Name: **Erik Sandbæk**

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Is it possible that a firm's ownership structure may affect the underpricing in an initial public offering?

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Content

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Abstract

This thesis examines the relationship between the underpricing of a firm in a public listing due to the ownership structure of the firm. The firms studied are listed on the Norwegian Stock Exchange. The data contains public listings from 2001-2011. The thesis uses the Ordinary Least Squares (OLS) procedure to test for the relationship. The findings indicate that the ownership concentration, owner type and the board size of the firm have an effect on the underpricing in an IPO. The board size and the ownership concentration will have a positive effect on underpricing. Further institutional, government and international ownership seems to have a negative effect with the underpricing of a firm. In other words this thesis finds support for the ownership structure having an effect on underpricing of IPOs in the Norwegian Stock Market.

1 Introduction

The average underpricing of initial public offerings (IPOs) is a widely studied phenomenon. As early as in 1975 Ibbotson (1975) discovers that there is an underpricing of IPOs. Further Ritter (1984) obtains the same results in the 1980s. Later on other previous literature have documented underpricing of initial public offerings in most countries all over the world. This documentation proves that firms going public on average leave "money on the table" when listing their firms on the stock exchange.

There are different explanations of underpricing of IPOs. Rock (1986) explains the underpricing based on information asymmetry. This thesis will try to explain the underpricing of an IPO based on the ownership structure of a firm. Underpricing of a firm due to the ownership structure might also be related to information asymmetry. This will be discussed later in the paper.

The findings on the relationship between the underpricing of a firm and the ownership structure, may help entrepreneurs and other firms to reconsider their ownership structure before going public. This to obtain a minimum underpricing. In this paper I have gathered data on firms listed on the Oslo stock exchange from 2001-2011.

The structure of the thesis is as following: Section 2 presents the background and relevant previous literature on underpricing of IPOs due to ownership structure. Section 3 presents the hypotheses, which the rest of the thesis is based upon. Section 4 explains the data used in the regressions, while section 5 explains the methodology and gives a summary of the statistics. Further section 6 explains the results of the findings. At last section 7 presents the conclusions, limitations of the study and suggestions for further research.

2 Background and Literature

This section explains the theoretical background of initial public offerings. Further the section provides evidence of an average underpricing of IPOs and presents some of the possible reasons for underpricing.

2.1 The IPO Process

The process of an initial public offering begins months before the firm gets publicly listed, and it is a time consuming process for the firm (Gretland 1997). The process consists of identifying the firm's goal for the public listing, an analysis of the firm, and further the valuation of the firm. After the firm's valuation the firm's prospectus are distributed. When the firm has been valued and the prospectuses have been distributed, the firm needs to market the initial public offering to its relevant investors. The IPO has occurred when the firm's stock has been sold on the public market for the first time (Ritter 1998). The type of shares the firm offers to the public could either be primary shares or secondary shares. Primary shares are new shares issued from the firm, and with these shares the company increases its equity capital. Secondary shares are already existing shares held by the firm´s shareholders (Goergen 2012). The secondary shares will not raise the equity capital of the firm, but the sales of secondary shares will benefit the shareholders, increasing their personal equity (Goergen 2012).

2.2 Reasons for Going Public

A firm chooses to go public mainly because of financial reasons. Usually a firm begins with only with a few early investors who help to raise equity capital. These few early investors have no liquid market for their investment. This makes it more difficult for the early investors to sell their stocks in the firm to other investors to get money out of their investment (Ritter 1998). These investors will be more reluctant with their investment. Therefore one of the main financial arguments for an initial public offering is that publicly listed firms easier can reach out to a greater number of investors when raising more equity capital. The need for more equity capital is often due to insufficient internal funds, or insufficient funds from existing shareholders, to finance available investment opportunities (Goergen 2012). Another positive effect of being publicly listed is that it is easier for the

owners/founders of the firm to convert their wealth into cash (Ritter and Welch 2002). This method of raising capital is beneficial because the firm does not have to compensate the investors for illiquidity. There are however other costs related to these benefits of going public (Ritter 1998). A last advantage is that it is easier for a public listed firm to spot a hostile takeover (Zingales 1995).

2.3 The Valuation and Underpricing in IPOs

When a firm decides to go public, there will be a pricing uncertainty for the investors. This is in contrast to firms traded on the stock market, which have the advantage of a much more accurate pricing. It is common that many listed firms are valued every day and often several times a day. A firm that is not yet publicly listed will not have the advantage of accurate pricing. For firms in an IPO process there will still be some uncertainty of the true value of the firm, and the firm cannot be certain that those responsible for the valuation reveal the firm's true value. Before a firm is publicly listed the firm has no pricing history, neither does it exist previous public information. These two factors increase the risk for investors in an IPO, and therefore investors demand a higher expected return. This is reflected in the underpricing of the firm (Sahoo and Rajib 2011).

The valuation process of an initial public offering varies across countries and markets. However, there are primarily three ways a firm can get valued. One method of valuing a firm is to give an offer at a fixed price. This means that the investment bank determines the price of the issued shares. When the price is set, the bank invites investors to issue stocks at the offer price (Goergen 2012).

Another and more complex method of valuation is to value the firm with a book-building offer. In this case the major clients of the investment bank (this will typically be institutional owners) are asked if they are interested in subscribing to a new equity issue. If the clients show interest they are asked what price they will be willing to pay, and the amount of shares they are interested in buying. After this process the investment bank will have a clearer picture of the willingness to pay. The next step for the investment bank is the book building process, and in the final step the bank determines the offer price and the strike price. The last valuation method is by auction (Goergen 2012).

In an initial public offering it is often an oversubscription of investors. Nevertheless the stock price of the firm after the first trading day, or after the first trading week, will on average be higher than the offer price during the IPO. This would imply that there on average is underpricing of IPOs (Goergen 2012). The underpricing of a firm going public is a phenomenon that has been studied for decades (Stoll and Curley 1970). As early as 1975 Ibbotson shows that there exists evidence of underpricing in initial public offerings. Firms going public in the U.S stock market between 1980-2001 were on average underpriced by 18.8 percent (Ritter and Welch 2002).

When estimating how much a firm has been underpriced by investors in an IPO, a useful proxy and a common method is to find the difference between the offering price to the investors and the closing price of the first day the firm is listed (Ritter and Welch 2002).

2.4 Reasons for Underpricing

Researchers disagree regarding which factors that matter for underpricing. However, it exists a general consensus regarding some of the categories that affect the underpricing of an IPO. One of these categories is the separation of ownership and control (Goergen 2012). The other three categories are; information asymmetry, behavioral approaches and institutional reasons (Ljungqvist and Wilhelm 2005) and (Sahoo and Rajib 2011).

2.4.1 Underpricing due to Asymmetric Information

Ritter (1987) argues that a firm in an initial public offering has two costs: Direct costs and the costs of underpricing. Firms with a greater uncertainty of the firm's true value will also have a higher underpricing. One explanation for this can be based on asymmetric information (Rock 1986).

The fact that the underpricing reflects the investors' perceived ex ante risk has also previously been documented by Beatty and Ritter (1986). They argue that when investors invest in an IPO they basically buy a call option, which has a

higher value the higher the uncertainty. The perceived level of risk for investors in an IPO, and its relationship with investors demand for a higher expected return, is also further documented by Ljungqvist and Wilhelm (2002) and Loughran and Ritter (2004).

2.4.2 Underpricing Due to Ownership and Control

Brennan and Franks (1997) explain the underpricing phenomena based on corporate governance problems. They argue that the underpricing of a firm is related to the allocation of power after the public offering. Their theory is that the owners or entrepreneurs of the firm underprice the issuing of the shares on purpose, resulting in only small owners. The reason for doing this is to still be the major owner of the firm, and in that way still be in control of the firm. Brennan and Franks (1997) further show that there is a link between the underpricing and oversubscription. In other words it seems like the oversubscription will be higher the lower the price of the shares is. They further find that if there is a high underpricing before the IPO, there would be a more dispersed outside ownership after the firm is publicly listed.

2.4.3 Institutional Reasons for Underpricing

This theory of underpricing is similar to the theory of asymmetric information. It states that much of the underpricing of IPOs may be caused by market imperfections. This is called the "Winner's Curse," which implies that the investor, who wins an auction by paying the highest price for an item, usually has a too high estimated value of the item. Therefore investors make an estimate of the value of the firm, and then "shave" their estimate with e.g. 10%. Therefore it is argued that underwriters need to underprice the firm, to include participation of the less informed investors in the IPO (Leite 2007) and (Rock 1986).

3 Hypotheses

This section to describes the hypotheses of underpricing due to the ownership structure of the firm. This is the foundation for the rest of the paper.

3.1 Hypothesis 1: Ownership concentration

Previous literature emphasizes the problem of asymmetric information and thereby also the principal-agent theory. One problem might be that the managers and the large early investors of the firm in the initial public offering are reluctant to reveal all the information needed for a correct valuation of the firm. Since it is difficult to get complete information from the firm, and since a great deal of IPO firms have little operating history, investors cannot rely on the firm's earlier history of performance to valuate its potential growth and health (Brav and Gompers 2003) and (Mason and Stark 2004). The managers and the large early investors might therefore try to inflate the value of the firm, by making the firm's expected revenues overoptimistic, and thereby increasing their IPO return (Bruton et al. 2010).

The early stage investor has a complex role in the firm. Often this investor has several governance roles in the firm, while also being the agent preparing for the public listing. The founder managers may have large equity stakes in the firm and these founders have the possibility to abuse the public market investors (Bruton et al. 2010). It is therefore possible that a dominant owner will not consider the smaller public investors/owners in the decision-making and sometimes he might even abuse the smaller public investors (Dharwadkar, George, and Brandes 2000), (Douma, George, and Kabir 2006) and (Welch 1992). Examples of this might be tunneling or transfer pricing (Goergen 2012).

Following the reasoning above the first hypothesis is based among others on the principal-agent theory:

H1: A high pre-IPO ownership concentration will increase the IPO underpricing

3.2 Hypothesis 2: Institutional Owner

To be an investor in an initial public offering is risky. A typical IPO firm is a young firm with a short operating history. Often the firm also need to have a lot of goodwill, considering that some of them goes public with negative earnings (Field and Lowry 2009). Due to these and other underlying factors, there will be a considerable variation in the stock performance of the different firms.

Institutional owners and investors are considered to be sophisticated when dealing with IPOs (Nagel 2005) and (Cohen, Gompers, and Vuolteenaho 2002). Therefore according to Field and Lowry (2009) there is reason to believe that they have an advantage over the individual owners and investors. Reasons for this might be that institutions have connections to the underwriters and venture capitalists (VCs), and that they might process information better, and can therefore obtain a more accurate pricing of the firm (Bøhren 2011). Further it is believed that institutional owners go public with different motives and with other strategies than for instance individual owners.

Based on the arguments and reasoning above the second hypothesis is formulated as:

H2: A high aggregated percent of the firm held by institutional owners will lead to a lower underpricing in the initial public offering.

3.3 Hypothesis 3: Government Ownership

According to Shleifer (1998) there is a general belief among investors that a private ownership is preferred over a government ownership in any industry where it is preferable to be innovative, generate revenue and to minimize costs. It is further stated that having the government as an investor in a firm will make the firm less innovative, because it is the investors who makes the incentives to innovate. Previous literature suggest that the government might have weaker incentives as owners for monitoring and profit maximization of a firm compared to e.g. individual owners, and that there may be a competence problem by the lack of experience state bureaucrats have with private businesses (Bøhren and Ødegaard 2001).

There might also be a possibility that the government might have other incentives than equity value maximization as an owner. This might lead the firm to prioritize social goals on the expense of value maximization. These goals could be; less difference in wages between top management and employers, a high local employment and a greener environment by decreasing pollution (Bøhren and Ødegaard 2001).

However, there will be times in a firm's cycle where there might be beneficial for the firm to have a less monitoring investor with less incentives for short term profits. A firm might sometimes benefit from prioritizing long term profits, and it will then be beneficial to have the government as an owner (Goergen 2012).

Firms with high government ownership is expected to have less demands for short term profit, and be less focused on profit maximization:

H3: A high aggregated share of the firm held by the government will lead to a higher underpricing.

3.4 Hypothesis 4: International Owners

Based on the theory of information-asymmetry it is more difficult for international owners to know all the relevant factors of a firm compared to domestic owners (Brennan and Cao 1997). Therefore it is expected that a large part of the international investment is carried out by institutional investors or pension funds (Brennan and Cao 1997).

Further, an international owner might be less active in the corporate governance of the firm (Bøhren and Ødegaard 2001). This can mostly be explained by information-asymmetry, where the international owner might have an informational disadvantage considering the knowledge of the country's legal framework. It might also be a disadvantage for the international owner not knowing the competitive environment in the industry the firm operates in, and also not knowing the institutional framework of the country. International owners would also know less about the other investors in the firm, and it is more likely

that they will "vote with their feet" instead of being monitors of the firm (Bøhren and Ødegaard 2001).

Considering the information asymmetry between domestic and international owners, it is not surprising that the average international owner tends to purchase ownership in foreign firms when the market gives a high return in foreign assets, and that he tends to sell down on foreign firms when the return is low (Brennan and Cao 1997).

Based on the reasoning above it seems like international owners may have both a negative and a positive effect on the underpricing of an IPO. However I am going to follow the reasoning by Brennan and Cao (1997) suggesting that an international owner only invests in foreign firms when the returns are high. Therefore, if a firm has a high aggregated percent of international owners before an IPO, there are reasons to believe that the firm will be lower underpriced than the average, since international owners are looking for high returns (Brennan and Cao 1997).

H4: A high aggregated percent of the firm held by international owners will lead to a lower underpricing of the initial public offering.

3.5 Hypothesis 5: Board Size

The board size in an initial public offering is a subject of interest to among others the entrepreneurs, considering the effect it has on underpricing (McConaughty, Dhatt, and Kim 1995), (McBain and Krause 1989) and (Finkle 1998).

Based on the theory of information-asymmetry regarding initial public offerings, firms may try to find ways to signal the quality and health of the firm to investors (Rock 1986), (Beatty and Ritter 1986) and (Beatty 1989). Previous literature suggest that the board size of a firm might be a signal of the quality of the firm, and therefore might have an impact on the underpricing. However, previous empirical studies disagree on the evidence regarding the underpricing based on board size, and there are several conclusions on how board size affects underpricing (Dalton et al. 1998) and (Dalton et al. 1999).

Previous literature finds that board size may both increase and decrease underpricing. Evidence from Yermack (1996) shows that it is more beneficial for a firm in an IPO to have smaller boards. However, other literature contradict these findings, and show evidence for the opposite; that larger board sizes are more effective (Alexander, Fennel, and Halpern 1993).

Other previous studies find that the board size on average is positively associated with firm performance, and that this relationship will even be stronger for smaller firms (Dalton et al. 1999). A larger board size might be viewed as beneficial before the initial public offering, and investors might perceive the firms with a large board size as stronger firms with access to a wider range of resources (Pfeffer and Salancik 1978). Since a large board size might imply a greater access to resources, this might help investors reduce their pricing uncertainty of the firm, and therefore this can lead to a lower underpricing (Certo, Daily, and Dalton 2001).

H5: *A high number of board members in a firm will lead to a lower underpricing in an initial public offering.*

3.6 Hypothesis 6: Percentage of Firm Sold

Based on the previous literature on asymmetric information, there might be a relationship between the percentage of the firm sold in the IPO and the underpricing. This will be similar to measuring the ownership concentration in hypothesis 1 and it might be an indication of how exposed smaller shareholders are to large owners.

H6: A higher percentage of the firm sold will lead to a lower underpricing.

4 Description of the Data

The dataset contains data from IPOs in the Norwegian stock market from 2001-2011. The data on the different owners, their aggregated percentage of shares held in a firm, and the year the firm went public was provided by the Department for Financial Economics at BI - Norwegian Business School. The ownership data was extracted from BI's CCGR database. Further the closing price, and for some firms, the issue price of the IPO was extracted from the "Oslo Børs equity feed," provided by the Department of Financial Economics at BI. There were however some missing data on the offering prices. These data have been found searching for firm prospects at Newsweb and Yahoo! Finance. There have also been used information from the Oslo Stock Exchange home page. The size of the issue and the total offer size have been found in the firms' prospectus and on Newsweb. If several offering prices were found I have used the last/final offer price. The underwriters where found using prospects and Newsweb. A summary statistics is found in table 1 showing the original data sample.

Table 1 The Sample Data

Table 1 Sample size	**2001-2011**
Total IPOs for the period	212
Missing ownership data	55
Missing prospectus data	43
Other missing factors	11
Final sample size	**103**

As we can see from table 1 the sample size contained 212 firms that have been listed on the *Oslo Stock Exchange* and *Oslo Axess* in the timespan 2001-2011. Of these 212 firms, 55 were removed due to missing ownership data, which is data containing the aggregated percent hold by each owner type, the board size of each firm etc. Another 43 firms had to be removed due to missing prospectus data, that is data as the number of shares issued, final offer price of the IPO, total number of shares issued etc. Further another 11 firms were removed due to other missing

variables such as the underwriter etc. After adjusting for missing values we end up with a final sample size of 103 firms.

4.1 Summary IPOs and Underpricing

Table 2, 3 and 4 give a summary statistics of the IPO data, the number of initial public offerings each year from 2001-2011 and the average underpricing each year.

Table 2: Summary of the yearly IPOs and the average underpricing

Table 2 Summary Statistics

Year	Number of IPOs	Underpricing	Median	Std	Min	Max
2001	8	7 %	0 %	23 %	-8 %	68 %
2002	4	2 %	1 %	2 %	0 %	4 %
2003	3	-2 %	0 %	6 %	-9 %	5 %
2004	14	0 %	0 %	14 %	-42 %	24 %
2005	32	6 %	3 %	11 %	-5 %	49 %
2006	18	4 %	2 %	7 %	-4 %	23 %
2007	30	5 %	4 %	8 %	-6 %	39 %
2008	8	0 %	-2 %	17 %	-25 %	29 %
2009	0	0 %	0 %	0 %	0 %	0 %
2010	13	-4 %	-3 %	14 %	-26 %	32 %
2011	4	7 %	2 %	10 %	0 %	25 %

Table 2 shows a summary statistics of the initial public offerings from 2001-2011. These findings show that 2005 had the most public offerings with 32 IPOs. We can see that there were no firms listed on the Oslo Stock Exchange or the Oslo Axess in 2009. This was due to the financial crisis late in 2008, where most of the IPOs that was scheduled for the months right after the crisis were delayed or cancelled. We can further see that the highest average underpricing a year was

7%, in year 2001 and 2008, while the lowest average underpricing a year was -4% in 2010, the first year where the firms started to go public again after the financial crisis. Further the maximum underpricing of a single firm was in 2001 with an underpricing of 68%, while the lowest underpricing of a firm was in 2004 with a negative underpricing (overpricing) of -42%. The highest standard deviation was at 23% in year 2001, while the lowest standard deviation was at 2% in year 2002. The median underpricing is highest at 4% in 2007 while the lowest median underpricing was in year 2010 with -3%.

Table 3: The number of Initial Public Offerings issued on the Oslo Stock Exchange and Oslo Axess 2001-2011

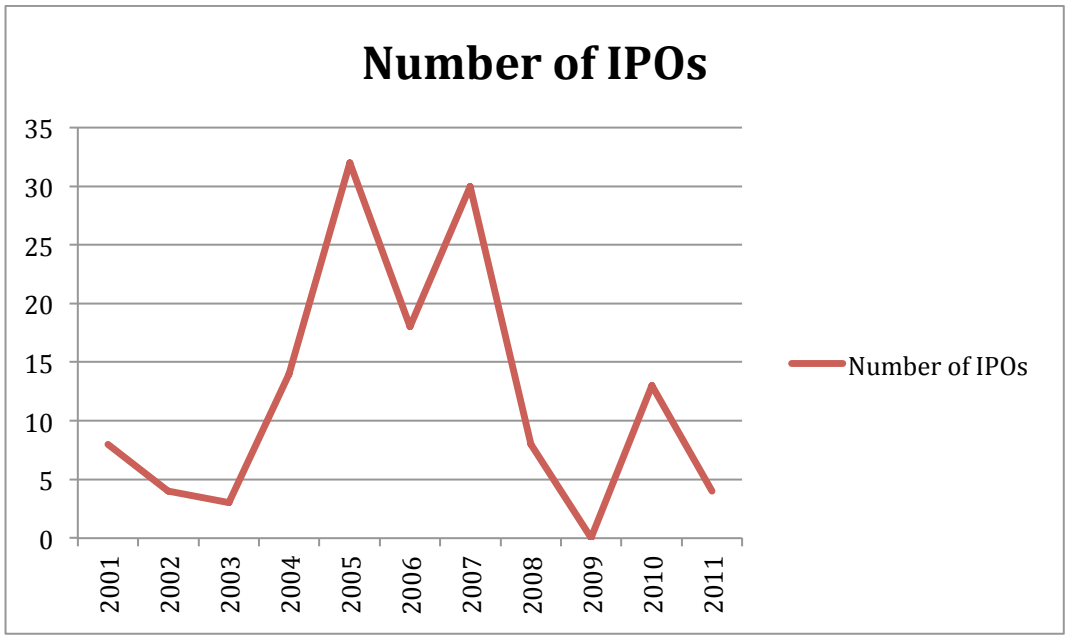

Table 3 shows the number of initial public offerings on the Oslo Stock Exchange and Oslo Axess from 2001-2011. As we can see from the graph, the number of IPOs is at the top in 2005. In 2007 the number of IPOs reaches a top before the number of IPOs falls steeply late in 2008 due to the economic crisis and reduces the public offerings to zero in 2009.

Table 4: The average yearly underpricing of IPOs on the Oslo Stock Exchange and Oslo Axess 2001-2011

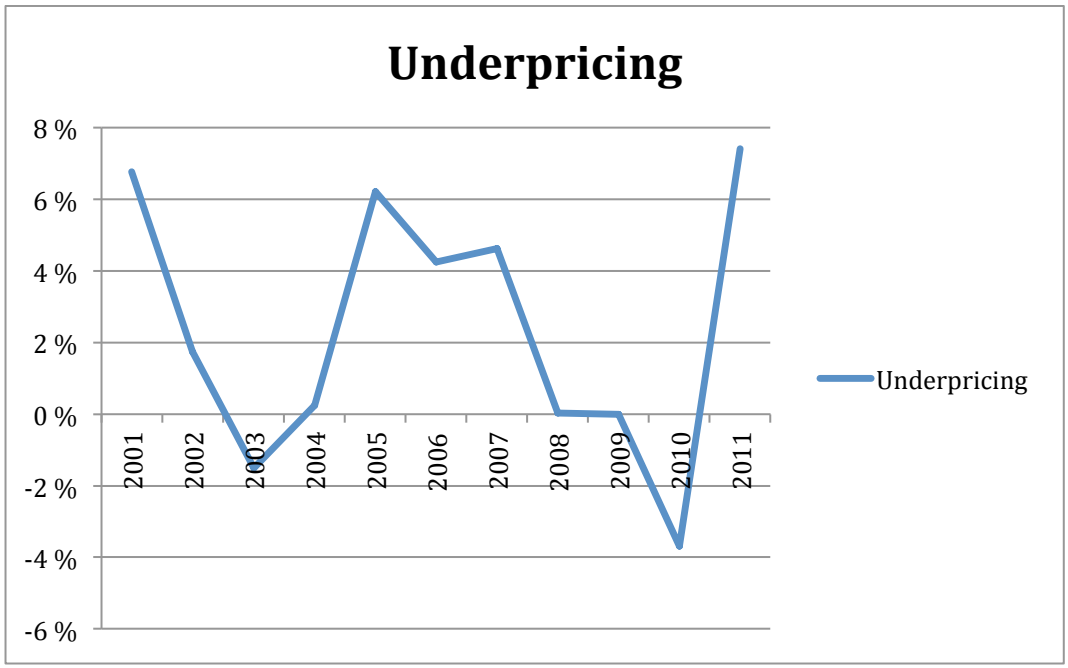

Table 4 shows the average yearly underpricing of the public offerings on the Oslo Stock Exchange and Oslo Axess. The graph indicates that the underpricing of public offerings follows a cycle and varies with the market state/time of the market (hot and cold markets). The graph also indicates that the average underpricing in 2010 was lower than the average underpricing in the period 2001-2011. This is interesting, since one would have expected investors to be skeptical after the crisis. However this is consistent with the theory of hot and cold markets, which will be discussed later in the paper.

4.2 The correlation of the data and multicollinearity

The correlation matrix of the data is presented in appendix 3. If there is a high correlation between two independent variables this indicates that the two variables capture much of the same factors, and therefore the model will have less explanatory power. Further the variables will have some changing values of the coefficient if there is correlation between the independent variables (Brooks 2008).

If there is no correlation between the independent variables, the variables are orthogonal. This means that if an orthogonal variable is removed from the regression, this will have no impact on the other independent variables, and the values of the other variables will remain the same. However in practical contents, the independent explanatory variables will always have some correlation with each other. The model will however not loose much of its precision if there is only a small correlation between the variables (Brooks 2008).

The problem of correlation between the independent variables occurs if the correlation is high. This is known as multicollinearity. Multicollinearity is present in the independent variables if two or more independent variables either have a perfect or non-negligible relationship. The problem with mulitcollinarity is that you will have two independent variables explaining only one parameter and not two (Brooks 2008).

It is worth noticing that the correlation matrix only indicates if it is covariance between the variables. I will first present the correlation between the independent and the dependent variables. This type of correlation is not multicollinearity. This correlation indicates that the independent variables will have some explanatory effect on the dependent variable.

By looking at the correlation matrix in appendix 3 we can see that there is a quite high positive correlation between ownership concentration and underpricing. This indicates that the first hypothesis might be correct. We can also see a quite high correlation between many of the other independent explanatory variables and the dependent variable underpricing. The weakest correlation between the independent explanatory variables and underpricing is STATE_25 with only -0.0276. This is unexpected and is in contrast to the hypothesis, since we expected a positive relationship between government ownership and underpricing.

When looking at the correlation between the independent explanatory variables we see that there are some variables with a high correlation. This correlation is mostly expected for the independent variables that have a high correlation. The reason for this is that the independent variable “percentage of the firm sold” has

been included together with other independent variables, while trying to find a connection between the percentage of the firm sold and the owner type. Therefore the highest correlation between the variables is 0.77. This is however between INDU_50 and INDU_50*PERCS. This is not that surprising since INDU_50 is in both variables.

When looking at the other independent variables in the correlation matrix, there are to some extent correlation between some of the other independent variables. However, none of the correlations between these variables are significant enough to disrupt the model. The conclusion is therefore that we do not have significant mulitcollinearity in the model. One should though keep in mind that since some of the variables have a high correlation between each other, there might be a higher R-squared than normal.

5 Methodology

This section provides explanations of the methodology and the statistical methods used. There will be a presentation of the dependent variable, the independent control variables, the independent explanatory variables and the regressions used before testing the robustness of OLS.

5.1 The Dependent Variable

In all four regressions there has only been used one dependent variable. The dependent variable is underpricing (UNDP). The reason for this is that we only want to see if there is a relationship between underpricing and the independent variables. The variable UNDP refers to that a great deal of the shares sold, in initial public offerings, on average are underpriced compared to the market value of the shares. This has empirical support by other finance papers (as discussed in section 2), among others Lee, Lochhead, and Ritter (1996). We can see a tendency of underpricing of the IPOs in the first day of trading, where the price of the shares issued on average increases on the first day. There is more than one way to define the average underpricing of a firm. In line with Beatty and Ritter (1986) and Nelson (2003), I choose to use unadjusted offering and closing prices. The model that has been used to find the percentage difference in underpricing is the percentage difference between offering price and the closing price the first day of trading.

$$\text{Underpricing}_i = \frac{Closing\ Price\ i,t+1 - Final\ Offer\ Price\ i,t}{Final\ Offer\ Price\ i,t}$$

5.2 Independent Variables: The Control Variables

This section provides explanation of the control variables used in the regressions.

5.2.1 Firm Age

The control variable for firm age is called CO_AR. CO_AR is the age of the company at the time it is introduced on the stock exchange. Previous research shows that firm age might affect the performance of the share price (Loughran and

Ritter 2004). One reason why firm age can give less underpricing might be that it is easier to value a company that has existed for some time compared to young companies, or newly established firms. Further Rock (1986) explains that the underpricing of a firm will increase with investors perceived risk. The perceived risk of investors might be higher if the company is young, because it will be more difficult to find the correct pricing of the firm. This is also consistent with Ritter (1984) who finds that an established company has less perceived risk for investors, than a newly established company. I will use the age of the firm as a control variable to see if the firm age can be related to investors' perceived risk.

The variable CO_AR is calculated by using the natural log of 1 + the years until the company went public. Mathematically this is

Firm age = ln (1 + (initial public offering year - years before the IPO)).

5.2.2 Market State

Another control variable is called CO_MST. This control variable is based on the previous literature by Ljungqvist, Nanda, and Singh (2006). Ljungqvist, Nanda and Singh believe that the IPO market can be generalized into two market states. They define these as hot and cold market states. A hot IPO market occurs when there is a presence of optimistic investors, and if there is any presence of pessimistic investors these are prevented from expressing their demands.

It can further be stated that the public offerings will follow a cyclical pattern, and most likely the average underpricing of the firm would be following the same cyclical pattern. While Ljungqvist, Nanda, and Singh (2006) define a hot market as a market with more optimistic investors, and a cold as one with more pessimistic investors. Loughran and Ritter (2004) define a hot market based on the volume of initial public offerings. Based on the theory by Loughran and Ritter (2004) I use the volume of public offerings to define whether there is a hot or a cold market. I define a hot market state when the number of IPOs are above the average, and a cold market when the number of IPOs are below average (Loughran and Ritter 2004). The variable constructed will be a dummy variable that takes the value of 1 when the initial public offerings in a year are above average, and takes the value of 0 when the initial public offerings in a year are

below average. This variable is going to see if the state of the market has any influence on the underpricing of initial public offering.

5.2.3 Offer Size

The control variable accounting for offer size is called CO_OFFERS. Previous literature suggests that the offer size might have a correlation with the underpricing of public offerings (Megginson and Weiss 1991). There is also found further evidence by Ruhani, Zamri, and Aminul (2010) who examine the Chittagong Stock Exchange and find that there is a lower underpricing the larger the offer size. This is also in accordance with Beneviste and Spindt (1989) who suggest that, based on information asymmetry, a larger offer size may decrease the risk of the issue.

The variable CO_OFFERS will allow me to see if the offer size of an issue will have any influence on the underpricing that is not captured by the other variables in the regression. The offer size is the natural log of the gross proceeds. The gross proceeds are measured as the number of shares issued times the final offer price. Mathematically this is:
Offer size = ln (Final offer price x Number of shares issued).

5.2.4 Underwriter Ranking

The last control variable measures the effect of the reputation of the underwriter on underpricing and is called CO_UNDW. This variable measures whether there is any relationship between the underpricing of a firm and the reputation of the underwriter. According to previous literature there seems to be a relationship between these two factors. Previous literature only suggests that the underwriters need to underprice the shares issued to attract investors to initial public offerings (Welch 1992) and (Beneviste and Spindt 1989). Later research shows that underwriters want to underprice public offerings more than needed, and that the level of underpricing can vary with underwriter reputation (Xiaoding and Ritter 2011), (Loughran and Ritter 2002) and (Ljungqvist and Wilhelm 2003).

Previous literature draws different conclusions on how underwriter reputation affects the underpricing in an IPO. However there seems to be a consensus that the underwriter reputation is used as a proxy for information asymmetry. Brav and Gompers (2003) suggest that underwriter reputation indicates something about the quality of the firm to be issued. If the underwriter has a good reputation, the firm going public is also considered to be a good firm. The variable CO_UNDW is calculated based on the underwriter's market share. To find the reputation of the underwriter I divided the data sample into three periods from 2001-2004, 2005-2007 and 2008-2011. When dividing the sample I have tried to consider the market state and the average number of IPOs. The market share of the underwriter is then found by dividing an equal share of the gross proceeds to all the underwriters participating in the initial public offering. The market share of the underwriter was then found by taking the underwriter's gross proceeds and divide them on the total proceeds of all IPOs for the period. The variable is calculated as: Underwriter Rank = ln (1 + the market share of the underwriter)

5.3 Independent Variables: The Explanatory Variables

This section provides presentations of the independent explanatory variables that have been used in the OLS regressions to test for the hypotheses.

5.3.1 Ownership Concentration

The independent explanatory variable HFO is used to see if there is any relationship between underpricing and ownership concentration in Norwegian firms. To measure the ownership concentration I have used the Herfindahl ownership concentration ratio provided by the department of Finance's CCGR database at BI. The Herfindahl index is one of the most widely used measures for ownership concentration according to Bikker and Haaf (2000). The index tends to capture information on all of the shareholders and is therefore called the full-information index. The maximum concentration ratio is 1, which equals an ownership concentration of a 100%. This independent explanatory variable allows me to test whether there is a relationship between the underpricing of an IPO and the ownership concentration of the firm in the Norwegian market. Previous literature on ownership structure indicates that there might be a relationship

between the ownership concentration and the underpricing of a firm in an IPO (Stoughton and Zechner 1998), (Brennan and Franks 1997) and (Hill 2006).

5.3.2 Institutional Owners

The independent variable INSTIT_25 takes into account that there might be a relationship between underpricing and institutional owners. As previously stated there will be a negative relationship between underpricing and institutional owners. The reasons is that firms with a high concentration of institutional owners are better to process information (Bøhren 2011). The variable INSTIT_25 is a dummy variable, which takes the value of 1 if there is an ownership concentration of institutional owners above 25%, and the value of 0 if the ownership concentration is below 25%.

5.3.3 Government ownership

The independent variable STATE_25 tries to find a relationship between government ownership and underpricing. As discussed in section 3 it is expected to be a positive relationship between underpricing and government ownership, because government owners among other factors often are less competent owners (Bøhren 2011). The variable STATE_25 is a dummy variable, which takes the value of 1 if it is a government ownership concentration above 25% in a firm, and the value of 0 if the ownership concentration is below 25%.

5.3.4 International Owners

The variable INTERN_50 measures the relationship between international owners and underpricing. As stated in hypothesis 4 there is believed to be a negative relationship between international owners and underpricing. The variable INTERN_50 is a dummy variable that takes the value of 1 if the aggregated percent held by international owners is above 50% of the firm, and the value of 0 if it is below 50%.

5.3.5 Board Size

The independent variable BS is used to see if there might be a relationship between the underpricing of an initial public offering and the size of the board of the firm going public. This variable is a dummy variable that takes the value of 1 if the number of board members in a firm is above average, and the value of 0 if the number of board members is below average.

5.3.6 Percentage of the Firm Sold

The independent variable PERCS, is applied to see if there is a relationship between the percentage of the firm sold and the underpricing. This variable will test hypothesis 6.

5.5 Regressions

This section presents the regressions used in the OLS procedure to see if any of the independent variables have any effect on underpricing.

5.5.1 Regression 1

The first regression will test for the relationship between different owners before the IPO and the underpricing of the firm. Therefore the only included variables in regression one will be the dependent variable underpricing and the independent explanatory variables. The variables are HFO, INSTIT_25, STATE_25, INTERN_50, BS and PERCS. These independent explanatory variables are variables with several different firm characteristics, and there is empirical support in other countries that these variables can affect underpricing. The results will be presented in section 6.

5.5.2 Regression 2

The second regression is an expansion of the first regression, by including the control variables. These variables are included to see if there is any excessive factors for underpricing that is not explained by the first variables. This is to find other relationships between underpricing and firm characteristics. If there is a firm that is less underpriced than the average firm in its category, without different

owners, I hope to capture the reasons in my control variables. These control variables have empirical support from previous literature. The results will be presented in section 6.

5.5.3 Regression 3

In the third regression the model is further expanded to include two more variables. These two variables are included to see if there is any further explanatory power between the percentage sold of the firm for the different owner types and the underpricing. The results are presented in section 6.

5.5.4 Regression 4

The last regression is further expanded with 5 variables. These variables are included to see if the underpricing pattern is the same for two other types of owners and to see if the percentage of the firm sold has any more or less effect on the underpricing for these two types of owners.

5.6 Summary statistics of the variables

Table 5 shows the summary statistics of each variable in the regressions.

Table 5: Summary statistics of the dependent, independent and control variables used in regression 1 and 2

	Mean	Median	Maximum	Minimum	Std. Dev.
UNDP	0,035	0,001	0,680	-0,262	0,122
HFO	0,183	0,104	1,000	0,007	0,197
INSTIT_25	0,092	0,000	1,000	0,000	0,290
STATE_25	0,010	0,000	1,000	0,000	0,101
INTERN_50	0,061	0,000	1,000	0,000	0,241
BS	0,469	0,000	1,000	0,000	0,502
PERCS	0,244	0,187	2,253	0,003	0,274
CO_AR	1,677	1,609	4,220	0,000	1,036
CO_MST	0,694	1,000	1,000	0,000	0,463
CO_OFFERS	18,757	18,659	23,290	13,290	1,722
CO_UNDW	0,115	0,132	0,195	0,001	0,051

As we can see from table 6 the average underpricing of a firm from 2001-2011 was almost 4%, while the lowest underpricing of a firm was (an overpricing of) 26,2% and the highest underpricing of a firm was 68%. Further we can see that the average ownership concentration of a firm based on the Herfindahl index is 0.183. We can also see that the average firm sells out 24,4% of the firm in the public offering.

5.7 Robustness of the model

The procedure used to test for the relationship between the variables has been OLS. Therefore this section will test for the underlying assumptions of OLS, to see if the data and the assumptions are robust.

5.7.1 Multicollinearity

The assumption of multicollinearity has already been tested and explained in the correlation matrix in section 4. As mentioned, the highest correlation between the independent variables was 0.77 between INDU_50 and INDU_50*PERCS. This is however expected since the variable INDU_50 is listed two times, and does only explain one factor.

5.7.2 Heteroscedasticity

One assumption of the OLS procedure is the assumption of homoscedasticity. In other words the variance of the standard errors is assumed to be constant. If the standard errors do not have a constant variance we have heteroscedasticity (Brooks 2008).

The consequences of heteroscedasticity are that the coefficient estimates will not have the minimum variance in the unbiased estimators. In other words the standard errors of the coefficients could be wrong and the conclusions drawn could therefore also be wrong (Brooks 2008).

There are several methods to test for heteroscedasticity. I have however used a residual graph (appendix 2) and White's test for heteroscedasticity. The results find indication of heteroscedasticity in White's test. There is also a tendency of a systematically changing pattern in the residual graph. I therefore reject the null hypothesis of homoscedasticity and conclude that I have a tendency of heteroscedasticity in my data.

In order to deal with the heteroscedasticity of the data I use heteroscedasticity-consistent standard error estimates, were the standard error estimates "have been modified to account for heteroscedasticity" (Brooks 2008) p 138. The effect of using this correction is that we will get a more conservative form of hypothesis testing, and that we will need more evidence before rejecting the null-hypothesis (Brooks 2008).

5.7.3 Autocorrelation

Another assumption of the OLS is that the error terms are uncorrelated with each other over time. If the error terms are not uncorrelated, they are autocorrelated. We test for autocorrelation on the residuals (Brooks 2008).

The consequences of ignoring autocorrelation are similar to ignoring heteroscedasticity; the estimates of the standard errors could be wrong, and we could make wrong conclusions (Brooks 2008).

There are different ways to test for autocorrelation, and I chose to use a Breusch-Godfrey test. This test is more general than the Durbin-Watson test, but it can often provide more accurate results. I find no evidence of autocorrelation in my data.

5.7.4 Normality

In OLS there is also an assumption of normality in the data. This we assume in order to test for the hypotheses.

The most common test for normality is Bera-Jarque, which is the test that I have used. According to the histogram there seem to be a weak tendency of non-normality (appendix 4). Further we see from the p-value that we have to reject the null-hypothesis of normality. I choose to not include more dummy variables in my regression, considering that this might only artificially improve the result. Instead I decide to proceed with the data set as it is and notice that the non-normality might have an undesirable effect on the coefficients (Brooks 2008).

5.7.5 Linearity

A further assumption of the linear regression model is that we have linearity in the parameters. To test for linearity we use Ramsey's RESET test. This is a test for misspecification of functional form. If there is found non-linearity one possibility could be to switch to a non-linear model.

The result from the RESET test shows that there is no apparent non-linearity within the model with a F-statistic of 1.63 and a probability of 0.22. I therefore conclude that it is appropriate to use a linear model.

5.7.6 Structural Break

Since the data sample consists of data from a longer period of time (10 years), a structural break is added to see if there is any changing pattern of underpricing, or if the underpricing has changed over the years. To test for a changing pattern of the data the variable STRBR was added in regression 4. This variable has a value of zero the first five years and a value of one the last five years. The results show a very small positive correlation, but the coefficient is not significant. This implies that the underpricing has no structural break.

6 Empirical Results

Section 6.1 explains the empirical results from the regressions in section 5. After explaining the results from the six hypotheses, section 6.2 will present other findings as for instance the effect of the control variables.

Table 6 shows the results of all four regressions and the effect the different variables have on the underpricing.

Table 6: The results from the regressions

Dependent variable Underpricing

Variable	Regression 1	Regression 2	Regression 3	Regression 4
C	-0.0052	0.3261	0.3169	0.1650
	(-0.232)	(2.206)**	(2.089)**	(1.079)
	(-0.161)	*(2.037)***	*(1.969)***	*(0.989)*
HFO	0.0694	0.1003	0.0969	-0.0290
	(1.034)	(1.559)***	(1.484)***	(-0.352)
	(1.210)	*(1.726)***	*(1.676)***	*(-0.466)*
INSTIT_25	-0.0542	-0.0637	-0.0448	-0.0887
	(-1.249)	(-1.573)***	(-0.582)	(-1.191)
	*(-2.859)**	*(-3.729)**	*(-1.551)*	*(-2.358)***
STATE_25	-0.0671	-0.0433	-0.0446	-0.0318
	(-0.541)	(-0.375)	(-0.382)	(-0.292)
	*(-3.443)**	*(-1.897)***	*(-1.895)***	*(-1.329)****
INTERN_50	-0.1110	-0.0865	-0.0360	-0.1200
	(-2.120)**	(-1.744)**	(-0.370)	(-1.246)
	*(-2.497)**	*(-1.844)***	*(-0.565)*	*(-1.746)***
BS	0.0308	0.0364	0.0380	0.0223
	(1.247)	(1.472)***	(1.514)***	(0.9307)
	*(1.298)****	*(1.753)****	*(1.772)***	*(1.101)*
PERCS	0.1136	0.1700	0.1730	-0.1682
	(2.341)**	(3.424)*	(3.440)*	(-1.795)**
	(1.102)	*(1.715)***	*(1.745)***	*(-1.570)****
CO_AR		-0.0100	-0.0115	-0.0137
		(-0.853)	(-0.951)	(-1.192)
		(-1.124)	*(-1.201)*	*(-1.296)*
CO_MST		0.0411	0.0393	0.0630
		(1.483)***	(1.397)***	(2.141)**
		*(1.518)****	*(1.442)****	*(2.088)***
CO_OFFERS		-0.0210	-0.0204	-0.0058
		(-2.462)*	(-2.333)**	(-0.639)
		*(-2.161)***	*(-2.110)***	*(-0.622)*
CO_UNDW		0.2201	0.2381	-0.0616
		(0.822)	(0.869)	(-0.221)

		(0.702)	*(0.740)*	*(-0.189)*
INSTIT_25*PERCS			-0.0912	0.1525
			(-0.286)	(0.499)
			(-0.689)	*(1.063)*
INTERN_50*PERCS			-0.2213	0.1085
			(-0.607)	(0.308)
			(-1.227)	*(0.528)*
INDU_50				-0.0955
				(-2.563)*
				*(-2.653)**
INDU_50*PERCS				0.4622
				(4.183)*
				*(3.757)**
PERSO_15				0.0102
				(0.098)
				(0.197)
PERSO_15*PERCS				-0.3081
				(-0.493)
				*(1.306)****
STBR				0.0095
				(0.354)
				(0.664)
N	103	98	98	98
Adj. R-Sq.	0.0829	0.1488	0.1332	0.2556
F-Statistic	2.5370	2.6955	2.2423	2.9584
P-Value (F-stat)	0.0253	0.0063	0.0163	0.0006

*** Significant at the 10% level

** Significant at the 5% level

* Significant at the 1% level

Table 6 shows the results of the four regression models. The sample size is between 103 and 98 firms that listed on the Oslo Stock Exchange or Oslo Axess between 2001-2011. The dependent variable in the regression is underpricing. This is measured by taking the closing price the first day the firm was listed minus the final offer price divided by the final offer price. HFO is the ownership concentration of a firm measured by the Herfindahl Index. INSTIT_25 is a dummy variable with the value of 1 if the aggregated percent held by institutional owners is above 25%, and the value of 0 if it is below 25%. STATE_25 is a dummy variable with the value of 1 if the aggregated percent held by the government in a firm is above 25% and the value of 0 if below 25%. INTERN_50 is a dummy variable with the value of 1 if there is above 50% ownership of international owners and 0 if below 50%. The variable BS is a dummy variable that takes the value of 1 if the number of members in the board is above average

and the value of 0 if the number of board members is below average. PERCS is the percentage of the firm sold in the initial public offering. The variables HFO, INSTIT_25, STATE_25, INTERN_50, BS and PERCS are the independent variables used to test for the hypotheses. Further CO_AR, CO_MST, CO_OFFERS and CO_UNDW are control variables. CO_AR is the firm age, CO_MST is the market state, CO_OFFERS is the offer size and CO_UNDW is the underwriter's reputation. The level of significance is presented by the smaller numbers in the parenthesis below each variable result. The last parenthesis number in each regression is the level of significance after accounting for heteroscedastisity.

6.1 Results hypotheses

6.1.1 Results hypothesis 1

The first hypothesis tests for a relationship between the ownership concentration in a firm before the IPO and the underpricing of the firm. The results from regression 1, 2 and 3 imply that there might be a relationship between ownership concentration and underpricing. We can see this relationship by comparing the three first regressions that show that there is a higher underpricing on an average (the average of the three first regressions) of 8.89% in firms with a high ownership concentration compared to other firms. This is also consistent with the correlation matrix, which shows a correlation of 0.18. Regression 2 and 3 is significant at the 5% level. This is consistent with hypothesis 1.

If there is a high ownership concentration, it indicates that the major owners of the firm do not sell their stocks. Therefore the stock price of the firm will not reflect the information the large owners have on the firm. The valuation of the firm will then be based on a very small information-base (Bøhren 2011). Further, a large owner can act in its own interest on the expenses of a small shareholder (Bøhren 2011). This is consistent with asymmetric information theory and principal-agent theory, which implies that there will be a higher underpricing if it is a high ownership concentration.

The results of the last regression (regression 4) indicate that there is a negative relationship between underpricing and ownership concentration. The variable

changes to a negative value in the last regression implying that firms with a higher ownership concentration are less underpriced than the average. There are some benefits of a large ownership concentration that might imply the lower underpricing. The benefits of having a large owner are mostly stronger incentive for good monitoring of the firm and fewer free riders (Bøhren 2011). However this coefficient is not significant in the regression.

The results of hypothesis 1 if we only consider the significant variables, regarding ownership concentration and underpricing, gives us an indication of a higher underpricing if there is a higher concentration of ownership. We can see the same trend in the correlation matrix, where there seem to be a positive relationship between the two variables. However we must take into account that we did not get the same sign in all four regressions. There is a concern that there is not a stable relationship between ownership concentration and underpricing in all four regressions.

6.1.2 Result hypothesis 2

The second hypothesis tests for a negative relationship between underpricing and institutional owners. As previously mentioned in section 3.2 it is believed that firms with institutional owners go public with different motives than for instance firms with personal owners. This could imply that a typical firm with a high concentration of institutional owners or venture capitalists is less in need of equity than for instance a firm with personal owners, and that these institutional owned firms and VCs go public more as an exit strategy. It is also believed that since institutional owners often are investment banks etc, they will be better at processing information than other owners (Nagel 2005), (Cohen, Gompers, and Vuolteenaho 2002) and (Bøhren 2011).

To test for the second hypothesis it was introduced a dummy variable called INSTIT_25. This variable is significant in all four regressions, and significant at the 1% level in regression one and two.

The variable INSTIT_25 is consistent with hypothesis 2, and it shows that firms with a high concentration of institutional owners are less underpriced than the

average. This is also consistent with the correlation matrix, which shows a negative correlation between underpricing and institutional owners. If we take the average result of the four regressions we see that a firm with a high concentration of institutional owners is 6.3% less underpriced than the average firm. Reasons for this are that institutional investors may have more competence as owners, or may be extra good at comparing/understanding the information of the firm, and understanding the true value of the company (Bøhren 2011).

Firms with institutional owners may go public with different motives than for instance personal owners, and will be less in the need of keeping in control of the firm. This would imply that these types of owners would sell a higher percentage of the firm in an IPO. Therefore table 7 shows the relationship between the percentages of the firm sold, and the percentage sold if owned by institutional owners.

Table 7 Percentage of firm sold

	PERCS
C	0,257657
	9,439*
INSTIT_25	-0,056702
	-0,5889

As we can see there is an indication of a smaller percentage sell out (on average) of firms held by institutional owners. This is inconsistent with what was expected. As we can see from table 7, while the average firm sells out 26% of the firm, the average institutional owned firm only sells out 20%. Regarding the previous reasoning, that institutional-owned firms go public as an exit strategy, it is worth noticing that they sell out less than the average and not more. However, one explanation could be that they tend to sell their stocks some time after the public listing, instead of selling out all stocks at once. We also need to notice that these results are not significant.

Trying to find the effects of the institutions selling out a smaller percent than the average, I included the variable INSTIT_25*PERCS. This variable did not have a stable effect on underpricing in the two regressions, and neither did it have any significance.

6.1.3 Results hypothesis 3

The third hypothesis tests for a higher underpricing when a high aggregated percent of the firm is held by the government. This is because as mentioned in section 3 government ownership is often believed to be a less effective owner than e.g. institutions, and it is also believed that the government as an owner might be a less competent owner (Bøhren 2011). Other reasons for higher underpricing of government firms could be that the government have different incentives than value maximization of the firm, as discussed in the hypotheses section (Bøhren and Ødegaard 2001).

A dummy variable was introduced to test for the third hypothesis. This variable is significant in all four regressions; In the first three regressions the coefficient is significant at the 1% and the 5% level. In the fourth regression the coefficient is significant at the 10% level.

The results from the regressions show that there is a negative relationship between underpricing and state ownership. It implies a lower underpricing if there is a high concentration of state/government ownership before the IPO. We can further see from the four regressions that a firm with a high government ownership is on average 4.68% less underpriced than the average firm. This is inconsistent with the hypothesis. One explanation for this finding could be that there in Norway are some firms with the government as an owner, were the government has equity value maximization as the main goal/incentive (Bøhren 2011).

6.1.4 Result hypothesis 4

The fourth hypothesis states that it is a lower underpricing in firms with international owners. In other words it is expected a negative relationship between underpricing and international owners. From the hypothesis section we see that

there are factors implying both higher and lower underpricing with international owners. Especially we need to consider the information asymmetry between the international owners of a firm, and the domestic owners. Also one need to consider that international owners know less about the local competition (Bøhren 2011). However hypothesis 4 expects that international owners will have a negative effect on the underpricing of a firm, considering that they only tend to buy foreign firms when there is a high return on foreign assets (Brennan and Cao 1997).

To test for the fourth hypothesis a dummy variable called INTERN_50 was introduced. This variable is significant at the 1% level in regression 1 and at the 5% level in regression 2 and 4.

As expected the variable shows a negative relationship with underpricing, consistent with the hypothesis. The variable implies that there on average will be a lower underpricing of firms with international owners. This is also consistent with the correlation matrix, which shows a negative correlation of -0.19 between underpricing and international owners.

Since it is lower underpricing of firms with international owners, a firm with international owners might have a higher percentage sell out. Where the percentage of the firm sold, also might be an explanation for a lower underpricing. This relationship was accounted for and the results are presented in table 8.

Table 8 Percentage of firm sold

	Percs
C	0,254371
	9,44*
INTERN_50	-0,023712
	-0,204

As we can see from the results in table 8, there seem to be on average less percentage of the firm sold with international owners than for the average firm. While the average firm in this case sells out 25.4% in an initial public offering, firms with international owners sell out 23% of the firm. This is not a great difference, and the variable is not significant.

The variable intern_50*PERCS was included, trying to find effects of international owner selling out less of the firm. This variable was not significant.

6.1.5 Result hypothesis 5

The fifth hypothesis tests for a relationship between underpricing and the number of board members in the firm. It is believed that a higher number of board members will lead to a lower underpricing. Reasons for the lower underpricing might be that a high number of board members could give the impression of good management and competence, and therefore be negatively related to underpricing (Certo, Daily, and Dalton 2001).

In order to test for the fifth hypothesis a dummy variable called BS was introduced. This variable is significant at the 10% level in regression 1 and significant at the 5% level in regression 2 and 3. Further the coefficient is stable over time and has no changes in the relationship with underpricing.

The results from the regressions show that there seem to be a positive relationship between board size and underpricing in the Norwegian market, meaning that a higher board size will lead to a higher underpricing. This is also consistent with the correlation matrix, which shows a correlation of 0.043, but it is inconsistent with the hypothesis. However this might be because a higher board size could indicate a more versatile board, and previous literature shows that a higher variety in the board may have a positive effect on underpricing (Bøhren 2011).

6.1.6 Result hypothesis 6

Hypothesis 6 tests for the relationship between the percentage of the firm sold in the IPO and the underpricing. The goal is to see if there is a lower underpricing of larger IPOs.

A variable called PERCS was introduced in order to test for the relationship between the percentage of the firm sold in an IPO and the underpricing of the firm. This variable has a significance of 5% in regression 1,2 and 3, and a 10% significance in regression 4. However the relationship between underpricing and percentages of the firm sold is not constant in all four regressions. In the three first regressions there seem to be a positive relationship between the percentage of the firm sold and the underpricing. This is inconsistent with the hypothesis. However in the fourth regression it seems to be a negative relationship between underpricing and the percentage sold, which is consistent with the hypothesis.

Since the variable implies both increasing and decreasing underpricing it is not possible to draw a conclusion.

6.2 Other findings

In regression 4 industrial and personal owners are included to see what impact they might have on underpricing of a firm in an IPO. Further we see if these owners tend to sell more or less of their firm in an IPO.

6.2.1 Industrial Owners

The variable INDU_50 was introduced to see if there were a relationship between industrial owners and the underpricing of a firm. We can see from regression 4 that industrial owners might have a negative effect on underpricing. The variable is significant at the 1% level. Industrial owners might sell out more of their ownership in the firm compared to the average. This might be an explanation for the lower underpricing. This relationship is tested in table 9.

Table 9 Percentage of firm sold

	PERCS
C	0,2441
	8,269*
INDU_50	0,042003
	0,512

As we can see from the findings in table 9, firms with a high aggregated ownership of industrial owners tend to sell out more of their firm in an initial public offering than the average. This might be one of the reasons for the lower underpricing of the firm. This variable however is not significant. Previous literature states that industrial owners are very similar to institutional owners, and that these owners might go public with similar motives as the institutional owners (Bøhren 2011).

6.2.2 Personal Owners

The variable PERSO_15 was introduced to see if there were a relationship between personal owners and underpricing. This is a dummy variable that takes the value of 1 if there is more than 15% personal ownership in a firm before it goes public. As we can see from the regression, it seems to imply a positive relationship between underpricing and personal owners. In other words it seems like firms with personal owners are more underpriced than the average firm. The variable is not significant.

One of the reasons for a higher underpricing of firms with personal owners could be that personal owners choose to go public with different motives than for instance institutional owners or venture capitalists. While venture capitalists goes public as an exit opportunity, personal owners might go public because of the need of new equity. This would imply that the personal owners still want to remain in control of the firm, selling out a less percentage of the firm, which could lead to a higher underpricing (Goergen 2012). This relationship was tested in table 10.

Table 10 Percentage of firm sold

	PERCS
C	0,257498
	9,678*
PERSO_15	-0,123122
	-0,875

As table 10 indicates, it seems to be a lower percentage of the firm sold with personal owners, than on average. This might support that firms with a high aggregated percent held by personal owners, tend to sell out less of their firm, to keep in control of the firm. This might lead to a higher underpricing.

6.2.3 Control variables

As we can see from table 6, some of the control variables seem to have an effect on the underpricing of a firm. The control variable that takes years into account (CO_AR) seems to be significant at the 10% level in regression 4. The variable seems to imply that there might be a negative relationship between the years a firm has existed before it goes public and the underpricing of the firm (Loughran and Ritter 2004).

Further the control variable that considers the market state (CO_MST) seems to be significant at the 10% and 5% level in all three regressions. This variable indicates that there might be a positive relationship between the state of the market and the underpricing. If the market currently is in a hot state with a great number of IPOs, it seems to be a higher underpricing than if the market is cold (Ljungqvist, Nanda, and Singh 2006).

The control variable offer size (CO_OFFERS) further implies that it might have a negative relationship with underpricing. The variable is significant at 5% in regression 2 and 3. This variable indicates that large offer sizes will be lower underpriced than smaller offer sizes (Megginson and Weiss 1991).

It seems like investors view the age of the firm and the offer size as an indication of a less risky firm. This implies that if there is an old firm which goes public with

a large offer size, this firm will be less underpriced than a young firm in the same category with a smaller offer size.

7 Conclusion and further research

This paper tries to find an explanation on underpricing in initial public offerings, of firms listed in Norway, based on the ownership structure of a firm before it goes public. The data sample of the paper consists of firms listed on the Oslo Stock Exchange from 2001-2011. As described from the findings there seems to be a relationship between the ownership structure of the firm before an initial public offering and the underpricing of the firm.

Although it is not possible to draw a solid conclusion, there seems to be a higher underpricing of a firm when there is a high ownership concentration in the firm. This is logical considering the asymmetric information theory and the principal-agent theory.

The thesis further finds that firms with institutional owners are less underpriced than the average firm in a public listing. There is in other words a negative relationship between institutional owners and the underpricing of a firm. Further if it is a high government ownership pre-IPO this might lead to a lower underpricing. This was unexpected.

The findings further imply that firms with a high aggregated percent of international owners will have a lower underpricing than the average firm. The finding of a higher underpricing with a higher board size was also surprising, but as discussed in the hypothesis section, this is consistent with some of the previous findings in other previous literature.

As a conclusion, the ownership structure of the firm before an IPO will most likely have an effect on the underpricing of the firm. However of the firms going public from 2001-2011 the data sample only consisted of 98 firms in some of the regressions. This might be a too low data sample for a significant conclusion, but one can at least see a trend and get an indication.

Suggestions for further research is to try to collect more data before testing for the relationship between underpricing and ownership structure. Further it would be interesting to see if there is a lower underpricing of government owned firms if the ownership concentration is above 60%.

Appendix

Appendix 1: Reference List

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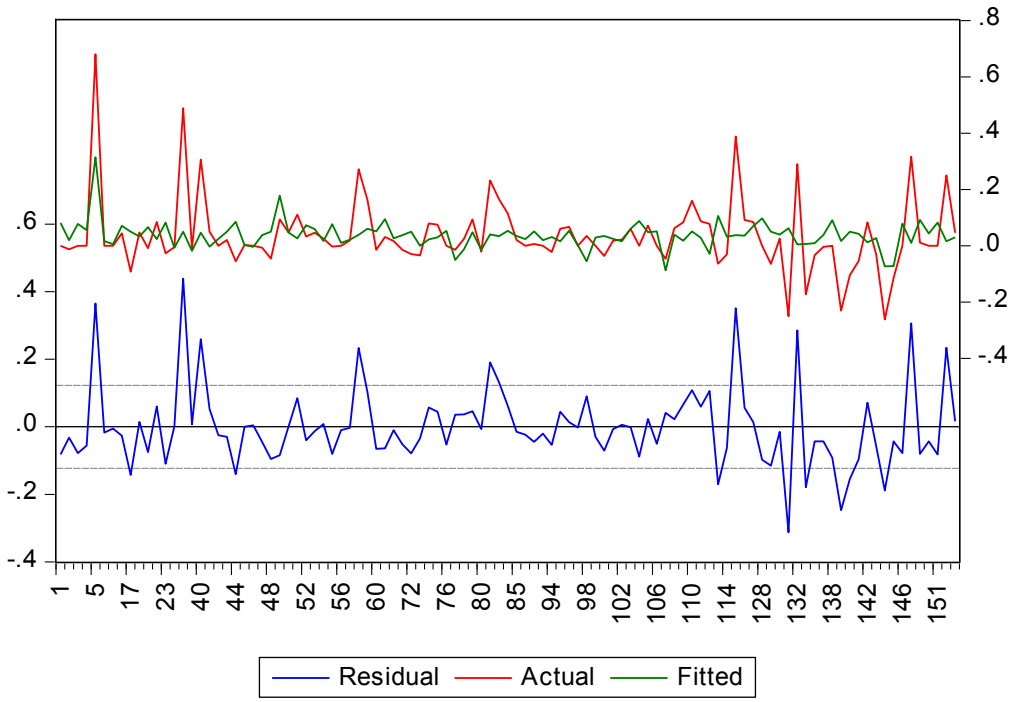
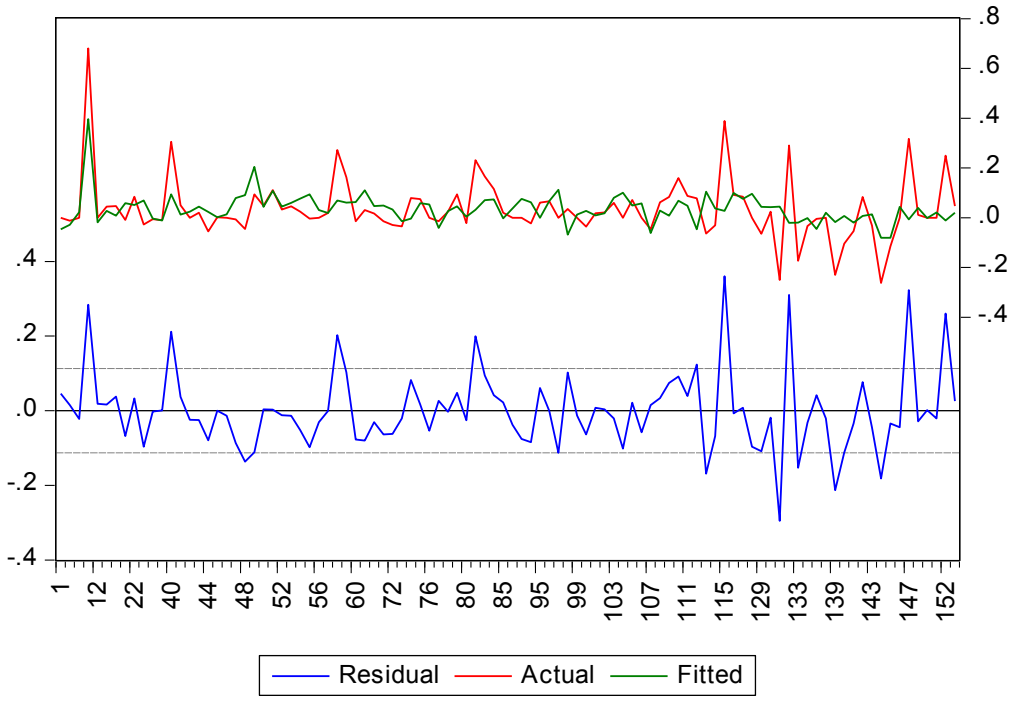
Appendix 2: Residual Graph

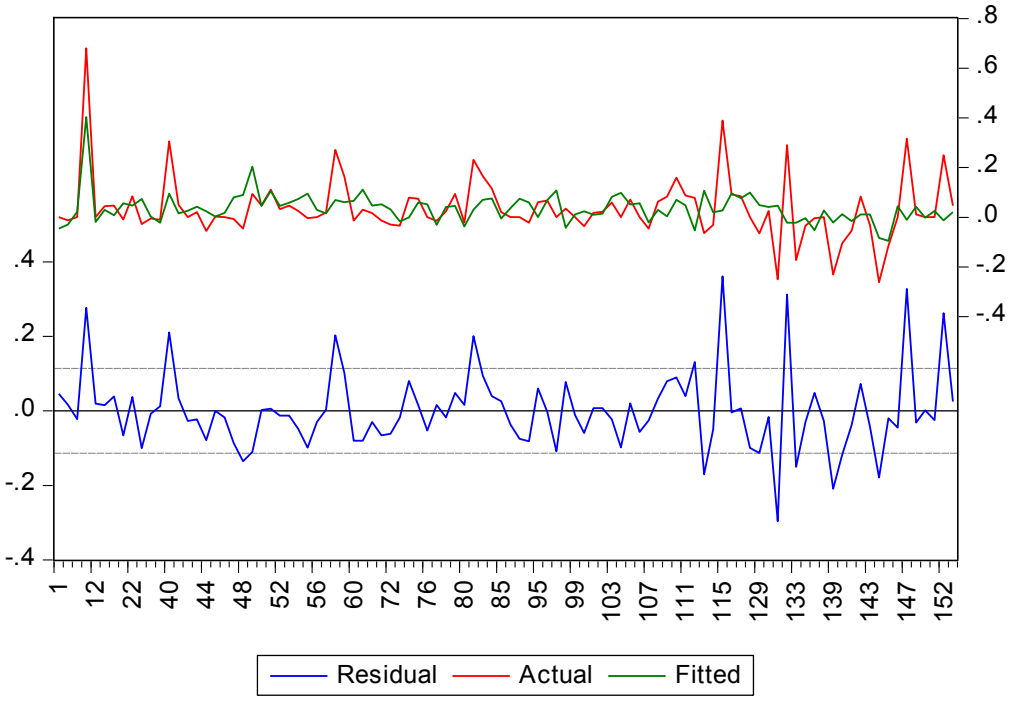
Regression 1:



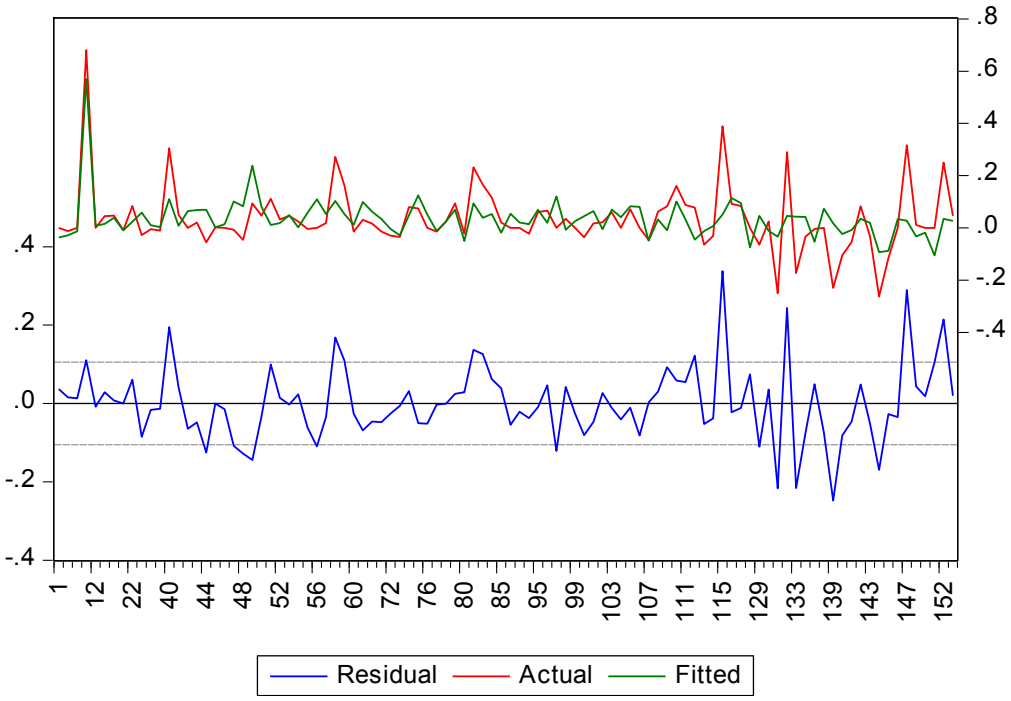
Regression 2:



Regression 3:



Regression 4:

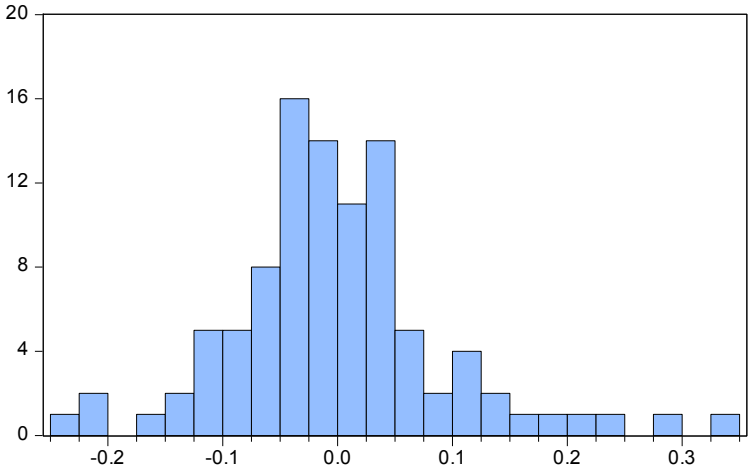


Appendix 3: Correlation Matrix

	undp	hfo	instit_25	state_25	intern_50	bs	percs	co_ar	co_mst	co_offers	co_undw	instit_25*percs	intern_50*perc	indu_50	indu_50*percs	perso_15	perso_15*percs	strbr
undp	1,000	0.178	-0.099	-0.030	-0.190	0.043	0.292	-0.055	0.110	-0.042	0.088	-0.097	-0.174	0.116	0.470	-0.033	-0.040	-0.138
hfo	0.178	1.000	0.012	0.003	0.123	-0.055	0.033	-0.045	0.004	0.330	0.160	0.065	0.089	0.510	0.058	-0.095	-0.048	-0.050
Instit_25	-0.100	0.017	1.000	-0.032	-0.081	0.125	-0.050	0.111	0.134	-0.044	0.105	0.083	-0.069	-0.171	-0.080	-0.056	-0.042	-0.170
State_25	-0.030	0.003	-0.032	1.000	-0.025	0.107	0.009	0.078	0.067	0.122	0.117	-0.027	-0.022	-0.054	-0.025	-0.018	-0.013	-0.099
Intern_50	-0.190	0.123	-0.081	-0.025	1.000	0.015	-0.012	-0.084	-0.015	0.160	-0.068	-0.068	0.085	-0.137	-0.065	-0.045	-0.034	0.175
BS	0.043	-0.005	0.125	0.107	0.015	1.000	-0.100	0.221	0.136	0.177	0.172	0.114	0.051	-0.065	-0.064	0.070	0.103	-0.226
percs	0.292	0.030	-0.050	0.009	-0.012	-0.100	1.000	-0.015	-0.173	0.049	-0.013	0.032	0.050	0.094	0.778	-0.079	-0.015	-0.026
co_ar	-0.055	-0.045	0.111	0.079	-0.084	0.221	-0.157	1.000	0.173	-0.136	0.026	0.018	-0.156	0.087	-0.018	0.094	0.068	-0.232
co_mst	0.109	0.004	0.134	0.067	-0.015	0.136	-0.173	0.172	1.000	0.007	0.381	0.060	-0.045	0.038	-0.124	-0.139	0.012	-0.367
co_offer	-0.042	0.330	-0.044	0.122	0.1666	0.177	0.409	-0.136	0.007	1.000	0.339	0.085	0.205	0.011	0.206	-0.110	-0.055	-0.057
co_undw	0.089	0.166	0.105	0.117	-0.068	0.172	-0.013	0.026	0.038	0.339	1.000	0.078	0.007	0.175	0.101	-0.137	-0.213	-0.035
instit_25*percs	-0.097	0.065	0.838	-0.027	-0.068	0.114	0.032	0.018	0.060	0.085	0.078	1.000	-0.058	-0.143	-0.067	0.047	-0.035	-0.041
intern_50*perc	-0.175	0.089	-0.069	-0.022	0.858	0.051	0.050	-0.156	-0.045	0.205	0.007	-0.058	1.000	-0.118	-0.055	-0.038	-0.029	0.087
indu_50	0.117	0.510	-0.171	-0.054	-0.137	-0.065	0.092	0.087	0.038	0.011	0.175	-0.143	-0.118	1.000	0.470	-0.095	-0.077	-0.037
indu_50*percs	0.470	0.520	-0.080	-0.025	-0.065	-0.064	0.778	0.012	-0.124	0.206	0.101	-0.067	-0.055	0.470	1.000	-0.045	-0.034	-0.142
perso_15	-0.033	-0.095	-0.056	-0.018	-0.045	0.070	-0.079	0.094	-0.139	-0.110	-0.137	-0.047	-0.038	-0.095	-0.045	1.000	0.750	-0.174
perso_15*percs	-0.040	-0.039	-0.042	0.013	-0.034	0.103	-0.015	0.068	0.012	-0.055	-0.213	-0.035	0.029	-0.072	-0.034	0.075	1.000	-0.131
strbr	-0.139	-0.013	-0.170	0.099	0.175	-0.226	-0.026	-0.232	-0.327	-0.057	-0.305	-0.041	0.087	-0.037	-0.142	0.174	-0.131	1.000

Appendix 4: Normality test

Regression 4:



Series: Residuals	
Sample 1 153	
Observations 98	
Mean	7.29e-18
Median	-0.008615
Maximum	0.337893
Minimum	-0.247661
Std. Dev.	0.095813
Skewness	0.649370
Kurtosis	4.987217
Jarque-Bera	23.01267
Probability	0.000010