule of thumb is that VIF-values above 10 indicate severe multicollinearity (Gujarati and Porter, 2009). As none of the VIF values exceeds 10, I can conclude that multicollinearity is not a problem.

A final important assumption is that the regression model is "correctly" specified. If this is not the case, we encounter the problem of specification error or specification bias. Among

other things, it is likely that one commit one or more of the following specification errors: Inclusion of irrelevant variables, omission of necessary variables, wrong functional form and measurement errors (Gujarati and Porter, 2009). It could, for example, have been beneficial to include variables for a previous listing in the OTC-market, whether the IPO was sold with or without a GSO and the size of the issue, which I examined in chapter 3. Choosing the correct variables has been both time-consuming and difficult. In addition, the sample size is relatively small, and therefore the results should be interpreted as an indication and not as a fact.

5 Conclusion

The analysis of the initial return shows a positive market adjusted return for the IPOs on Oslo Stock Exchange between 2006 and 2011. This finding is in line with previous studies, although the average abnormal initial return is significantly lower than previous findings. I also find a higher initial return for IPOs introduced between January 01, 2006 and August 31, 2008 than for the issues completed between September 01, 2008 and December 31, 2011. Further, I find the positive average return to decline in the longer run, which also is in line with previous studies (Ritter, 1991).

When investigating where the final offer price was set relative to the indicative price range and how this affected the share price development I find that the IPOs in the sample most frequently was priced in the lower part. This is especially true for the issues between September 01, 2008 and December 31, 2011. Further on, I observe that small bookbuilt IPOs and IPOs sold without a GSO more frequently were priced in the lower part of the indicative price range. My results show that 18 of the IPOs in the sample were priced exactly at the bottom of the range, while eight were priced exactly at the top. My results also indicate that the performance in the aftermarket is affected by where in the range the offer price is set. These findings are consistent with previous studies.[3] I find that IPOs priced equal to or above the midpoint of the range perform better both on short and long term. The fact that they perform better in the longer run is inconsistent with previous empirical evidence (Bakke, 2012).

The different regression analyses suggest that both private and public information are only partially incorporated into the final offer price.

The regression analyses indicate that when the offer price is set in the upper part of the range, the IPO perform better. This finding is partially in line with previous studies. When I included a control variable for market return, my findings suggest that the underwriter does not fully take into account the market situation in the period prior to the listing when pricing the issue. This finding is according to Bakke, Leite and Thorburn (2011), who in their study find that this is both theoretical and empirical consistent with the Benveniste and Spindt

[3] For example Bakke, Leite and Thorburn, 2011 - ”Public Information and IPO Underpricing”.

(1989) framework. In addition, Loughran and Ritter (2000)[4] find that both public and private information are only partially incorporated into the issue price.

Further on, I find a positive correlation between a price revision and the return after the first day of trading. As mentioned in chapter 2, previous studies suggest that a positive revision is followed by a positive initial return. This can be interpreted as indications that the underwriter only partially incorporates the positive private information learned during the bookbuilding period. This is in line with the partial adjustment theory presented in chapter 2, which states that private information from investors is only partially incorporated into the final offer price.

In addition, my results indicate that IPOs previously traded in the OTC-market as well as large issues tend to have a lower standard deviation, which means that the returns are centered around the mean. Every IPO that used fixed-price when setting the price is characterized as a small issue, whereas bookbuilding is both used among large and small issues. Further on, my results suggest that bookbuilding does not provide a more accurate pricing, as one would expect. I also investigated the relationship between a previous listing in the OTC-market and method used to set the offer price, and my findings suggest that fixed-price is more often used among former OTC-listed companies. Surprisingly, I find no clear relation between whether an issue was sold with or without a GSO and the performance in the aftermarket.

Due to the small sample size it is impossible to draw any clear conclusions based on the various analyses. However, most of the findings are in line with previous studies presented earlier and in line with the model presented by Benveniste and Spindt in 1989.

[4] Referred to in Lowry and Schwert, 2001

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Appendix

Appendix 1

Overview of data: Market adjusted returns, price range, final offer price (IPO price), previous OTC listing, size and use of Green Shoe Option

Issuer	Price Range Low	Price Range High	IPO price	Abnormal Initial Returns	Abnormal five day returns	Abnormal six month Returns	OTC	Issue Size	GSO
Block Watne Gruppen ASA	28,00	33,00	33,00	9,82	3,36	15,19	NO	Large	YES
SeaBird Exploration Ltd.	16,00	20,00	20,00	29,25	30,79	69,17	NO	Small	YES
Dolphin Interconnect Solutions ASA	17,50	17,50	17,50	13,36	4,05	-15,60	YES	Small	YES
Renewable Energy Corporation ASA	69,00	88,00	95,00*	22,11	-0,39	12,80	NO	Large	NO
Petrojarl ASA (Teekay Petrojarl ASA)	37,00	47,00	43,00	-5,16	-25,01	44,74	NO	Large	YES
Ability Group ASA	45,00	53,00	47,00	-4,61	-5,67	-5,35	NO	Large	YES
Trolltech ASA	14,00	20,00	16,00	10,71	26,82	-11,57	NO	Small	YES
Clavis Pharma ASA	45,50	45,50	45,50	-0,33	-2,10	-15,00	NO	Small	NA
Austevoll Seafood ASA	38,00	43,00	39,00	0,14	-6,11	16,54	YES	Large	NA
Marine Farms ASA	14,00	14,00	14,00	-3,57	-8,11	24,19	YES	Small	NO
Codfarmers ASA	21,00	26,00	26,00	-8,29	-7,94	-3,18	NO	Small	YES
Eitzen Chemical ASA	27,60	31,50	28,00	-6,37	-13,05	-34,57	YES	Large	NA
AKVA group ASA	33,00	40,00	35,00	0,01	-2,92	17,05	NO	Small	NO
Det norske oljeselskap ASA (Ex. Petra)	60,00	60,00	60,00	2,49	2,59	-44,46	YES	Small	NO
Norwegian Property ASA	50,00	55,00	53,50	6,28	6,17	31,94	YES	Large	YES
Faktor Eiendom ASA	34,00	42,00	35,00	-3,70	-8,20	-34,00	NO	Large	NO
Spits ASA	20,00	23,00	16,00*	-1,08	-5,82	-17,52	NO	Small	NA
NEAS ASA	33,00	41	33,00	-4,34	-3,68	-22,85	NO	Small	NO
Algeta ASA	41,00	51,00	47,00	-5,01	-3,73	-18,05	NO	Small	YES
Electromagnetic Geoservices ASA	100,00	135,00	135,00*	7,94	-0,77	-38,93	NO	Large	YES
Nexus Floating Production Ltd	68,00	74,00	71,00	1,63	-0,40	-11,17	YES	Small	NO
Wavefield Inseis ASA	37,00	44,00	44,00	7,24	7,35	45,26	YES	Large	NA
Rem Offshore ASA	38,00	44,00	40,00	3,89	27,13	25,34	NO	Small	NA
SalMar ASA	39,00	39,00	39,00	0,13	0,68	-1,16	NO	Small	NO
ScanArc ASA	33,00	42,00	40,00	6,34	5,84	-19,69	NO	Large	YES
Fred. Olsen Production ASA	25,50	28,00	26,00	5,09	-5,56	-14,20	YES	Small	NA
Bouvet ASA	40,00	46,00	40,00	-1,40	-5,80	54,74	NO	Small	YES
Maritime Industrial Services Co Ltd. Inc	30,00	30,00	30,00	2,07	14,74	-9,81	YES	Small	NO
Protector Forsikring ASA	14,00	14,00	14,00	4,51	0,70	-29,36	YES	Small	NA
Arrow Seismic ASA	65,00	73,00	70,00	1,82	0,08	37,89	YES	Small	YES
RomReal Ltd.	24,50	27,00	25,00	25,03	-5,71	-12,50	NO	Small	YES
Badger Explorer ASA	32,00	43,00	32,00	6,60	-1,09	2,49	YES	Small	YES
Grieg Seafood ASA	23,00	23,00	23,00	-0,01	3,24	-32,34	NO	Small	NO
Dockwise Ltd	23,10	25,00	25,00	0,75	-4,70	-33,87	YES	Large	YES
Seajacks International Ltd.	55,00	55,00	55,00	3,21	NA	26,23	YES	Small	YES
London Mining Plc	18,00	22,00	17,00*	7,01	8,92	82,23	YES	Small	NO
Pronova BioPharma ASA	23,00	29,00	23,00	1,08	0,93	-27,84	NO	Large	YES
Ability Drilling ASA	22,00	28,00	15,00*	3,85	9,59	-20,29	YES	Small	NA

Nøtterø Sparebank	110,00	110,00	110,00	2,78	5,43	-8,62	NO	Small	NA
Eastern Echo Holding Plc.	7,00	8,00	7,60	2,87	5,88	91,92	YES	Large	YES
Scandinavian Clinical Nutrition AB	12,00	16,00	12,90	8,67	-3,20	NA	NO	Small	NA
Hafslund Infratek ASA (Infratek ASA)	20,00	25,00	18,00*	-1,46	3,43	8,80	NO	Small	YES
Aker Exploration ASA	56,00	56,00	56,00	12,17	2,08	7,92	YES	Small	NO
Aker Philadelphia Shipyard ASA	57,50	57,50	57,50	4,74	-0,65	3,56	NO	Small	NA
IGE Nordic AB	12,50	12,50	12,50	-1,20	-2,34	-33,90	NO	Small	NA
Aqua Bio Technology	9,00	9,00	9,00	2,28	11,56	4,05	NO	Small	NO
PCI Biotech Holding ASA	20,00	20,00	20,00	-10,57	-46,02	10,98	NO	Small	NO
Norway Pelagic ASA	40,00	40,00	40,00	8,26	-5,43	34,90	YES	Small	NO
Remedial Offshore PLC	27,00	31,00	27,00	16,47	5,74	-28,41	YES	Small	NO
Bergen Group ASA	31,00	31,00	31,00	-0,99	-4,87	-26,84	YES	Small	NO
Spectrum ASA	18,63	18,63	18,63	1,16	2,72	-32,69	NO	Small	NO
Polarcus Limited	4,00	6,00	4,50	-9,18	-14,46	NA	YES	Large	NO
FLEX LNG LTD	4,50	8,00	5,50	0,73	-2,69	68,36	YES	Small	NO
North Energy ASA	25,00	33,00	26,50	5,84	-0,69	-32,55	NO	Small	NO
P/f Bakkafrost	27,00	31,00	31,00	11,50	14,09	28,30	NO	Large	YES
Sølvtrans Holding ASA	30,00	35,00	25,00*	-3,00	-5,79	-20,25	NO	Small	NO
Bridge Energy ASA	22,00	26,00	22,00	-12,95	-21,78	-42,74	NO	Small	NO
NetConnect ASA	3,20	3,20	3,20	-7,97	-11,60	-68,31	YES	Small	NO
Dannemora Mineral AB	52,15	52,15	52,15	-3,58	-3,76	-27,86	YES	Small	NO
Wilh. Wilhelmsen ASA	24,20	28,20	24,20	-1,48	1,09	51,91	NO	Large	NO
Morpol ASA	22,00	28,00	22,00	-6,06	-3,12	-31,14	NO	Large	YES
CellCura ASA	5,00	5,00	5,00	-25,14	-22,95	-54,53	NO	Small	NO
Statoil Fuel & Retail ASA	32,00	41,00	39,00*	4,28	6,20	42,89	NO	Large	YES
Floatel International Ltd	14,00	16,00	14,00	-1,51	-5,76	13,49	NO	Small	YES
Gjensidige Forsikring ASA	54,00	64,00	59,00*	0,29	-1,16	19,41	NO	Large	YES
Norway Royal Salmon ASA	23,00	30,00	21,00*	3,47	0,69	-23,25	NO	Small	NO
Sevan Drilling ASA	16,00	21,00	8,00*	-2,05	-4,76	-31,44	NO	Large	YES
Höegh LNG Holdings Ltd.	38,00	54,00	38,00*	3,78	4,19	42,48	NO	Large	YES
Hofseth BioCare ASA	4,00	6,00	4,00	25,49	-10,59	NA	NO	Small	NO
Average				**2,41**	**-1,06**	**-0,02**			

* Amended price range

Appendix 2

Average initial return, return after one week and return after six months of trading (not market adjusted).

Initial Return	**2006-2007**	**2009-2011**	**Total**
Number of Issues	51	18	69
Abnormal Return	2,98	-1,18	2,05
Return after 1 week	**2006-2007**	**2009-2011**	**Total**
Number of Issues	50	18	68
Abnormal Return	2,98	-4,36	-0,58
Return after 6 months	**2006-2007**	**2009-2011**	**Total**
Number of Issues	50	16	66
Abnormal Return	0,48	1,71	0,78

Appendix 3

Various test results (Normality test, test for Heteroscedasticity, test for Autocorrelation and test for multicollinearity).

Shapiro-Wilk Normality Test			
Dependent Variable	**p-value**	**α**	**H0:**
loginitialreturn	0,003	0,05	Rejected
logfivedayreturn	0,000	0,05	Rejected
logsixmreturn	0,359	0,05	Not Rejected

White's General Heteroscedasticity Test				
Regressions		**χ^2**	**Critical Value**	**H0:**
1)		0.04, 0.17, 0.00	3,93E-05	Rejected*
2)	II	14.44, 21.38, 19.42	9,89	Rejected
	III	0.99, 2.91, 1.47	0,21	Rejected
	IV	19.30, 26.41, 27.45	13,79	Rejected
3)		0,77	0,01	Rejected
4)	I	48,00	27,99	Rejected
	II	36,38	20,71	Rejected
	III	26,97	13,79	Rejected
	IV	21,27	11,16	Rejected

* The null hypothesis is not rejected when the dependent variable is return after six months of trading

Durbin-Watson d statistic						
Regression	**d**	**Number of Explanatory Variables**	**N**	**Lower Bound (dL)**	**Upper Bound (dU)**	**Conclusion**
1	1.099, 1.102, 1.193	1	48	1,503	1,585	Positive Autocorrelation
2. II	1.182, 1.128, 1.075*	7	48	1,081	1,692	Zone of indecision
2. III	1.051, 1.061, 1.238	2	48	1,285	1,446	Positive Autocorrelation
2. IV	1.131, 1.075, 1.150	8	48	1,039	1,748	Zone of indecision
3	1.000	1	48	1,503	1,585	Positive Autocorrelation
4. I	1.028	10	48	0,955	1,864	Zone of indecision
4. II	1.038	9	48	0,997	1,805	Zone of indecision
4.III	1.065	8	48	1,039	1,748	Zone of indecision
4.IV	1.061	7	48	1,081	1,692	Positive Autocorrelation

* 1,075 lies below the lower bound dL (1,081) and indicates Positive Autocorrelation

Variance Inflation Factor (VIF) - Multicollinearity									
	1.	2. II	2. III	2. IV	3.	4. I	4. II	4. III	4. IV
PriceRangehds	1	1,36	1,08	1,66	1				
Pricerevision						1,59	1,47	1,4	1,37
dnb		1,22		1,22		1,2	1,2	1,2	1,19
first		1,14		1,2		1,31	1,21	1,18	1,17
pareto		1,45		1,51		1,57	1,53	1,52	1,31
seb		1,13		1,18		1,29	1,29	1,21	1,21
abg		1,12		1,2		1,16	1,15	1,12	1,09
carnegie		1,2		1,2		1,23	1,23	1,22	1,16
logmarketreturn			1,08	1,38		1,18	1,18		
age						1,55	1,24	1,24	
listed06_aug08						1,67			