Initial return of Scandinavian public offerings

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Executive summary

The purpose of this thesis is to examine, if there have been underpricing of IPOs in Scandinavia from 2002 to 2010, and to verify if there are properties in these IPOs, that can help predict higher or lower underpricing, and if these properties can be used to give recommendations to investors in order to make a high initial return from investing in IPOs.

The properties of the IPOs are analyzed by testing 8 hypotheses. These 8 hypotheses are both testing for properties about the market at the time of the IPO and properties about the company performing the IPO.

The thesis finds average underpricing of Scandinavian IPOs of 4%, where underpricing is 2% in Norway, 5% in Sweden and 10% in Denmark. The test of the hypotheses finds no clear tendency between underpricing of IPOs in Scandinavia and volatility in the market prior to the IPO, the size of the company, the age of the company, the industry the company operates in and the offer method.

There is found to be significant higher underpricing in periods with high IPO activity, and when the industry index is performing better than on average. These findings can help investors, when to invest in IPOs. But since there could be found no properties about the specific company, and since average underpricing in Scandinavia in this sample is moderate, these findings are not considered useful for investors.

The markets investigated are small and therefore the data sample only consists of 98 IPOs. The small data sample could be the reason that many of the hypotheses are rejected.

The underpricing found in this thesis is much lower than earlier findings - both in foreign countries and in Scandinavia. This is found to be due to many cold years in the analysis and more accurate pricing of Scandinavian IPOs.
# Table of content

1  Introduction .................................................................................................................... 1

2  Problem statement ......................................................................................................... 2
   2.1 Hypotheses ................................................................................................................ 2

3  Delimitations .................................................................................................................. 4

4  Methodology .................................................................................................................. 5

5  Structure ......................................................................................................................... 6

6  Description of the Scandinavian markets ................................................................... 8
   6.1 Development in the Scandinavian stock markets .................................................... 10

7  Theory ............................................................................................................................. 11
   7.1 Going Public .............................................................................................................. 11
      7.1.1 Advantages and disadvantages of going public ................................................ 12
      7.1.2 Pricing of the company ...................................................................................... 13
      7.1.3 Introduction method ......................................................................................... 14
   7.2 Underpricing ............................................................................................................ 15
      7.2.1 Definition of underpricing .............................................................................. 15
      7.2.2 History of underpricing ................................................................................... 16
   7.3 Scandinavian studies on underpricing ..................................................................... 17
   7.4 Theories on underpricing ....................................................................................... 19
      7.4.1 Winners Curse .................................................................................................... 19
      7.4.2 Risk compensation ............................................................................................ 21
      7.4.3 Windows of opportunity .................................................................................. 24
      7.4.4 Hot issue markets ............................................................................................ 24
      7.4.5 Offer method ..................................................................................................... 24
      7.4.6 General about the theories .............................................................................. 25
   7.5 Formulas used ......................................................................................................... 25
      7.5.1 Formula for underpricing ................................................................................ 25
   7.6 Test statistics .......................................................................................................... 26
      7.6.1 Normality test or parametric tests .................................................................. 27
      7.6.2 Jarque-Bera test for normality ......................................................................... 27
      7.6.3 Non-parametric tests ...................................................................................... 27
   7.7 Correlation analysis ............................................................................................... 29

8  Reliability and validity .................................................................................................. 30
   8.1 Errors in data ........................................................................................................... 30
   8.2 Errors in models ...................................................................................................... 31

9  Data ................................................................................................................................ 32
   9.1 Data collection ......................................................................................................... 32
      9.1.1 Industries .......................................................................................................... 33
      9.1.2 Benchmark ....................................................................................................... 33
1 Introduction

One of the most basic financial theories is the efficient-market hypothesis. This theory states that the financial markets are efficient and that investor cannot achieve excess return with the risk and public information taking into considerations. But in many cases, several analysts have proven this theory to be wrong. One of the areas where this theory has proven not to be correct is in initial public equity offerings (IPOs).

IPOs have always been subject to much discussion for investors and researchers, and therefore there is much literature describing this subject. Two areas about IPOs have been subject to intensive research; underpricing, which results in positive initial returns, and poor long-run performance 3-5 years after the IPO. Even though there has been much research, no theory has yet been identified that can explain the two phenomenon’s.

Both abnormalities are interesting to look into, and many earlier research of underpricing have analyzed both, but the fact that underpricing exist and in a large degree have been the more analyzed of the 2 abnormalities. This abnormality have been the property about IPOs that deviates most from other stocks performance and from an investors point of view the possibility of earning an excess return is most interesting. The fact that IPOs are often underpriced could both be analyzed from the issuer view and from investors view. The investor cannot affect the degree of underpricing, but can select which IPOs to invest in. It is interesting to analyze, if investor can pick out which IPOs that is more underpriced than others, and then earn a high return. Therefore this thesis will look at underpricing from an investors view, and will analyze if there can be found properties about the IPOs, that can help investors predict the level of underpricing.

Earlier research has mostly been done on IPOs in the 80s and 90s and is focused on large stock markets. There haven’t been much research done in Denmark (DK), Sweden (SE) and Norway (NO), and no earlier studies have compared these 3 markets. This thesis will therefore analyze underpricing of IPOs in DK, SE and NO and compare this to earlier theories on the subject.

In the last couple of years there have been low IPO activity, this is due to the financial crisis. Now the economy is growing again and there are expectations of more IPOs in the next couple of years. Especially those companies than did not want to go public, while there was crisis,
and investors were not optimistic. This thesis will look at IPOs done in Scandinavia from 2002-2010\(^1\) and see if there are properties, that can help investors pick out IPOs that are more underpriced.

## 2 Problem statement

In earlier research many properties have been applied in order to test for the reasons for underpricing, but no clear pattern has been found. This thesis wants to analyze if it is possible for investor to sort out which IPOs that are more or less underpriced than others. This leads to the overall question in this thesis:

*Is it possible to find properties in Scandinavian IPOs that can predict higher or lower underpricing?*

This thesis is thought to give investor recommendations on how to get a high initial return from investing in IPOs. Therefore it is interesting to see, if the properties found can be used to give recommendations to investors to get a larger initial return. The properties are analyzed by testing 8 hypotheses. These 8 hypotheses are both testing for properties about the market at the time of the IPO and properties about the company performing the IPO.

### 2.1 Hypotheses

The first hypothesis will test for general underpricing:

_Hypothesis 1:_

*Scandinavian IPOs have shown significant underpricing in the years 2002 to 2010*

Earlier studies in Denmark, Sweden and Norway have shown significant underpricing. This paper wants to test, if underpricing still exists in Scandinavia and in each of the 3 individual countries.

The next 3 hypotheses want to test if there are properties in the market that affect underpricing:

_Hypothesis 2:_

*There are more underpricing in hot issue periods than in cold issue periods.*

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\(^1\) The data gathering were done in august 2010, so IPOs done after august 2010 are not included in the data sample.
In some periods investors are considered to be over optimistic and this encourage companies to go public and therefore there can be seen more IPOs than on average in some periods. These are called “hot markets”. Earlier theories states that there also is higher underpricing in these periods.

Hot and cold periods, are often dependent on the performance in the stock market. Therefore a hypothesis of underpricing compared to stock market performance is made:

**Hypothesis 3**

*Companies that conduct IPOs, when the stock market is performing better than on average, experience higher underpricing.*

When the stock market is more volatile, the investors are often more careful and pessimistic about investing in shares. The interest in IPOs and therefore underpricing could be lower in times, when the stock market index is more volatile:

**Hypothesis 4**

*Companies that conduct IPO in times of great uncertainty, as measured by market volatility ahead of the listing, experience higher levels of underpricing.*

The next 4 hypothesis will examine if there are properties about the company performing the IPO that affect the size of underpricing.

**Hypothesis 5**

*There are differences in underpricing across different industries*

Some industries are more risky than others, this should affect the valuation and therefore the pricing of companies in that industry. To compensate for the risk and to get investors to purchase risky companies, there should be more underpricing of shares in risky industries.

**Hypothesis 6**

*Larger companies are less underpriced.*

Larger companies are monitored more extensively by the media, investors, the government, shareholders and other stakeholders. This monitoring reduces agency costs and therefore reduces the risk of the company and therefore there should be less underpricing. Furthermore larger companies have larger assets, and are therefore more likely to survive in crises.
Hypothesis 7

**Older companies are less underpriced.**

Older companies have proved they can operate in the market for a long period and are therefore less risky. They keep a longer track record of financial information and profitability and are therefore less risky and easier to price.

Hypothesis 8

**There are differences in underpricing depending on the type of the offer.**

The bookbuilding process is more market oriented and based on the price and demand from the investors. Therefore this type of offer should be less underpriced than offerings done by fixed price.

All of the hypotheses have been found to be true, when tested on earlier IPOs in other countries, and some of them have also been found to be true in earlier analyses of Scandinavian IPOs. It is therefore interesting to analyze if the hypotheses can also be proven on Scandinavian IPOs from 2002 to 2010.

3 Delimitations

The research is delimited to the years 2002 to August 2010 and to the main stock markets in Scandinavia. This means that the smaller stock exchanges in Scandinavia; first north, NOTC and aktietorget, will not be analyzed. These smaller exchanges have lower requirements for the companies going public, and this affects the risk taking by the investors. This will affect the stock price and because of this these stock exchanges are excluded.

There are many theories and properties that could be tested for to affect the level of underpricing. Many of the theories are not used in this analysis. This is mainly due to 2 reasons; the property is only visible after the offer period or the property is too complex. Two examples of these exclusions are oversubscription and underwriter reputation. Earlier research has used oversubscription as a variable that affect underpricing. The subscription to an IPO offer is first shown after the offer period and can therefore not be used to predict underpricing before the IPO. Another often used theory is how the choice of underwriter affects underpricing. Since this analysis is performed on 3 different countries, there are many different underwriters, and it would therefore be too complex to draw conclusions about the individual underwriter.
The thesis will only analyze what is called real IPOs. Companies that are going public but are not performing an initial public offering, or companies that are already priced, are not considered real IPOs and are therefore not included in the analysis\(^2\).

2002 are chosen as the start year since Oslo stock exchange only has information on IPOs from 2002 and forward and 2010 are included until August in order to have as many new IPOs as possible. Since this period includes both periods with many IPOs (hot markets) and periods with few IPOs (cold markets) it is considered to be a suitable time period.

The process of going public is complicated and a huge topic, and writing about this process could be a separate thesis. Therefore this process is only explained briefly.

4 Methodology
This analysis will focus on companies listed on the 3 Scandinavian stock exchanges; Copenhagen Stock exchange (CSE), Stockholm stock exchange (SSE) and Oslo stock exchange (OSE). These 3 stock exchanges have been chosen, because they are small stock exchanges, and because they are quite similar. It is therefore interesting to look at similarities and differences between them.

The data series goes from 2002 to September 2010. This period is chosen for 3 reasons. Firstly to get the most recent data, secondly, to get enough number of IPOs to make a reliable analysis and thirdly, because there have been several studies in the 80s and 90s but less studied in the 00s.

A longer time period could have been used, and this might have had an impact of the findings in this analysis. But IPOs before 2002 have already been researched and the data about the IPO is harder to find the longer time since the IPO occur. Since the analysis is done on small stock exchanges a longer period is preferred to get as much data as possible, but due to limitations in finding the data, a longer period would reduce the reliability of the data. The period chosen is long enough, to get enough data to get a reliable conclusion. And it include both “hot” and “cold” periods. Therefore the period chosen is considered acceptable.

\(^2\) For a more specific explanation of the exclusion of some IPOs see section 10.1
Data has been collected from different places. The IPOs have been found in public list of IPOs in each of the 3 stock exchanges. Then each IPO in this list have been examined to find out if it was a real IPO\(^3\). The prospect of each of the remaining IPOs have been found either by the stock exchange or at the company website and here the offer method, the price and the day of the pricing have been found. The industry of the specific company is also found on each of the 3 stock exchanges. The size and the age of the company are found at the company’s website. Both the stock exchanges and the company website are assumed to give reliable information.

The closing price of the first day of trading of each of the IPOs is extracted from the DataStream database.

Theories are mainly found in literature published in scientific journals that have been found through various databases in the CBS library.

Existing empirical findings are based on earlier analysis and thesis’s from other countries(mainly US) and from Denmark, Sweden and Norway.

The analysis is based on the 8 hypotheses. These hypotheses are based on earlier research, both from other countries and from the 3 Scandinavian countries. The hypotheses does not try to explain the existence of underpricing but try to explain if there are properties that causes more or less underpricing.

Statistical test are used to determine if the hypotheses can be accepted or must be rejected. This approach makes sure, that the conclusion is statistically valid. Excel has been used to make these tests and each of the results is verified to make sure, that no mistakes are made. The statistical tests are described in section 7.6.

## 5 Structure

In this section the structure of the thesis is described:

The thesis is divided into 4 overall sections and ends with a conclusion:

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\(^3\) See section 10.1 for the definition of a real IPO.
1. **Background:** In the first section the introduction, the problem statement and hypotheses, the delimitations, methodology, the structure of this thesis and the description of the 3 markets that are investigated, are described.

2. **Theory:** In the next section the theory behind the thesis is described. First a short description of the process of going public, the advantages and disadvantages and pricing of the company is described. Then the definition of underpricing is described along with a short history of underpricing. This is followed by a description of the relevant theories of underpricing, and earlier research and findings of these theories are presented. The last part of the theory section the formulas and tests used is described.

3. **Data:** The first part of the data section discusses the reliability and validity of the data sample. Hereafter the collection of data is described. At the end, the distribution of the data sample in countries, years, industries, size, age and introduction method is described.

4. **Analysis and findings:** This final section analyzes underpricing in the data sample. First the underpricing in the whole sample is analyzed and tested. Then each of the hypotheses are analyzed, statistically tested and discussed. The findings are thereafter compared to other studies and the findings and differences are discussed.

5. **Conclusion**

The figure below show the graphical structure of the 4 overall parts of the thesis

![Structure of the thesis](image.png)
The thesis is divided into different sections and each section is starting with an introduction to the section and is ending with a brief conclusion. In the sections where the hypotheses are tested, each section will start by showing the hypothesis that is tested.

6 Description of the Scandinavian markets

In this section the 3 stock market in the analysis will be described. All 3 stock exchanges are small compared to US or UK stock exchanges. In 2006 the stock exchanges in Copenhagen, Stockholm and Helsinki were merged into a common Nordic stock exchange called OMX Nordic Exchange and common listing demands were introduced. There are therefore differences in listing requirements for DK and SE companies before 2006 and after 2006. There will therefore be 4 different stock exchanges to describe; Oslo stock exchange, Stockholm stock exchange, Copenhagen stock exchange and the OMX Nordic stock exchange.

The Stockholm stock exchange (SSE) was founded in 1863, and is considered one of the largest stock exchanges in Northern Europe. The Copenhagen stock exchange (CSE) was founded in 1808 and in 1998 the CSE and SSE took a step toward forming a joint Nordic market by forming the Norex, a joint Nordic alliance, and in 2006 Norex became part of the OMX Nordic group.

Oslo stock exchange (OSE) was founded in 1819; in 1999 OSE joined Norex together with the Iceland stock exchange. Later all the Nordic exchanges beside OSE were bought by NASDAQ, OSE became independent and the Norex alliance ended.

To compare the 3 markets (after 2006 CSE and SSE are both under OMX Nordic) a list of the most relevant and comparable requirements are shown:

\[\text{in December 2009 the market capitalization of listed companies were approx 30,000 billion $ for NYSE, 10,000 billion $ for London stock exchange, 2,000 billion $ for OMX and 500 billion $for OSE.}\]
The table show both similarities and differences in the stock exchanges. If we compare OSE, SSE and CSE, CSE have least requirements to the company going public. CSE have much less requirements to the size of the company going public and to the number of shareholders compared to the other 2 exchanges. It only require that the company have operated in 3 years prior to the IPO where the other 2 exchanges are more strict and require annual reports in at least 3 years prior to the IPO. The SSE is the strictest exchange in number of shareholders and history of the company, where OSE have most strict rules about the size of the company. After SSE and CSE merged into OMX Nordic, the requirements become a mixture of the earlier rules. The size of the company become less strict and is only 1 million euro, the percentage of shares to the public are the same as earlier, number of shareholders goes from 2000 to 500 for SSE, but are the same for CSE and the company should have published annual reports for at least 3 years prior to the IPO which is more strictest than before for CSE and less strict for SSE.

If a stock exchange has more strict requirements, it would often mean that the investors get more information about the company and therefore investing in the company is less risky. Since underpricing can be seen as a way to compensate investors for the risk they take, there would be expected more underpricing in markets with less restrictions. From the requirements for the stock exchanges, it would therefore be expected, that from 2002 to 2006 Danish IPOs is more underpriced than the other two countries and from 2007 to 2010 Norwegian IPOs is less underpriced than IPOs from the other 2 countries.

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5 All 3 stock exchanges give dispensation for all of the rules, if they believe the company can perform well on the exchange.
6 The requirements are those that exist in 2006 for Copenhagen and Stockholm and in 2010 for Oslo and Omx Nordic.
6.1 Development in the Scandinavian stock markets

The development in the stock market index show how the individual stocks are performing on average. If the index is increasing, it is a sign, that there is an increase in average demand for stocks in the index. In this section the development in the market index for OSE, SSE and CSE in the period of the analysis, will be described.

![Stock market index for SSE, OSE and CSE.](image)

From 2002 to 2003 all 3 stock exchange indexes have decreased. From 2003 to august 2007 all 3 index increases, but SSE has increased less than OSE and CSE. In august 2007 the growth in all 3 indexes stopped and the prices was varying a lot. The financial crisis stroke in the middle of 2008 and OSE index was the one that decreased the most. All 3 stock exchanges have regained some of their value, since the crisis started, and are starting to reach the values, they had before the crisis.

All 3 stock exchanges reached the lowest index level in the year of this analysis in March 2003 and after a period with increasing indexes they all reached the second lowest point in October 2008. In these 2 “down periods” it is expected to see a lower IPO activity than in the other periods due to low investor optimism.

There are differences in how much each of the indexes increase or decrease in each of the years. E.g. from 2003 to 2007 the OSE index increased by 150 index points and CSE by 120 index points, where SSE only increased by 90 index points. The Oslo stock exchange index is the one of the 3 that has performed best over the years in our analysis and the Swedish stock exchange index is the one that has performed worse.

On average the 3 stock exchanges have increased 5,8% each year from 2002 to august 2010. CSE have on average increased 6,2% each year, SSE have on average increased 4,2% each year and OSE have on average increased 7% each year.
7 Theory

In this section both the theory behind going public and the theory behind underpricing will be explained. This section is only to introduce the reader to the various theories and processes and therefore this section will mostly be explanatory. The theories will be discussed in the analysis section.

7.1 Going Public

The process behind an IPO can be divided into 5 general steps (Jenkinson & Ljungqvist, 2001).

1. The company needs to select the market they want to go public in. Earlier it was most common to choose the domestic country. Today it is not always the domestic country that is chosen as market.

2. The issuer need to choose an investment bank to be used as underwriter in the IPO. The company and the investment bank set up the most appropriate arrangement for the process. They have to agree on the offer method, fixed price or bookbuilding, the date of the IPO, the role of the underwriter best effort or firm commitment and other relevant things. The investment banks acts like an intermediary between the issuer and the investors.

3. The next step is to design the prospectus which is containing information about the company; both the information that is required and information that acts as advertisement to get investors to buy shares in the company.

4. The fourth step is where the underwriter gets information from the market, e.g. potential investors that are needed to set the offer price or offer price range. The information gathering also acts as a marketing effort to promote the offer to potential investors. When this phase is complete the prospectus is finalized with a price or price range and dates of the offer and the offer period starts.

5. The final phase is when the offer period is finished and the investment banks have the bids from investors. Depending on the offer method there are 2 different processes of the final phase.

When the offer price is fixed the allocation of shares is to be decided. If there is excess demand for the shares, the shares are either allocated through lottery or on a pro rata basis. When the bookbuilding method is used, the offers from the investors are analyzed and the final offer price is chosen. The allocation of shares is in advance allocated into 2 groups, private and public investors. If the shares are oversubscribed the shares in the private investor
group are distributed as a percentage of the desired shares and in the public group the shares are distributed individually for each investor.

There are 3 actors in an IPO; the company going public, the underwriter, and the buyers. There are different intentions for each of the 3 actors. The company going public is interested in raising as much money as possible but at the same time they want to make sure that the investors are satisfied, so if the company later on would want to issue shares, the investors would buy their shares. The buyers of the shares could be private or public investors. These buyers would only buy the shares, if they believe that it is a good investment compared to the risk. Else they would invest their money in something more profitable. Since an IPO is associated with the ex-ante uncertainty of the firm value, investors will require a lower price as compensation for taking this risk. This results in underpricing.

The underwriter is often a bank and act as an intermediate between the issuer and the investors. The underwriters advertise for the shares of the IPO and participate in determining the offering price, which is most commonly negotiated between the issuer and underwriter. The underwriter must ensure that both the issuer and the investors are satisfied. In order to keep a good reputation among both parties the underwriter need to set a price, which would give the investors compensation for the risk they are taking, but still is acceptable for the issuing company.

7.1.1 Advantages and disadvantages of going public

There a many reasons for a company to go public and also reasons not to. These reasons vary depending on the company and its surroundings. In this section the most well-known advantages and disadvantages are briefly explained.

7.1.1.1 Advantages

New capital: One of the most common reasons for a company to go public is to raise new capital. (Brealey 2000) The new capital is often used to finance growth of the company in form of new assets, new investments, or increasing R&D spending.

Future capital: When the company is public it is easier to raise new capital by equity offerings and it is easier, and often cheaper for the company to get access to loans. The company is already priced so both new investors and banks knows the value of the company.

Publicity and image: A public company is subject to the rules of the stock exchange and they are required to give out more information than a non public company. Investors, stock analyst
and the media follow the company. This gives the company more publicity and is a way to attract employees and investors.

7.1.1.2 Disadvantages

Loss of control: When a company goes public the company goes from being controlled by a few shareholders to be controlled by many new shareholders. The original owners will have to share their voting rights with the new investors and would lose some of the control of the company.

Profit sharing: If the company want to pay out dividends the old owners need to share the profit with an increased number of shareholders, but the company will also have more capital to make greater investments that could result in larger profit.

Reporting and loss of confidentially: A public company is subject to rules about clarity and need to make half years and annual reports. The company has to reveal information about its business like products, markets and activities, that gives competitors insight into the company, and that the company would have liked to keep for themselves. These revelations of information are also costly and time consuming.

The costs of going public: There are several direct and indirect costs of going public. The direct costs are for instance cost of auditors, lawyers, consultants and underwriters. Indirect costs are cost that is not so easily measured for instance time spends for the company on preparing the IPO.

Taking a company public has large impact on the business, both as advantages and disadvantages. The profitability for the company to go public is determined from the individual characteristics of the company.

A survey among European CFOs found that most CFOs identify increased publicity and increased access to new capital to finance growth as the most important reason for going public (Bancel & Mittoo 2009).

7.1.2 Pricing of the company

When the company goes public, the valuation of the company determines the price of the offered shares. Underpricing is determined as the difference between the price of the shares in the offer period and the price of the shares at the end of the first trading day. Since underpricing exists it could be because the shares are offered to low in the offer period.
Valuing the companies before the IPO is not different from valuing other shares. There are several models, that can be used, but these will not be discussed. The most common approach is the discounted cash flow (DCF) analysis and comparison to similar companies. But since the company doesn’t always have a long history of accounting information, this can be difficult, and often also a preliminary valuation from potential investors is used.

This process ends up with a value of the company, and from the number of shares the final offer price or offer range is found.

### 7.1.3 Introduction method

When the company is valued and the underwriters pricing of the shares are decided, the method of offering the shares is to be determined. The most used methods are offering a fixed price or offering by bookbuilding\(^7\).

#### 7.1.3.1 Fixed price

The fixed price model is when the company and the underwriter determine the final price at the beginning of the sales period. The price is though often decided by interaction with potential investors.

The advantages by using this model is that it is simple and investors knows the exact price they are paying and the company knows the exact amount of money raised at the IPO. This model often leads to shorter sales period and reduced market risk, and it is simple and therefore less costly.

The main disadvantage of this model is that it does not achieve an efficient market price. The price is not set by demand, so when there is a high demand for the new shares the price don’t change.

#### 7.1.3.2 Book building

The second model is the book-building model. In this model the issuer and the underwriter determine an offer price range. This price range is given to investors and they can then submit bids for a number of shares at a certain price in the interval. The final price is determined by the bids and the allocation of shares takes place. Before the IPO the allocations of shares are

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\(^7\) Earlier the tender method was often used, and some companies have also offered their shares trough an auction. Since there are none of the IPOs in this data sample that are offered by these methods they won’t be described.
divided into 2 sections; one for private investors and one for institutional investors. In the public section it is possible for investors to change their bids during the process. In the small tranche investors bids are binding. When the final price is set, the allocation of shares for private investors are divided according to their demand and for the institutional investors the issuer can choose the allocation of shares as they want.

The advantage of using this model is that the price of the shares is set by the demand in the market and that the price can increase or decrease, in the interval, according to investors demand. It is therefore important to get the offer advertised, so that there is high demand. If the shares are underpriced, this method will reduce some of the underpricing since the final price will end up at the highest end of the interval.

The disadvantage is, that the company doesn’t know the exact price they will get by the IPO, and that this method is complex.

Which type of offer method the company chooses depends on how the individual company weights the advantages of the 2 methods. But in the recent years the bookbuilding method has become the most used.

7.2 Underpricing

Many theories about underpricing have been developed and tested throughout the years, but no single and conclusive theory has yet been found, that describes the existence of underpricing. In this section the theories that will be used in the analysis will be described.

7.2.1 Definition of underpricing

Initial return is defined as the difference between the offered price before going public and the closing price at the first day of trading. When initial return is positive the IPO is said to be underpriced. Since underpricing exists, it indicates that the offer price could have been set higher without lack of investor’s interest. Therefore the company could have earned more money from the IPO. Despite the fact that this violates the established theory of market efficiency, the phenomenon of underpricing has been documented and discussed since the 1970s(Logue (1973) and Ibbotson (1975)) .

When the price at the first day of trading is lower than the offer price it is called overpricing. This phenomenon is seen in some IPOs but it happens more rarely than underpricing.
7.2.2 History of underpricing

The reason why IPOs on average is underpriced have received extensive attention in the literature of finance and several researchers have documented systematic increase in the price from the offer period to the price at the first day of trading. But even though many have researched this subject, no single theory has yet been able to give a complete explanation.

The literature on underpricing goes back to the 1970s where Dennis E. Logue was among one the first to document underpricing (Logue 1973). Shortly after, Roger G. Ibbotson documented an abnormal initial return for U.S. IPOs. Ibbotson (1975) studied the initial return of IPOs from the offer period to the first month after listing from 1960 to 1969, and found that IPOs on average outperformed the market with over 11%.

Since the 1970s a lot of people have researched the topic of underpricing. Most of the research has been done on IPOs’ done in US. There has been few in Scandinavia, this is probably due to the smaller markets and fewer IPOs. One of the most known researchers in the field of IPOs is Jay Ritter. Ritter have analyzed most of the theories and researched IPO underpricing in many countries and in many time periods.

In the last decade there has been a lot of research outside the US. Loughran et al. (2008) have collected results from various studies in 45 countries around the world. The results have varied significantly between countries and between continents. While first-day returns in Europe and North America generally has remained between five and 30 %, the underpricing in other continents, especially in several Asian countries is much higher. Chan et al. (2004) find an average underpricing of Chinese IPOs in the period 1993-1998 of 178 % and Ritter found Initial average return of 70% in Malaysia from 1980-2006. The research in developing countries has shown higher underpricing. This difference could be due to the presence of more asymmetric information among investors in the developing countries and therefore higher underpricing is seen.

Also among European countries, there are significant differences. For example, the underpricing of IPOs is significantly higher in Germany than in France. It is likely that this is partly due to differences between the institutional rules and laws in these countries (Ljungqvist 2007). Below the graph shows the findings of underpricing in 20 European countries and the United States.
It can be seen that underpricing varies between the different countries. This can be due to many different things. In addition to much variation between different countries research has shown, that the degree of underpricing varies significantly between time periods. Jay R. Ritter (2010) has made a list of first-day return for IPOs from U.S. from 1960 to 2008. The data shows that the degree of underpricing varies between decades. For example, the average initial return is under 7 % in the 80's while in the 90's was over 21 %.

In earlier studies the distribution of initial return is often found to be positive skewed(Ibbotson 1975 and Gajewski and Gresse 2006), with a positive mean and a median near zero. Ibbotson (1975) found a skewed distribution (with a long right tail) so that a randomly selected IPO investment would be about as likely to have positive and negative abnormal return, but the positive returns were much higher than the negative.

7.3 Scandinavian studies on underpricing

Earlier studies on IPO underpricing are mostly based on large stock exchanges such as US, UK and China. There are advantages to study large stock exchanges due to the large quantity of data available, but the small stock exchanges like those in Scandinavia could also be interesting due to the smaller size and the lack of evidence from IPOs from these stock exchanges. Some of the properties and theories that have been found from research in IPOs in large stock exchanges might not be present on smaller exchanges. Therefore the small size of the stock exchange is interesting.

In this section earlier studies of IPOs in Scandinavia will be described. Since all 3 stock exchanges are small, there have not been a large number of studies in these 3 countries.
There have been a few theoretical articles and some thesis’s analyzing underpricing in these 3 countries. The findings from these are gathered in the graph below that shows the development in findings of underpricing in the 3 countries from 1986 until 2001.

Figure 4: Development in underpricing from 1986-2001 in Denmark, Sweden and Norway.

There have been some years in the 1980s were all 3 stock exchanges had high average initial return. In 1986 Norway had an extreme large average initial return of 36%. And except for Sweden in 2001 the IPOs were on average under-priced in all years for all 3 countries. In all of the years except 2000 and 2001 Denmark have had the lowest average underpriced of the 3 countries, and overall it is the country with the lowest average underpricing. Norway has been the country with both the lowest and the highest average underpricing and therefore this is the most risky of the 3 countries. Except for 2001 Sweden has been the country with the most stable and often highest average underpricing.

Loughran and Ritter (2003) wrote an article where they discussed the changes in average underpricing over time. They studied U.S. IPOs from 1980 to 2003 and found significant differences between underpricing depending on the years companies were listed. The article finds evidence of an average underpricing of 65% in 1999 and 2000, 7% in the period from 1980-1989 and 15% in the period 1990-1998. In the earlier research from Denmark, Sweden and Norway such large differences in average underpricing cannot be seen, but there are periods where all 3 stock exchanges have higher underpricing than on average.

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8 Data from this graph is from various earlier research and thesis’s, the figure is just showed to give an impression of the development in underpricing through the years, and therefore the results have not been thoroughly verified.
In 2010 Ritter gathered the findings from many different studies of underpricing into one report. In this study findings of underpricing in Denmark, Sweden and Norway were also gathered. The table below shows the results:

<table>
<thead>
<tr>
<th>Country</th>
<th>Obs.</th>
<th>Years</th>
<th>Avg. Underpricing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>145</td>
<td>1984-2006</td>
<td>8%</td>
</tr>
<tr>
<td>Norway</td>
<td>153</td>
<td>1984-2006</td>
<td>10%</td>
</tr>
<tr>
<td>Sweden</td>
<td>406</td>
<td>1980-2006</td>
<td>27%</td>
</tr>
</tbody>
</table>

Table 2 Underpricing in DK, SE and NO. Source Loughran, Ritter and Rydqvist(2010).

This table is consistent with the findings in figure 4; Denmark has the lowest underpricing, Norway has a little higher average underpricing and Sweden have had high underpricing. It can also be seen that the number of IPOs in Sweden is much larger than the number for Denmark or Norway.

7.4 Theories on underpricing

Since the phenomenon of underpricing was first discovered in 1975 there have been many theories that try to explain why, and under what conditions underpricing exists. In this section the theories that try to explain the reasons for underpricing is presented. But since there are many theories, only the theories that are relevant for the analysis is explained.

The theories are not mutually exclusive. Some of them even support each other. Most of the theories are based on theories on asymmetric information, where some of the players have more information than others. This analysis wants to see if there can be properties before the IPO that can predict the level of underpricing. Therefore, all of the theories mentioned affect the share price before the IPO.

7.4.1 Winners Curse

The winners curse theory is one of the most cited theories within the field of underpricing. The theory was formed in 1986 by Kevin Rock. Rock assumes that due to uncertainty in the value of the company, there is asymmetric information between investors. There are 2 types of investors. One group of informed investors, that have more information about the value of the company than the average investors and a group of uninformed investors that don’t know the value of the company.

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9 The survey from Sweden include 4 more years, but this shouldn’t give than many more IPOs.
10 Other famous theories are the signaling theory and the partial adjustment theory.
Neither the company issuing new shares nor the underwriter has perfect information about the value of the company, and the price of the company may be priced to low or to high. The uninformed investors will on average subscribe to all issues, but the informed investors will only bid on the undervalued issues. Therefore the undervalued issues will become oversubscribed and the uninformed investors will get a smaller portion of the underpriced issues. The uninformed investors will get a small, and sometimes negative, return on their investments and they will not continue to invest in the market. To keep the uninformed investors in the market, the issuers will on purpose underprice their issues. This will not change the allocation of return, it will thus give the informed investors a higher return on their investment and the uninformed investors will no longer get an average negative return.

According to Rock (1986), underpricing should be regarded as a rational action taken by the issuers to reduce the risk of not getting enough demand for their shares and then have to withdraw the offering.

**Criticism of this theory**

This theory has been criticized due to 2 reasons. The first reason is the division of investors into 2 groups, informed and uninformed investors. If some investors are totally uninformed they would probably not invest directly in the company. They would probably do it through more informed channels like investments funds or through other informed investors and thereby avoid the winners curse problem.

The second criticism is that the theory requires proportional allocation of the shares of oversubscription of the issue. Benveniste and Spind (1988) find that the facilitators have a tendency to prioritize their regular customers in the allocation of shares. And in recent years the bookbuilding process has become more used and in by using this method the winners curse problem is reduced.

Ritter and Beatty (1986) have extended the winners curse theory. They argue that there is a positive correlation between the uncertainty surrounding the company's value before the IPO and the anticipated underpricing. The more uncertainty there is about a company, the more difference there is between informed and uninformed investors. Therefore the uninformed investors request a higher compensation in the form of underpricing, when there is much uncertainty about the company value.

The uncertainty of the company’s value can be considered as the risk of the company. In the next section the theory that underpricing is correlated with the risk of the company is
described, and some of the most common and simple ways to measure the risk of the company will be presented.

7.4.2 Risk compensation

In basic finance theory investors get compensated for taking risk by getting a higher return. Shares from a newly listed company are more risky than stocks from companies that have been traded before. Therefore underpricing can be seen as compensation to investors for taking the risk of investing in a newly issued company.

But there are differences in the level of risk of the individual company performing an IPO, and this should be reflected by differences in underpricing. The changing risk composition hypothesis is based on the assumption, that more risky IPOs will be underpriced by more than less-risky IPOs. The risk is measured as the uncertainty of the valuation of the company. Uncertainty is highly correlated with the degree of information about the company. The more information investor has of the company, the less risky the investment is.

Earlier literature has found that underpricing increases, when the risk of the company increases. There have been used many different variables as proxies for uncertainty. Many studies have shown that the beta value of the company is a good measure for uncertainty (Ritter 1984) and Beaver (1970). The problem with this measure is that it is only available after the IPO. The measured of risk used in this thesis are the easiest to measure or see and the ones that can be observed before the IPO.

Industry

The company going public is highly affected by the risk in the industry they are in. The risk between industries differs a lot, some industries are highly affected by their surroundings, and some are less affected. This affects the valuation of the company.

The variation of the stock prices within the different industries could be because some industries have industry specific risks. Industry specific risk could be changes in commodity prices. If a company is dependent on one specific commodity, price changes one this commodity would be important for the company. Another industry specific risk could be risk in the future earnings of the company, which makes the company hard to price, and therefore the valuation is more risky. In companies with many R&D cost the future earnings is much dependent on the success or failure of these projects. R&D projects can sometimes be a huge
success or a failure, and the value of these are hard to price. Therefore industries like health care and IT will be difficult to price.

Some industries have many intangible assets. These are difficult to price, and industries with many intangible assets will be harder to price, e.g. the finance industry and IT industry.

The risk of the valuation of the company is therefore dependent on the industry the company operates in, and investors would be compensated for investing in companies, in risky industries, by getting higher initial return.

Loughran and Ritter (2003) investigated the difference between different sectors in US IPOs from 1980 -2000 and found evidence of much higher underpricing associated with high-tech and information technology firms and some higher underpricing in startup biotech companies. Evidence of this has also been found in Swedish IPOs, Alm, Berglund & Falk (2009). They found the same phenomenon in Swedish IPOs from 1998 to 2007.

The company

The individual company can also be risky. This could be due to products, markets, customers, the size of the company and etc. Even if two companies are from the same country and industry, there can be significant differences in the risk of the 2 companies. The risk properties of the individual companies are difficult to measure, but one well known way to measure the risk of the individual company is by the beta value.

The beta value show how risky the company is compared to the market. A beta value of 1 is when the company has the same risk as the market, a beta value of less than one indicates lower risk than the market and a beta of more than one indicates higher risk than the market. The problem with beta values is that it calculated as the movements in the company shares compared to the market. Therefore beta values cannot be found for the companies before the IPO. A way for investor to get the risk of the company before the IPO is to find a similar company that is already listed and then use this beta value. Since the OSE, NSE and CSE are small exchanges this would be difficult.

Another way to measure the risk of the company is to analyze the individual company. But this is costly for investor and could therefore not always be profitable. There could be general properties of the company that could be used as a measurement for risk. In this thesis the company size and age are used as measurements for risk, and these values are not costly for investor to evaluate.
Company size

Earlier research have shown that the degree of underpricing vary with the size of the company. Larger companies often get more media attention and therefore there is more information available about these companies. This information reduces the information asymmetry and reduces the risk for the investors. Larger companies often have a larger financial foundation, and it is easier for them to survive in crises. Therefore it is expected, that larger companies have lower underpricing. This is in line with research from Chambers and Dimson(2008) that research IPOs done in UK from 1946 to 1986 and finds that small companies have a 6% point higher underpricing, than larger companies have. Later studies as Ritter (1984) and Hanley (1993) have also shown that the larger the company is the less underpricing exists.

Different studies have used different measurements for the size of the company. Beatty & Ritter (1986) use the size of the proceeds and Pedersen(2002) uses total assets. The 2 measurements are most similar. But since the company doesn’t need to offer all their shares in an IPO the total proceeds can be misleading as a measure of size. Therefore the size of total assets in the latest annual report is used as a proxy for firm size.

Company age

Older companies have proven they can stay in the market for long time and there is more historical information available for older companies. This makes them less risky than younger companies.

Several studies such as Ritter (1984 and 1991), Beatty and Ritter (1986) and Megginson and Weiss (1991) use company age as property for the degree of information asymmetry. Ritter (1984) states that company age measures how ‘established’ the company is, implying that for smaller companies, with short operating history, it will be more difficult to establish the right price per share than for older companies. Therefore younger companies must compensate the investors for buying shares in their IPO by being more underpriced than older companies. It is therefore expected that there is a negative relationship between the age of the company and the underpricing of the IPO.

The age of the company is measured as the years from the company was founded to the year of the IPO.
7.4.3 **Windows of opportunity**

The "Windows of opportunity" theory states that there is a larger demand for shares in some periods, and in these periods IPOs become more overvalued. The company going public should therefore try to take advantage of this opportunity, since it is limited by time. Investors are more optimistic during market peaks and hence overvalue the IPOs, and the issuing company should float their shares, when the demand in the market is high and therefore receive a better price for their shares. Ritter (1998) found that IPOs that were introduced during market peaks are more underpriced than others. The windows of opportunity theory are defined as periods with larger demand for stocks than on average. The market index of the stock exchange is therefore used as a measure for testing windows of opportunities. When the market index is increasing more than average, it is expected that there are more underpricing.

7.4.4 **Hot issue markets**

One of the observations in the literature of underpricing is that IPO activity is cyclical. Ibbotson and Jaffe (1975) introduced the expression ‘hot markets’, which they define as periods where the average first month initial return of IPOs is abnormally high (Ibbotson and Jaffe 1975). The theory states that the stock market goes through cycles of high and low returns on shares. In periods with high stock returns, there are more companies going public (Ritter and Welch 2002) and higher underpricing, and this phenomenon makes even more companies go public and therefore periods with both high IPO activity and high underpricing can be seen. These periods are defined as “hot issue markets”.

Since Ibbotson and Jaffe (1975) first documented the pattern, there have been several confirmations of the theory; Ritter (1984) found evidence for IPOs in US from 1960-82. He found a high 48.4% average initial return in the “hot issue” market in 1980-1981 while he found a relatively low initial return of 16.3% for the “cold issue” market in the remaining 1977-82 years. Ibbotson, Sindelar and Ritter (1988) extended the sample period to 1960-87 and reconfirmed the phenomenon.

They also found evidence of the relationship between the average initial return and the number of offerings: high underpricing of IPOs lead to high volume periods of new offerings after 6 to 12 months.

7.4.5 **Offer method**

The winners curse theory assumes that the shares are evenly divided between informed and uninformed investors. By using the bookbuilding method, the number of shares for the private
investors, which are often the uninformed, are decided before the offer period. When using the bookbuilding method the uninformed investors won’t get a lower number of shares, when the IPO is under-priced. The winner curse problem should be reduced, when the book building method is used and less under-pricing is expected, when this offer method is used.

The bookbuilding method is often expected to lead to more accurate pricing, since it enables underwriters to estimate the demand in the premarket. Ljungqvist (2001) test this assumption empirically, and find this to be true for US IPOs and a comparison made by Ritter (1998) shows that the average under-pricing in countries, that usually use fixed by IPOs, is 37%, while countries where the bookbuilding is more common, on average, experience under-pricing of 12%. However, this may be due to differences in the characteristics of the company in the various countries, and not only by the offer method.

7.4.6 General about the theories
The phenomenon of under-pricing has been researched and proved since 1975. The existence of under-pricing indicates that the offer price is too low compared to the actual value of the shares. Almost all of the under-pricing theories assume uncertainty of the future return of the company performing the IPO. In order to get investors attention and to compensate for the risk about the actual value of the company, the company performing the IPO offers their shares at lower price, so that it is likely to generate a positive return during the first days of trading.

7.5 Formulas used
In this section the formulas, that are used, is described.

7.5.1 Formula for underpricing
Initial return is defined as the difference between the offer price and the closing price at the first day of trading. The initial return is calculated for each of the IPOs in the sample using the approach of Ritter (1991).

The initial return for $i_{th}$ company is calculated in percentage by the formula:

$$r_i = \frac{P_{i1} - P_{i0}}{P_{i0}}$$

Where $r_i$ is the first day return of stock $i$, $P_{i1}$ is the closing price of the stocks of company $i$ at the first day of trading, $P_{i0}$ is the stock offer price for company $i$. To get the average initial return for the whole sample the individual initial return are summed and divided by the number of companies in the sample.
The days between the offer period and the first day of trading varies from the different IPOs. In this sample the days varies between 1 to 20 days, and the average is 4 days. In the days between the offer period and the first day of trading there can be movements in the stock market that can affect the first day trading price. Therefore the initial return is adjusted for movements in the market. By subtracting the changes in the market in the time between the pricing and the first day the general differences in the market are removed, and only the clean movements in the price of the IPO are left.

There are different ways of correcting for the movements in the market. The most accurate way is to find a similar company as the one performing the IPO, but since the markets in this analysis are small, this is not possible. Therefore the correction is done by using movements in the industry index of the country of the company performing the IPO. The industry index return is defined as:

$$I_i = \frac{I_{i1} - I_{i0}}{I_{i0}}$$

Where $I_i$ is the market index return, $I_{i1}$ is the industry index at the time at the first day of trading at stock $i$, $I_{i0}$ is the stock market index at the end of offer period for stock $i$. All 3 stock exchanges in this analysis use the Global Industry Classification Standard (GICS) to divide companies into industries. This classification is therefore also used in the analysis.

Initial return is therefore calculated by the formula:

$$\text{Initial return} = r_i - I_i = \frac{P_{i1} - P_{i0}}{P_{i0}} - \frac{I_{i1} - I_{i0}}{I_{i0}}$$

This returns the underpricing in percentage terms. If the percentage is negative, it means that the IPO were overpriced.

Earlier studies have used different time periods after the IPO to measure underpricing. Both 1 day, 2 days, 1 week, 1 month have been used. The most widely used measurement is 1 day and many earlier studies have shown, that the highest initial returned can be seen by using the first day closing price. Therefore in this analysis 1st day return are used to measure underpricing.

7.6 Test statistics

There are several techniques that can be used for testing, if the sample is significantly different than their corresponding benchmark. The following section discusses the use of parametric or non-parametric tests for this purpose.
7.6.1 Normality test or parametric tests

When testing data one of the most easy and used methods are the normal distributed tests. As the name implies these tests assume that the underlying distribution of the data is normal distributed. If the data, that is used, are not normal distributed the reliability of these tests are very low, and the findings from these tests cannot be trusted since the p-value may be inaccurate. When the data distribution is not normal distributed the parametric tests are not well specified, and therefore non parametric tests are more reliable.

7.6.2 Jarque-Bera test for normality

The Jarque Bera test is a test that measure if a data sample is normal distributed. The test has the null hypothesis that the data are from a normal distribution. A normal distribution is expected to have a kurtosis of 3 and a skewness of 0 and if the data have large deviations from this the JB value increases. The JB test is defined as:

\[ JB = \frac{n}{6} \left( S^2 + \frac{(K-3)^2}{4} \right) \]

Where \( n \) is the number of observations, \( S \) is the sample skewness and \( K \) is the sample kurtosis. When the sample is close to being normal distributed the \( K \approx 3 \) and \( S \approx 0 \) and then \( JB \approx 0 \). The JB value is compared to the chi-square distribution with two degrees of freedom. Large values of JB will often reject normality.

In the empirical section, the analysis of the data is found not to be normal distributed and normal distributed tests cannot be used. Therefore these tests will not be described further.

7.6.3 Non-parametric tests

When the data sample is not normal distributed the non-parametric tests outperform the parametric tests, both in terms of power and efficiency (Barber & Lyon 1996). Therefore when the distribution of the empirical data violate the assumptions of the parametric, (e.g., if the distributions are highly skewed) the non parametric tests are more reliable.

Nonparametric tests compare medians (where parametric compare means) and below is a description of the non parametric tests used in the analysis. There are 2 non parametric tests used: The Wilcoxon Signed Rank Test is used to compare a group to a value, and the Mann-Whitney test is used for comparing two unpaired groups.

The Mann-Whitney test
Mann-Whitney U test is the non-parametric alternative to the parametric t-test. Mann-Whitney U test is used to test whether the median of two not dependent samples are statistically equal or not. The test ranks each value of the 2 samples from lowest to highest; the ranks of the 2 samples are summed. If the 2 populations have the same median what is the chance that the sum of the rankings in each sample, are as different as found in the test. The sum of the ranks in the 2 samples are therefore compared to critical value tables to see if the observed difference is a result of coincidences or due to statistical differences in the 2 samples.

The null hypothesis that is tested is: H₀: No difference between samples.

And the alternative hypothesis is: H₁: The 2 samples are different.

The test is calculated by ranking all the samples from lowest to highest with no regard to which samples the observations is from. In both sample 1 and 2 the ranks of each observation is summed. The test value U from sample 1 is then calculated by the formula:

\[ U_1 = R_1 - \frac{n_1(n_1 + 1)}{2} \]

Where R₁ is the sum of ranks in sample 1, n₁ is the sample size for sample 1. The U value for sample 2 can be calculated by the same formula just by using R and n for sample 2.

\[ U_2 = R_2 - \frac{n_2(n_2 + 1)}{2} \]

The smallest of the U₁ and U₂ is the value used to test against significance tables. If the sample size is large U is approximately normal distributed and can be standardized by the formula:

\[ z = \frac{U - m_U}{\sigma_U} \]

Where mₚ is the mean of U and \( \sigma_U \) is the standard deviation of U and they are calculated by:

\[ m_U = \frac{n_1 n_2}{2} \]

\[ \sigma_U = \sqrt{\frac{n_1 n_2 (n_1 + n_2 + 1)}{12}} \]

The z value can then be compared to critical values for the chosen significant level of 0.05. If U or z exceeds the critical value the null hypothesis can be rejected.

**Wilcoxon Signed Rank Test**
The Wilcoxon Signed Rank test is much similar to the Mann Whitney test but it is more useful when comparing a sample to a value. The null hypothesis of the Wilcoxon Signed Rank Test is:

\[ H_0: \text{The median of the sample is equal to zero} \]

And the alternative hypothesis: \[ H_1: \text{The median are not equal to zero.} \]

The test is calculated by ranking the absolute values in the sample, with the lowest absolute value having the lowest rank. Then the ranks of the positive and the negative ranks are calculated. Then tests are made of the mean of the positive and the mean of the negative ranks. The hypothesis is that there is no significant difference between positive and negative ranks, and that the median therefore are zero.

The lowest value of the sum of ranks is chosen as \( U \) and then the \( z \) value is calculated as:

\[
z = \frac{U - E(t)}{\sigma_t}
\]

Where \( E(t) \) is the expected value of the ranks and can be calculated as \( E(t) = \frac{n(n+1)}{4} \)

and \( \sigma_t \) is the standard deviation and can be calculated as \( \sigma_t = \sqrt{\frac{n(n+1)(2n+1)}{24}} \)

The \( z \) value can then be compared to critical values for the chosen significant level of 0.05. If \( z \) exceeds the critical value, the null hypothesis can be rejected.

**Critique of the models**

Non parametric test compare medians by ranking the values. If the data have large differences between 2 ranks, the model does not value these differences. If the data have extreme values the model does not take the extreme values into its calculations. Higher positive values than negative values will though be seen by differences in the mean of the 2 samples. Since our data is not normal distributed the parametric test cannot be used. To make up for the weaknesses by the non parametric models the mean in each of the tests are also considered even though they are not statistically analyzed.

**7.7 Correlation analysis**

The correlation coefficient indicates the strength and direction of a linear relationship between two variables. There are several correlation coefficients measuring the degree of correlation. The most common of these is the Pearson correlation coefficient, which is measuring the
linear relationship between two variables. The Pearson correlation coefficient is calculated by dividing the covariance of the two variables by the product of their standard deviations. The coefficient range from -1 to +1. If the correlation is positive it means that if one variable increases the other will also increase, and the opposite if the correlation is negative.

The relationship between two variables can also be seen by how close the two variables are to form a straight line when plotted on an X-Y chart. To test correlation coefficient it is a good idea to graph the 2 variables in a scatter plot. If the data show another function than similar to a straight line the correlation coefficient should be used with caution.

8 Reliability and validity

When making empirical studies, there could be some error sources. It is important to be aware of these, since they can affect the results of the study. In this section the properties affecting the empirical findings are discussed. Overall, there are two types of errors that are particularly relevant in this type of quantitative study; errors in data and errors in the models that are used to analyze the data. In the following, these 2 errors will be discussed separately.

8.1 Errors in data

Errors in data mainly concern the collection of data. This refers to the type of data used, and how it is obtained. The data need to be valid and reliable. This is done by making sure that the data shows what is intended to show, and that the data is appropriate and reliable. High reliability is a prerequisite for high validity, but not alone any guaranty for this. Generally good validity and reliability is essential to rely on the data sample.

The data in this study are only collected from secondary sources, which give low control over the reliability. The data is mainly gathered from financial markets, such as OSE, CSE and SSE, and these sources are believed to be credible, and the reliability of this data is high.

Other type of data is collected from the different company’s website. That type of information could be tampered with by the company to make the company look better. The type of information that is gathered from the website is data like age and size, and this information is considered reliable.

The list of IPOs in each country is collected from each of the 3 stock exchanges lists of IPOs and there is no risk of missing an actual IPO. Based on the collected lists, each IPO is examined to see if it is a real IPO (see section 10.1). Since this selection is made manually
there could be errors by either excluding correct IPOs or by keeping wrong IPOs. To reduce these types of errors, each excluded IPO have been further controlled by several sources and the kept IPOs is further validated throughout the analysis. So these types of errors would be expected to be found and corrected n the data gathering.

The 2 greatest risks to reliability are the possibility of random errors and the size of the data sample. The data set is very widespread and all input in the models are processed manually. Therefore it cannot be ruled out that small errors have occurred. Each type of information is reviewed by the author, so the possibility of this type of error is considered small. The smaller the data samples are, the more the results can be affected by extreme observations and outliers. All 3 stock exchanges in this analysis are small, and therefore there number of IPOs is also small. Furthermore in the different hypothesis the data is divided into even smaller groups to be tested up against each other. Therefore the occurrence of outliers and extreme observations should be kept in mind, when looking at the data sample.

With all of the above in mind it implies that the reliability of the data is high.

The validity of the data is also considered high. The data comes from financial markets and from company websites and are mainly numbers, therefore there is little room for subjective interpretations. The exclusion of some IPO are done manually, but the reasons for exclusions can be explained and can also be found in earlier analysis of underpricing of IPOs and therefore this manual exclusion won’t reduce validity. Earlier analysis, that go further back in time, have excluded some IPOs due to missing data, since this analysis only goes 8 years back and since much more information is posted on the internet in that time period, no IPOs have be excluded due to lack of data and therefore the validity have not been reduced.

8.2 Errors in models

When setting up a model there are some assumptions and some input. Often the model is not an entire fit to reality, and therefore it needs simplifications of the input and the processes that handle the input. This increases the risk, that the structure of the model, will affect the results of the analysis.

The model used for analyzing underpricing is defined as the difference between the closing price at the first day of trading and the offer price. This model are build on previous research of underpricing and is therefore considered reliable. The way the model differs from some other studies, are by the variables used and the number of days used to measure underpricing.
In this study the measurement periods for underpricing is defined as 1 day, other studies have used more days. By expanding the periods there is a possibility, that more of the market reaction to the IPO would be caught, but on the other hand, there is also the risk that other events would affect the share price. Since most studies have found that using 1 day as the measurements period, returns the highest underpricing, this is considered as the most reliable period.

Previous research has found numerous variables that influence underpricing. The research on underpricing is a broad field, and there seems to be little consensus regarding what causes underpricing or how to explain it. The restricted number of variables to test for underpricing is therefore a limitation to the results. It was not possible to include all variables, and therefore a selection of the most relevant and useful variables were conducted. If more variables had been chosen it could have given a more thorough explanation of underpricing. But due to lack of time, space and information some have to be left out and the selected are the most commonly used, most relevant and those that best explain this data sample.

In this section a number of properties that could affect reliability and validity of the data have been discussed. Each point has been discussed and it is described how the risk is considered. The most important weaknesses both in models and in data have been highlighted and it is important to be aware of these properties in the analysis and in the conclusions.

9 Data
This section will describe the process on how, and from where the data sample was gathered.

9.1 Data collection
The data have been collected from several different sources depending on the information. First a list of all IPOs on each of the stock exchanges was found. Each stock exchange makes a list for each year of the new companies listed. These lists were merged into one list with all IPOs in the 3 countries. Thereafter information is found on each of the IPOs. Each of the stock exchanges has a record of announcements from each of the listed companies. Listing date, industry and often prospectus is identified on these lists. If the prospectus is not present in the stock exchange it is found by the company website. In the prospectus, the offer price, the offer period and the offer method were identified. By the information gathering, many of the IPOs were found not to have an offer price and were therefore removed from the sample (see section 10.1 for
further explanation). First day closing price, stock exchange index and industry index was extracted from DataStream.

The first day closing price of each IPO was compared to the offer price, and the clean initial return was calculated. In each IPO the value of the industry index was found for the day of the end of the offer period and for the first day of trading, and the industry index was calculated. By subtracting the industry index from each of the clean initial return, the true initial return for each IPO were calculated.

Size and age of the company at the time of the IPO were found in the financial company database Orbis. In order to be able to match the size of the company between the 3 countries, all total assets have been converted to DKK.

9.1.1 Industries

In the analysis the companies performing an IPO are divided into different industries. Therefore it is required, that the companies can be divided into industries across the 3 countries. Since all 3 exchanges use the Global Industry Classification Standard (GICS) as a standard for industry classification, this index is used.

The index has several layers and the company is located according to its principal business activities. The GICS Index have 10 sectors: Energy, materials, industrials, consumer discretionary, consumer staples, health care, financials, information technology, telecom and utilities.

9.1.2 Benchmark

To calculate abnormal return as underpricing, there is a need for a benchmark, that show what normal return is, e.g., what the investor could have earned by investing in a similar share. The initial return adjusted for the normal return is defined as abnormal returns. The way to measure normal return can be chosen in different ways. Earlier analysis of underpricing has chosen a specific company, an industry index or a stock index.

The different measurements of the benchmark have different advantages and disadvantages. The most optimal benchmark would be a company, that have been public for more than 3 years, that operates in the same industry, is from the same country, and that have the same size.

__________________________

If a company have business activities in more than one industry it is placed in the industry where it creates most revenue.
as the company performing an IPO. This benchmark is often used in analysis of large samples
(see Ritter 1991), but in this analysis the stock exchanges are small\textsuperscript{12} and it would be difficult
to find a company that matches all 3 requirements for each of the companies in the sample.
Therefore this benchmark cannot be used in this analysis.

Another benchmark that can be used is the industry index. Here the company is matched to the
index of the industry it is in. The industry index is an index that consists of all the stock’s
performance in the industry. By using this type of benchmark the IPO company is adjusted for
changes in the general market, but also for the specific industry it belongs to. If the industry is
highly dependent on some commodities, an increase in the price of these will be reflected in
the industry index, but not necessarily in the market index.

All 3 stock exchanges in this analysis have industry indexes\textsuperscript{13}, and therefore all companies in
the sample can be matched to their respective industry index. To adjust the share price from
the price is set to the first day of trading, for changes in both the industry and in the general
market the industry index for each country is used as a benchmark in this analysis.
The disadvantage of this type of index is that when the index is small it is more affected by
each single company. If the share price of one company in the industry is increasing a lot in
the period of the IPO, this would affect the benchmark and therefore the price of the initial
return will be adjusted down by more than the general index.

This analysis is done on 3 small exchanges; and the industry index therefore consists of few
companies. To be sure that one company does not affect the industry, each industry index in
each country is controlled for especially large companies and how big a percentage they
account for in the index. The indexes with large companies are industries with more than 15
companies and therefore the movements in the share price of these large companies are not
considered to have a significant impact on the industry index.

A third benchmark is to use the index of the stock exchange, where the company is listed. This
will adjust the return by general movements in the market. The advantage is that this index
consists of all stocks on the exchange. Therefore movements from one individual company
will not affect this index significantly. The disadvantage by using this index is that it does not
adjust for industrial specific movements.

\textsuperscript{12} 20th September there are 198 companies on the CSE, 288 on SSE and 185 on OSE.
\textsuperscript{13} These indexes are adjusted for dividends.
Some earlier analyses of first day return have argued that the period from the offer price is set to the first day of trading is so short, that there is no need to adjust for the benchmark. In this analysis the days between the settings of the offer price to the first day of trading varies between 1 to 20 days. Therefore it is considered important to correct for movements in the market.

10 Empirical findings

In this section the empirical findings will be introduced. The first section list the reasons for excluding IPOs, and the next sections show and explain the distribution of the remaining IPOs into country, year, industry, size, age and introduction method. Appendix 1 shows a list of all these IPOs and their properties. The description of the empirical findings is used later in the analysis section to describe some of the results.

10.1 Data sample

During 2002-august 2010 307\textsuperscript{14} companies went public on the main stock exchanges in Denmark, Sweden and Norway. Of these 208 have been excluded from the sample due to different reasons:

**Merger or spinoff of companies that were already listed:** When 2 companies merge, the shareholders from the company that no longer exists are offered shares in the new company, and often no new shares are being offered.

When a company perform a spin off, shares in the new company will be offered to the shareholders in the company the spin off came from, and no new shares are being offered.

In these 2 types of IPOs the public aren’t offered to buy shares in the company and therefore there is no offer price and underpricing can’t be calculated.

**Secondary listings:** A secondary listing is when a company is already listed on a stock exchange and is being listed on a secondary stock exchange. The company shares are already priced, and this type of offering can’t be compared to a public offering, where the share is priced for the first time.

**Moving from smaller exchange:** The company has been listed on the smaller exchange (First north, NOTC or aktietorget) and is now being listed on the main stock exchange.

\textsuperscript{14} 58 in DK, 102 in SE and 147 in NO.
All 3 countries have small stock exchanges. Here the listing rules are less strict than the main stock exchanges. Many companies start on these smaller stock exchanges, and after a while they delist their shares on the small exchange and finally list their shares on the main exchange. Therefore the new shares are already priced, and this type of listing can’t be compared to an initial public offering.

**Listing of investment companies:** Investment companies whose main business is holding securities of other companies purely for investment purposes are affected more by the stock market than other types of IPOs, and therefore these types of companies are excluded.

Overall 68% of the original 307 companies have been removed\(^\text{15}\), and that leaves 98 real IPOs in the data sample. 22 of these are from Denmark, 27 are from Sweden and 49 are from Norway. These 98 IPOs are in the next sections divided into the variables; year, industry, size, age and introduction method.

**10.1.1 Years**

The distribution of the 98 IPOs in years and in the 3 countries can be seen in the table below.

<table>
<thead>
<tr>
<th>Year</th>
<th>DK</th>
<th>SE</th>
<th>NO</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2003</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2004</td>
<td>0</td>
<td>3</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>2005</td>
<td>2</td>
<td>4</td>
<td>20</td>
<td>26</td>
</tr>
<tr>
<td>2006</td>
<td>10</td>
<td>8</td>
<td>11</td>
<td>29</td>
</tr>
<tr>
<td>2007</td>
<td>4</td>
<td>4</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>2008</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2009</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2010</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>27</td>
<td>49</td>
<td>98</td>
</tr>
</tbody>
</table>

Table 3. Distribution of IPOs in countries and years.

The number of IPOs each year varies a lot. From 2002-2004 all 3 countries have few IPOs, this period could be a cold period. This period is right after the economic downturn after the It-bobble broke and after 11th September.

In 2005 20 Norwegian companies went public while only a few went public in Denmark and Sweden. In 2006 the number of IPOs increases in all 3 countries, and this year was a hot period. 2007 still have many IPOs but the trend is decreasing. 2008-2009 were again a cold period.

\(^{15}\) 62% of the Danish, 74% of the Swedish and 67% of the Norwegian IPOs have been removed.
period. In 2010 there were 7 IPOs, but the sample only covers the year 2010 until August, so it looks like 2010 is going to be a hot year. The research period includes both hot and cold markets, which is useful, since one of the hypothesis states that there are differences in underpricing between these 2 types of periods.

In the sample the number of IPOs is distributed with 20% in DK, 28% in SE and 52% in NO. When analyzing the whole sample, it should be taking into consideration that more than half of the sample is from Norway.

Norway is the country with most IPO in the years of the sample, even though it is the smallest of the 3 exchanges. Earlier studies (see table 2) have shown that OSE were the stock exchange with fewest IPO over the years. OSE could therefore be an emerging stock exchange. The number of IPOs could be correlated with performance in the market. In figure 2 it was found that OSE index was the stock market index that have performed best in the years of this analysis. This could be the reason that Norway is the country with most IPOs.

The number of IPOs could be correlated with the stock market index performance. 2002-2004 and 2008-2009 is the years where the stock market index has performed worst, and these years are also the years with fewest IPOs. And from 2005 to 2007 all 3 stock indexes increases and these 3 years are the years with most IPOs. An explanation to this could be that if companies consider going public, then they are closely following the performance of the stock market. This means that during periods of strong stock market, more companies choose to go to the stock market to obtain capital. This outcome is also supported in the article "A review of IPO activity" which found that in periods with increasing index performance there were a larger number of IPOs.

10.1.2 Industries

Figure 5 shows the industry distribution of the IPO sample. The sample is mainly divided between 7 of the 10 industries, in the sectors telecom and utilities there are only 1 IPO and in the sector materials there are only 3 IPOs. Industrials are the largest sector with 20 IPOs, the remaining 6 sectors have 10-14 IPOs in each.
The distribution of industries is important in the analysis. If the sample was dominated by IPOs in one industry, the analysis would be affected by the initial return in this industry. Since this sample is not dominated by one specific industry, this is not a problem.

Another problem could be, if there are few IPOs in one of the industries. The analysis of this industry will be highly affected by the initial return of the individual companies, and the conclusion won’t be useful. The industries Telecom and utilities only include 1 IPO. The analysis of these industries will therefore be of each of the IPOs and not about the industry. Therefore these industries are not analyzed in the industry section.

The distribution of industries between the 3 markets is also interesting. To see if there are some of the countries that have IPOs that mainly come from some industries, the IPOs in each industry is split up between the 3 countries:

<table>
<thead>
<tr>
<th>Industry</th>
<th>DK</th>
<th>SE</th>
<th>NO</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Materials</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Industrials</td>
<td>4</td>
<td>7</td>
<td>9</td>
<td>20</td>
</tr>
<tr>
<td>Consumer discretionary</td>
<td>0</td>
<td>10</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>Consumer staples</td>
<td>1</td>
<td>1</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Health Care</td>
<td>5</td>
<td>2</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Financials</td>
<td>7</td>
<td>1</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>IT</td>
<td>3</td>
<td>4</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>All</td>
<td>22</td>
<td>27</td>
<td>49</td>
<td>98</td>
</tr>
</tbody>
</table>

Table 4. Distribution of IPOs in countries and industries.
It can be seen that there are some of the industries where the IPOs mainly come from one of the countries. From table 4 it can be seen that:

- All the IPOs from the energy industry come from Norway. Norway has a lot of oil resources. Therefore there are a lot of energy companies in Norway.
- 10 of the 13 IPOs in consumer discretionary come from Sweden.
- 8 of the 10 IPOs in consumer staples come from Norway.

The IPOs in the industries; materials, industrials, health care, financials and IT are all divided between the 3 countries. If each of the countries is compared to the general distribution of all the IPOs, Denmark has many IPOs in the financial sector, Sweden have a lot of IPOs from consumer discretionary, and Norway have many IPOs in the energy sector. These distributions are important to have in mind, when the underpricing in each of the countries is analyzed.

10.1.3 Size

The size of the companies in the sample ranges from a value of total assets of 19 billion DKK to 4 million DKK, and the average company in the sample has a size of 1,7 billion DKK. Most of the companies have assets of less than 5 billion and 4 companies have assets larger than 10 billion DKK.

The sample of IPOs is divided into 2 equal size groups after the size of the company. In Table 5 the distribution of the size of the companies in the 3 countries can be seen:

<table>
<thead>
<tr>
<th></th>
<th>DK</th>
<th>SE</th>
<th>NO</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large</td>
<td>8</td>
<td>18</td>
<td>23</td>
<td>49</td>
</tr>
<tr>
<td>Small</td>
<td>14</td>
<td>9</td>
<td>26</td>
<td>49</td>
</tr>
</tbody>
</table>

Table 5. Distribution of IPOs into size.

Denmark has more small companies, Sweden have more large companies and Norway have almost equal number of IPOs in the 2 groups. One of the hypothesis in the analysis states, that large companies are less underpriced than small companies. If the analysis shows that this hypothesis is true the higher portion of larger companies in Sweden should make IPOs in Sweden less underpriced.
10.1.4 Age

The age, at the time of the IPO, of the companies in the sample ranges from 149 years till under a year\textsuperscript{16}. The oldest company in the sample was founded in 1861 and went public in 2010. The average age in the sample is 28 years.

The age of the companies is divided into 2 groups: old and new. The distribution in these groups between the 3 countries can be seen in table 6:

<table>
<thead>
<tr>
<th></th>
<th>DK</th>
<th>SE</th>
<th>NO</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old</td>
<td>8</td>
<td>19</td>
<td>22</td>
<td>49</td>
</tr>
<tr>
<td>Young</td>
<td>14</td>
<td>8</td>
<td>27</td>
<td>49</td>
</tr>
</tbody>
</table>

Table 6 – distribution of IPOs into age.

The table is much similar to the table that shows the size of the companies. Denmark has mostly young firms going public compared to Sweden, that mostly have older companies going public, and the Norwegian IPOs are almost equally distributed.

Old companies are often larger than young companies, so there should be some correlation between age and size. This can be seen since table 5 and 6 is much similar. To test if there actually is a relationship between size and age in this sample, a graph with size as a function of age is made, and can be seen in figure 6. In the figure it looks like there are some kind of relationship between age and size, but there is no clear tendency. The correlation coefficient between age and size is 0.45, which shows that there are some but low positive correlation between firm size and firm age.

![Figure 6 – Correlation between age and size of the IPOs.](image)

\textsuperscript{16} All 3 stock exchanges have rules that the company at minimum should have operated in 3 years. The reason why there are younger companies in our sample is that each company can apply for listing even though they aren’t in compliance with the requirements.
The moderate correlation coefficient indicates that there are no clear relationship between size and age. An explanation of the missing correlation could be that the size of the company is measured by total assets. Some companies could be in industries where there aren’t very large assets, and therefore the company would be measured as small or medium but in real life it should be considered medium or large.

One of the hypothesis state that older companies should be less risky and therefore less underpriced. If the hypothesis is analyzed to be true, there should be less underpricing in Sweden, since more IPOs in Sweden are done by older companies.

**10.1.5 Introduction method**

Hypothesis 8 state that there are differences in underpricing depending on the offer method. If this hypothesis is true and if one country or one year has many IPOs done by one of the methods it would affect underpricing in the year or country. Therefore the distribution of offer method is shown both between countries and years.

In the data sample 62% of the IPO offers are done by the bookbuilding method:

<table>
<thead>
<tr>
<th>Method</th>
<th># IPOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bookbuilding</td>
<td>61</td>
</tr>
<tr>
<td>Fixed Price</td>
<td>37</td>
</tr>
</tbody>
</table>

Table 7 – Distribution of IPOs in offer method.

This distribution is consistent with earlier research that shows that bookbuilding is the most used method in Scandinavia(Gajewski & Gresse 2006).

The distribution of the 2 methods in each year can be seen in figure below:

![Figure 7 – Distribution of IPOs in offer method and years.](image)

2006 and 2008 are the only years where there have been more or equal number of IPOs offered by the fixed method compared to the bookbuilding method. In all the other years
bookbuilding have been the most used method of offering an IPO. 2005, 2007 and 2010 have been the years, where the difference between the number of offerings done by bookbuilding compared to fixed price have been largest. If hypothesis 8 is analyzed to be true there should be more underpricing in 2006 and 2008 since there is a larger number of the IPOS that is done by the fixed offer method.

When the offer method is distributed for each country, it can be seen that Denmark is the country with the highest percentage of IPOs done by the fixed price and Sweden has the lowest percentage.

<table>
<thead>
<tr>
<th></th>
<th>Fixed Price</th>
<th>Bookbuilding</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>DK</td>
<td>13 (59%)</td>
<td>9 (41%)</td>
<td>22</td>
</tr>
<tr>
<td>SE</td>
<td>7 (26%)</td>
<td>20 (74%)</td>
<td>27</td>
</tr>
<tr>
<td>NO</td>
<td>17 (35%)</td>
<td>32 (65%)</td>
<td>49</td>
</tr>
</tbody>
</table>

Table 8 - The offer methods divided into the 3 countries. The percentage in parentheses shows how large a percentage of all IPOs in that country that is done by this method.

If hypothesis 8 is true, the larger number of fixed price IPOs in Denmark and the larger number of bookbuilding in Sweden would lead to higher underpricing in Denmark and lower in Sweden.

The distribution of the sample between countries, years, industries, size, age and offer method should be taking into considerations when testing the different hypothesis. Especially the size, age and offer method showed differences in the distribution.

11 Analysis of underpricing

In this section the empirical findings of underpricing will be presented and analyzed according to the hypothesis presented in section 2.1. The first section is analyzing the whole sample and the subsequent sections will go more deeply in to the sample and analyze it according to the hypotheses.
### 11.1 The whole sample

Out of the 98 companies analyzed, 59 were underpriced. The descriptive statistics for the whole sample is calculated and shown in the table below.\(^{17}\)

<table>
<thead>
<tr>
<th>Initial return</th>
<th>Mean</th>
<th>Median</th>
<th>(\sigma)</th>
<th>Kurtosis</th>
<th>Skewness</th>
<th>Min.</th>
<th>Max.</th>
<th>25(^{th})</th>
<th>75(^{th})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial return</td>
<td>7%</td>
<td>2%</td>
<td>22%</td>
<td>26</td>
<td>4,6</td>
<td>-14%</td>
<td>161%</td>
<td>-2%</td>
<td>10%</td>
</tr>
</tbody>
</table>

Table 9 - Descriptive statistics for the whole sample

The average initial return is 7%, with a maximum initial return of 161% and minimum of -14%, which gives the sample a standard deviation of 22%. The 25th and 75th are included to show that 25% of the initial returns are lower than -2% and 25% are above 10%.

The median is 2%, this shows that 50% of the observations are higher than 2%. The median is lower than the mean, which indicates that there are some really high values that increase the mean. This is also shown by the skewness of 4.6.

To see how initial return is distributed, figure 8 shows the histogram of the sample. There are 3 extreme observations with extremely high initial return.\(^{18}\) Since the overall sample is relatively small these 3 extreme values will increase the mean and affect the data analysis and therefore a closer analysis at these 3 observations is done.

The 3 observations have initial return of 163%, 99% and 86%. The 3 observations are more than 3 standard deviations away from the mean and could therefore be described as outliers. Since these 3 values are so far away from the other data, they will affect our data. The mean and the standard deviation will increase for the whole sample. When testing the hypotheses the data is divided into smaller samples, and then these 3 outliers will affect the mean and the standard deviation even more. If these 3 high values of initial return have some variables in

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\(^{17}\) Appendix 1 shows all the IPOs, their initial return and the other values used in the analysis.

\(^{18}\) Since these 3 observations are much different than the other observations they have been further controlled for errors, both in collection of the data and in the calculations, and they are correct.
common, the mean and the standard deviation will be affected even more. So we look deeper into the different specifications of these 3 observations:

<table>
<thead>
<tr>
<th>Company</th>
<th>Offer method</th>
<th>Price</th>
<th>Initial return</th>
<th>Industry</th>
<th>Country</th>
<th>Year</th>
<th>Age</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>ChemoMetec</td>
<td>Fixed</td>
<td>8,35</td>
<td>161%</td>
<td>Health care</td>
<td>DK</td>
<td>2006</td>
<td>9</td>
<td>20.169</td>
</tr>
<tr>
<td>Sparekassen</td>
<td>Fixed</td>
<td>250</td>
<td>99%</td>
<td>Financials</td>
<td>DK</td>
<td>2006</td>
<td>47</td>
<td>5.543.046</td>
</tr>
<tr>
<td>Himmerland</td>
<td>Fixed</td>
<td>7,5</td>
<td>86%</td>
<td>IT</td>
<td>DK</td>
<td>2006</td>
<td>4</td>
<td>31.715</td>
</tr>
</tbody>
</table>

Table 10 – Description of the 3 outliers

All 3 observations occur in 2006, in Denmark and they were all 3 offered at a fixed price. The whole sample of IPOs is not very large (98 observations) so if these 3 extreme values are included in the analysis the mean and the standard deviation becomes really high and the results of the analysis might not be trustworthy. It is not likely to observe such extreme observations in the future. Therefore these 3 values are excluded from the rest of the data analysis.

11.2 Data sample without 3 outliers

The descriptive statistics of the sample without the 3 outliers is calculated and shown in the table below.

<table>
<thead>
<tr>
<th>Initial return</th>
<th>Mean</th>
<th>Median</th>
<th>σ</th>
<th>Kurtosis</th>
<th>Skewness</th>
<th>Min.</th>
<th>Max.</th>
<th>25th</th>
<th>75th</th>
</tr>
</thead>
<tbody>
<tr>
<td>4%</td>
<td>2%</td>
<td>10%</td>
<td>1</td>
<td>0,9</td>
<td>-14%</td>
<td>37%</td>
<td>-2%</td>
<td>9%</td>
<td></td>
</tr>
</tbody>
</table>

Table 11 - Descriptive statistics for the sample without the 3 outliers.

After the 3 outliers have been removed from the sample, the descriptive statistics have changed. The mean decrease from 7% to 4% and becomes much closer to the median, which indicate that the sample are less skewed, which also can be seen since the skewness decrease from 4,6 to 0,9. The skewness is lower, but is still not zero and indicate, that the sample is not normal distributed.

The standard deviation decrease from 22 % to 10 % which shows, that the observations are now closer to the mean and have less variation.

The sample with the 3 outliers had a rather high kurtosis of 26 which indicate extreme observations in the tails of the sample. The data sample without the 3 extreme observations has a kurtosis of 1. A normally distributed sample have an excess kurtosis of 0 (kurtosis of 3), and by removing the 3 outliers the sample goes from a positive excess kurtosis to a negative excess kurtosis. The sample therefore goes from having more values in the tails to have fewer values in the tail than the normal distribution.
These changes can also be seen from the new histogram. The sample is now much more centered around the mean and has fewer values in the tails.

11.2.1 Test for normal distribution of the sample

The normal distribution has an expected skewness of 0 and kurtosis of 3, from the descriptive statistics it looks like the sample aren’t normal distributed. To test for normality the Jarque Bera test is made. The JB statistics have a value of 28. If the data is normal distributed the JB statistics are expected to be zero, and by looking at the chi-square distribution with 2 degrees of freedom a JB value under 6 makes normality accepted. Since this sample has a JB value of 28 normality is rejected. Therefore the normality tests can’t be used and in the rest of the analysis non parametric tests are used instead.

11.2.2 Underpricing countries

The distribution of underpricing for each of the countries is shown in the table below:

<table>
<thead>
<tr>
<th></th>
<th>DK</th>
<th>SE</th>
<th>NO</th>
<th>Scandinavia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average underpricing</strong></td>
<td>10%</td>
<td>5%</td>
<td>2%</td>
<td>4%</td>
</tr>
<tr>
<td><strong>No. IPOs</strong></td>
<td>19</td>
<td>27</td>
<td>49</td>
<td>95</td>
</tr>
<tr>
<td><strong>% underpriced firms</strong></td>
<td>79%</td>
<td>63%</td>
<td>49%</td>
<td>59%</td>
</tr>
<tr>
<td><strong>Median</strong></td>
<td>7%</td>
<td>3%</td>
<td>0%</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Maximum</strong></td>
<td>28%</td>
<td>37%</td>
<td>29%</td>
<td>37%</td>
</tr>
<tr>
<td><strong>Minimum</strong></td>
<td>-13%</td>
<td>-14%</td>
<td>-13%</td>
<td>-14%</td>
</tr>
<tr>
<td><strong>Std. deviation</strong></td>
<td>11%</td>
<td>11%</td>
<td>9%</td>
<td>10%</td>
</tr>
</tbody>
</table>

Table 12 – Descriptive statistics of Initial return for each of the countries.

All 3 countries have experienced average underpricing on IPOs from 2002 to 2010 but the amount of underpricing differs between the countries.

Denmark is the country with fewest IPOs but it is the sample with the highest underpricing and largest percentage of companies that were underpriced. The median are 7% while the average underpricing are 10%. The Swedish sample has an average underpricing of 5%, with 63% of the IPOs being underpriced. Norway is the sample with the highest number of IPOs.
and the lowest underpricing. Average underpricing for the Norwegian sample is 2% and the median is 0%.

For all 3 countries the mean are higher than the median. That makes underpricing positive skewed in IPOs in all 3 countries. This show that the IPOs have been higher underpriced than they have been overpriced.

All 3 countries have standard deviation almost similar to each other, and the maximum and minimum underpricing is also almost similar.

From these descriptive numbers the underpricing of Danish IPOs have higher mean and median, but the same standard deviation than the other 2 countries. Therefore investing in Danish IPOs gives a higher return with the same risk than the other 2 countries and is therefore a better investment.

11.2.3 Test of initial return countries and whole sample

From the numbers in table 12 it looks like there is higher underpricing from IPOs performed in Denmark and that IPOs performed in Norway is not different from zero. To test these observations the non parametric Wilcoxon test is applied on the data.

The Wilcoxon test has the null hypothesis that the median of initial return is zero. The results of the Wilcoxon test can be seen below.

<table>
<thead>
<tr>
<th></th>
<th>Median</th>
<th>σ</th>
<th>Wilcoxon Test Z-values</th>
<th># obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>7%</td>
<td>11%</td>
<td>2,10</td>
<td>19</td>
</tr>
<tr>
<td>Sweden</td>
<td>3%</td>
<td>11%</td>
<td>2,56</td>
<td>27</td>
</tr>
<tr>
<td>Norway</td>
<td>0%</td>
<td>9%</td>
<td>0,91</td>
<td>49</td>
</tr>
<tr>
<td>Scandinavia</td>
<td>2%</td>
<td>10%</td>
<td>3,44</td>
<td>95</td>
</tr>
</tbody>
</table>

Table 13 – Wilcoxon test of initial return for each of the countries and the whole sample.

By looking at a normal distribution table the Z values for DK, SE and Scandinavia are all significant different from zero at the 5% level, and Sweden and Scandinavia are also significant different from zero at the 1% level. The reason that the Danish sample has a lower z-value than Sweden (in spite of the higher median) is that Denmark has 2 high ranked negative values and then the rest of the ranks are much higher positive values. Therefore the Z value is lower than Sweden. As mentioned in the explanation of the test this is one of the disadvantages of this test and the size of the z-value should be interpreted with caution.

Underpricing in Norway is not significant different from zero.
From an investors point of view it would be most profitable to invest in IPOs done in Denmark or Sweden. If looking at the median the Danish IPOs have yielded the highest initial return in the period from 2002 to 2010 and therefore this would have been the most profitable investment. This statement is made from the assumption that investments are made in all IPOs. In the next section the whole sample will be divided into different groups to test, if there are properties in the IPOs that can predict higher underpricing.

11.2.4 Underpricing pr. year

The first property to test for is to see if there are differences in underpricing in the different years and to see if there any trends in underpricing through the years. Table 14 show the underpricing of IPOs in the different years:

<table>
<thead>
<tr>
<th>Year</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average underpricing</td>
<td>1%</td>
<td>-2%</td>
<td>4%</td>
<td>4%</td>
<td>7%</td>
<td>5%</td>
<td>-1%</td>
<td>-11%</td>
<td>2%</td>
<td>4%</td>
</tr>
<tr>
<td>No. IPOs</td>
<td>4</td>
<td>3</td>
<td>8</td>
<td>26</td>
<td>26</td>
<td>16</td>
<td>4</td>
<td>1</td>
<td>7</td>
<td>95</td>
</tr>
<tr>
<td>% underpriced firms</td>
<td>50%</td>
<td>67%</td>
<td>50%</td>
<td>58%</td>
<td>65%</td>
<td>69%</td>
<td>50%</td>
<td>0%</td>
<td>43%</td>
<td>62%</td>
</tr>
<tr>
<td>Median</td>
<td>3%</td>
<td>1%</td>
<td>0%</td>
<td>2%</td>
<td>4%</td>
<td>3%</td>
<td>0%</td>
<td>-11%</td>
<td>-1%</td>
<td>2%</td>
</tr>
<tr>
<td>Maximum</td>
<td>8%</td>
<td>5%</td>
<td>24%</td>
<td>27%</td>
<td>37%</td>
<td>22%</td>
<td>11%</td>
<td>-11%</td>
<td>11%</td>
<td>37%</td>
</tr>
<tr>
<td>Minimum</td>
<td>-9%</td>
<td>-13%</td>
<td>-9%</td>
<td>-11%</td>
<td>-14%</td>
<td>-5%</td>
<td>-13%</td>
<td>-11%</td>
<td>-7%</td>
<td>-14%</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>8%</td>
<td>9%</td>
<td>11%</td>
<td>10%</td>
<td>12%</td>
<td>7%</td>
<td>10%</td>
<td>-</td>
<td>6%</td>
<td>10%</td>
</tr>
</tbody>
</table>

Table 14 – Descriptive statistics of initial return for each of the years from 2002-2010.

There are differences in both number of IPOs and underpricing in the different years. There is average underpricing in 6 of the 9 years studied; in year 2002, 2004-2007 and in 2010. In these years the average underpricing varies from 1% in 2002 to 7% in 2006.

It should be noticed, that in some of the years there are very few IPOs’, and therefore one IPO with really high underpricing will weigh more in the years with few IPOs. 2009 only had one IPO that were underpriced by 11%, so this year will not be included in the analysis.

The average underpricing varies from year to year, but the standard deviation each year is not changing much. So underpricing has the same variation from year to year. Earlier analyses of IPOs have shown large differences in underpricing between different years (see section 7.2.2). The differences found in this analysis not as large.

There are no years, where there has not been an IPO with negative underpricing, and in 3 of the years, 2002, 2004 and 2008, there are only half of the companies, that went public that had underpricing. This show that investing in IPOs to earn money from underpricing is not always profitable and investor need to be selective in the investments of IPOs.
The most profitable years to earn profit from underpricing of IPOs are the years 2004-2007. Here investor on average could have earned 5% from the underpricing of IPOs. The next sections analyze if there are any special properties that exist in these years, so investor could use this to predict profitable years in the future.

In section 0 the sample was divided into 3 periods depending on the number of IPOs in each year. 2002-2004 and 2008-2009 were cold market periods and 2005-2007 were a hot market period. From Table 14 it looks like there is less underpricing in the cold market periods and more in the hot market periods. In the next section an analysis of these hot and cold market periods are conducted.

11.2.5 Hot and cold markets

From Table 14 it can be seen that in years with few IPOs there are less underpricing and the years with many IPOs there are more underpricing. 2003 and 2009 are years with few IPOs and these years are also the 2 years with the lowest average initial return. 2005 and 2006 are the 2 years with the most IPOs and these 2 years are also years with the high average initial return. To see the relationship between number of IPOs and underpricing the 2 variables are plotted into a graph that show number of IPOs and underpricing for each of the years.

The graph shows that there is a relationship between number of IPOs and underpricing. The correlation coefficient between the 2 variables is calculated to $0.7^{19}$ which shows that there is a high and positive relationship.

---

19 The graphical relationship of the correlation can be seen in appendix 2
This is consistent with the theory of hot issue markets. It states that in periods with high initial return, there are more companies going public. A hot market is earlier defined as a period with high number of IPOs and high underpricing, where a cold is a period with low number of IPOs and low underpricing. In the next section hypothesis 2 will be tested.

**Hypothesis 2:**

*There are more underpricing in hot issue periods than in cold issue periods.*

The idea behind this hypothesis is that issuers take advantage of periods with high optimism in the market, and the willingness to invest in IPOs are high.

The years are divided into periods with higher number of IPOs than on average (hot periods) and periods with lower or average number of IPOs (cold periods). It is difficult to assess the optimal length of the periods. In this analysis a year is chosen. It could be argued that this period is too long, but due to the small data sample a shorter period cannot be chosen.

From section 10 there are 3 different periods:

- 2002-2004: cold period
- 2005-2007: Hot period
- 2008-2009: Cold period

The 2 cold periods are put together and the descriptive statistics is calculated:

<table>
<thead>
<tr>
<th></th>
<th># IPOs</th>
<th>Average number of IPOs pr. year</th>
<th>Mean</th>
<th>Median</th>
<th>σ</th>
<th>Max</th>
<th>Min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold</td>
<td>20</td>
<td>4</td>
<td>1%</td>
<td>0%</td>
<td>10%</td>
<td>24%</td>
<td>-13%</td>
</tr>
<tr>
<td>Hot</td>
<td>68</td>
<td>23</td>
<td>5%</td>
<td>3%</td>
<td>10%</td>
<td>37%</td>
<td>-14%</td>
</tr>
</tbody>
</table>

Table 15 - Descriptive statistic for hot and cold markets.

There are differences in the average number of IPOs each year between the hot and the cold periods. The hot period had on average 23 IPOs each year while the cold period had 4. The IPOs in the hot market have larger underpricing than IPOs in cold periods. The mean initial return during hot periods is 5% compared to a mean of 1% during cold periods. The median during hot periods are 3% point higher than during cold periods. The standard deviations and the minimum value are almost similar in the 2 periods, but the maximum value is much higher for the hot period.

To test if there are differences in underpricing in the 2 periods the Mann-Whitney test is applied. The test returns a Z value of 5.11 and the probability of getting this value is 0.024 of the two samples have the same median. It can therefore be rejected that the 2 samples have similar medians and it is found that there are differences in the initial return between IPOs.
issued during hot markets and cold markets and the difference is statistically significant. The conclusion is that investors can get larger return by initial return on IPOs issued in hot periods.

Another way to define the hot issue markets, is by periods where the general stock market performs well. The idea is, that since the stock market is rising, there must be high demand for shares, and therefore also higher demand for IPOs and therefore issuers has better conditions to perform an IPO. In the next section the performance of the 3 stock markets and underpricing is analyzed.

11.2.5.1  Stock market performance and underpricing

_Hypothesis 3_

Companies, that conducts IPOs when the stock markets are performing better than on average, experience higher underpricing.

In figure 2 the stock market index performance were graphed. From 2003 to 2007 all 3 stock indexes are increasing, and therefore more underpricing in these years is expected. If we compare this graph to Table 14, the years with most underpricing are 2004-2007. These are also the years where the stock index increases. In mid 2009 all 3 stock exchanges starts to increase again, and there is more underpricing in 2010 than in 2009.

In 2008 the financial crisis hit all 3 countries, and there can be seen a large decrease in all 3 stock indexes. This year there is only one company going public and that company had a overpricing of 11%.

By comparing the stock market performance and underpricing each year it looks like there is a relationship between the 2 variables. To see if this is true, the correlation between stock market performance and initial return is calculated. The performance of the market is measured at the stock index performance, but it is difficult to know how long back the performance need to be measured (dependent on the “memory of the investors”). A long time period will be less affected by cyclical movements, while shorter periods will have the most recent information showed. It is not certain which period are the best measure, and therefore the performance is measured in 3 different time periods, 3, 6 and 12 months prior to the IPO, and the correlation between underpricing and these periods are calculated. Both the stock
exchange index and the industry index could be used, but since the industry index contains both market movements and movements for the specific industry this index is chosen\(^\text{20}\).

<table>
<thead>
<tr>
<th>Industry Index</th>
<th>3 months</th>
<th>6 months</th>
<th>12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>34%</td>
<td>32%</td>
<td>33%</td>
</tr>
</tbody>
</table>

Table 16 – Correlation between industry index performance and underpricing.

All 3 correlations from this analysis are positive and at a moderate level. Since the correlation 3 months prior to the IPO is highest this is used as measurement for performance in the test statistics.

To test if there could be difference between underpricing depending on the industry index performance, the observations are divided into 2 equal size groups; one with high performance and one with low performance.

Hot markets are often defined as a period where the stock market is performing above average. In the test for hot and cold markets, hot markets were defined as a period with high IPO activity. Therefore the high performance IPOs would be expected to contain mostly IPOs done in hot periods and the low performance group to contain mostly cold markets. By looking at the 2 groups the high performance group contains 76% IPOs from hot periods and the low performance only contains 60% IPOs from hot periods, so there is some coherence between the two groups. The reason why both measurements are chosen is because hot and cold markets say something about the market for IPOs, whereas industry index performance says something about the general stock index performance.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low performance</td>
<td>1,51%</td>
<td>0,00%</td>
</tr>
<tr>
<td>High performance</td>
<td>6,20%</td>
<td>4,90%</td>
</tr>
</tbody>
</table>

Table 17 - Initial return for IPOs done in high and low industry stock performance periods.

Both the mean and the median is almost 5% point higher in periods with high industry stock index performance compared to periods with low performance. To verify if there is significant difference between initial return in these 2 samples, the Mann Whitney U test is applied. The

\(^{20}\)To make sure that the market index is not a better match; the correlations are also calculated for this index. The index shows the same level of correlations and can be seen in appendix 3.
test returns a Z value of 5,9 and the probability of initial returns is similar in the 2 samples are 1,5%. Therefore the hypothesis that initial return in the 2 samples is similar can be rejected.

It is concluded, that initial return is correlated with stock index performance, and that there is higher initial return in periods with high stock index performance compared to periods with low performance. An explanation could be that when the general demand for shares increases so does the demand for IPOs and that increase underpricing.

The performance of IPOs can also be affected by the uncertainty in the markets. This next section will look into this hypothesis.

11.2.5.2 Stock market volatility and underpricing

*Hypothesis 4*

Companies that conduct IPO in times of great uncertainty, as measured by market volatility ahead of the listing, experience higher levels of underpricing.

The winners curse theory is based on the uncertainty of the value of the company. In times where the stock market is more volatile, the expected future earnings are also more volatile and therefore there are more uncertainty about the value of the company. In order for investors to be willing to invest in an IPO shares in times of higher uncertainty, the investors will demand higher initial return. Therefore in times of high stock market volatility, there is more uncertainty, the asymmetric information will increase, and it is expected that there will be more underpricing.

The risk in the market while conducting an IPO can be measured by the volatility in the period up to the IPO. By this measure it is also difficult to say how long back the volatility need to be measured to measure the current risk, and both the stock exchange index and the industry index can be used. Due to the same reasons as the above section, the industry index is chosen\(^{21}\) and the correlation with underpricing is calculated for 3 different time periods, 3, 6 and 12 months before the IPO.

\(^{21}\)To make sure that the market index is not a better match; the correlations are also calculated for this index. The index shows the same level of correlations and can be seen in appendix 4.
Table 18 - Correlation between market index volatility and underpricing.

<table>
<thead>
<tr>
<th>Correlation</th>
<th>3 months</th>
<th>6 months</th>
<th>12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>-7%</td>
<td>-6%</td>
<td>0%</td>
<td></td>
</tr>
</tbody>
</table>

From the hypothesis it is expected that there is a positive correlation between the risk in the industry and underpricing. Table 18 show that all 3 correlation coefficients are small and 2 of them are negative. From the table it can’t be concluded that there are no relationship between the volatility in the market prior to the IPO and underpricing.

To be sure that there is no significant difference between underpricing in times with high volatility and in times with low volatility in the market the Mann Whitney test is applied. Since the 3 months volatility has the highest correlation, the 3 months are used as measurements for volatility. The observations are divided into 2 equal size groups; one with high volatility and one with low volatility and the Mann Whitney U test is applied to test if there are differences in underpricing between the 2 samples. The test gives an H value of 1,85 which gives a 17,4% probability, that the medians of the 2 samples are equal. This probability is higher than the 5% significance level and we cannot reject that the mean of the 2 samples are equal.

So the hypothesis that there are more underpricing when the IPO is done in volatile markets can be rejected. And it can be concluded that investors cannot look at the market volatility and predict which IPOs that is more underpriced.

There may be several reasons why our analysis does not find any positive correlation between volatility and underpricing. One of them could be that the measure we use for uncertainty is not an appropriate measure. The uncertainty of the individual company or the probability of bankruptcy in the market could be a better measurement, but both of these are difficult to measure. Another explanation could be that when the market is volatile, investors won’t invest in IPOs, since they are more risky than normal shares and the demand for IPOs is decreases so the underpricing, that would have been seen from increasing asymmetric information, is equalized.

11.2.6 Underpricing Industries

Hypothesis 5

There are differences in underpricing across different industries

The risk level for companies in different industries varies. In some industries the earnings of companies are greatly dependent on the overall trend in the economy, whereas the earnings of
companies in other industries are almost unaffected by the economic development. In some industries the companies have large movements in their earnings, while others are more stable. The risk of the IPO is therefore related to which industry the company operates in.

Normally the risk of a share is reflected in the price. The price of the share is set to reflect the risk; therefore the share price should reflect the risk and not the underpricing. However, by underpricing IPOs of more risky shares can be seen as a way to get investors to invest in more risky IPOs. Furthermore riskier IPOs are harder to price and this create a risk for the investors. In order to get investors to invest in these risky IPOs the offer price is set lower to compensate for this risk.

It is therefore expected that risky industries will be more underpriced. To analyze whether there are differences in underpricing between industries, the sample of IPOs are divided into industries and the underpricing of the IPOs in different industries is seen below²²

<table>
<thead>
<tr>
<th>Industry</th>
<th>Energy</th>
<th>Materials</th>
<th>Industrials</th>
<th>Consumer</th>
<th>Consumer</th>
<th>Health</th>
<th>Financials</th>
<th>IT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average underpricing</td>
<td>6%</td>
<td>1%</td>
<td>4%</td>
<td>8%</td>
<td>-1%</td>
<td>3%</td>
<td>6%</td>
<td>2%</td>
</tr>
<tr>
<td>No. IPOs</td>
<td>10</td>
<td>3</td>
<td>20</td>
<td>13</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>% underpriced firms</td>
<td>60%</td>
<td>33%</td>
<td>70%</td>
<td>69%</td>
<td>20%</td>
<td>55%</td>
<td>75%</td>
<td>57%</td>
</tr>
<tr>
<td>Median</td>
<td>4%</td>
<td>-1%</td>
<td>3%</td>
<td>3%</td>
<td>-1%</td>
<td>3%</td>
<td>3%</td>
<td>0%</td>
</tr>
<tr>
<td>Maximum</td>
<td>29%</td>
<td>6%</td>
<td>16%</td>
<td>37%</td>
<td>11%</td>
<td>17%</td>
<td>27%</td>
<td>28%</td>
</tr>
<tr>
<td>Minimum</td>
<td>-11%</td>
<td>-1%</td>
<td>-11%</td>
<td>-9%</td>
<td>-8%</td>
<td>-7%</td>
<td>-13%</td>
<td>-14%</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>13%</td>
<td>4%</td>
<td>6%</td>
<td>13%</td>
<td>7%</td>
<td>8%</td>
<td>11%</td>
<td>13%</td>
</tr>
</tbody>
</table>

Table 19 - Initial return in the different industries.

There are wide differences in underpricing across the industries. Underpricing in the different industries varies from -1% in consumer staples to 8% in consumer discretionary.

There are 3 industries, that have larger underpricing than the others; Energy, financials and consumer discretionary. These 3 industries are together with IT also the 4 industries with the highest standard deviation in underpricing, which makes initial return from IPOs in these 4 industries more risky. If some industries were more risky, the IPOs would in general be more underpriced. It can be seen, that the industries with high average underpricing also have some

²² Since telecom and utilities only consist of 1 company each, they can’t be categorized as an industry and they have been removed from this table. The industry materials only have 3 IPOs and should therefore be interpreted with caution.
IPOs with large overpricing, and that their medians are not especially larger than the other industries.

Earlier studies have shown that IT companies and biotech companies have been more underpriced due to the risk level in their industry$^{23}$. These 2 industries have lower underpricing than the average so this is not the case in this analysis.

There are no clear relationships between underpricing and number of IPOs in an industry. The industries with most IPOs are industrials, IT and consumer discretionary and only one of these industries have a larger underpricing than the average. The industries with the lowest average underpricing are materials and consumer staples, and here materials are the industry with the lowest number of IPOs.

There are some industries with higher underpricing than others. To test if there are significant differences between the individual industries the Mann Whitney test is applied to test if underpricing in each industry is significantly different than underpricing in each of the other industries. The test shows that there is only significant difference in underpricing between consumer discretionary and consumer staples. These finding were expected since these 2 industries are the one with the lowest and the one with the highest underpricing. Since there is no other significant difference between underpricing between the other industries, we cannot say anything about underpricing in the individual industries.

In the distribution of the data sample into industries, it was seen, that there were differences between number of IPOs in the different industries between the 3 countries (see table 4). Therefore initial return in the industries is divided into countries:

$^{23}$ Ritter (2004) found 20% points higher return for IT companies in IPOs from 1980-2000.
There are large differences between initial return in the same industry between the 3 countries. This could be because there are differences in the same industries across countries. This difference could be due to differences in the risk of the industries in different countries. To test if there is correlation between the industry risk in each country and underpricing, the correlation between the beta value for the industry\textsuperscript{24} and underpricing is calculated to 0.24.

There are no clear correlation between risk in industries and underpricing.

There are some of the industries, where there is larger underpricing than other industries. But the difference is not large enough to be significant. Industries that have been more underpriced in earlier analyses are not higher underpriced than other industries, and there is no correlation between industry Beta values and underpricing. The hypotheses, that higher industry risk lead to higher underpricing is rejected.

Another explanation could be that the individual company has different risk than the industry it operates in. Therefore in the next sections, properties about the size and the age of the company are tested.

11.2.7 Size of the company

Hypothesis 6

Larger companies are less underpriced.

The hypothesis assumes that larger companies are less risky and therefore they are easier to price and it is easier to get investors to invest in them, and therefore they are less underpriced.

\textsuperscript{24} This is calculated as the movements of the industry index compared to the market.
This hypothesis expects that there are negative correlation between the size of the company and underpricing.

The size of the company is calculated by total assets of the company and the correlation between this number and underpricing is calculated for each IPO. The correlation coefficient is -0.03. The correlation has the right sign but it is very small. To test if there are more general differences in underpricing depending on the size of the company, the sample is divided into 2 groups; large and small companies.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
<th>σ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large</td>
<td>3,5%</td>
<td>3%</td>
<td>9%</td>
</tr>
<tr>
<td>Small</td>
<td>4,5%</td>
<td>1%</td>
<td>11%</td>
</tr>
</tbody>
</table>

Table 21 - Initial return distributed into small and large companies.

There is no large differences initial return between the 2 groups. And if the Mann Whitney test is applied, there are 90% probability that the 2 groups having same median.

It is concluded that investor cannot get a better return from investing in IPOs due to company size, and the hypothesis that larger companies have lower underpricing is rejected.

The reason for rejection of this hypothesis could be due to the measurement of size. The measurement used is total assets, and there could be industries, were there is no need for large assets and therefore the company is considered smaller than it actual is. Another measurement that could have been used as a measurement for size, is the size of the offering. But since there is no rule, that the company should sell all their shares at the IPO, this measurement could also be wrong.

The hypothesis assumes that larger companies are more monitored by the shareholder and therefore there is less asymmetric information, and this reduces underpricing. But larger companies are also often less flexible and more bureaucratic, and they are could be more difficult to price due to complexity and size.

11.2.8 Age of the company

Hypothesis 7

*Older companies are less underpriced.*

25 See correlation figure in appendix 5
The hypothesis states that older companies are less risky and easier to price. In section 10.1.4 it was found, that there were a medium correlation between size and age of the company. The hypotheses of size and underpricing were rejected and therefore it is likely that this hypothesis is also rejected, but since the correlation coefficient was only 0.45 a test is also made between age and underpricing.

The correlation coefficient between age and size is found to be -0.08. The coefficient has the right sign but is small\(^{26}\). The companies are divided into 2 groups; old and small companies:

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
<th>(\sigma)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old</td>
<td>5%</td>
<td>3%</td>
<td>9%</td>
</tr>
<tr>
<td>Young</td>
<td>3%</td>
<td>0%</td>
<td>11%</td>
</tr>
</tbody>
</table>

Table 22- Initial return distributed into old and young companies.

There is a small difference in the mean and medians of the 2 groups but when the Mann Whitney test is applied there is a 24% probability that the 2 medians are similar. Therefore this hypothesis that there is a relationship between age and underpricing are also rejected.

11.2.9 Introduction method

**Hypothesis 8**

*There are differences in underpricing depending in the type of the offer.*

In the period of this analysis there have been 2 different ways of offering the shares in an IPO; the bookbuilding and the fixed price method. In this section the hypothesis, that there is lower underpricing, when the IPO is done by bookbuilding, is tested.

The 95 observations are divided into 2 groups, those done by the fixed method and those done by the bookbuilding method. This gives 2 samples one with 61 observations done by the bookbuilding method and one with 34 observations done by the fixed price method.

<table>
<thead>
<tr>
<th>Method</th>
<th># IPOs</th>
<th>Initial return</th>
<th>Median</th>
<th>(\sigma)</th>
<th>Max</th>
<th>Min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bookbuilding</td>
<td>61</td>
<td>3%</td>
<td>2%</td>
<td>8%</td>
<td>29%</td>
<td>-13%</td>
</tr>
<tr>
<td>Fixed Price</td>
<td>34</td>
<td>6%</td>
<td>2%</td>
<td>12%</td>
<td>37%</td>
<td>-14%</td>
</tr>
</tbody>
</table>

Table 23 - Descriptive statistic for the offer method of IPOs.

\(^{26}\) See correlation figure in appendix 6
The average underpricing is higher when the offer is done by a fixed price. The medians are the same and the minimum values are almost the same in the 2 samples. This indicates that there are some IPOs offered at a fixed price, which have really high initial return. There are 9 IPOs in the samples, which had an underpricing larger than 20% 6 of these are done by the fixed price method.

To test if there are differences between the initial return in the 2 samples, the Mann Whitney U-test is used. The null hypothesis is that there are no differences in the median of the 2 samples. The test show a probability of 0.29 of these to samples having similar medians, this is higher than the significant value of 5% and it cannot be rejected that the 2 samples have similar medians.

The Mann Whitney test is done by comparing medians, but in the table above it can be seen, that there is 3% point difference between the mean of the offer methods. Therefore it is concluded, that there can be observed differences in underpricing depending on the offer method. The difference is however not statistically different, when comparing medians. So it looks like the bookbuilding method leads to lower underpricing.

The bookbuilding method is also expected to lead to more accurate pricing, since the method set the price after the demand in the market. More accurate pricing could be seen by lower underpricing but another way to see more accurate pricing is by less variation in underpricing.

The variance of underpricing by the bookbuilding method is 8% where it is 12% or the fixed price method. There is less variation in underpricing, when the offer is done by the bookbuilding method. If we look at the highest underpriced shares and the 3 highest overpriced shares, 4 of these 6 IPOs are done by the fixed offer method. It looks like the bookbuilding method helps the company to get a more accurate offer price. So the offer price will be closer to the actual price at the first day of trading.

IPOs done by the fixed method had higher average initial return, but IPOs done by this method were also more risky and some of the most overpriced in the sample. The findings can therefore not be used to make recommendations for investor depending on the offer method.

### 11.3 Recommendations for investor

The purpose of this analysis was to see if there were properties in an IPO that can explain or predict higher or lower underpricing of IPOs. In this section these findings will be listed to see, if they can be used for investors.
The analysis of countries showed that the largest initial return in the sample where from Danish IPOs and that Norwegian IPOs on average not have had initial return different from zero. But since Norway has had some IPOs with high initial return, investor will not be recommended to stay away from Norwegian IPOs.

There were found significant differences between underpricing of IPOs when the market was hot, and when the industry index was performing better than average. But there could not be found any properties about the specific company, e.g. size, age or industry that could help predict higher or lower underpricing. IPOs done by the fixed method were found to have higher underpricing, but they were also more risky.

Investors should invest in IPOs at the offer period and sell at the first day of trading when these 2 conditions are present:

1. In hot periods – Periods with more IPO activity and underpricing higher than average.
2. When the industry index performance is higher than average 3 months prior to the IPO.

If these recommendations were used on IPOs from 2002 to 2010 investors would have invested in 36 IPOs and have gotten a first day return of 9%.

<table>
<thead>
<tr>
<th>No. IPOs</th>
<th>Mean</th>
<th>Median</th>
<th>σ</th>
<th>Min</th>
<th>Max</th>
<th>% underpriced IPOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>9%</td>
<td>6%</td>
<td>12%</td>
<td>-14%</td>
<td>37%</td>
<td>83%</td>
</tr>
</tbody>
</table>

Table 24 - Descriptive statistics for those IPOs investors should have invested in if the recommendations were followed.

The table above shows the descriptive statistic for the IPOs, that investors would have invested in if the recommendations were followed. Investor would have got a return of 9% which is higher than the average 4% for all the IPOs. 29 of the 36 IPOs that were overpriced would have been avoided. But the standard deviation in these recommended IPOs is higher than for the whole sample, and the recommendations have not removed the IPO, that had the highest overpricing.

The recommendations can help investor to sort out some of the IPOs with low initial return, but it looks like there is something else that makes IPOs more or less underpriced. These properties could be more specific properties about the individual company performing the IPO than those tested for in the analysis. The problem with more specific properties is that these are costly to find and measure for investor and the cost of these could be too high compared to the gained return.
11.4 Conclusion on analysis

In this section the findings in from testing the 8 hypothesis are summarized and the conclusion on this section is made.

3 of the 8 hypothesis were accepted, 4 were rejected and 1 showed differences in underpricing but the difference were not significant.

The analysis of underpricing in Scandinavia showed, that the whole sample had an average underpricing of 4% from 2002 to 2010 and that this was significant different from zero at the 1% level. The underpricing in the 3 countries showed that Denmark has had the largest average underpricing, and Norway have had the lowest. The statistical test showed that at the 5% level both Denmark and Sweden have had underpricing different than zero.

Investors could therefore have made a return of 4% from investing in all Scandinavian IPOs, and even more from investing in Danish or Swedish IPOs issued from 2002 to 2010. The average investment in Norwegian IPOs would only have made a small initial return.

There were found more underpricing from 2004 to 2007, and there were found correlation between number of IPOs and underpricing for each of the years. The test for differences between hot and cold periods showed significant difference between the median of the 2 samples. Investors could have earned 4% point higher initial return by investing in IPOs in hot periods compared to cold periods. Hot periods are correlated with index performance, and there were also found to be higher underpricing in periods with high stock market index performance 3 months prior to the IPO.

The analysis of differences in underpricing between industries showed that there were some industries that were more underpriced than others. But the differences were not significant. Industries that have been more underpriced in earlier analyses were not higher underpriced, and there were no correlation between industry Beta values and underpricing. The analysis also showed that there were no differences in underpricing when testing for stock market volatility and the size or age of the company.

When the offer method was done by the fixed offer method, there was higher average initial return. But IPOs done by this method were also more risky and some of the most overpriced in the sample. And the median of initial return in IPOs done by the fixed method were not significant different from IPOSs done by the bookbuilding method.
The analysis showed that there are some properties in the market that can help investors predict the level of underpricing, but there were not found any properties about the company that would help investors predict the level of underpricing.

It should furthermore be noticed that these findings are done on IPOs done in the past. It is not certain that these properties will also affect underpricing in future IPOs. But since they have had significant influence on underpricing the last 8 years, they should have some affect in the future.

12 Compare to earlier studies

In this section the findings from the analysis is compared to other studies. This is done by comparing the findings to international findings and to findings from Scandinavia. The differences and reasons for these are discussed.

12.1 General underpricing

The analysis of underpricing showed that there were average underpricing in the whole sample and in all 3 countries, and therefore hypothesis 1 were accepted.

<table>
<thead>
<tr>
<th></th>
<th>DK</th>
<th>SE</th>
<th>NO</th>
<th>Scandinavia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average underpricing</td>
<td>10%</td>
<td>5%</td>
<td>2%</td>
<td>4%</td>
</tr>
<tr>
<td>No. IPOs</td>
<td>19</td>
<td>27</td>
<td>49</td>
<td>95</td>
</tr>
</tbody>
</table>

Table 25 - Underpricing in the 3 countries and in Scandinavia

The average underpricing in the whole sample were 4%. These findings are much smaller that international studies, but are more similar to Scandinavian research.

Compared with figures for the U.S. and other European countries (see Figure 3), the average underpricing found in this analysis is very low. When looking at underpricing in each of the countries, it were found that Denmark had the highest underpricing of 10% and Norway had the lowest at 2%. When comparing these results to earlier findings in Scandinavia, the results are somehow similar.

The findings in Denmark are consistent with earlier findings. Ritter(2010) found underpricing in Denmark from 1984-2006 of 8% and various earlier thesis’s(among others; L. Nielsen and R Pedersen) found underpricing around 10%.

Underpricing in Sweden was found to be 5% in the years investigated. This is much lower than findings in earlier studies. Rydqvist (1999) found average underpricing of 31% in
Swedish IPOs from 1980-1998 and Ritter(2010) found an average underpricing of 27% for Sweden in IPOs from 1980-2006. Earlier thesis (among others Niiranen& Jerresan and Alm, Berglund & Falk) have found underpricing in the range of 10-25%.

The Norwegian IPOs were those with the lowest underpricing. In earlier studies Norway has been found to have higher underpricing than found in this analysis. Ritter (2008) found underpricing in Norway of 10%(years 1984- 2006) and Ruud and Ullevoldsæter (1987) found underpricing of 15% (years 1982-1986) while later thesis’s found underpricing of 3-5% (Barrera & Langmoen 2009).

The deviation between this study and previous studies could be due to 2 reasons; the method used to calculate underpricing or differences in data.

12.1.1 Differences in the method
The formula used to calculate underpricing are almost the same compared to earlier studies. Some earlier studies have not subtracted initial return by an index. However most studies have subtracted and index, and those where no index is subtracted is arguing that there are no substantial change in initial return, by doing it.

Another area where the method is different is by the days used to measure initial return. Most Earlier studies (e.g. Loughran and Ritter (2003)) have used 1 day return to measure initial return, but a few studies have used more than 1 day to measure the initial return (Håland (1994) used 5 days, Ruud & Ullevoldsæter (1987) used 3 days). To be sure that the difference in the results found in this study, is not due to the period chosen for initial return, the initial return for 3 and 5 days are calculated:

<table>
<thead>
<tr>
<th></th>
<th>DK</th>
<th>SE</th>
<th>NO</th>
<th>Scandinavia</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 days initial return</td>
<td>8%</td>
<td>4%</td>
<td>2%</td>
<td>4%</td>
</tr>
<tr>
<td>5 days initial return</td>
<td>5%</td>
<td>4%</td>
<td>2%</td>
<td>3%</td>
</tr>
</tbody>
</table>

Table 26 - Initial return 3 days and 5 days after the IPO.

By using different days for initial return, the results in Denmark and Sweden decreases, but the overall results doesn’t change. So the difference in these results, compared to earlier finding, is not due to the use of different days.

12.1.2 Differences in the data
This study is based on newer data than most of the earlier research. Earlier research is based on IPOs done in the 80s and 90s. Here some really large initial returns can be found. Looking
at earlier findings, the average underpricing are lower, but the median have not decreased by much. This indicates that there are fewer really high initial returns.

From comparing the findings in this analysis, it looks like average underpricing have decreased through the years. The really high initial returns are not so common anymore, which could be because the underwriters are getting better at pricing the issues. Earlier, most IPOs were offered at a fixed price, but since the 00’s, the bookbuilding method has become the most used. In this sample 64% of the IPOs are offered by the bookbuilding method. The decrease in highly underpriced IPOs could be due to more use of the bookbuilding method and better market feedback and therefore more precise pricing.

The years investigated could also affect the level of underpricing. The analysis starts right after the IT crisis and the attack at 9/11. The first 2 years of the sample, there are few IPOs and low underpricing. This could be due to low expectations in the market from investors and companies. After this period, there are 4 good years where a lot of IPOs and higher underpricing can be seen. In 2008 and 2009 there is financial crisis in all markets and there are again few IPOs and low underpricing. In the analyses it was shown, that both number of IPOs and underpricing is highly affected by the performance in the markets. The data sample has only 3 hot years, the rest is cold (2010 is not defined). So the domination of years with low stock market performance in the sample could be the reason that underpricing is lower than other studies.

Overall by comparing this study with earlier studies, underpricing in Sweden and Norway has decreased. This could indicate that investors, issuers and underwriters are aware of the underpricing, and that it have decreased. In Denmark the average underpricing are much similar to earlier findings. But, earlier, Denmark has also been the country with more moderate underpricing.

12.2 Hypotheses
In this section the hypotheses are compared to earlier findings and the differences is discussed.

Hypotheses 2 and 3 were accepted. The findings were a bit less significant than earlier studies in the test of both hypotheses. The average underpricing in this sample is lower than earlier studies, and this is probably the reason for less significant results.

The next 4 hypotheses tested if the uncertainty of the IPO would lead to higher underpricing, and they were all rejected. The hypotheses had 4 different measurements for risk of the IPO.
Hypothesis 4 tested for properties in the market at the time of the IPO, and the last 3 hypotheses tested different properties of uncertainty, for the company performing the IPO.

12.2.1 Volatility in the market prior to the IPO
In hypothesis 4 it was expected to find, that the degree of underpricing increases when the industry stock index's volatility increase. The analysis found no correlation and no difference in initial return done in periods with high or low volatility, and rejected the hypothesis.

A study of Turkish IPOs made by Kucukkocaoglu (2008) finds that increased volatility ahead of an IPO is positively correlated with the degree of underpricing. The same is found by Derri & Womack (2006) in French IPOs.

Other studies such as Schill (2004), that studied U.S. IPOs in the period 1970-1998, found no clear relationship between the underpricing of IPOs and the volatility in the market ahead of the IPO.

Since earlier research has shown different results of this hypothesis, the conclusion is that there is no clear relationship or that the relationship is much dependent on the data; the years and the country investigated.

12.2.2 Differences in underpricing across industries
Hypothesis 5 tested if there were more underpricing in different industries. The hypothesis found that there were small differences between different industries, but there could not be concluded anything about the differences.

Many earlier analyses have found that high risk industries were more underpriced. High risk industries have often been defined as high-tech and Internet businesses. Loughran & Ritter (2003) investigated IPOs in US from 1980-2000 and found that IT and high tech industries were underpriced by 30% compared to other industries that were underpriced by 11%. Later Alm, Berglund & Falk(2009) found large differences between underpricing in IT industries and other industries in Swedish IPOs from 98-2007. The IT industry had an underpricing of 59% compared to the average underpricing of 23%.

Both of these studies have investigated IPOs done in years around the IT bubble period. 1997-2000 are known as the years where a lot of IT-companies went public. The investors had high expectations and there were a high demand for these types of companies. This resulted in high underpricing for most IT companies. But in 2001 the IT bubble burst, and there were much more skepticism about these types of companies. The reason for the large difference in earlier research could be because the IT companies were in a period of high demand. The risk of the
different industries differs in cyclusses. From this analysis it looks like there are no high risk industries right now. In the future the risk of industries could change and perhaps periods like the IT bubble could be seen again, and it would be expected that IPOs in this industry in this period would be more underpriced than other industries. But from 2002-2010 the industry of the IPO company have not been able to predict the level of underpricing. More company specific measures could be more suited to predict the level of underpricing. This is also supported by the fact that there are large differences in underpricing of companies in the same industry.

Furthermore the data sample is small and when it is divided into industries for each country the number of IPOs in each industry get small. Therefore the individual companies’ weight a lot on the average initial return and it is difficult to say something in general about IPOs in the industries. Much earlier research has been made on larger samples, and therefore it could be easier to see differences between industries.

12.2.3 Size and age of the company

Hypothesis 6 and 7 tested for differences between underpricing and the size and the age of the company. The hypotheses wanted to test for more company specific risk measures, and the expectations were that larger and older companies were less risky and therefore less underpriced. Both hypotheses were rejected, there was a low correlation between the 2 variables and underpricing and there were no significant difference between larger or older companies and underpricing.

There have been many earlier analyses of age and size of the company and underpricing. In 1986 Beatty and Ritter found a relationship between underpricing and ex ante uncertainty. As measures of uncertainty, they used the amount of money raised in the IPO. It would be expected that the amount of money raised is correlated with the size of the company. But since the company doesn’t have to issue all their shares, these 2 measurements are not the same.

In 2003 Loughran & Ritter (2003) investigated US IPOs from 1980-2000 and found that large proceeds were 12% more underpriced than small proceeds and that younger companies were 11% more underpriced than old companies. Scandinavian studies (Pedersen 2002, Barrera & Langmoen 2008) have found the same results, but the difference is much lower and many of the studies have not been able to prove significant differences.
It is interesting that these studies find that large and young companies are more underpriced. In this study the age of the company is correlated by 0.45 with the size, therefore many of the old companies will be large and many of the young companies will be small, and this could be the reason that this study finds no difference in underpricing. To see if the findings from earlier analyses can be applied on this data, the companies that are young and large are filtered out. The underpricing of this group is found to be 0.13% and is actually lower than average underpricing in the sample.

Most of the studies that have accepted these 2 hypotheses are done on IPOs from US. The reason that this study doesn’t find evidence of these hypotheses could be due to differences in the companies going public, between US and Scandinavia. Earlier research (Vandemaele (2003)) have found that the median age of European IPOs, during 1984-1995, was 28 years. Meanwhile, Loughran and Ritter (2003) found that the median age was 7 years of US IPOs during 1980-2000. In this sample the average age of the companies going public are 23 years, which shows that companies are older than in US when going public. If younger companies are more underpriced the age of the companies in this sample could be the reason for lower underpricing than earlier research done in US.

12.2.4 Offer method
Hypothesis 8 tested for differences in underpricing depending in the type of the offer. The analysis showed 3% point’s higher average underpricing, when the IPO were offered at a fixed price, but the medians were similar.

Studies done before 2000 have shown large differences in underpricing between offering methods (see Ritter(1998) and Jenkinson & Ljungqvist, 2001). Research done after 2000 (see Nielsen 2002 and Kalstad 2007) have found result more similar to this thesis; higher underpricing when the fixed price methods is used, but the difference is small and is not significant. So the difference between underpricing in the 2 methods has been reduced through time.

In earlier analyses there have been really high initial returns when the fixed offer method is used. In this analysis 6 of the 7 highest initial returns are offered by the fixed price method, but 2 of the 3 most overpriced IPOs are also done by the fixed offer price and the variance is largest in this type of offer. So the reason for less difference between the 2 offer methods could be due to better price of IPOs.
In the 80s and 70s the most used method were the fixe method. The bookbuilding method were introduced in Scandinavia in the 90s (Ritter 2003), and today the most used offer method is bookbuilding. There could not be found evidence from Scandinavia before 2000 that tested for differences between offer methods and therefore it is unknown, whether there has never been a difference in initial return between the 2 methods or if IPOs are more accurate priced today.

13 Discussion of the findings

It was found that underpricing existed in Scandinavia, but the analysis rejected 5 of the 8 hypotheses and there could not be found company specific properties that could predict more or less underpricing. The only advice to give to investors, that want to invest in initial return of IPOs, was to invest, when the market is hot, and when the industry index is performing better than on average.

The problem with these 2 recommendations is, that in these periods most other investors are optimistic and there is large demand for IPOs. The individual investors will therefore get fewer shares than they would like.

Earlier analysis of underpricing, both in foreign countries and in Scandinavia, has found large average initial return. This analysis showed low underpricing, and it rejected 5 hypotheses that there have been found evidence for before.

There could be many reasons why this analysis differs from earlier analyses. The two main reasons will be discussed below:

Small sample

All 3 stock exchanges are small and therefore the sample of Scandinavian IPOs contains few observations. When using a small data sample, each of the observations affects the results more than in large samples. Therefore the results may be affected significant by deviations. By taking out the 3 outliers some of these errors are corrected. But there could be others deviations that are not easy to identify that the data have not been corrected for.

27 The law of large numbers.
Another disadvantage by having a small sample is that it is difficult to test for more specific properties. It would have been preferred to conduct more tests that could show something about the company, but since the sample were small and from 3 different countries this was not possible.

**Changes in underpricing**

The average underpricing found in this study were 4%. This result is substantially lower than the findings from similar studies conducted several years ago. Compared to more recent studies the results are more similar. Earlier findings have found large differences in underpricing in different years, and it is obvious, that the underpricing depends largely on the specific years included in the study. This study includes 5 cold years, with low initial return. The percentage of cold years in the sample could be a plausible explanation for the low average return in the sample.

A different reason for the lower underpricing of IPOs in this sample could be a general decrease in underpricing. There has been much focus on the issue of underpricing in the 90s and in the start of the 00s. This has increased the awareness of underpricing of IPOs. Investors are aware of this large probability of making a high first day return, and there could be investors, that have speculated in IPOs, by selling them at the first day of trading. The issuers use underpricing as a way to attract investors to their company. If the buyers only invest to get the first day return, the issuers are less willing to ‘leave money on the table. The increased awareness of underpricing of IPOs could also lead to higher demand for IPOs, and therefore the issuer won’t need to underprice the shares by much.

This analysis still found that underpricing exists, but it was only moderate. Underpricing is a way for issuers to get the investors to buy the new issued shares. If investor already owns other shares, there must be something extra to attract the investor to buy shares in the IPO. Underpricing is often seen as a way to attract investors to these new and often more risky issues. If the shares were not underpriced, investors would not have the same motivation for buying the new shares, and the offer might not be fully subscribed. Even though underpricing has decreased, it would be expected that IPOs would continue to be underpriced.

28 This can be seen as an increasing amount of articles about IPOs and underpricing in these years.
For investors to get the initial return they would have to invest in the offer period and sell at the first day of trading. This period is on average 4 days in this sample. Investors would probably have their money invested in other investments, and they need to withdraw their money from these investments to buy the IPOs shares. The initial return in this sample is not high compared to the cost of buying and selling the shares in the few IPOs in Scandinavia that could be profitable.

14 Conclusion
The purpose of this thesis were to analyze if underpricing existed in Scandinavia and if there could be found properties, regarding Scandinavian IPOs, that could predict higher or lower underpricing. And if these properties could be used for investors to choose which IPOs that would be most profitable.

The analysis investigated average underpricing of IPOs done in Scandinavia from 2002-2010 and found an average underpricing of 4%. The results showed overall underpricing of 10% in DK, 5% in SE and 2% in NO. These findings were lower than earlier findings in both other countries and in Scandinavia.

The properties that could affect the degree of underpricing were described in 7 hypotheses. Only 2 of these hypotheses were accepted. There were found higher underpricing in periods with more IPOs than on average, called hot markets, and in periods with high stock market index performance 3 months prior to the IPO. There could not be found evidence of significant higher underpricing depending on the industry, the volatility in the market, the size or age of the company or depending on the offer method.

The analysis could only find 2 properties that could be used as recommendations to investors. In periods when these 2 conditions were fulfilled, investor should buy shares in IPOs and sell them at the first day of trading. If this was done in IPOs from 2002-2010 investors could have earned 9% initial return. The problem with these recommendations is, that in periods were the markets are “hot” and the stock market is performing well, there are large demands for IPOs, and investor will often get a lower fraction of the shares, than the requested. Furthermore the return, that could have been earned if the recommendations were followed on this sample, is not high enough compared to the cost of withdrawing money from other investments.
When comparing the results, in this thesis to earlier research, the data sample is smaller and the average underpricing is lower. A small data sample makes the tests less reliable. If the data sample has been larger it could have given other results, and maybe some of the hypotheses would not have been rejected.

The reason for finding lower underpricing in this thesis could be due to the years investigated or a general decrease in underpricing of IPOs. The years investigated contains many cold years, in these years there is seen low or negative underpricing and few IPOs. This could be a reason that there is found less underpricing in this thesis.

Another reason for the lower underpricing could be due to increased awareness of underpricing and more accurate pricing of IPOs. This sample contains more moderate initial returns than earlier research. This could indicate that issuers are becoming better at pricing IPOs and that they don’t need really high initial returns, to attract investors.

Underpricing is a way for companies to attract investors to buy the shares in the IPO, so it is expected to see underpricing in the future, but from the trend found in this thesis it is not expected to see really high initial returns in the future.

Therefore the conclusion of this thesis is that there are few properties of IPOs that can help predict higher or lower level of underpricing. But since there are found no properties about the individual company and since the average underpricing in Scandinavia has decreased, the properties cannot be used to give recommendations for future investments in IPOs. Underpricing of Scandinavian IPOs should be seen as a way to attract new long term investors to the IPO. It should not be a way for investors to make a quick profit.
15 Literature


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16 Appendix:

List of appendixes:

Appendix 1: List of Ipos: ........................................................................................................75

appendix 2: Relationship between underpricing and number of Ipos: ........................................77

appendix 3: Correlation between underpricing and market index performance ................................78

appendix 4: Correlation between market index volatility and underpricing ................................78

appendix 5: Correlation between size of the company and underpricing ......................................78

appendix 6: Correlation between age of the company and underpricing .......................................78
### Appendix 1: List of IPOs:

<table>
<thead>
<tr>
<th>Company</th>
<th>Offer method</th>
<th>1st day of trading</th>
<th>Offer price</th>
<th>Initial return</th>
<th>Age</th>
<th>Size</th>
<th>Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morpol ASA</td>
<td>bookbuilding</td>
<td>30-06-2010</td>
<td>22</td>
<td>-6,54%</td>
<td>14</td>
<td>1.779.060</td>
<td>Consumer staples</td>
</tr>
<tr>
<td>Wilh. Wilhelmsen ASA</td>
<td>Fixed price</td>
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<td>MQ holding AB</td>
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<td>Consumer discretionary</td>
</tr>
<tr>
<td>Chr. Hansen</td>
<td>bookbuilding</td>
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<td>2.211.117</td>
<td>Materials</td>
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<tr>
<td>Byggmax group AB</td>
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<td>02-06-2010</td>
<td>46</td>
<td>5,4%</td>
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<td>Consumer discretionary</td>
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<td>P/f Bakkafrøst</td>
<td>bookbuilding</td>
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<td>11,38%</td>
<td>42</td>
<td>365.779</td>
<td>Consumer staples</td>
</tr>
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<td>bookbuilding</td>
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<td>-2,3%</td>
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<td>983.196</td>
<td>Utilities</td>
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<td>Cimber Sterling Group A/S</td>
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<td>-11,02%</td>
<td>59</td>
<td>1.080.383</td>
<td>Industrials</td>
</tr>
<tr>
<td>Investea Sweden Properties A/S</td>
<td>Fixed price</td>
<td>15-12-2008</td>
<td>386</td>
<td>-12,92%</td>
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<tr>
<td>Prime Office A/S</td>
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<td>10-07-2008</td>
<td>103,75</td>
<td>1,30%</td>
<td>0</td>
<td>37.497</td>
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<tr>
<td>NunaMinerals A/S</td>
<td>bookbuilding</td>
<td>25-06-2008</td>
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<td>-1,47%</td>
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<td>136.734</td>
<td>Materials</td>
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<tr>
<td>DGC One AB</td>
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<td>16-06-2008</td>
<td>33</td>
<td>10,8%</td>
<td>21</td>
<td>118.355</td>
<td>Telecom</td>
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<tr>
<td>Hafslund Infratek ASA</td>
<td>bookbuilding</td>
<td>05-12-2007</td>
<td>18</td>
<td>-1,69%</td>
<td>5</td>
<td>864.959</td>
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<tr>
<td>Duni AB</td>
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<td>0,3%</td>
<td>58</td>
<td>2.780.748</td>
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<td>HMS Networks AB</td>
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<td>1,7%</td>
<td>19</td>
<td>275.030</td>
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<td>Systemair AB</td>
<td>bookbuilding</td>
<td>12-10-2007</td>
<td>78</td>
<td>-0,1%</td>
<td>33</td>
<td>1.375.965</td>
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</tr>
<tr>
<td>Pronova BioPharma ASA</td>
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<td>3,48%</td>
<td>72</td>
<td>2.689.918</td>
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<tr>
<td>Griffin IV Berlin A/S</td>
<td>Fixed price</td>
<td>06-07-2007</td>
<td>2</td>
<td>0,28%</td>
<td>0</td>
<td>2.163.779</td>
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<tr>
<td>Færøya Banki P/F</td>
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<td>21,69%</td>
<td>101</td>
<td>8.416.923</td>
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<tr>
<td>Nordic Tankers A/S</td>
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<td>12-06-2007</td>
<td>85</td>
<td>9,41%</td>
<td>23</td>
<td>1.176.736</td>
<td>Industrials</td>
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<td>Exion A/S</td>
<td>bookbuilding</td>
<td>29-05-2007</td>
<td>40</td>
<td>12,50%</td>
<td>12</td>
<td>229.470</td>
<td>Health Care</td>
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<td>Nederman Holding AB</td>
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<td>16-05-2007</td>
<td>87</td>
<td>9,8%</td>
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<tr>
<td>SalMar ASA</td>
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<td>08-05-2007</td>
<td>39</td>
<td>-0,21%</td>
<td>16</td>
<td>2.383.565</td>
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<tr>
<td>Klepp Sparebank</td>
<td>Fixed price</td>
<td>03-05-2007</td>
<td>110</td>
<td>10,38%</td>
<td>84</td>
<td>4.267</td>
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<tr>
<td>Electromagnetic Geoservices ASA</td>
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<td>30-03-2007</td>
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<td>7,78%</td>
<td>5</td>
<td>664.087</td>
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<tr>
<td>Rem Offshore ASA</td>
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<td>30-03-2007</td>
<td>40</td>
<td>6,52%</td>
<td>11</td>
<td>2.223.958</td>
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<tr>
<td>Algeta ASA</td>
<td>bookbuilding</td>
<td>27-03-2007</td>
<td>47</td>
<td>-5,17%</td>
<td>10</td>
<td>178.110</td>
<td>Health Care</td>
</tr>
<tr>
<td>NEAS ASA</td>
<td>bookbuilding</td>
<td>23-03-2007</td>
<td>33</td>
<td>-4,45%</td>
<td>19</td>
<td>210.844</td>
<td>Industrials</td>
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<tr>
<td>Tilgin AB</td>
<td>Fixed price</td>
<td>15-12-2006</td>
<td>25</td>
<td>-14,4%</td>
<td>9</td>
<td>226.311</td>
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<tr>
<td>Spits ASA</td>
<td>bookbuilding</td>
<td>12-12-2006</td>
<td>16</td>
<td>-0,84%</td>
<td>0</td>
<td>45.428</td>
<td>Consumer staples</td>
</tr>
<tr>
<td>FirstFarms A/S</td>
<td>Fixed price</td>
<td>12-12-2006</td>
<td>105</td>
<td>-3,67%</td>
<td>1</td>
<td>508.818</td>
<td>Consumer Staples</td>
</tr>
<tr>
<td>Faktor Eiendom ASA</td>
<td>bookbuilding</td>
<td>08-12-2006</td>
<td>35</td>
<td>-4,11%</td>
<td>5</td>
<td>579.706</td>
<td>Financials</td>
</tr>
<tr>
<td>Rovsing A/S</td>
<td>Fixed price</td>
<td>05-12-2006</td>
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<td>16,27%</td>
<td>14</td>
<td>31.430</td>
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<tr>
<td>Lindab International AB</td>
<td>bookbuilding</td>
<td>01-12-2006</td>
<td>110</td>
<td>2,5%</td>
<td>135</td>
<td>6.043</td>
<td>Industrials</td>
</tr>
<tr>
<td>Griffin III Berlin A/S</td>
<td>Fixed price</td>
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<td>2</td>
<td>15,89%</td>
<td>0</td>
<td>1.720.643</td>
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<tr>
<td>Rezidor Hotel Group</td>
<td>bookbuilding</td>
<td>28-11-2006</td>
<td>52</td>
<td>2,8%</td>
<td>46</td>
<td>2.822.345</td>
<td>Consumer discretionary</td>
</tr>
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<td>BE Group AB</td>
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<td>24-11-2006</td>
<td>62</td>
<td>6,2%</td>
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<td>2.081.244</td>
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<td>LifeCycle Pharma A/S</td>
<td>bookbuilding</td>
<td>13-11-2006</td>
<td>44</td>
<td>7,40%</td>
<td>4</td>
<td>321.707</td>
<td>Health Care</td>
</tr>
<tr>
<td>Company</td>
<td>Offer method</td>
<td>1st day of trading</td>
<td>Offer price</td>
<td>Initial return</td>
<td>Age</td>
<td>Size</td>
<td>Industry</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------------</td>
<td>--------------------</td>
<td>-------------</td>
<td>----------------</td>
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<td>----------------------------</td>
</tr>
<tr>
<td>AKVA group ASA</td>
<td>bookbuilding</td>
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<td>-0,95%</td>
<td>5</td>
<td>1.316.680</td>
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<tr>
<td>Det norske oljeselskap ASA</td>
<td>Fixed price</td>
<td>10-11-2006</td>
<td>60</td>
<td>5,78%</td>
<td>21</td>
<td>295.291</td>
<td>Energy</td>
</tr>
<tr>
<td>Codfarmers ASA</td>
<td>bookbuilding</td>
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<td>26</td>
<td>-8,49%</td>
<td>4</td>
<td>128.012</td>
<td>Consumer staples</td>
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<td>Mondo A/S</td>
<td>Fixed price</td>
<td>06-10-2006</td>
<td>11,5</td>
<td>1,53%</td>
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<td>51.930</td>
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<tr>
<td>Biovitrum AB</td>
<td>Fixed price</td>
<td>15-09-2006</td>
<td>100</td>
<td>11,5%</td>
<td>5</td>
<td>1.940.710</td>
<td>Health Care</td>
</tr>
<tr>
<td>Clavis Pharma ASA</td>
<td>Fixed price</td>
<td>07-07-2006</td>
<td>45,5</td>
<td>-0,45%</td>
<td>5</td>
<td>114.175</td>
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</tr>
<tr>
<td>Trolltech ASA</td>
<td>bookbuilding</td>
<td>05-07-2006</td>
<td>16</td>
<td>9,38%</td>
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<td>Ability Group ASA</td>
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<td>-3,23%</td>
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<td>75</td>
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<td>Fixed price</td>
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<td>11-04-2006</td>
<td>20</td>
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<tr>
<td>Gant Company AB</td>
<td>Fixed price</td>
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<td>33</td>
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<tr>
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<td>28,30%</td>
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<td>14-12-2005</td>
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<tr>
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<tr>
<td>Odim ASA</td>
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<td>0,0%</td>
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<td>-7,30%</td>
<td>15</td>
<td>65.941</td>
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<td>BW Gas ASA</td>
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<td>82</td>
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<td>24-10-2005</td>
<td>44</td>
<td>-1,62%</td>
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<td>209.448</td>
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<td>Powel ASA</td>
<td>bookbuilding</td>
<td>24-10-2005</td>
<td>15</td>
<td>0,18%</td>
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<td>TrygVesta A/S</td>
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<td>14-10-2005</td>
<td>230</td>
<td>10,87%</td>
<td>3</td>
<td>36.357</td>
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<td>Bluewater Insurance ASA</td>
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<td>13-10-2005</td>
<td>30</td>
<td>3,62%</td>
<td>4</td>
<td>698.975</td>
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<td>Hemtex AB</td>
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<td>06-10-2005</td>
<td>56</td>
<td>20,4%</td>
<td>32</td>
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<td>Indutrade AB</td>
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<td>05-10-2005</td>
<td>65</td>
<td>12,7%</td>
<td>27</td>
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<td>23-09-2005</td>
<td>11</td>
<td>-5,93%</td>
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<td>11-07-2005</td>
<td>65</td>
<td>1,54%</td>
<td>0</td>
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<td>33,15</td>
<td>-10,80%</td>
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<td>197.237</td>
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<td>Revus Energy ASA</td>
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<td>42</td>
<td>4,76%</td>
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<td>505.280</td>
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<td>24-06-2005</td>
<td>46</td>
<td>3,26%</td>
<td>18</td>
<td>1.512.297</td>
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<td>TopoTarget A/S</td>
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<td>16,89%</td>
<td>5</td>
<td>237.687</td>
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<tr>
<td>Norway Energy &amp; Marine Insurance ASA</td>
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<td>16</td>
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<tr>
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<td>13-05-2005</td>
<td>29</td>
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<td>Company</td>
<td>Offer method</td>
<td>1st day of trading</td>
<td>Offer price</td>
<td>Initial</td>
<td>Age</td>
<td>Size</td>
<td>Industry</td>
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<tr>
<td>Oslo Areal ASA</td>
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<td>53</td>
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<td>15</td>
<td>3.743.368</td>
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<tr>
<td>Polimoon ASA</td>
<td>Fixed price</td>
<td>26-04-2005</td>
<td>21,5</td>
<td>-1,40%</td>
<td>21</td>
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<tr>
<td>International Maritime Exchange ASA</td>
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<td>04-04-2005</td>
<td>81</td>
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<td>Financials</td>
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<tr>
<td>Wilson ASA</td>
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<td>17-03-2005</td>
<td>19,5</td>
<td>1,64%</td>
<td>63</td>
<td>669.970</td>
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<tr>
<td>NOTE AB</td>
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<td>23-06-2004</td>
<td>75</td>
<td>-9,3%</td>
<td>62</td>
<td>331.714</td>
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<td>Unibet Group Plc</td>
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<td>08-06-2004</td>
<td>135</td>
<td>23,7%</td>
<td>7</td>
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<td>25-05-2004</td>
<td>25</td>
<td>0,00%</td>
<td>11</td>
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<td>Mamut ASA</td>
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<td>7</td>
<td>0,37%</td>
<td>10</td>
<td>120.381</td>
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<tr>
<td>Aker Kværner ASA</td>
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<td>02-04-2004</td>
<td>130</td>
<td>-2,69%</td>
<td>37</td>
<td>17.546.495</td>
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<td>Catch Communications ASA</td>
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<td>29-03-2004</td>
<td>20</td>
<td>-1,66%</td>
<td>4</td>
<td>473.863</td>
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<td>Oriflame Cosmetics S.A.</td>
<td>bookbuilding</td>
<td>24-03-2004</td>
<td>190</td>
<td>9,7%</td>
<td>37</td>
<td>2.168.532</td>
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<td>Opera Software ASA</td>
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<td>11-03-2004</td>
<td>10</td>
<td>14,00%</td>
<td>9</td>
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<td>bookbuilding</td>
<td>19-12-2003</td>
<td>25</td>
<td>-13,06%</td>
<td>3</td>
<td>1.971.400</td>
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<td>Norwegian Air Shuttle ASA</td>
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<td>18-12-2003</td>
<td>32</td>
<td>4,69%</td>
<td>10</td>
<td>345.869</td>
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<td>Gudme Raaschou Vision A/S</td>
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<td>25-06-2003</td>
<td>103,75</td>
<td>1,30%</td>
<td>1</td>
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<td>Nobia AB</td>
<td>bookbuilding</td>
<td>19-06-2002</td>
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<td>-9,0%</td>
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<td>Ballingslöv AB</td>
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<td>64</td>
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<td>6</td>
<td>4.852.120</td>
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<td>07-06-2002</td>
<td>47</td>
<td>6,4%</td>
<td>79</td>
<td>2.836.391</td>
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<td>Alfa Laval AB</td>
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<td>17-05-2002</td>
<td>91</td>
<td>7,7%</td>
<td>119</td>
<td>13.205.043</td>
<td>Industrials</td>
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</table>

Appendix 2: Relationship between underpricing and number of IPOs:
Appendix 3: Correlation between underpricing and market index performance

<table>
<thead>
<tr>
<th>Market Index</th>
<th>3 months</th>
<th>6 months</th>
<th>12 months</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>35%</td>
<td>26%</td>
<td>27%</td>
</tr>
</tbody>
</table>

Appendix 4: Correlation between market index volatility and underpricing.

<table>
<thead>
<tr>
<th>Market Index</th>
<th>3 months</th>
<th>6 months</th>
<th>12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>35%</td>
<td>26%</td>
<td>27%</td>
</tr>
</tbody>
</table>

Appendix 5: Correlation between size of the company and underpricing.

![Size vs Underpricing Graph]

Appendix 6: Correlation between age of the company and underpricing.

![Age vs Underpricing Graph]