

The usage and effects of overallotment arrangements in Swedish IPOs

- An empirical study of IPOs on the Stockholm Stock Exchange 1999-2008

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ABSTRACT

The majority of Swedish IPOs nowadays include an overallotment arrangement which enables the underwriter to stabilize the share price of the IPO if it is needed. This thesis examines how the underwriter uses the overallotment arrangement, and what beneficial effects the arrangement has for investors and the seller of the IPO. Specifically, we examine if the underwriters stabilize the share price and use the accompanied overallotment option rationally to maximize their payoff. We also study if stabilization has any impact on the share price and if the seller benefits through less IPO underpricing by including an overallotment arrangement in the IPO. The empirical observations consist of IPOs on the main lists of the Stockholm Stock Exchange between 1999-2008. We find that: (1) underwriters generally use the overallotment arrangement as one would expect; (2) the price stabilization associated with the overallotment arrangement do impact the share price, but only for a limited time period; (3) sellers are not able to sell IPOs at more 'fair value' if an overallotment arrangement is included. The findings suggest that it is the underwriters, and investors instantly selling their holdings, which are the primary beneficiary of the overallotment arrangement. The question to why the seller should include an overallotment arrangement in the first place remains unanswered.

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1. INTRODUCTION

“In connection with the offering SEB Enskilda might conduct transactions that stabilize or maintain share prices at levels that otherwise would not persist on the market.” (Gant Prospectus p. 1, 2006)

More than 70 percent of the initial public offerings (IPOs) during the time period of 1999-2008, on the main lists of the Stockholm Stock Exchange, contained expressions similar to the one in Gant's prospectus. Through the eyes of an investor these words probably appear very appealing. Expressions like this are connected with an instrument called the overallotment option and the overallotment arrangement. This arrangement will not only maintain share prices on unnatural levels, it is also suggested to help reduce underpricing which will yield more money for each share to the seller of the shares in an IPO. Meanwhile, when looking closer at the payoff structure of the overallotment arrangement, one can see that the bank who sells the IPO will always earn money – no matter what direction the share takes in the market. An instrument that can satisfy all involved parts in an IPO truly looks appealing for both capital markets as well as a subject for academic research.

In spite of this, the topic has not received much attention in the academic world, especially in light of how much research have been conducted on IPOs and IPO underpricing. (Franzke and Schlag, 2002) With this as a background, it is interesting to examine the usage and effects of the overallotment arrangement – especially for the Swedish capital markets, where the research is even more limited.

1.1 The overallotment arrangement and the overallotment option

The overallotment option is commonly also referred to as the Green Shoe-option since the IPO of Green Shoe Co (nowadays Stride Rite Corp.) in 1960 was the first one to include this type of instrument. (Martin, 2004) Since the option for the first time was introduced in the Green Shoe offering, it is nowadays related to the most common method for aftermarket price support. (Finansinspektionen, 2007:11)

Fundamentally one can view the overallotment option as a plain American call option which gives the holder of the option the right, but not the obligation, to buy a certain amount of shares from the issuer of the option at a predetermined price within the time to maturity. (Hansen et al., 1987) Why is it called an *overallotment* option then? Whenever this type of option is used, it is in the context of an offering, such as an IPO. One can view the *overallotment option* as part of what Franzke and Schlag (2002) defines as the *overallotment arrangement*. The overallotment arrangement is an agreement between the seller of the IPO and the underwriters (investment banks) in charge of taking a company public. The overallotment arrangement enables the underwriters to sell more shares to the public than the actual size offered (i.e. *overallot* the IPO), with a limited risk. When the underwriters overallot the IPO

they borrow shares from the sellers, which are subsequently sold to the public for the same price (the offering price) as the ordinary shares offered. Thus, when overallotting, the underwriters have sold shares that they do not own, meaning that they have an obligation to the lenders. The underwriters then have two alternatives when ‘repaying the loan’ to the lenders of the overallotted shares.

The first alternative is to hand back the borrowed shares, by repurchasing them in the open market when trading in the stock has commenced. If the underwriters repurchase the borrowed shares on the market the action is intended to stimulate the total demand in the stock, in an attempt to protect the share price from decreasing (Lombardo, 2007). This transaction is called *aftermarket short covering*. This is what is meant by “...transactions that stabilize or maintain share prices at levels that otherwise would not persist...” The payoff to the underwriters in aftermarket short covering would be the difference between the price they sold the borrowed shares at (the offering price) and the price they had to pay when later buying back the shares in the market.

The other alternative is to exercise the overallotment option which is included in the overallotment arrangement. In this case the underwriters compensate the lenders by repaying them in cash instead of handing back the shares. The underwriters will buy the overallotted shares from the lenders at a price equal to the offering price less a fee when the option is exercised. The payoff for the underwriter will then be that fee. This repayment alternative is not intended to stabilize the share price.

To summarize, there are two ways for the underwriters to end their obligation to the lenders of the shares. They can either hand the shares back through aftermarket short covering or they can compensate the lenders by paying them the offering price less a fee for each share borrowed (i.e. exercising the overallotment option).

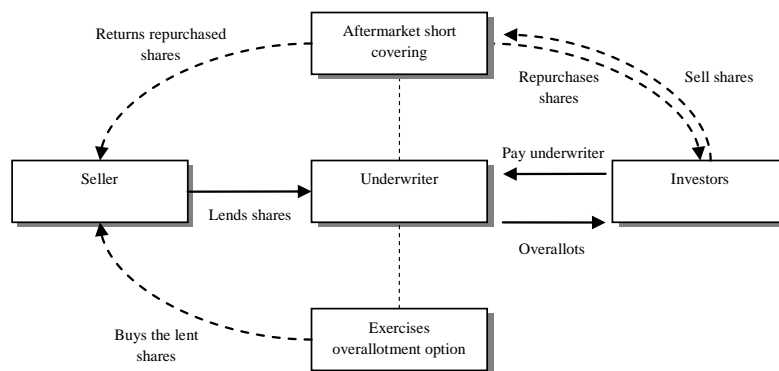


Figure 1.1: Overview of overallotment arrangement

1.2 Motivation and purpose

The purpose of this thesis is to examine the use and effects of overallotment arrangements on the Swedish stock market to see how underwriters use the arrangement in practice, whether an overallotment arrangement should be included by the seller and if the investors should place any emphasis on the

arrangement in terms of the stabilization it is said to provide. Specifically, we study IPO transactions between 1999-2008 on the main lists of the Stockholm Stock Exchange (SSE) to examine how underwriters use the overallotment arrangement, what stabilizing effects (if any) the overallotment arrangement has on the stock price in the aftermarket and if an inclusion of the overallotment arrangement would benefit the seller through less underpricing.

1.3 Contribution

To our knowledge, this is the first research within the field of overallotment arrangements on the Swedish market and will be of relevance for anyone that might be involved in an IPO, especially as an investor or as a seller. In order to get a broad picture about the effects of the overallotment arrangement and how it is used, we build our analysis upon three different studies. By combining these three studies we are able to analyze and assess how beneficial the overallotment arrangement is for the parties involved in an IPO; the seller; the underwriter; and the investor.

1.4 Outline

The outline of this thesis is organized as follows. We will initiate by giving the reader empirical examples about the exercise of the overallotment option as well as aftermarket short covering. In the following section we provide a general introduction to the subject, covering the IPO process in general to familiarize the reader with the surroundings of an overallotment arrangement. Furthermore, we touch upon the practices and legal framework of price stabilization in Sweden. We then present the theoretical framework within the field of overallotment arrangements and price stabilization. With this as a background, we develop our hypotheses and the methodology we will use for testing them. Thereafter, we provide the reader with an overview of our dataset, followed by an analysis of the usage, effects and benefits of the overallotment arrangement. We conclude by discussing our findings and make suggestions for further research.

1.5 Case studies of the overallotment arrangement

Below two examples are outlined in order to shed light on how the overallotment arrangement works practically with regards to exercising the overallotment option and aftermarket short covering. The first example is for the situation where the option has been exercised, whereas the second example corresponds to an IPO where price stabilization was done.

1.5.1 Exercising the overallotment option for the Gant IPO

Trading in Gant commenced on the 28th of March 2006. The offering price of the IPO was fixed at SEK 141 and the total offering consisted of approximately 8.7 million shares or SEK 1.23 billion sold by Klas Käll, one of the founders, and the private equity-firm 3i. An overallotment option from the selling

shareholders was granted to the underwriters of an additional 968,610 shares to cover for an overallotment. The offering was well received by the investors, with a total subscription rate of 41 times the total offering size. The share gained around 38 percent during the first trading day and stayed at these levels throughout the following days, with volume in the stock coming down. Three days after the listing, a press release announced that the overallotment option had been fully exercised and that no stabilization had been conducted. This meant that Klas Käll's holdings in Gant were further reduced, whereas 3i's position in the company was closed. In compensation, Klas Käll and 3i received SEK 141 less the underwriter gross spread (i.e. the underwriters' fee) for each share. Including the exercised overallotment option the total offering size amounted to approximately 9.7 million shares or SEK 1.37 billion before adjustments for underwriting costs. Since the actual underwriter gross spread was not disclosed we will have to make an assumption about the spread in order to shed light on payoff for the underwriters. Assuming a gross spread of 3 percent, a 'back of the envelope' calculation yields a fee of SEK 36.8 million relating to the offering size of 8.7 million shares. The additional fee gained by exercising the option amounted to SEK 4.1 million. That is, the overallotment option generated an additional 11 percent of revenues to the underwriters.

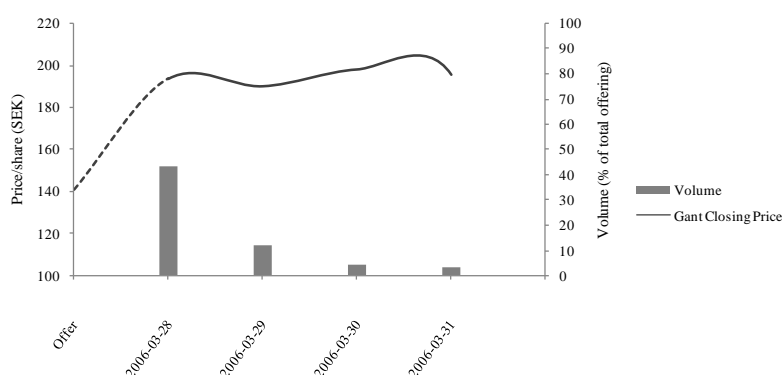


Figure 1.2: Initial share price performance and daily trading volume for the Gant share

1.5.2 Aftermarket short covering in HMS Networks' share

HMS Networks was listed on the 19th of October 2007. The offering price of SEK 74 per share amounted to 92.5 percent of the highest interval in the book building range (SEK 80) and at that price the subscription rate was 3 times the offering size of approximately 6.5 million shares. Just as with Gant, the offering referred to existing shares. The shares were offered by the two founders of the company, and the private equity firm Segulah. Along with the offering, Segulah had granted an overallotment option to the underwriters for approximately 650,000 additional shares. If this overallotment option would subsequently be exercised, Segulah would not have any holdings left in the company. However, in comparison to Gant, HMS Networks' share traded below its offering price during the first day and gradually declined over the first month of trading. At the 16th of November, when the stabilizing period

had lapsed, the company informed that the underwriters had chosen not to exercise the overallotment option. Instead the underwriters had carried out price stabilizing transactions (aftermarket short covering) and repurchased approximately 650.000 shares during the first trading day at prices in the interval of SEK 70-74. Thus Segulah was subsequently given back the shares that the underwriters previously had overallotted. Once again assuming a gross spread of 3 percent the fee for selling the 6.5 million shares amounted to approximately SEK 14.4 million. Assuming that the underwriters repurchased the shares at an average share price of SEK 72 the underwriters gained an additional SEK 1.3 million, corresponding to additional 9 percent in revenues.

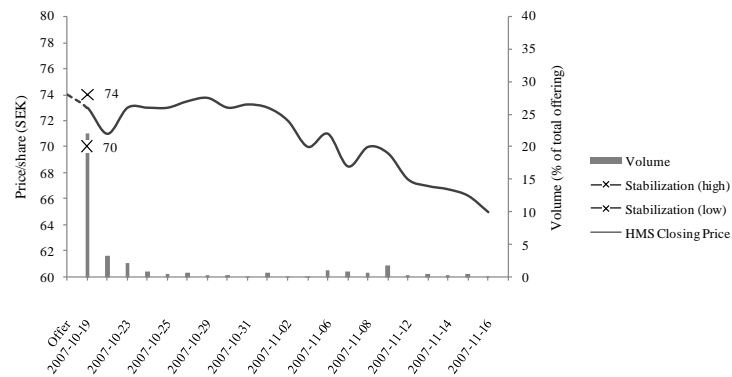


Figure 1.3: Share price performance and daily trading volume for the HMS Networks' share

2. THE SURROUNDINGS OF THE OVERALLOTMENT ARRANGEMENT

In this section we will initially describe the IPO process. We will also give an explanation to how the over allotment arrangement is used in the Swedish institutional setting.

2.1 The IPO process

When a company is about to list, it is generally using one or several syndicates of investment- and commercial banks (underwriters) whose role is to sell the shares to the public investors. The syndicate in turn is lead by a *lead underwriter*¹, commonly an investment bank, which coordinates the IPO process step by step. (Lombardo, 2007) There are two different types of syndicates which relates to the two main types of contractual agreements between the underwriter and the seller. (Högfeldt, 1997) The *firm commitment* syndicate buys the shares from the seller and then resells them to investors. A firm commitment syndicate bears *ex ante* the risk of the distribution of shares as it keeps all shares it was unable to sell to investors. (Lombardo, 2007) However, the risk for the underwriters actually ending up needing to keep the position of shares it was unable to distribute is normally quite low since this contract is signed at a very late stage of the IPO process and conditional upon different properties. (Pontus Enquist, Advokatfirman Vinge AB, 2009-03-19). For instance the offering could be withdrawn if a disturbance would occur on the market that would make it difficult for the underwriter to execute the offering (Finansinspektionen, 2007:11). The *best efforts* syndicate does not face any liabilities for unsold shares. The syndicate simply tries to sell all shares on a best effort basis (Lombardo, 2007) and should the amount of shares sold be less than the amount agreed upon, the offer is withdrawn. (Brealey et al., 2006) The most common type of contract with respect to Swedish IPOs is the firm commitment contract. (Enquist, 2009-03-19).

Once the syndicate has received and accepted the offer of taking the company public the preparation starts. Besides solving practical matters, such as when and how the transaction will be executed, a price must be specified for the company's shares. There are two different types of IPO pricing; *fixed price* and *book building*. (Finansinspektionen, 2007:11). In a *fixed price* offering a specific share price is determined *ex ante* where the investor's simply specifies the amount of shares they want to purchase at the predetermined price, which is fixed throughout the subscription period. (Högfeldt, 1997) *Book building* is instead a pricing form where the syndicate determines *ex ante* a price range for the share. Institutional investors thereafter place bids considering both the price and quantity they are interested in. This process is ongoing during the subscription period and once it ends the issuer and the underwriters determine the final price based on the bids submitted. The bids from institutional investors are only seen as an indication of interests, meaning that they are free to alter or withdraw their indication of interests

¹ In many cases there will be more than one lead underwriter (Jens Plenov, SEB Enskilda 2009-04-15)

throughout the subscription period. Retail investors simply state how much shares they want to buy and will then have to wait to see what the final price for each share will be. For retail investors the same contractual rules apply as with a fixed price offering, i.e. the registration is legally binding. (Finansinspektionen, 2007:11) Book building is the most used price mechanism worldwide (Lombardo, 2007) and is common for larger IPOs in the Swedish market (Finansinspektionen, 2007:11).

2.2 Initial trading

Once the subscription period has ended the underwriter assess the registrations that the investor's have submitted and outline a proposal on how to allocate the shares between investors. Once the proposal is outlined, the issuer takes the final decision on how to allocate the shares to the investors. (Finansinspektionen, 2007:11) The time between the end of the subscription period and when the share starts to trade varies. For the IPOs we examined the time interval ranges between 1 and 26 days, with an average of 9 days.

During the first days of trading, it is commonly only institutional investors that have the possibility to sell shares that they were allocated. Retail investors on the other hand often have to wait longer than the institutions before they can sell their allocated position. This is because it usually takes a few days before the retail investor knows if he was allocated any shares in the IPO. (Marcus Rylander, Handelsbanken Equity Capital Markets, 2009-04-22) Meanwhile, the first two-three days of trading are characterized by high trading volume. The high volume is not necessarily only related to 'flipping' by investors that want to realize a short term return, but can also be due to ownership adjustments by large institutional investors after they have received their allocation. If the received allocation is not justified in terms of economical size, the institutional investor might instead choose to exit instantly instead of trying to build up a large enough position over time by acquiring stocks on the market. (Rylander, 2009-04-22)

2.3 Overallotment details

The importance of the underwriters continues beyond the date when the stock becomes publicly traded. (Ellis et al., 2000) The lead underwriter is responsible for all the aftermarket activities (e.g. aftermarket short covering and option exercise) for the syndicate (Aggarwal, 2000). For IPOs with several lead underwriters, commonly one lead underwriter is decided to handle the aftermarket activities and will share the proceeds incurred from the aftermarket activities with the other firms within the syndicate. (Plenov, 2009-04-15). When the final price² and quantity of the IPO have been determined, the lead underwriter can establish a short position in the offered company's share by overallotting (i.e. allocating more than 100 percent of) the offering. (Aggarwal, 2000) For Swedish IPOs, the underwriter typically overallots the issue by borrowing shares from major shareholders. (Finansinspektionen, 2007:11). The

² For IPOs using the book building process

overallotment option, granted in connection with the arrangement, typically refers to these existing shares. The technical procedure of the overallotment is that the underwriter borrows shares from the major shareholders whose shares the overallotment option refers to. (Enquist, 2009-03-19) These shares are then being distributed to the investors in the overallotment procedure. The major shareholder will then be handed back their shares or a compensation consisting of the offering price less the underwriter spread depending on whether the option was exercised or not. (Plenov, 2009-04-15) The repayment forms are not mutually exclusive the underwriter can choose to compensate the seller by handing back some short covered shares and partly exercise the overallotment option in order to cover for the overallotment. (Lombardo, 2007)

The overallotment option sometimes instead refers to primary shares but it is not very common. The reason for this is that if the overallotment option would refer to primary shares, it would mean that the amount of proceeds that will flow into the company actually would be conditional upon the share price development. Hence, if the underwriters choose not to exercise the overallotment option, fewer proceeds would flow into the company. (Plenov, 2009-04-15) The seller is typically not compensated for granting the arrangement, even though one could argue that *all* existing shareholders would reap the same potential benefits from the arrangement granted by one or several major shareholders. The argument for this is that there is a close alignment between the company and its major shareholders, meaning that what is good for the company will also be good for a shareholder holding a significant stake in the company. (Plenov, 2009-04-15)

2.4 Legal framework for overallotment in Sweden

The European Commission regulation no. 2273/2003 outlines how the overallotment arrangement can be used without breaching the general prohibition of market manipulation in the Market Abuse Directive (Directive 2003/6/EC, Article 5). (Lombardo, 2007) The conditions in regulation no. 2273/2003 were implemented in the Swedish Law of Market Manipulation (Lag 2005:377) in 2005. In summary, the underwriter will not violate the law of market manipulation as long as the stabilization is done at a price at or below the offering price, the underwriter limits the stabilized amount of shares to the shares covered by the overallotment option and ceases with price support within 30 calendar days from the first trading day of the share. Moreover, it states that the maximum amount of shares that can be covered by the overallotment option is 15 percent of the total amount of shares offered. (Finansinspektionen, 2007:11)

Another important aspect is that underwriters may only exercise the overallotment option, if they actually have overallotted the offering.³ (Lombardo, 2007) Prior to 2005 there were no explicit rules outlined regarding stabilizing activities in the law. Instead, *Stockholms Fondbörs* (nowadays the SSE) had outlined rules together with practitioners concerning stabilization. (Regeringen, Prop. 2004/05:142 p. 84).

Beyond the overallotted shares covered by the option, the syndicate also has the opportunity of overallotting an additional 5 percent of the IPO, but this part must not be covered by an overallotment option (naked short position). Should the share subsequently rise in the aftermarket, the underwriter would incur a loss on the naked short position. (Aggarwal, 2000) Accordingly, the naked short position will only be taken if the underwriter believes that there will be a weak market sentiment surrounding the IPO. (Finansinspektionen, 2007:11) Jens Plenov (2009-04-20) notes that naked short positions are reasonably common, occurring in 10-15 percent of IPOs with values above EUR 50 million. However, in line with the potential negative effects brought forward by Finansinspektionen (2007:11), he adds:

“They are used with a lot of caution as losses to the syndicate could be substantial”

There are also other potential aftermarket activities that an underwriter can use apart from overallotting (see e.g. Aggarwal, 2000). Since these activities are not regulated in any safe-harbor clauses it is important that the underwriter makes sure it acts in accordance with existing laws of market manipulation if it chooses to use them. (Finansinspektionen, 2007:11) However, it is uncommon that other aftermarket activities are used. (Plenov, 2009-04-15; Rylander, 2009-04-22)

³ Without this restriction, one could argue that there would be substantial benefits for the underwriter. Once again using the Gant example; the underwriters would without overallotting earn nearly SEK 52 million, assuming that the option was exercised the first day when the share price increased 38 percent. $[968,610 \text{ shares} \times (141 \times 1.38 - 141) \approx \text{SEK } 52 \text{ million}]$. One could then argue that it would never be in the interest of the underwriter to overallot shares, given the potential gain they could make.

3. THEORETICAL FRAMEWORK

In this section we present the theories that will be used in the thesis for examining how the options should be used by the underwriters, what the impact the option might have on aftermarket prices and what benefits the overallotment option might have for the seller.

3.1 How should the overallotment arrangement be used by the underwriter?

The existing literature provides a few explanations to why the overallotment arrangement should be included in the first place. A common suggestion (see e.g. Hansen et al., 1987 and Muscarella et al., 2000) is that the underwriters want to overallot the IPO in order to protect them from the possibility that an investor who has indicated that he wants to participate in the IPO later choose not to subscribe to any shares. This would be a problem for the underwriters as the most common contract, the firm commitment contract, between the underwriters and the sellers specifies that the underwriters have to keep all shares they were unable to sell (Lombardo, 2007). In this case the underwriters would be exposed to the risk of having to sell the reneged shares in the market at a price lower than the offering price. By overallotting, this risk is mitigated since the reneged shares then effectively will be sold to the buyers that the underwriters have overallotted the offering to (Muscarella et al., 1992). Illustrating this with an example most can relate to; in the airline industry it is common to sell more tickets than seats available since the airline expects that some passengers will not show up.

Most often however, the number of reneged shares will be less than the number of shares overallotted by the underwriters (Lombardo, 2007). Given this, the underwriter will have a short (negative) position in the shares. But what happens if the share price increases? If the underwriters did not have an overallotment option, they would be exposed to the risk of having to buy back the overallotted shares at a price higher than the offering price, thus incurring a loss. Since IPOs indeed often are underpriced meaning that the share price would be higher than the offering price once trading has commenced, a short position would frequently lead to losses as the underwriters would have to buy back the shares at a higher price than the offering price. Somehow the underwriters must be compensated for this risk. Hansen et al. (1987) argue that the seller can compensate the underwriters for this risk by granting an overallotment option. The overallotment option may be exercised anytime within a fixed period from the first trading day and typically lasting 30 calendar days. Hence, if the share price rises in the aftermarket the lead underwriter will simply exercise the overallotment option in order to cover the shorted position. (Hansen et al., 1987) It is not uncommon that the lead underwriter also exercises the option even for IPOs that trade slightly below the offering price. This is because underwriters earn a spread on the shares it sold. (Aggarwal, 2000) Hence, the *strike price* of the option is in fact not the offering price, but the offering price less the spread. (Fishe, 1999) Say for instance that the underwriter

overallotted a share for SEK 100. With a spread of 3 percent, this would mean that the underwriter would have the incentive for exercising the option as long as the share price is above SEK 97 when trading have commenced.

Apart from exercising the option the underwriters also have the possibility to buy back the overallotted shares through aftermarket short covering. Legally, the underwriter can repurchase the shares in the market at all prices at or below the offering price (in this case SEK 100). However if one considers the payoff scheme for the overallotment arrangement it would not make sense for a revenue maximizing underwriter to short cover the share at the offering price.

Franzke and Schlag (2002) outline the payoff scheme for the overallotment arrangement in two different parts:

- i) The spread, which will be earned by the underwriter if the overallotment option is exercised to cover the shorted position,
- ii) or the trading profit that could occur if the underwriter covers the shorted position by purchasing shares in the market at prices below the offering price.

Taking both payoffs into consideration yield the following payoff for the underwriter:

General

$$\text{Max}\{S^* - S_t; E\}$$

S^* = The offering price

S_t = The aftermarket share price at time t

E = Underwriter gross spread

Or in the form of a payoff diagram;

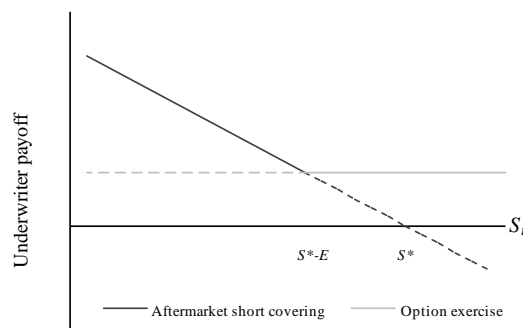


Figure 3.1: Payoff diagram overallotment arrangement

Example

$$\text{Max}\{100 - S_t; 3\}$$

S^* = 100

S_t = The aftermarket share price at time t

E = 3

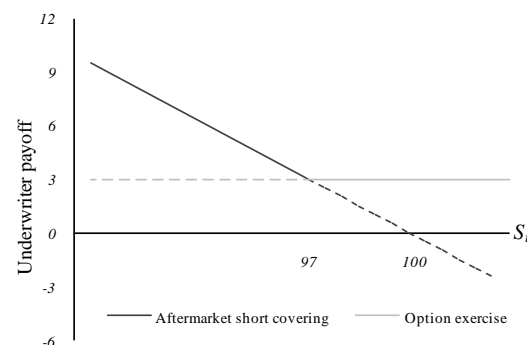


Figure 3.2: Payoff diagram example

A strictly profit maximizing underwriter would thus always follow these decision rules. Hence,

Hypothesis I: The underwriter will exercise the option when the share trades above the strike price and stabilize the share for all other levels

Table 3.1: Relevant empirical findings

Authors	Country	Time period	Main findings relevant for our hypothesis
Muscarella et al. (1992)	USA	1983-1987	• The overallotment option is exercised when it is 'in the money'

3.2 Price stabilizations effect on near term returns

Apart from the potential reneging problem for the underwriter, another common proposal is that the action of aftermarket short covering will work as a stabilizing activity for the share price. (See e.g. Aggarwal, 2000; Oehler et al., 2006). With a short position in the shares, the underwriter will have the incentive to repurchase shares when the share price drops below the strike price. This is also when the share price is in need of price stabilization. If the share price increases once trading commences, it would not be necessary to stabilize.

It is not only the payoff from the overallotment arrangement that gives incentive to the underwriter for the action of aftermarket short covering if the share price would drop. Two of the underwriter's most valuable assets is its *network* of institutional investors (as the underwriter will market other IPOs to these investors in the future), and its *market reputation* (which will ensure credibility of the information the underwriter presents to investors about the company to be listed). In order to sustain a good relationship with its clients and keep its reputation, it is therefore in the interest of the underwriter to ensure that the IPO does not become unsuccessful. If the share eventually starts to fall when trading commences, the underwriter can then carry out price stabilizing activities. The price stabilization is thus a tool for mitigating the risk of having an unsuccessful IPO. (Högfeltdt, 1997)

Ruud (1993) argues that the high *average* initial returns for IPOs, historically explained as IPO underpricing, are also caused by price stabilizing activities by the underwriters. This comes from the fact that some shares are 'held up' by the lead underwriter and shows a zero or slightly negative return instead of a more negative return that would have been the case without the price support. Ruud also argues that if price stabilization does have an impact, the distribution of IPO returns will be positively skewed and have excess kurtosis. Ruud argues that underpricing alone, cannot be the reason for why distributions change shapes. If underpricing is present, it would merely shift the mean of the distribution to the right (to a mean return above zero), but not affect the skewness and kurtosis of the distribution (See Technical proof in the appendix for formal argument). The skewness and excess kurtosis will instead come from the underwriter artificially holding up share prices located in the left tail of the distribution. The shape of the distribution should according to Ruud transform over time and move towards a normal distribution with decreasing positive skewness and excess kurtosis as the underwriters' price stabilizing activities ceases.

Aggarwal (2000) states that the share repurchases done through aftermarket short covering will increase the demand of the share which should stabilize the share price. In contrast to this suggestion, theories of perfect liquid capital markets state that the buying (demand) and selling (supply) of shares should not have any impact on prices at all. (Franzke and Schlag, 2002) If the market assesses the *true price* of one share to SEK 10, then this price should hold regardless of how many shares are supplied and demanded in the market. However, there is research questioning this theory. Harris and Gurel (1986) study the effect on share price performance for companies that are added to S&P 500. They argue that a company being added to the index should not convey any new information about the future prospects of the company, but simply that the demand for the companies share will increase due to the listing. This is because many index funds that replicate S&P 500 will buy shares of the company that have been added. They find that the share prices of the observed companies increase after they have been added to S&P 500, but that the increase fade away after a few weeks. Their result is consistent with the *price-pressure hypothesis* stating that short term demand curves for share prices may be less than completely elastic. (Harris and Gurel, 1986). Using the same analogy for the overallotment arrangement, aftermarket short covering which stimulates demand might have a short term effect, but the share price should eventually revert to its true price. Hence,

Hypothesis II: Stabilization does have an effect on share performance

Hypothesis III: The stabilizing effect will only be temporary

Table 3.2: Relevant empirical findings

Authors	Country	Time period	Main findings relevant for our hypothesis
Aggarwal (2000)	USA	1997	<ul style="list-style-type: none"> • If aftermarket short covering is conducted, it is always done during the first trading day • Price support tends to end after 10-15 days
Friberg (2006)	Sweden	1979-1997	<ul style="list-style-type: none"> • Argues that stabilization is less needed in Sweden, in comparison to USA, since Swedish IPOs are relatively more underpriced
Oehler et al. (2006)	Germany	1997-2002	<ul style="list-style-type: none"> • Price stabilization activities are not effective
Ruud (1992)	USA	1982-1983	<ul style="list-style-type: none"> • Price support, besides underpricing, can explain high average initial returns for IPOs • The effect of price support gradually declines over time

3.3 Overallotment arrangement as a means to reduce underpricing

Franzke and Schlag (2002) argue that the overallotment arrangement should lead to some benefit for the sellers who grant the arrangement to the underwriter. Without any benefit, the seller would be better off by not granting an overallotment arrangement in the first place. Under the arrangement the seller will be

handed back his shares when the share price is lower than the offering price (aftermarket short covering). In this case the seller would have been better off if all the borrowed shares were sold to investors and none were handed back to him. Conversely, the seller will be compensated with the offering price less the spread whenever the share price is above the offering price (option exercise). Here the seller would have been better off if the shares were given back to him.⁴

Franzke and Schlag argue that the underwriter's holding of the overallotment *arrangement* (not to be confused with the overallotment *option* alone) can be valued as a *put* option plus a fixed payment (the gross spread). The value of a put will increase the lower the share price is relative to the strike price of the option. Hence, the underwriter will have an incentive to reduce the amount of underpricing for an IPO in order to maximize the value of the overallotment arrangement as this will increase the probability of 'the put' ending up in the money. However, Franzke and Schlag also stress that the underwriter will still be reluctant to *overprice* the IPO using similar arguments about preserving underwriter reputation as Högfeldt (1997) (see section 3.2).

Chowdry and Nanda's (1996) theory also suggest that the overallotment arrangement may reduce underpricing. They base their argumentation on a common theory, which was initially developed by Rock (1986), that there are *informed* and *uninformed* investors. The informed investors will avoid subscribing to overpriced IPOs while the uninformed investors will bid on all IPOs. Assuming that the average IPO was offered at fair value, with some IPOs being underpriced and others overpriced, the uninformed investors would then on average lose money by investing in IPOs. This is because the uninformed investors will receive a relatively larger fraction of overpriced rather than underpriced IPOs. Both types of investors are necessary since the demand from informed investors alone would not be sufficient for every IPO, so the uninformed investors must be compensated in order to participate. (Jenkinson and Jones, 2006) By underpricing the IPO, the uninformed investors are compensated *ex ante* for this problem so that they on average would earn the risk free rate instead of losing money by participating in IPOs. (Rock, 1986)

Chowdry and Nanda (1996) argue that aftermarket support is a less costly way for compensating the uninformed investors rather than underpricing. The problem with compensating uninformed investors *ex ante* through underpricing, is that the informed investors will benefit from underpricing as well. Chowdry and Nanda propose that aftermarket support will instead work as a compensation *ex post*, where the offer from the underwriter to buy back shares at (or below) the offering price, will be similar to providing a put option for investors. This option will thus mainly be valuable for uninformed investors, as the informed investors will only subscribe to IPOs they expect have a higher true price than the offering

⁴ To exemplify, consider an investor that can choose between selling 115 shares, or 115 where 15 shares falls under the overallotment arrangement. With an offering price of SEK 10 after adjustments for spreads, the investor will get SEK 1,150 for the IPO if not granting the arrangement. With an overallotment arrangement, the seller will get SEK 1,150 if the option is exercised. If the 15 shares instead are returned through aftermarket short covering meaning that the share trades below the offering price, the value of his holdings will be worth less than SEK 1,150.

price. Similarly, Aggarwal (2000) proposes that investors are more likely to invest in IPOs that investors expect will be stabilized if needed. Investors will perceive IPOs less likely to be overpriced if the underwriter commits to stabilize it if needed.

There are however other theories and empirical findings opposing the proposal from Chowdry and Nanda (1996). Jenkinson and Jones (2006) resemble uninformed investors with *retail investors* and informed investors with *institutional investors*. They note that the lead manager in charge of stabilizing can direct the price stabilization between institutional investors and retail investors, even without knowing their identity, by observing the size of the sell order as the orders from institutions tend to be larger. Empirical findings by Benveniste et al. (1998) find support for institutional investors being the ones reaping most benefits from price stabilization, which is in contrast to the argument by Chowdry and Nanda that the uninformed (retail) investors are the ones receiving the benefits.

We note that there are contradictive theories regarding who will benefit from price stabilization. This may cast doubt on Chowdry and Nanda's theory which suggest that the overallotment arrangement may reduce IPO underpricing. Considering the full picture, there are more arguments in favor of the overallotment arrangement reducing underpricing. In addition, taking into account how common the overallotment arrangement actually is, we would suspect there should be some benefits for the seller by including it. Hence,

Hypothesis IV: IPOs including overallotment arrangements faces lower underpricing

Table 3.3: Relevant empirical findings

Authors	Country	Time period	Main findings relevant for our hypothesis
Franzke and Schlag (2002)	Germany	1997-2001	<ul style="list-style-type: none"> • No evidence of reduction in underpricing • No evidence of other benefits such as a smaller gross spread
Hansen et al. (1987)	USA	1979-1983	<ul style="list-style-type: none"> • No evidence of reduction in underpricing • No evidence of other benefits (e.g. lower gross spread)

4. METHODOLOGY

In this section we present the methodology used for examining the hypotheses. Our methodology generally follows previous research with some modifications in order to adjust for the data available.

4.1 Calculation of returns

4.1.1 Underpricing

We have chosen to use the initial (first day) return as an estimation of over- and underpricing in line with e.g. Ritter (2008). The formula is given in equation 4.1 and represents the first-day return for the investors who were allocated shares at the offering price.

$$IR_1 = \left(S_1 / S^* \right) - 1 \quad (4.1)$$

Where,

S_1 = The closing share price the first day of trading

S^* = The offering price

4.1.2 Short term performance

When calculating the near-term return we use an equivalent formula, which is specified in equation 4.2.

$$IR_t = \left(S_t / S^* \right) - 1 \quad (4.2)$$

Where,

S_t = The closing share price at time t

S^* = The offering price

4.2 The choice of exercising the overallotment option

When examining the exercise pattern for overallotment options, we follow the methodology of Muscarella et al. (1992). We select IPOs that included an overallotment arrangement and divide them in two groups depending on whether the option subsequently was exercised⁵ or not. Each group is then divided into two subgroups where the first refers to the IPOs where the share price after 20 trading days is below the strike price and the second to those with a price above the strike price. Just like Muscarella et al. we use a 20 day time window since the permitted stabilization period of 30 calendar days approximates 20 trading days.

⁵ This group also contains observations where the option was partly exercised.

This methodology of using a 20 day time window is done since Muscarella et al. do not have the explicit dates for when the options were exercised. We will expand the methodology by also looking at the IPOs where we have specific information for when the options was exercised. Similarly we will consider the IPOs where we have explicit information about aftermarket short covering. Important to note is that aftermarket short covering is usually done over several days. If aftermarket short covering has been done for more than one price level, we will consider the highest stabilizing bid.

The analysis of Muscarella et al. is based on the true strike price of the overallotment option, i.e. the offer price less the underwriter gross spread. Since we do not have explicit data about the underwriter spread for most of our observations, we perform our analysis by assuming spreads of 3 and 6 percent, which is what normally is paid to the underwriter (Högfeltdt, 1997).

4.3 The effect of price stabilization

When analyzing aftermarket short covering, the optimal scenario would have been to have explicit data about how and when underwriters have stabilized specific IPOs – at what price levels and to what extent. Only in 4 out of 24 cases we have dates and at what price levels IPOs have been short covered (i.e. stabilized), but not to what extent (volumes). Instead we use a proxy methodology to examine the effect of price support, which was developed by Ruud (1993).

In order to examine the initial distribution of share price returns we plot a histogram of the log returns for the observations which include an overallotment arrangement. The reason for this is that we argue that the IPOs including overallotment arrangements are the ones most likely to be stabilized (as noted earlier, aftermarket short covering is the most common method for providing price support). Moreover, we examine how the distribution is transformed over 20 trading days, with five day increments. For each time interval, we test whether the distribution is skewed or has excess kurtosis. We also perform a joint test for these two properties to test for normality. In addition, we extend the methodology by sensitizing our analysis by observing the distributions for IPOs that did not include an overallotment arrangement.

Ruud also looks at the migration over time for the IPOs with initial returns of zero, examining if the share prices falls back as the potential price support diminishes. We will explicitly look at the migration of IPOs where the overallotment option were not exercised (implying that the underwriter conducted aftermarket short covering) and examine how the share prices develop over time in comparison to the other observations.

4.4 Benefits of including the overallotment option

We conduct a multiple regression analysis in order to examine whether the inclusion of an overallotment option lowers the amount of underpricing for an IPO. The regression is fairly similar to the one carried out

by Franzke and Schlag (2002), although we have used some other explanatory variables to adjust for the data available.

4.4.1 Variable selection and expected sign of variables

The description of each variable included in the regression together with the expected sign of each variable coefficient is summarized in table 4.1. From Hypothesis IV it follows that the inclusion of an overallotment arrangement should lead to a reduction in underpricing and we therefore expect a negative coefficient of the *OAA_Dummy* variable. However, we need to consider other potential variables that might have an impact on the first day performance of the share.

We have not seen any previous research using the subscription rate as an explanatory variable but we think it is a good indicator on the investor appetite of the IPO and therefore plausibly also the underpricing. A higher demand for an IPO should *ceteris paribus* indicate that the investor community looks favorable on the development of the share price relative to the offering price. Hence, we would expect to see a positive relation between *Subscription_Rate* and underpricing.

Franzke and Schlag (2002) argue that IPOs of smaller firms will be more underpriced since these IPOs will be considered as more uncertain. They use the number of employees to control for size. We have instead chosen to use the variable *Sales* in order to control for company size and expect a negative relation between sales and underpricing. We have chosen company sales instead of the number of employees since there are missing data of the number of employees for some observations. Furthermore we argue that sales should be equally good as the number of employees to control for firm size and uncertainty. Everything else equal, we believe that an investor should be at least as reassured by high company sales prior to the IPO as a high number of employees.

Company *age* is another variable that is used to control for uncertainty by investors in line with Oehler et al. (2006). Loughran and Ritter (2004) argue that younger companies also are riskier and that investors should be compensated for this risk. Hence a negative relation between company age and underpricing is expected, *ceteris paribus*, since the fact that a company has been around for long should mitigate the uncertainty faced by investors.

A dummy variable for *book building* has been included with the motive that IPOs where offering prices have been set through the book building process should be less underpriced. Högfeldt (1997) notes that fixed price offerings are expected to have a higher amount of underpricing, *ceteris paribus*. This is because investors face additional uncertainty when subscribing to buy shares at a fixed price a long time before the actual market price can be observed. (Remember that book building prices will be set close to the listing date and be conditional on the investor demand of the IPO).

OMXS30_prev is used in line with Franzke and Schlag (2002) who uses the market trend of Germany's Nemax All Share Index over the 40 days prior to the IPO. A positive sign of the coefficient is expected since a more bullish sentiment should lead to stronger aftermarket performance, *ceteris paribus*.

Table 4.1: List of variables included and the expected sign of their expected sign

Variables Included	Expected sign	Description
<i>Subscription_Rate</i>	+	Total investor subscription for the offering in relation to the amount of shares offered
<i>ln(Sales)</i>	-	The log of the latest available 12 month company sales figure at the time of the offering (SEK '000)
<i>OAA_Dummy</i>	-	A dummy variable with value 1 if the IPO includes an overallotment arrangement
<i>Bookbuild_Dummy</i>	-	A dummy variable with value 1 if the offering price was set through the book building pricing mechanism
<i>ln(Age)</i>	-	The log of the company age (in years) at the time of the IPO
<i>ln(OMXS30_prev)</i>	+	The log of the performance of OMXS30 over the 40 days immediately prior to the first trading day of the IPO

4.4.2 Functional form

The theoretical log-lin model that will be used is specified in equation 6.4.

$$\ln(1 + IR_{1i}) = \beta_0 + \beta_1(\text{Subscription_Rate}_i) + \beta_2 \ln(\text{Sales}_i) + \beta_3(\text{OAA_Dummy}_i) + \beta_4(\text{Bookbuild_Dummy}_i) + \beta_5 \ln(\text{Age}_i) + \beta_6 \ln(\text{OMXS30_prev}_i) + u_i \quad (6.4)$$

The reason to why this particular functional form has been chosen is firstly, that it is the conventional of having the regressands logged in return models for securities. (See e.g. Ruud, 1993) Considering the regressors, we have a mix of logged and linear variables. *OAA_Dummy*- and the *Bookbuild_Dummy*-variable has been set as linear due to the fact that some of the observations for these variables will have a value of 0, thus making logged values inappropriate. The *Sales*- and *Age*-variables are logged since we do not believe that there is a linear relationship between these variables and the regressand. We would argue that an investor considers the age increment of 5 years more important when comparing two companies established 6 versus 1 year ago in comparison to if the investor would compare two companies established 85 versus 80 years ago. A similar argument goes for company sales, i.e. that investors place a higher emphasis on a given sales increment when the sales are relatively low.

Subscription_Rate have been set in linear form with the argument that an increase of 1.0x in the subscription rate should have approximately the same impact regardless of the original value of the subscription rate. Consider an offering of 200,000 shares. If the subscription rate would increase 1,0x this means that there is (at least theoretically⁶) an additional demand of 200,000 shares, regardless whether previous demand was 300,000 shares or 500,000 shares.

⁶ See discussion of limitations of Subscription rate in section 5.2

The performance of OMXS30 is logged upon the argument that a 1 percent increase (decrease) in the index should carry more information to the initial returns, rather than how many index points OMXS30 has increased (decreased) the past 40 days.

5. DATA DESCRIPTION

In this section the collected data is presented that will subsequently be analyzed. A short description will follow on how the data was collected. We also present an overview of the IPO activity on the SSE and of the observed data.

5.1 Data collection

The overall data used in this thesis is not readily available and therefore has been manually collected by us. To the best of our knowledge, we are the first one to create a database of the inclusion and use of overallotment arrangements for Swedish IPOs. When building the database, we have started with the market terminal Bloomberg's list of historical IPOs done on the Swedish market which also included some details for each respective IPO. The IPO data has then been compared with the annual compilation of Börsguiden in order to ensure that no adequate IPO is excluded from the database. Carve outs and list transfers have been excluded since they do not include an offering to the public for subscription of shares, and therefore are incomparable with ordinary IPOs. A compilation of the included, as well as the excluded IPOs, can be found in table A.1, A.2 and A.3 in the appendix.

We have chosen to study IPOs between 1999-2008 in order to get a reasonable high sample of IPOs. We would prefer to go even further back in time to increase the sample but find this to be virtually impossible due to very limited data about the inclusion of overallotment arrangements in general, and information about the exercise of overallotment options in particular for IPOs prior to 1999. Moreover we have chosen only to examine IPOs on the main lists of the SSE, thereby excluding IPOs on other lists and market places such as First North, Nordic Growth Market, Aktietorget and equivalently. This restraint is set in order to ensure comparability between IPOs since the characteristics of companies listed on the different exchanges vary considerably. Another reason is to facilitate the information accessibility for each respective IPO.

5.2 IPO information

We have examined prospectuses and press releases for each respective IPO in order to find information on the variables found to be interesting and necessary for analyzing our hypotheses. These data sources have been complemented with investor media articles and the investor-relations department of the respective company, when the information has been insufficient. The variables collected for the IPOs are specified in table 5.1.

Table 5.1: Overview of information collected on each IPO

Variables	Description
<i>IPO Date</i>	The date when the company was listed
<i>Offering price</i>	The price paid by the investors for one share in the company
<i>Primary shares</i>	Amount of primary shares offered to the public in the offering
<i>Secondary shares</i>	Amount of existing shares offered to the public in the offering
<i>Subscription rate</i>	The total subscription rate for all investors relative to the offering size
<i>Book building</i>	Specifies whether book-building was used to price the IPO
<i>OAA included</i>	Specifies whether an overallotment arrangement was included or not
<i>OAO Size</i>	The size of the overallotment option relative to the total offer size (%)
<i>OAO New shares</i>	Specifies whether the overallotment option corresponded to existing or primary shares
<i>OAO Exercised</i>	The amount of shares exercised in the option in relation to total overallotment option size
<i>Year established</i>	The year when the company was established

Abbreviations: OAA - Overallotment arrangement, OAO - Overallotment option

The collection of most of these variables has been relatively straight forward. However, there is a different reporting procedure between the companies relating to the subscription rate. Whereas the majority of the companies report the *total subscription rate*, there are also several companies reporting the *oversubscription rate*. We have adjusted for this in the database adding 1 to the oversubscription rate in order to arrive at the total subscription rate.

A caveat relating to the subscription rate worth noting is that Finansinspektionen (2007:12) recognizes that there are differences amongst the underwriters' procedure of calculating the subscription rate for IPOs that have used the book building mechanism. The difference comes from the fact that some underwriters report the total subscription rate including indication of interest at prices below the final offering price, whereas other underwriters only considers the indication of interest from investors at prices above or at the final offering price. Moreover the total subscription rate faces the potential of being exaggerated when investors inflates their indication of interest in order to assure that they get some allocation of popular IPOs.

With regards to the overallotment arrangement, we have had to assume that if the overallotment option was not exercised, then instead aftermarket short covering was conducted to close the overallotted position. Only a few observations have explicitly reported that aftermarket short covering has been conducted. Prior to 2005, when the safe harbor clauses were implemented in Sweden, stabilizing activities only needed to be reported to the SSE⁷. (Jan Axelsson, Finansinspektionen, 2009-05-14)

When determining company age, we have looked on the company websites for year of establishment while also making sure that the fundamental business of the company during the specified year is similar to the business of the company at the time it was about to list.

Gross spreads and other listing costs are not included in the dataset since this information is available only for a limited part of the sample. Some of the companies provide information only about

⁷ Stabilizing trades were noted in their trading system, but not available to the public.

other listing costs (excluding gross spread) in the prospectuses, whereas other companies add these two items together, making the items inseparable.

In addition to these variables, the closing prices as well as the daily trading volumes have been downloaded from Datastream. The closing price and daily volume figures are unadjusted for later company actions such as stock splits. The company sales figures also come from Datastream. The figures are reported as *trailing* twelve months sales from fiscal period 2002 and *annual* sales figures for the fiscal years prior to 2002. In a few cases when sales were unavailable, the latest available trailing twelve month sales (prior to the date of the IPO) were downloaded from Affärsdata.

5.3 Data overview

Our dataset contains 77 IPOs in total with the majority of the IPOs coming from the years 1999-2000 during the dot-com era. The number of IPOs follows the market performance relatively well which can be seen in figure 5.1. Considering the nominal value of IPOs on SSE, by comparing figure 5.1 and figure 5.2, it seems that the numbers of IPOs follows the market development better than the aggregated values of IPOs done in each year. Year 2000 is by far the most active year in terms of IPO-value, accounting for over 60 percent of the total value of the observed IPOs in 1999-2008. This finding can be explained by the fact that 2000 was the year of the listing of (formerly) Telia AB. This IPO corresponded to nearly 80 percent of the aggregated value IPOs in year 2000. Interesting to note is the relatively high aggregated values of IPOs done during 2002, a year when the number of IPOs done went down in line with OMXS30. This outcome is once again due to a big IPO, in this case AlfaLaval, which amounted to approximately SEK 5.1 billion.

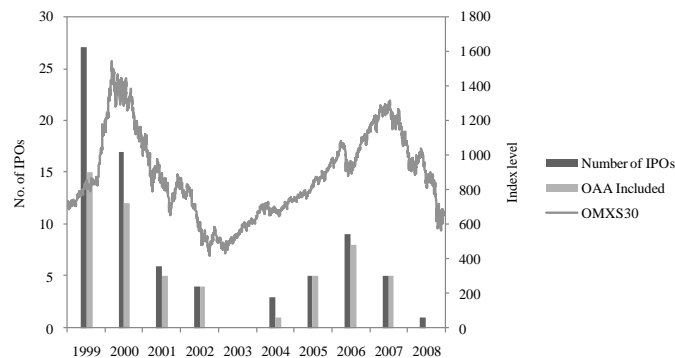


Figure 5.1: Total IPOs and the number of IPOs including overallotment arrangements in the dataset and OMXS30 performance 1999-2008

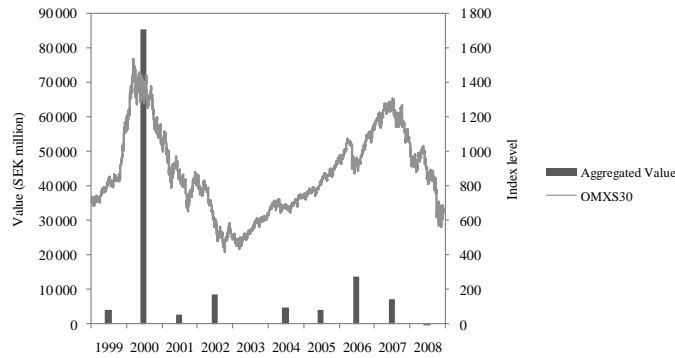


Figure 5.2: Accumulated IPO Value (excluding overallotment) on the SSE and OMXS30 performance 1999-2008

5.3.1 Overview of IPO size, excess demand and first day return

In table 5.2 a brief overview of IPO size, subscription rate and first day return are presented. As expected Telia shows up as the biggest IPO during the period while the IPO-value of Naturkompaniet merely made up to SEK 13 million, due to a lack of investor interest in the company. The investor appetite for Gant shares was substantially higher with an oversubscription rate of 41 times the offered amount of shares. Looking on the first-day performance one can conclude that Cybercom, which was listed in 1999, skyrocketed during the first day. The magnitude on the downside was not as extensive, with the worst performer being Retail and Brands falling 23 percent the first day. One can see that the average amount of underpricing was high during the examined period.

Table 5.2: Summary of IPO-size, subscription rate and underpricing during 1999-2008

	Size (SEK mln)	Company	Subscription Rate	Company	IR(1)	Company
Max	66 548	Telia	41x	Gant	243.5%	CyberCom
Min	13	Naturkompaniet	0.38x	Naturkompaniet	-22.9%	Retail and Brands
Median	354	Mekonomen	6.1x	Sectra	4.8%	Audio Development
Average	1 708		8.59x		11.4%	

5.3.2 Intense trading in the first few days

The practitioners emphasized the large initial trading volumes as reasons to why the overallotment arrangement should be included. Looking on figure 5.3, we can conclude that there is indeed a very high activity in the first few days following the listing of a share. On average, nearly 20 percent of the total offering changes hands during the first day of trading. The activity decreases substantially after the first 3-4 days and then stays roughly at the same levels throughout the stabilizing period. Figure F.1 and F.2 in the appendix show the trading volume for two groups of IPOs, with the first group representing IPOs including the overallotment arrangement and the second group for those without. The average trading volume clearly differs between the two groups even if they both show a decreasing pattern during the first trading day.

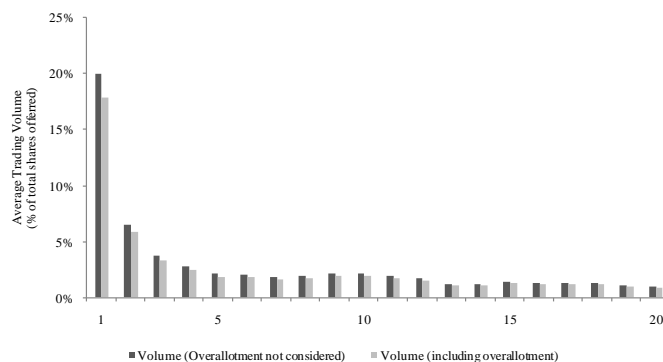


Figure 5.3: Average trading volume as percentage of total offering (excluding and including overallotted shares) for all IPOs

5.4 Overview overallotment options

Table 5.3 provides an overview of the overallotment properties for the IPOs examined. 55 of the 77 observed IPOs included an overallotment arrangement but there is no observable trend in terms of whether the option has become more frequent during the last few years. The majority of IPOs including overallotment arrangements subsequently had the option exercised by the lead underwriter. There has been some variability in this variable over the years, with a slightly increasing trend towards more and more IPOs including the overallotment option, also having it exercised. When exercising the overallotment option, the general pattern has been to exercise the option fully. However, for 8 out of 40 observations the option was only partly exercised.

Table 5.3: Overview inclusions of overallotment arrangements and the use of overallotment options for IPOs in 1999-2008

	No. IPOs	No. IPOs including OAA	(%) of total IPOs	No. OAOs exercised	No. OAOs fully exercised
2008	1	0	-	-	-
2007	5	5	100%	4	2
2006	9	8	89%	6	5
2005	5	5	100%	5	4
2004	3	1	33%	1	1
2002	4	4	100%	3	3
2001	6	5	83%	2	2
2000	17	12	71%	8	4
1999	27	15	56%	11	11
Total	77	55	71%	40	32

Abbreviations: OAA - Overallotment arrangement, OAO - Overallotment option

5.5 Characteristics of IPOs including/excluding the option

Table A.4 in the appendix shows the firm- and IPO-characteristics for firms including an overallotment arrangement and compares them to those who did not include it. The major differences between the groups are that firms including an overallotment arrangement have relatively larger IPOs and a higher subscription rate. The finding in section 5.3.2, that the IPOs including an overallotment option has markedly higher trading volumes relative to the total offering size, is also confirmed. In addition it appears that the firms including the overallotment option has significantly higher sales. The higher sales figure is

consistent with the finding that the IPO size is higher, although one could make the argument that a company with relatively high sales could choose to do a smaller offering. Regarding the performance of the IPOs, figure 5.4 presents an overview of the average IPO performance for the two groups. In addition, the IPOs with an overallotment option have been divided into two subgroups depending on whether the overallotment option was subsequently exercised or not.

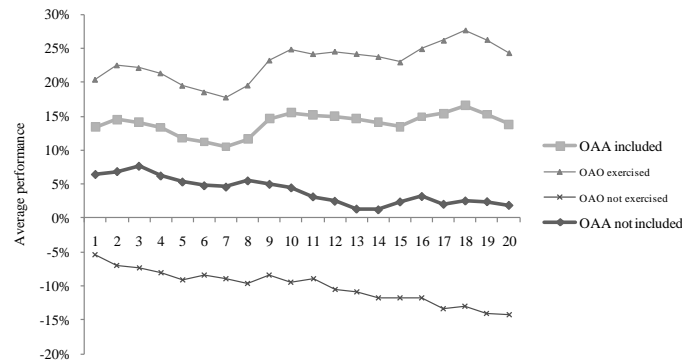


Figure 5.4: Average IPO performance the first 20 trading days

The figure provides a brief overview of the hypotheses we want to examine as well as an unrefined suggestion as to how they translate into the empirical observations. Based on the figure it seems that the underwriters do use the overallotment arrangement according to theory; exercising the option for IPOs trading up in the aftermarket, while instead conducting short covering transactions for the IPOs falling in the aftermarket. For the remaining hypotheses the picture provided is more inconclusive. The price stabilized IPOs, on average, continue to trade down over time, indicating that the short covering transactions might not have the stabilizing effect as proposed, at least not over a longer term perspective. Regarding underpricing, the IPOs with an overallotment arrangement actually seem to be more underpriced on average in comparison to the other IPOs with first day average returns clearly above the corresponding returns for IPOs not including the option. Before rejecting or accepting each respective hypothesis we need to consider more factors and conduct more in depth examinations to form a more solid foundation for assessing the hypotheses. This brings us to the empirical analysis.

6. EMPIRICAL ANALYSIS

In this section we will compare our hypotheses with the empirical observations from our dataset. The results will be presented and discussed in three sections. The first section relates to how the overallotment arrangement is used and the second to whether the overallotment arrangement has a stabilizing effect. The third section relates to whether the inclusion of an overallotment arrangement yields lower IPO underpricing.

6.1 Is the overallotment arrangement rationally used?

In table 6.1 and table 6.2 we have assumed a gross spread of three and six percent respectively. If the underwriters act according to our hypothesis, the observations should be grouped in the top left and bottom right corners of the tables (numbers in bold). When observing the tables we see that, given the assumed spreads, between 85-87 percent of the observations fall into the expected categories.

Table 6.1: Exercise pattern for overallotment options after twenty trading days including an underwriter spread of 3 percent

	IR(20) - 3% ≤ 0	IR(20) - 3% > 0	Total
Not Exercised	11	4	15
Exercised	4	36	40
Total	15	40	55

Table 6.2: Exercise pattern for overallotment options after twenty trading days including an underwriter spread of 6 percent

	IR(20) - 6% ≤ 0	IR(20) - 6% > 0	Total
Not Exercised	10	5	15
Exercised	2	38	40
Total	12	43	55

Important to remember is that the overallotment option is of American type, meaning that it can be exercised at any time up until maturity. The abnormalities found (numbers in top right and bottom left of the tables) could therefore potentially be explained by actions undertaken by the lead underwriter prior to the 20th trading day. If an observation initially starts off trading above the exercise price, the underwriter can exercise the option while the share still might be trading below the exercise price at the end of the period, thus appearing as an abnormality in the tables shown above. In addition, shares initially trading below the exercise price could be bought back by the lead underwriter to cover the short position and the option will then not have to be exercised. Thus, when merely looking at the 20th trading day the results might appear as inconsistent with theory.

When controlling for the returns throughout the entire twenty day period, we find that all of the abnormal observations can be explained by the above reasoning. The returns during the twenty day period were at least once negative, making it possible for the holder of the option to buy back his short position in the market. For a gross spread of 3 percent all but one observation can be explained by looking at the closing prices prior to the maturity date. This observation did not have its option exercised even though its share price closed above the strike price throughout the 20 day period. However, when controlling for the

intraday prices, it can be observed that the share actually traded below this limit, and thus, aftermarket short covering could have been conducted by the underwriter. When using a 6 percent gross spread, we find three observations that never exercised its option, even though the share traded at levels above the strike price throughout the 20 day time period. Two out of these three observations appear as rational when once again examining intraday prices. These two observations did at least once trade below the strike price. The third observation can most probably be explained by the assumption regarding the spread. The observation did not deviate from our predictions when using a spread of 3 percent which implies that the actual spread for this observation is lower than 6 percent. It is plausible that the two other observations (which indeed could be explained by observing intraday prices) can be explained by this reasoning as well. Therefore, it is important to note that the assumed strike prices only are approximations and varies somewhere between 94-100 percent of the offering price.

Following the methodology of Muscarella et al. (1992) we note that the underwriters actions for all our observations can be seen as rational according to our hypothesis. However, we also see that the outcome relies on rather strong assumptions. We therefore also choose to study the observations where we have more details regarding the actions of the underwriter. Table A.5 in the appendix outlines the information for the 22 observations we have explicit information about the dates when the options were exercised. Table A.6 relates to the observations where aftermarket short covering has been conducted. Considering the exercise pattern of these overallotment options we find that all observations were exercised according to our hypothesis. That is, all options were exercised when the share traded above the strike price. We do not need to make an assumption about the gross spreads as all options were exercised for share prices at or above the offering price. For 7 out of the 22 observations, the underwriter had the possibility to conduct aftermarket short covering prior to exercising the option since the share had previously traded below the offering price. This was also the case for 5 observations, meaning that the overallotment option was subsequently only partially exercised. For the remaining two observations, it is plausible to assume that the underwriter chose not to stabilize the share since the payoff would have been lower than the gross spread received by exercising the option. (The lowest closing price return for these observations amounted to -3.13 vs. -1.05 percent). Conversely, there is also evidence that the underwriter sometimes stabilize the share price when it instead would have been better to exercise the option in terms of payoff to the underwriter. From table A.6 one can see that in 3 out of 4 observations the underwriter repurchased shares at the offering price (i.e. above the strike price). This finding is not consistent with maximizing the payoff from the overallotment arrangement and indicate that the underwriter sometimes prefer stabilizing the IPO to maximize its payoff. We would however need more observations in order to draw any conclusions about this finding. In most cases, price stabilization and rational use of the option will be aligned. It is only when the share is trading below the *offering price*, but above the *strike price*,

where the two can be in conflict. For these cases the underwriter will face a tradeoff between maximizing the payoff from the arrangement and supporting the IPO to promote its reputation as an underwriter that stabilizes the share when possible.

Based on our findings we can conclude that most underwriters do use the overallotment arrangement according to our hypothesis. In line with Muscarella et al. (1992), we find that the underwriter generally exercises the overallotment option rationally, and conducts aftermarket short covering for share prices below the strike price. We also note that the underwriters incentives for using the arrangement is not always aligned with the interest of investors. Investors would likely want to see that the share price is stabilized for all returns below zero. This is however not necessarily in the interest of underwriters as they will reap higher payoffs from exercising the option for relatively small negative returns.

6.2 Does price stabilization have any impact?

When examining the effect of price support we start out with analyzing the shape of the distribution for IPOs including an overallotment option, and the distributions' transformation over a 20 day period. We also formally test if the return distributions are symmetric and normally distributed. In addition, we make a robustness control by only considering IPOs without overallotment arrangement. Finally we examine the migration pattern of IPOs that we know were supported in the aftermarket and compare this to the pattern of the other observations.

6.2.1 Graphical overview

All the plotted histograms of the log returns for IPOs including an overallotment arrangement can be found in figure F.3 in the appendix. For the first trading day a positively skewed distribution can be observed, with fewer observations in the negative tail and a couple of observations with very high first day return. There is also a considerable amount of observations clustered at and around a zero return, which is highlighted by the peakedness of the distribution. The combination of the positive skewness and excess kurtosis imply that there are few observations that fall below their offering price the first day which is an indication that price stabilizing activities are successful in counteracting the downward pressure in some shares. Observing how the distribution changes over time, one can see that the returns transform toward a bell-shaped distribution at the end of the time series. It is also notable that fewer observations are clustered around a zero return.

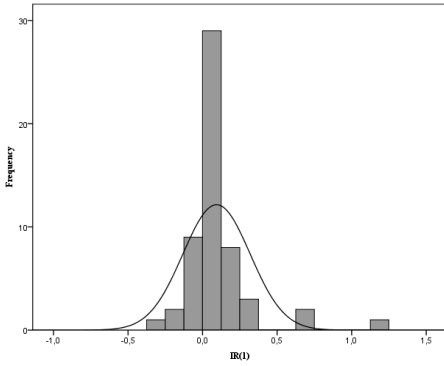


Figure 6.1: Distribution of 1st day log returns for IPOs including the overallotment arrangement

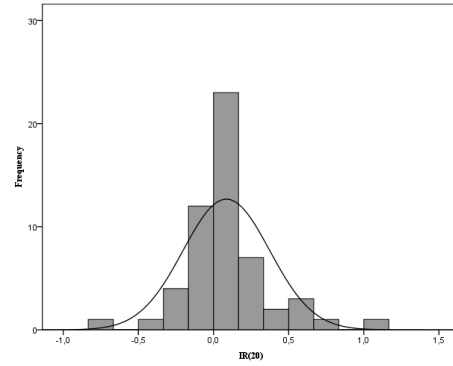


Figure 6.2: Distribution of 20th day log returns for IPOs including the overallotment arrangement

6.2.2 Formal testing

In table 6.3 (and table A.7 in the appendix) further descriptive statistics can be found for the IPOs that included an overallotment arrangement, which supports the visual findings from the histograms. Observing the mean and median returns, one can see that they initially differ from each other. If the distribution is symmetric then the mean and median should be the same. However, for our data this is not the case for the first weeks. Observing the pattern over time the mean and median approach each other and the dispersion is diminished. After twenty trading days the dispersion has been reduced considerably. Worth noting is that twenty trading days is approximately the time limit for how long price stabilization is allowed.

Looking at the minimum return, one can see that a large change occurs during the first week, compared to the first trading day. For the first trading day, the worst performing observation is down 23 percent⁸. At the fifth trading day the worst performer is noted to be down 32 percent and the downward trend in minimum returns continues over time. This could be seen as an additional indication for how price supporting activities might be successful initially, but that share prices adjust accordingly when the short position has been covered by the lead underwriter.

The skewness and kurtosis measures verify what visually could be observed from the histograms. The skewness which was noticeable in figure 6.1 is confirmed to be positive, implying a larger fraction of positive returns than expected for the initial returns. In addition, the high kurtosis levels also confirm what can be observed, that the data initially is clustered around zero returns. Although we see that there is a clear trend with decreasing skewness and kurtosis over time, the sample distribution cannot be assumed to be normally distributed at any time during the observed time window. This outcome is a bit puzzling since we would expect the distribution to become normal as price stabilization ceases. This outcome can be either due to the fact that price stabilization has a more long lived effect on share prices and/or that the

⁸ $e^{-0.26} - 1 = -23\%$

sample is not normally distributed. When we control for normality for a more long term perspective (100 days) we still reject the test of normality (not reported), although there is some volatility in the outcome (e.g. we cannot reject the test of normality after 80 trading days). The other potential explanation, that the distribution does not become normal because stabilization has a long-lived effect, will be tested for in section 6.2.3.

Table 6.3 Statistics for the log returns for the 55 observations including an overallotment option

	IR(1)	IR(5)	IR(10)	IR(15)	IR(20)
Mean	0.094	0.078	0.100	0.090	0.085
Median	0.047	0.034	0.054	0.038	0.077
Min	-0.260	-0.379	-0.481	-0.455	-0.783
Skewness	2.989*	2.478*	1.684*	0.923*	0.575***
Kurtosis	14.499*	13.383*	8.444*	4.779**	5.902*

* Significant at the 0.01 level (2-tailed), ** Significant at the 0.05 level (2-tailed)

*** Significant at the 0.10 level (2-tailed)

Comparing our findings with IPOs without overallotment arrangements, we see a significantly different pattern. This is in line with our expectations since we argued that price support should be uncommon for the IPOs that did not include an overallotment arrangement. Table 6.4 shows a mean and a median for the group that is similar to each other throughout the entire 20 day period. Observing the skewness and kurtosis measures we see that they are considerably lower (and sometimes even negative) even though almost all of them are statistically insignificant from the properties of a normal distribution. However, regarding the minimum observation we see a similar decreasing pattern as for the observations including the overallotment arrangement, but the magnitude is not as large. Table A.8 in the appendix shows a more detailed view for these IPOs.

Table 6.4 Statistics for the log returns for the 22 observations excluding an overallotment arrangement

	IR(1)	IR(5)	IR(10)	IR(15)	IR(20)
Mean	0.056	0.043	0.031	0.010	0.001
Median	0.041	0.013	0.003	0.000	-0.009
Min	-0.163	-0.179	-0.294	-0.357	-0.470
Skewness	0.037	0.098	-0.084	-0.430	-0.623
Kurtosis	2.000	1.762***	2.396	2.433	2.847

*** Significant at the 0.10 level (2-tailed)

6.2.3 Migration

In the previous section we saw that the skewness and kurtosis of the distribution for IPOs including overallotment arrangements gradually declined. This could be seen as an indication that the price stabilizing effect decreases over time. This indication is confirmed by table 6.5 where the migration pattern over the first 20 trading days shows that the stabilized group has a steady decline over time. For

the remaining 62 observations in table 6.6 the pattern is different, showing more stability with some improvement during the third and fourth week.

Table 6.5 Migration pattern for the 15 IPOs that did not exercise the overallotment option at all

	IR(5)<IR(1)	IR(10)<IR(1)	IR(15)<IR(1)	IR(20)<IR(1)
No. obs	9	10	12	12
% of total	60%	67%	80%	80%

Table 6.6 Migration pattern for the remaining 62 observations

	IR(5)<IR(1)	IR(10)<IR(1)	IR(15)<IR(1)	IR(20)<IR(1)
No. obs	35	38	31	34
% of total	56%	61%	50%	55%

The migration pattern for IPOs that did not exercise their options (i.e. that were short covered) indicates that the effect of price stabilization decreases over time. The question then becomes whether the gradual decline of the price stabilization is due to the fact that the price support has less impact on the market as time passes by or due to the fact that underwriters simply stop to stabilize the share. We have three arguments to support the latter explanation:

- i) *Relative market impact*: Leaving the theory of perfectly liquid markets aside, the market should not be less, but instead *more* impacted by price stabilizing activities over time as trading volumes decreases. I.e. a short covering transaction of a certain amount should have a more stabilizing effect during the second trading week when volumes are almost eight times lower the volumes of the first trading day. (See figure 5.3)
- ii) *Practical reason to stabilize*: Fundamentally, the share should be in most need of price stabilization during the first days of trading when the trading volumes are the highest. This will force the lead underwriter to front load the price stabilizing activities the first days. Bearing in mind that the shorted amount of shares are limited to a maximum of 15 percent in the safe-harbor clauses, it is likely that the lead underwriter will have used most of the price stabilizing power during the first few days when it is most needed.
- iii) *Previous research*: As mentioned in section 3.2, Aggarwal (2000) findings show that price stabilization is done during the first day for *all* IPOs that are stabilized. In addition, price stabilization tends to end after 10-15 days.

Referring back to the puzzling outcome that the distribution of returns does not become normal, we find it hard to believe that this is due to a long lived effect of price stabilization. We find that the supported shares falls back over time which indicate that price supporting effect is temporary. In addition, we do not find it reasonable to argue that previous stabilization can explain a non-normal distribution 100 trading

days after the listing took place. Instead we would argue that the finding is related to other characteristics of the sample returns which we have not been able to define.

To summarize, we find that the price stabilization does have an impact on the share price performance but that the effect is temporary. This is in line with both our hypotheses and with previous research. In line with Ruud (1993) we find that the distribution of the first day return is positively skewed and have excess kurtosis which decreases over time when the underwriter ceases with price support. The finding that the effect only is temporary would be in line with the argument of Oehler et al. (2006) that the price support is not very effective, as the support will be mainly beneficial for the investors selling their shares when stabilization is conducted.

6.3 Benefits of including an overallotment arrangement

In order to examine whether the inclusion of an overallotment arrangement could lead to lower underpricing we conduct a multiple regression analysis as specified in section 4.4. We also perform robustness checks and test for multicollinearity, spatial autocorrelation and heteroscedasticity.

6.3.1 Statistical analysis

Our initial regression is based on 76 available observations which is one observation less than the total sample. The IPO of East Capital Explorer done in 2007 has been excluded since this company is a closed end fund whose purpose is to raise money and invest in other companies thus yielding returns to investors, rather than profits and dividends. Therefore by definition East Capital Explorer does not have any sales figures in comparison to other companies, meaning that this observation will be excluded when the regression is conducted, as the log of sales is an explanatory variable in the regression.

Although the data is available for the other 76 observations, some technical adjustments have been needed in order to conduct the analysis. Regarding the oversubscription rate, there are 15 observations where the subscription rate has been stated in expressions such as ‘Heavily Oversubscribed’ instead of providing an actual figure. In order to adjust for this, we have estimated the subscription rate using the properties of the subscription rates of the other IPOs where this figure has been explicitly observable. These observations and its respective estimate are tabled in section A.9 in the appendix.

Before carrying out the regression we have tested for multicollinearity, spatial autocorrelation and heteroscedasticity in the data in order to avoid misleading results in the regression. Section B in the appendix shows the properties of the dataset that is used to detect the presence of strong multicollinearity. For our dataset however, there is no imminent problem of strong multicollinearity. Noteworthy is that the most collinear variables are *Bookbuild_Dummy* and *OAA_Dummy*. This outcome is expected since most of our observations that had an overallotment arrangement also used the book building pricing mechanism. Although collinearity exists between these two variables, it is not very strong in terms of

tolerance- and variance inflation factors, meaning that the collinearity should not have a big influence when distinguishing each variables effect on the IPO underpricing.

The tests for spatial autocorrelation and heteroscedasticity are shown in section C and section D in the appendix. We do not find any prevalence of spatial autocorrelation for our explanatory variables, but reject the hypothesis of a homoscedastic error term. Therefore we will use White's heteroscedasticity consistent variances and standard errors going forward.

6.3.2 Initial Regression

After controlling for multicollinearity, autocorrelation and heteroscedasticity we run the regression for the 76 observations. The summary of the result is presented in table 6.7 below, while the total regression result can be found in table E.1 in the appendix. Table E.2 in the appendix also interprets the result using the IPO of Oriflame as an example.

Table 6.7: Summary of regression result, initial regression

Variable	Coefficient	Expected Sign	In line with expectations?
Subscription_Rate	0.013*	+	Yes
ln(Sales)	-0.005	-	Yes
OAA_Dummy	-0.010	-	Yes
Bookbuild_Dummy	-0.010	-	Yes
ln(Age)	0.003	-	No
ln(OMXS30_prev)	0.569***	+	Yes

* Significant at 1% level, *** Significant at 10% level

Considering the signs in front of the coefficients, the outcome is fairly in line with our expectations. Although insignificant, age is positively related to underpricing which is in contrast to theory. A plot of the initial IPO returns over company age is presented in figure F.4 in the appendix. The figure visualizes the lack of relation between first day return and company age, even if outliers, and potentially influential observations outside the 95 percent confidence interval are excluded.

The other explanatory variables have signs in line with theory, but it is only the coefficients of the subscription rate and the previous performance of OMXS30 that are statistically significant at reasonable levels. The subscription rate is still statistically significant on a 1 percent level when excluding the 15 observations where the subscription rates were stated as expressions, meaning that this outcome is not conditional upon including these 15 observations (not reported).

The coefficient of *OAA_Dummy* suggest that a company including an overallotment arrangement in its IPO will lower the underpricing with 1.02 percent if the subscription rate, the company sales, the pricing mechanism, the company age and the previous 40 day performance of OMXS30 are held constant. However, based on the low significance level of the coefficient we cannot say that the inclusion of an overallotment arrangement actually lowers underpricing.

Before rejecting the hypothesis that an overallotment arrangement should lead to lower IPO underpricing, we need to consider two outliers, and potentially highly influential observations, namely the IPO of Cybercom and Connecta in 1999. Cybercom closed 244 percent higher, while Connecta closed 106 percent higher the first trading day in comparison to their offering prices and they both included an overallotment arrangement. Figure F.5 in the appendix visualizes the high residuals of these two observations and indicates that the observations might pull the coefficient of the overallotment arrangement dummy variable upwards, i.e. towards more underpricing.

6.3.3 Regression after removal of outliers

Important to note is that immediate rejections of outliers are not always a wise procedure as long as the outliers does not arise from errors in the data. (Gujarati, 2003). Although caution is at place regarding removal of outliers as suggested by Gujarati, it is interesting to examine whether Cybercom and Connecta has any significant effect on the outcome of our test.

Table 6.8: Summary of regression result after removal of outliers

Variable	New Coef.	Original Coef.	Expected Sign	In line with expectations?
Subscription_Rate	0.009*	0.013*	+	Yes
ln(Sales)	-0.004	-0.005	-	Yes
OAA_Dummy	-0.022	-0.010	-	Yes
Bookbuild_Dummy	-0.004	-0.010	-	Yes
ln(Age)	0.022	0.003	-	No
ln(OMXS30_prev)	0.433***	0.569***	+	Yes

* Significant at 1% level, *** Significant at 10% level

The full regression result can be found in table E.3 in the appendix. The removal of the outliers did not have a significant effect on the outcome. The age variable still has an inconsistent sign and the dummy variable for the inclusion of an overallotment arrangement remains insignificant along with the book building dummy and company sales.

6.3.4 Assessment of regression outcome

Based on the analysis of our dataset we cannot find support for our hypothesis that IPOs including the overallotment arrangement faces lower underpricing. The empirical outcome is consistent with the results from Franzke and Schlag (2002) and Hansen et al. (1987), but is still a bit puzzling from a theoretical point of view. One could use the argument proposed by Hansen et al. (1987) that the overallotment option is solely used to compensate the underwriter for reneging risk. However, as noted earlier, the firm commitment contracts are not unconditional and a run of investors would probably lead to a deferral or withdrawal of the IPO instead of the underwriters taking on the reneged shares. In addition, reneged shares should not pose a significant problem for most of our observations given the high subscription rates (see table A.9). If the total investor demand is three times the total offering size, there should still be

sufficient demand to meet some reneging. Should 10 percent of the indicative offers from institutional investors be withdrawn, the offer would still be oversubscribed and the underwriter could then simply to distribute the reneged shares to other investors.

A more plausible explanation to the outcome is that the benefits for investors in general, and retail investors in particular, from the overallotment arrangement is fairly low, meaning that they demand the same amount of underpricing as they would for IPOs not including the arrangement. From the analysis about the impact aftermarket short covering has on the share price, we concluded that the underwriter only temporarily give support to the share price – mainly during the first few days of trading. This temporary support is likely to mainly benefit institutional investors that sell some or all of their shares, since many retail investors must wait a few days before they know if they have any shares to sell. When retail investor later have information about their allocation, the underwriter is also likely to have used most of its stabilizing power given the heavy trading volumes that have endured in the first few days, which we previously argued can explain why stabilized shares gradually declines after the first day of trading. This argument would be in line with Benveniste et al. (1998) who find empirical support of institutional investors being the ones benefiting most from price stabilization. Applying Chowdry and Nanda's (1996) theory we would therefore argue IPOs including the overallotment arrangement will be required to have a similar degree of underpricing if the retail (uninformed) investors are not compensated accordingly (through effective price stabilization) for demanding less underpricing.

The question then becomes why the sellers should include an overallotment option in the first place. With no benefits associated by including an overallotment arrangement, the seller would be better off to not include it all, as argued by Franzke and Schlag (2002). The seller granting an overallotment arrangement without any benefit is effectively lending shares and providing a call option to the underwriter (overallotment option) for free. No rational seller would agree on this tradeoff. From this we would suggest that there are other benefits rather than lower underpricing by including the option. A possible benefit would be a smaller underwriter spread charged by the underwriter. Empirically however, neither Hansen et al. (1987) nor Franzke and Schlag (2002) have found such evidence.

We would like to support the suggestion made by Aggarwal (2000) that the overallotment arrangement makes the IPO better received by investors when the IPO is marketed – especially by institutional investors. Based on our observed IPOs, the characteristics of the ones including the arrangement are that the IPO size is significantly larger in comparison to those without. Trading volumes during the first day are also higher for these IPOs. Given these characteristics more money will be at stake, particularly for large institutions that want to hold a certain percentage of the offering and that might want to sell its holding instantly if it did not receive a large enough allocation. In this case it should be comforting for the investor to know that the underwriter will stand ready to stabilize the share price if

the share starts to fall when trading commences. Not including the overallotment arrangement would therefore possibly raise concern amongst the investors. In order to avoid spending time and effort in arguing why the overallotment arrangement was not included in the IPO, the seller might therefore (especially for relatively large IPOs) prefer to include it in order to improve the prospects for the IPO actually being conducted. This suggestion would however need to be verified through a more qualitative approach by interviews with investors and companies that have done, or are in the process of doing, an IPO.

7. CONCLUSION

The purpose of this study has been to examine the use and effects of overallotment arrangements on the Swedish market. Given this purpose we wanted to investigate if an overallotment arrangement should be included by the seller, and if the investors should place any emphasis on the instrument. Our findings show that the underwriters in general stabilize IPOs when this coincides with their interest to maximize the payoff from the arrangement. Moreover, we find that price stabilization does have an impact on share prices, but the effect is only temporary. IPOs that were stabilized tend to fall as time passes by, indicating that it is mainly the investors that instantly sell their allocations who benefits from price stabilization. Finally, we do not find any evidence of the overallotment arrangement mitigating underpricing. Considering these findings we conclude that it is the underwriter; and those investors that instantly sell their allocations, who seem to be the primary beneficiaries of the overallotment arrangement. An issue that remains unanswered is why the seller should grant the underwriter and the investors an overallotment arrangement in the first place.

For the analysis we have collected data for 77 IPOs on the main lists of the SSE during 1999-2008 with a focus on whether an overallotment arrangement was included and if the accompanied overallotment option subsequently was exercised or not. We analyze the exercise pattern for the IPOs including an overallotment arrangement and find that the lead underwriters use of the arrangement in general is according to theory – exercising the option when the share price is above the share price and conducting short covering transactions for lower share price levels. We also look at the distributions of returns for IPOs including the option and find that the distribution is positively skewed and have a high kurtosis during the first trading day. This indicates that the price stabilizing activities creates an artificial distribution by supporting shares with initial negative returns. Over time we find a gradual decline of the skewness and kurtosis and that the supported shares tend to fall. We argue that this is due to the removal of price support, implying that the stabilizing effect is temporary. When examining the effect of an overallotment arrangement on underpricing we conduct a multiple regression analysis but find the dummy variable for the overallotment arrangement to be insignificant in terms of lowering underpricing.

7.1 Limitations

As we have mentioned in the methodology section we have had to make assumptions regarding gross spreads. Hence, our analysis regarding the exercise pattern for the overallotment arrangements to some extent relies on these assumptions. Even though we have used two different estimates for the spreads, we feel that having access to each IPO's unique underwriter gross spread would add value to the analysis.

Another limitation is that we do not have the explicit data for most observations with regards to the dates, prices and volumes that aftermarket short covering was conducted at. We also lack the specific

exercise dates for the overallotment option for several of the observations. To our knowledge, Aggarwal (2000) is the only one that has had access to such data.

7.2 Further research

Given that the academic world's attention to overallotment options has been quite limited there are several opportunities for further research within the subject that we have encountered. Firstly it would be interesting with a more qualitative study on the investors' perception about the overallotment arrangement and on the sellers' motive on why they grant the arrangement.

Secondly, one could examine whether the price stabilizing activities pave the way for arbitrage opportunities by short-selling shares that are price stabilized as these shares tend to fall when price support ceases. We have understood that the process of short-selling IPOs is fairly complicated but still possible.

A third potential topic would be to more thoroughly discuss the benefits and costs for the syndicate that distribute an IPO with an overallotment arrangement – and try to estimate how much the underwriters gain by having an overallotment arrangement. Relating to the topic would be to examine more thoroughly the cases when the underwriter have had the opportunity to exercise the option but chosen to support the share instead and qualitatively examine whether the underwriter prioritize price stabilization to revenues when these two factors are not aligned.

Finally, we know that there is an interest among practitioners in a juridical investigation about the problems related to short covering transactions in SEOs. Many SEOs, especially in recent times, have been offered at a significant discount to the market price of the share. With the legal framework stating that price stabilization must not be done at prices above the offering price, the hypothetical question is whether the overallotment arrangement should be considered as useless for heavily discounted SEOs since the share price for these SEOs will be above the offering price.

9. REFERENCES

Articles and books

Aggarwal, Reena, 2000, Stabilization activities by underwriters after initial public offerings, *Journal of Finance*, Vol 55, No. 3, 1075-1103

Benveniste, Lawrence, Sina M. Erdal, and William J. Wilhelm Jr., 1998, Who benefits from secondary market price stabilization of IOPs?, *Journal of Banking & Finance* 22, 741-767

Brealey, Richard A., Stewart C. Myers, and Franklin Allen, 2006, Corporate finance, 8th edition, New York: McGraw-Hill

Chowdry, Bhagwan, and Vikram Nanda, 1996, Stabilization, syndication and pricing of IPOs, *The Journal of Financial and Quantitative Analysis*, Vol. 31, No. 1, 25-42

Ellis, Katrina, Roni Michaely, Maureen O'Hara, 2000, When the underwriter is the market maker: an examination of trading in the IPO aftermarket, *Journal of Finance*, Vol. 55, No. 3, 1039-1074

Fische, Raymond, 1999, How stock flippers affect IPO pricing and stabilization, Working paper, University of Miami and U.S. Securities and Exchange Commission

Franzke, Stefanie A. and Christian Schlag, 2002, Over-allotment options in IPOs on Germany's Neuer Markt - an empirical investigation, CFS working paper No. 2002/16, Center for Financial Studies

Friberg, Staffan, 2006, Underprissättning och prisstabilisering vid svenska börsintroduktioner, Master thesis, Uppsala University, Department of Economics

Gujarati, Damodar N., 2003, Basic econometrics, 4th Edition, New York: McGraw-Hill

Hansen, Robert S., Beverly R. Fuller, and Vahan Janjigian, 1987, The over-allotment option and equity financing flotation costs: an empirical investigation, *Financial Management*, Vol. 16, No. 2, 24-32

Harris, Lawrence, and Eitan Gurel, 1986, Price and volume effects associated with changes in the S&P 500 list: New evidence for the existence of price pressures, *The Journal of Finance*, Vol. 41, No. 4, 815-829

Högfeldt, Peter, 1997, Vad vet vi om svenska börsintroduktioner, in *Från optionsprissättning till konkurrenslagstiftning*. Clas Bergström and Tomas Björk, ed. Stockholm: Graphic Systems AB, 31-61

Jenkinson, Tim, and Howard Jones, 2006, The economics of IPO stabilization, syndicates and naked shorts, Working Paper, Saïd Business School, Oxford University and CEPR

Lombardo, Stefano, 2007, The stabilisation of the share price of IPOs in the United States and the European Union, *European Business Organization Law Review*, Vol.8, No. 3, 521-565

Loughran, Tim, and Jay Ritter, 2004, Why has IPO underpricing changed over time, *Financial Management*, Vol.33, No. 3, 5-37

Muscarella, Chris J., John W. Peavey, and Michael R. Vetsuypens, 1992, Optimal exercise of the over-allotment option in IPOs, *Financial Analysts Journal*, Vol. 48, No. 3, 76-81

Oehler, Andreas, Marco Rummer, and Peter N. Smith, 2006, Does stabilisation by means of initial short covering help IPOs to perform well during the first days of trading?, Working paper, Saïd Business School, University of Oxford

Ritter, Jay, 2008, Money left on the table in IPOs by firm, Working paper, University of Florida

Rock, Kevin, 1986, Why new issues are underpriced, *Journal of Financial Economics* 15, 187-212

Ruud, Judith S., 1993, Underwriter price support and the IPO underpricing puzzle, *Journal of Financial Economics* 34, 135-151

Newspaper articles

Martin, Paul R., 2004, Green-shoe's footprint, *style & substance - A Wall Street Journal Bulletin*, Vol. 17, No. 9, September 17, 2004

Interviews

Axelsson, Jan, Professional, Finansinspektionen, 2009-05-14

Enquist, Pontus, Lawyer, Advokatfirman Vinge AB, 2009-03-19

Plenov, Jens, Professional, SEB Enskilda, 2009-04-15

Rylander, Marcus, Professional, Handelsbanken Equity Capital Markets, 2009-04-22

Database and information materials

Historical IPO data, Bloomberg market terminal, Swedish IPOs 1999-2008

Historical IPO data, 2008, Börsguide 2008:2, Stockholm, Placera Media Stockholm AB

Historical IPO data, 2008, Börsguide 2008:1, Stockholm, Placera Media Stockholm AB

Historical IPO data, 2004, Börsguide 2004:2, Uppsala, Avanza Vikingen AB

Historical IPO data, 2001, Börsguide 2001:2, Uppsala, Delphi Finansanalys AB

Historical IPO data, 1999, Börsguide 1999:3, Stockholm, Delphi Economics AB

Prospectuses, annual reports, press releases and company websites, 77 observed companies on the SSE for 1999-2008

Share prices and volumes (unadjusted), company sales, Datastream Thomson Financial, observed companies on the SSE for 1998-2008

Electronic and other sources

Edlund, Per-Olov, 2007-09-13, Multicollinearity and heteroscedasticity, Course 8103 Basic Econometrics, Lecture no. 7, Stockholm School of Economics, Sweden

Finansinspektionen, Rapport 2007:11, Processen vid nyintroduktioner och emissioner, available [online]:
http://www.fi.se/upload/20_Publicerat/30_Sagt_och_utrett/10_Rapporter/2007/Rapport2007_11.pdf

Finansinspektionen, Rapport 2007:12, Emissioner och nyintroduktioner - fungerar skyddet för investerarna?, available [online]:
http://www.fi.se/upload/20_Publicerat/30_Sagt_och_utrett/10_Rapporter/2007/Rapport2007_12.pdf

Prospectus Gant, 2006, Inbjudan till förvärv av aktier i Gant Company AB (Publ), available [online]:
http://investors.gant.com/files/press/gant/Noteringsprospekt_Gant_2006.pdf

8. APPENDIX

Technical proof - Ruud's pricing model

Ruud (1993) shows that in the case offering prices were unbiased estimates of the true market price, the mean of the distribution of initial returns would be centered around 0. If instead underpricing occurs, then the distribution of initial returns should have the same shape as the distribution of unbiased offering prices (normal if the error terms are normally distributed), but its mean should be shifted to the right, by the degree of underpricing. Suppose that the estimated price, \hat{S} , is an unbiased estimate of the true market price, S_{true} , with an error term of ε according to equation 1.

$$\hat{S} = S_{true} \times \varepsilon \text{ where } \log \varepsilon \sim N(0, \sigma^2) \quad (1)$$

Taking the natural logarithms of equation 1 yields the corresponding equation

$$\log \hat{S} = \log S_{true} + \log \varepsilon \quad (2)$$

The error terms is assumed to be log-normally distributed since:

- i) the process of determining the price are dependent on several different inputs such as prices of comparable firms, fundamentals of the company and the indication of interest of potential investors. It is likely that the errors associated to these inputs are *independent*.
- ii) The central limit theorem suggests that a large sample of independent random variables is approximately normally distributed.

Ruud further argues that a multiplicative error term is the most plausible functional form, as the error is likely to be proportional to the share price.

If the offering price, S^* , is the unbiased estimate of the true market price, \hat{S} , then the expected value of the log initial returns would be zero, and the variance would be σ^2 . This relation is given in equations 3 and 4

$$S^* \equiv \hat{S} = S_{true} \times \varepsilon \quad (3)$$

$$\begin{aligned} \log\left(\frac{S_{true}}{S^*}\right) &= \log S_{true} - \log S_{true} - \log \varepsilon \\ &= -\log \varepsilon \end{aligned} \quad (4)$$

where $\log \varepsilon$ has a mean of zero and variance σ^2 as stated in equation 1.

Now instead suppose that underwriters intentionally underprice the IPO and set the offering price, S^* , to some fraction, θ , of the unbiased estimate, \hat{S} with $0 < \theta < 1$. This relation is shown below. When underpricing occurs, the price will be set as:

$$S^* = \theta \times \hat{S} \quad (5)$$

$$= \theta \times S_{true} \times \varepsilon$$

From equation 5 it follows that the expected value of the log return is $-\log \theta$, but the variance will still be σ^2 .

$$\log\left(\frac{S_{true}}{S^*}\right) = \log S_{true} - \log S_{true} - \log \theta - \log \varepsilon \quad (6)$$

$$= -\log \theta - \log \varepsilon$$

which has an expected value of $-\log \theta$ and a variance of σ^2 . Comparing equation 6 and 4, the conclusion is that the mean is shifted by $-\log \theta$ (a positive number as $0 > \log(0 < \theta < 1)$). However the distributions of the initial returns will still have the same shape, in terms of variance, skewness and kurtosis as the unbiased forecast in equation 4. Based on the assumption that the price is forecasted with error but without bias, underpricing would simply shift the mean of the initial returns to the right, but not the shape of the distribution.

A. Tables

Table A.1: List of companies used in our study

Year	Company	Year	Company
2008	DGC One AB	2000	Mind AB
2007	Nederman Holding AB	2000	Telia AB
2007	Systemair	2000	AU-System AB
2007	East Capital Explorer	2000	Axis AB
2007	Duni AB	2000	Biotage AB (formerly PyroSequencing AB)
2007	HMS Networks	2000	Jobline International AB
2006	Kappahl Holding AB	2000	AudioDev AB
2006	Gant Company AB	2000	Netwise AB
2006	Diös Fastigheter AB	2000	Eniro AB
2006	Biovitrum AB	2000	ORC Software AB
2006	BE Group AB	2000	NeoNet AB
2006	Rezidor Hotel Group AB	1999	NOCOM AB
2006	Lindab International AB	1999	SECTRA AB
2006	Linkmed AB	1999	Telelogic AB
2006	Tilgin AB	1999	Malmbergs Elektriska AB
2005	Indutrade AB	1999	HiQ International AB
2005	Hemtex AB	1999	Teligent AB
2005	TradeDoubler AB	1999	Kungsleden AB
2005	Orexo AB	1999	Naturkompaniet AB
2005	Hakon Invest AB	1999	Jeeves Information Systems AB
2004	NOTE AB	1999	Frango AB
2004	Oriflame Cosmetics S.A.	1999	DV Sweden AB
2004	Unibet Group Plc	1999	Sorb Industri AB
2002	Alfa Laval AB	1999	RKS AB
2002	Intrum Justitia AB	1999	Adera AB
2002	Nobia AB	1999	ReadSoft AB
2002	Ballingslöv AB	1999	Framtidsfabriken AB
2001	Dimension AB	1999	Poolia AB
2001	BTS Group AB	1999	BOSS MEDIA AB
2001	BioInvent	1999	NOVOTEK AB
2001	Vitrolife AB	1999	Connecta AB
2001	RNB Retail and Brands AB	1999	Clas Ohlson AB
2001	Carnegie & Co, D.	1999	Proffice AB
2000	Micronic Laser Systems AB	1999	Enlight Interactive AB
2000	Tele1 Europe Holding AB	1999	A-Com AB
2000	JC AB	1999	Cyber Com Consulting Group Scandinavia AB
2000	Mekonomen AB	1999	M2S Sverige AB
2000	Viking Telecom AB	1999	Q-Med AB
2000	Scandinavia Online AB		

Table A.2: Description of the observations that were excluded from our sample

Year	Company	Comment	Year	Company	Comment
2008	Nordic Service Partners Holding AB	Transfer from First North	2005	Connecta AB	Transfer from Other marketplace
2008	Morphic Technologies	Transfer from First North	2004	Ainax AB	Transfer from Other marketplace
2008	Swedol AB	Transfer from First North	2004	Bostadsaktiebolaget Drott	Spinoff - shares allocated to Drott's (Fabeges's) shareholders
2008	ITAB Shop Concept	Transfer from First North	2004	Lundin Mining Corporation	Transfer from Other marketplace
2008	Nordic Mines AB	Transfer from First North	2004	Millicom International Cellular	Secondary listing - no offering of shares
2008	Global Health Partner AB	Transfer from AIM London	2004	Netonnet AB	Transfer from Other marketplace
2008	Loomis AB	Spinoff - shares allocated to Securitas shareholders	2004	Powerwave Technologies Inc.	Listing after acquisition of LGP Allgon
2008	Hexpol AB	Spinoff - shares allocated to Hexagon's shareholders	2004	Probi AB	Transfer from Other marketplace
2008	Carl Lamm Holding AB	Listing after recapitalization of Carl Lamm AB (listed)	2003	Consilium AB	Transfer from A-list
2008	PSI Group ASA	Secondary listing after acquisition of Cashguard (listed)	2003	Pfizer Inc.	Un-sponsored listing on Xterna Listan
2007	Tanganyika Oil	Transfer from First North	2003	Human Care HC AB	Transfer from Other marketplace
2007	Björn Borg Group	Transfer from First North	2003	Lundin Petroleum AB	Transfer from Other marketplace
2007	West Siberian Resources	Transfer from First North	2003	Bilia AB	Transfer from A-list
2007	AB Sagax	Transfer from First North	2003	Brinova Fastigheter AB	Spinoff - shares allocated to Peab's shareholders
2007	Aerocrine	Pure floating - No offering to the public	2003	Altima AB	Spinoff - shares allocated to NCC's shareholders
2007	NovaCast Technologies	Transfer from NGM	2002	Diamyd Medical AB	Transfer from Other marketplace
2007	Vostok Nafta Investment	Spinoff from Vostok Nafta	2002	Nobel Biocare Holding AG	Exchange of shares following new corporate structure
2007	Peab Industrier AB	Spinoff- shares allocated to Peab's shareholders	2002	HQ Fonder AB	Transfer from Other marketplace
2006	Old Mutual Plc	Secondary listing after acquisition of Skandia	2002	Sign On i Stockholm AB	Transfer from Other marketplace
2006	LogicaGMC	Listing on Xterna Listan	2002	Active Capital AB	Transfer from Other marketplace
2006	Catena AB	Spinoff - shares allocated to Bilia's shareholders	2002	NCC AB	Transfer from A-list
2006	Husqvarna AB	Spinoff - shares allocated to Electrolux's shareholders	2002	Sapa AB	Transfer from A-list
2006	Securitas Direct AB	Spinoff - shares allocated to Securitas shareholders	2002	Axfood AB	Transfer from A-list
2006	Securitas Systems AB	Spinoff - shares allocated to Securitas shareholders	2002	Salusansvar AB	Transfer from A-list
2006	Carl Lamm	Spinoff - shares allocated to Scribona's shareholders	2002	Kaupthing Bank Hf.	Listing after acquisition of JP Nordiska
2006	EpiCept Corporation	Listing after acquisition of Maxim Pharmaceuticals	2001	Avesta Polarit	Listing following merger between Avesta Sheffield & Outokumpu
2006	Lawson Software Inc.	Secondary listing after acquisition of Intentia AB	2001	Metro International	Transfer from Other marketplace
2006	Aarhus Karlshamn AB	Transfer from First North	2001	Cellpoint Inc.	Secondary listing after acquisition of Unwire
2006	Uniflex AB	Transfer from First North	2001	Aspiro AB	Transfer from Other marketplace
2006	Melker Schörling AB	Transfer from First North	2001	Epsilon AB	Spinoff - shares allocated to Sigma's shareholders
2006	PA Resources AB	Transfer from Other marketplace	2001	Pergo AB	Spinoff - shares allocated to Perstorp's shareholders
2006	Svithoid Tankers AB	Transfer from Other marketplace	2001	Capinordic A/S	Secondary listing (Copenhagen listed)
2006	Rejlerkoncernen AB	Transfer from Other marketplace	2001	Academia AB	Transfer from Other marketplace
2006	New Unibet Group Ltd	Exchange of SDR's following new corporate structure	2001	SAS AB	Exchange of shares following new corporate structure
2005	Wihlborgs Fastigheter AB	Spinoff - shares allocated to Wihlborgs shareholders	2001	Addtech AB	Spinoff - shares allocated to Bergman & Beving's shareholders
2005	Gunnebo Industrier AB	Spinoff- shares allocated to Gunnebo's shareholders	2001	Lagercrantz Group AB	Spinoff - shares allocated to Bergman & Beving's shareholders
2005	Invik & Co AB	Spinoff- shares allocated to Kinnevik's shareholders	2001	Transcom WroldWide	Spinoff - shares allocated to Kinnevik's shareholders

Table A.3: Description of the observations that were excluded from our sample (cont'd)

Year	Company	Comment	Year	Company	Comment
2001	Sigma AB	Spinoff - shares allocated to Sigma's shareholders	2000	TMT One AB	Spinoff - shares allocated to Öresund's shareholders
2001	Diffchamb AB	Transfer from Other marketplace	2000	Dial NXT Group AB	Transfer from Other marketplace
2001	Billrud AB	Spinoff - shares allocated to Assi Domän's shareholders	2000	Ufors AB	Transfer from Other marketplace
2001	Boliden AB	Transfer from TSE (Canada)	2000	Öresund, Investment AB	Transfer from A-list
2001	Wihlborgs Fastigheter	Transfer from A-list	2000	Daydream Software AB	Transfer from Other marketplace
2001	JM	Conversion of shares into one class of shares	1999	CTT Systems AB	Transfer from Other marketplace
2001	Studsvik	Spinoff - shares allocated to Atlas shareholders	1999	Know IT AB	Transfer from Other marketplace
2001	Sensys Traffic	Floating - No offering to the public	1999	Capona AB	Spinoff - shares allocated to PrisFast's shareholders
2000	Geveko AB	Transfer from A-list	1999	Forcenergy Inc	Transfer from A-list to O-list observation section
2000	The Empire AB	Transfer from Other marketplace	1999	AstraZeneca PLC	New share replacing Astra shares due to Zeneca merger
2000	Pharmacia Corporation	New SDR's following merger between Pharmacia & Upjohn and Monsanto	1999	Linné Group AB	Transfer from Other marketplace
2000	Fingerprint Cards AB	Transfer from Other marketplace	1999	Perstorp AB	Transfer from the O-list
2000	Riddarhyttan Resources AB	Transfer from Other marketplace	1999	Independent Media Group Sweden AB	Transfer from Other marketplace
2000	TeleTrade Financial Services AB	Transfer from Other marketplace	1999	Boliden Ltd	Spinoff - shares allocated to Trelleborg's shareholders
2000	Time Space Radio AB	Floating - No IPO	1999	Modern Times Group MTG AB	Transfer from Other marketplace
2000	Kipling Holding AB	Transfer from Other marketplace	1999	Artema Medical AB	Transfer from Other marketplace
2000	Traction AB	Transfer from Other marketplace	1999	ScanMining – Scandinavian Mining AB	Transfer from Other marketplace
2000	Cash Guard AB	Floating - No IPO	1999	Net Insight AB	Transfer from previous unofficial trading
2000	Feelgood Svenska AB	Transfer from Other marketplace	1999	ARETE AB	Transfer from Other marketplace
2000	Glocalnet AB	Transfer from Other marketplace	1999	Wilh. Sonesson AB	Spinoff - shares allocated to Active Biotech's shareholders
2000	Beijer Electronics AB	Spinoff - shares allocated to G&L Beijer's shareholders	1999	All Cards Service Center – ACSC AB	Transfer from Other marketplace
2000	Vision Park Entertainment AB	Transfer from Other marketplace	1999	Meto AG	Spinoff - shares allocated to Esselte's shareholders
2000	C Technologies AB	Transfer from Other marketplace	1999	ABB Ltd	New share replacing ABB AB (former Asea) & ABB AG (former Brown Boveri) shares
2000	Novestra AB	Transfer from Other marketplace	1999	SPCS-Gruppen ASA	Secondary listing after merger with PC-Systemer
2000	Cherryföretagen AB	Transfer from Other marketplace	1999	ProAct IT Group AB	Transfer from Other marketplace
2000	Hagströmer & Qviberg AB	Spinoff - shares allocated to HQ,SE's shareholders	1999	Ticket Travel Group AB	Transfer from the O-list
2000	The Empire AB	Re-listing following acquisition of Ledstiernan	1999	Duroc AB	Transfer from Other marketplace
2000	I.A.R. Systems AB	Floating after directed share issue to Turnit's shareholders	1999	Pronyx AB	Transfer from Other marketplace
2000	Tripep AB	Insufficient information	1999	TietoEnator Abp	New share replacing Enator shares due to Tieto merger
2000	Thalamus Networks AB	Transfer from Other marketplace	1999	Gränges AB	Transfer from the O-list
2000	Mogul.com Group AB	Transfer from Other marketplace	1999	Société Européenne de Communication S.A.	Transfer from Other marketplace
2000	Frilufisbolaget Ekelund & Sagner AB	Transfer from Other marketplace	1999	Array Printers AB	Transfer from Other marketplace
2000	Precise Biometrics AB	Transfer from Other marketplace	1999	Perbio Science AB	Spinoff - shares allocated to Perstorp's shareholders
2000	Capio AB	Spinoff - shares allocated to Bure's shareholders	1999	SwitchCore AB	Transfer from Other marketplace
2000	Midway Holding AB	Transfer from Other marketplace	1999	MultiQ International AB	Transfer from Other marketplace
2000	Custos AB	Transfer from Other marketplace	1999	Gräninge AB	Exchange of shares from Gräningevarken
2000	Syngenta AG	Spinoff - shares allocated to Astra Zeneca's shareholders			

Table A.4: Comparison of characteristics for firms including/not including the overallotment arrangement

P-values correspond to two-sided tests with null hypothesis that the properties of OAA Included and No OAA are the same. For mean testing, the p-values are shown within brackets since this t-test relies on the assumption that the distribution is normal. Hence, these values should be interpreted with caution. The test for different medians is a non-parametric Mann-Whitney U test.

Variable	Mean		(p value)	Median		p value
	OAA Included	No OAA		OAA Included	No OAA	
IR(1)	13.4%	6.5%	(0.24)	4.8%	4.2%	0.87
IR(20)	13.8%	1.9%	(0.08)	8.0%	-0.9%	0.34
Size excluding overallotment (SEK million)	2 347	140	(0.07)	582	120	0.00
Size including overallotment (SEK million)	2 680	140	(0.07)	638	120	0.00
Subscription rate	9.6x	5.7x	(0.00)	7.0x	4.0x	0.02
Secondary shares overallotment not considered (% of total)	50.3%	34.6%	(0.11)	50.0%	29.2%	0.11
Secondary shares overallotment considered (% of total)	44.4%	34.6%	(0.29)	44.4%	29.2%	0.27
Sales (SEK million)	2 555	305	(0.03)	406	171	0.07
First day trading volume overallotment not considered (% of total issue)	24.1%	9.7%	(0.00)	22.4%	5.9%	0.00
First day trading volume overallotment considered (% of total issue)	21.2%	9.7%	(0.00)	19.7%	5.9%	0.00

Note: Subscription rate excludes 16 observations that was stated as expressions instead of figures

Abbreviations: OAA - Overallotment arrangement

Table A.5: Detailed information regarding exercise dates for 22 observations

Company	Listing date	Exercise date	Return at exercise date	Min. return prior to exercise date	Could they have stabilized prior to exercise date?	Did they?
Nederman Holding	2007-05-16	2007-05-29	8,05%	8,05%		
Lindab	2006-12-01	2006-12-07	11,36%	2,50%		
BE Group	2006-11-24	2006-12-05	2,02%	-3,23%	YES	YES
Rezidor Hotels	2006-11-28	2006-12-21	8,65%	-0,96%	YES	YES
Biovitrum	2006-09-15	2006-09-22	16,00%	11,50%		
Kappahl	2006-02-23	2006-03-03	3,57%	3,57%		
Gant	2006-03-28	2006-03-31	38,65%	34,75%		
Tradedoubler	2005-11-08	2005-12-07	8,64%	-4,55%	YES	YES
Orexo	2005-11-09	2005-12-08	0,00%	-4,44%	YES	YES
Hemtex	2005-10-06	2005-10-17	10,71%	10,71%		
Indutrade	2005-10-05	2005-10-12	15,38%	12,69%		
Hakon Invest	2005-12-08	2005-12-13	12,01%	5,84%		
Oriflame	2004-03-24	2004-03-24	9,74%	9,74%		
Ballingslöv	2002-06-19	2002-07-02	6,25%	-3,13%	YES	NO
Intrum Justitia	2002-06-07	2002-06-14	6,38%	5,96%		
Alfa Laval	2002-05-17	2002-05-28	1,65%	1,65%		
Carnegie	2001-06-01	2001-06-11	18,26%	15,65%		
Dimension	2001-02-20	2001-03-07	4,92%	0,00%		
Eniro	2000-10-10	2000-11-07	8,93%	-4,76%	YES	YES
AU-System	2000-06-21	2000-07-10	24,21%	5,26%		
Axis Communication	2000-06-27	2000-07-05	7,89%	-1,05%	YES	NO
Scandinavia Online	2000-06-07	2000-06-28	13,91%	7,39%		

Note: Return are calculated as simple returns using closing prices

Table A.6: Information regarding aftermarket short covering for 4 observations

Company	Highest stabilizing price	Offering Price	Payoff short covering
BE Group	60	62	3,23%
Tradedoubler	110	110	0,00%
Duni	50	50	0,00%
HMS Networks	74	74	0,00%

Table A.7: Descriptive statistics for the 55 IPOs containing an overallotment arrangement. To test for normality we use Stata's SKtest, which combines kurtosis and skewness into one joint test.

	IR(1)	IR(5)	IR(10)	IR(15)	IR(20)
Mean	0.094	0.078	0.100	0.090	0.085
Median	0.047	0.034	0.054	0.038	0.077
Max	1.234	1.244	1.266	0.916	1.066
Min	-0.260	-0.379	-0.481	-0.455	-0.783
Std. Dev	0.226	0.232	0.275	0.260	0.289
Skewness	2.989	2.478	1.684	0.923	0.575
<i>p</i> -value	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	<i>0.006</i>	<i>0.067</i>
Kurtosis	14.499	13.383	8.444	4.779	5.902
<i>p</i> -value	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	<i>0.021</i>	<i>0.003</i>
Joint test	60.360	52.360	33.260	12.890	12.000
<i>p</i> -value	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	<i>0.002</i>	<i>0.003</i>

Table A.8: Descriptive statistics for the 22 IPOs not containing an overallotment option. To test for normality we use Stata's SKtest, which combines kurtosis and skewness into one joint test.

	IR(1)	IR(5)	IR(10)	IR(15)	IR(20)
Mean	0.056	0.043	0.031	0.010	0.001
Median	0.041	0.013	0.003	0.000	-0.009
Max	0.245	0.236	0.346	0.268	0.298
Min	-0.163	-0.179	-0.294	-0.357	-0.470
Std. Dev	0.121	0.140	0.167	0.175	0.200
Skewness	0.037	0.098	-0.084	-0.430	-0.623
<i>p</i> -value	<i>0.931</i>	<i>0.820</i>	<i>0.845</i>	<i>0.326</i>	<i>0.163</i>
Kurtosis	2.000	1.762	2.396	2.433	2.847
<i>p</i> -value	<i>0.224</i>	<i>0.051</i>	<i>0.741</i>	<i>0.793</i>	<i>0.700</i>
Joint test	1.490	3.860	0.150	1.030	2.090
<i>p</i> -value	<i>0.476</i>	<i>0.146</i>	<i>0.929</i>	<i>0.597</i>	<i>0.351</i>

Table A.9: Estimation of Subscription Rate

We estimate the Subscription Rate for the 15 companies tabled below by analyzing the phrasing of the companies. The estimates for the Subscription Rate comes are derived from the Subscription Rates available for the remaining 61 IPOs. As an example the phrasing “Heavily Oversubscribed” has been interpreted to indicate a Subscription Rate in the higher interval of the direct observations, and we have therefore used the 75th percentile of the available observations as an estimate for these IPOs.

Company	Comment	Estimation	Estimated Subscription Rate	Explicit observations	Subscription Rate
LinkMed	Heavily Oversubscribed	75th Percentile	11.5x	Median	6.1x
Netwise	Heavily Oversubscribed	75th Percentile	11.5x	Mean	9.0x
Jobline Intl	Heavily Oversubscribed	75th Percentile	11.5x	Mode	3.0x
AddNode (fd Adera AB)	Heavily Oversubscribed	75th Percentile	11.5x	5th Percentile	1.6x
RKS	Heavily Oversubscribed	75th Percentile	11.5x	10th Percentile	2.6x
Biotage (fd PyroSequencing AB)	Very Oversubscribed	75th Percentile	11.5x	25th Percentile	3.8x
Diös	Well Oversubscribed	Median	6.1x	75th Percentile	11.5x
Tilgin	Oversubscribed	Mode	3.0x	90th Percentile	18.8x
ORC Software	Oversubscribed	Mode	3.0x	# Observations	61
Sorb Industri	Oversubscribed	Mode	3.0x		
Jeeves Information	Oversubscribed	Mode	3.0x		
Intoi AB (fd Nocom)	Oversubscribed	Mode	3.0x		
Orexo	Enough Oversubscribed	10th Percentile	2.6x		
Neonet	Fully Subscribed	10th Percentile	2.6x		
RNB Retail and Brands	Low Interest	5th Percentile	1.6x		

B. Detection of multicollinearity

We follow the check list from lecture 7 (2007-09-13) in Basic Econometrics, course 8103, at Stockholm School of Economics in order to examine the presence of multicollinearity in the data.

Table B.1: Pair-wise correlations among explanatory variables

The table shows the SPSS output for the pair-wise correlations among the explanatory variables. The pair-wise correlations are not very high with a maximum of 0.479 between ln(Sales) and ln(Age), indicating that there is a positive relation between the age of the company and company sales. A pair-wise correlation coefficient above 0.8 signals a serious multicollinearity problem. (Gujarati, 2003)

Variable		Subscription_Rate	ln(Sales)	OAA_Dummy	Bookbuild_Dummy	ln(Age)	ln(OMXS30_prev)
Subscription_Rate	Pearson Correlation	1	0.073	0.233**	0.125	0.076	0.323*
	Sig. (2-tailed)		0.532	0.043	0.282	0.512	0.004
	N	76	76	76	76	76	76
ln(Sales)	Pearson Correlation	0.073	1	0.194	0.244**	0.479*	-0.105
	Sig. (2-tailed)	0.532		0.093	0.034	0	0.368
	N	76	76	76	76	76	76
OAA_Dummy	Pearson Correlation	0.233**	0.194	1	0.475*	-0.012	0.066
	Sig. (2-tailed)	0.043	0.093		0	0.92	0.569
	N	76	76	76	76	76	76
Bookbuild_Dummy	Pearson Correlation	0.125	0.244**	0.475*	1	0.071	-0.246**
	Sig. (2-tailed)	0.282	0.034	0		0.54	0.032
	N	76	76	76	76	76	76
ln(Age)	Pearson Correlation	0.076	0.479*	-0.012	0.071	1	-0.102
	Sig. (2-tailed)	0.512	0	0.92	0.54		0.382
	N	76	76	76	76	76	76
ln(OMXS30_prev)	Pearson Correlation	0.323*	-0.105	0.066	-0.246**	-0.102	1
	Sig. (2-tailed)	0.004	0.368	0.569	0.032	0.382	
	N	76	76	76	76	76	76

* Correlation is significant at the 0.01 level (2-tailed), ** Correlation is significant at the 0.05 level (2-tailed)

Table B.2: Condition Indexes for base case regression

The table below shows the SPSS output for the condition indexes. Condition indexes exceeding 30 signals severe multicollinearity, whereas condition indexes between 10 and 30 signals moderate to strong multicollinearity. (Gujarati, 2003)

				Variance Proportions						
Dimension	Eigenvalue	Condition Index		(Constant)	Subscription_Rate	ln(Sales)	OAA_Dummy	Bookbuild_Dummy	ln(Age)	ln(OMXS30_prev)
1	5.114	1.000		0.00	0.01	0.00	0.01	0.01	0.00	0.00
2	1.017	2.243		0.00	0.02	0.00	0.00	0.02	0.00	0.61
3	0.332	3.926		0.01	0.22	0.00	0.07	0.17	0.08	0.01
4	0.299	4.135		0.00	0.74	0.00	0.10	0.11	0.01	0.23
5	0.152	5.792		0.00	0.00	0.00	0.72	0.68	0.01	0.13
6	0.077	8.151		0.08	0.00	0.02	0.09	0.00	0.76	0.01
7	0.009 ¹	23.526		0.91	0.00	0.97	0.01	0.01	0.14	0.00

Dependent Variable: ln(1+IR)

Table B.3: Significance levels and Collinearity statistics for base case regression

A classic symptom of multicollinearity is the case of a high coefficient of determination (R^2) combined with few significant t-ratios for the slope coefficients. Several of the explanatory variables are statistically insignificant from zero, but meanwhile the coefficient of determination is not very high. A variance inflation factor (VIF) exceeding 10 for an explanatory variable can be used as a rule of thumb for deeming that explanatory variable highly collinear. Meanwhile, the closer the tolerance values is to zero, the greater the degree of collinearity of that explanatory variable to other explanatory variables. And conversely, the closer the tolerance value is to 1, the greater the evidence that the variable is not collinear with the other explanatory variables. (Gujarati, 2003)

R^2	0.389			
Variable	t	Sig.	Tolerance	VIF
(Constant)	0.310	0.758		
Subscription_Rate	2.884	0.005	0.826	1.211
ln(Sales)	-0.595	0.553	0.712	1.404
OAA_Dummy	-0.252	0.802	0.711	1.407
Bookbuild_Dummy	-0.160	0.873	0.672	1.489
ln(Age)	0.146	0.884	0.749	1.335
ln(OMXS30_prev)	1.766	0.082	0.782	1.279
Dependent Variable: $\ln(1+IR_1)$				

Table B.4: Summary of Multicollinearity Identification

There is no presence of strong multicollinearity in the dataset. The Bookbuild_Dummy and OAA_Dummy is the most collinear variables, indicating that many IPOs that use the book building price mechanism also tend to include an overallotment option.

Identification of multicollinearity	Check
High R^2 (e.g. 0.8) but few significant t-ratios	No
High pair-wise correlations among the explanatory variables (One $ r > 0.8$ or several $ r > 0.5$)	No
High Condition Index (CI) (10 < CI < 30 indicates moderate to strong multicollinearity, CI > 30 severe)	Moderate
Source: Lecture Notes, Lecture 7 (2007-09-13), Basic Econometrics (Course 8103), Stockholm School of Economics	

C. Test for spatial autocorrelation

Table C.1: Durbin-Watson d Test for Spatial Autocorrelation

Spatial Autocorrelation refers to the case of autocorrelation in space (rather than over time), which can be present for cross sectional data. (Gujarati, 2003) Our dataset falls in the cross sectional data category and we therefore need to control for potential autocorrelation between the observed IPO's. When testing for spatial autocorrelation, Gujarati notes that it is important to have some logical ordering of the data. Therefore we have sorted the tested explanatory variable by a descending order for each case. The estimated d-statistic has thereafter been generated by SPSS for each sorting. If no autocorrelation exist, then the estimated first-order coefficient of autocorrelation (estimated ρ) should be 0. Hence we will test for positive (negative) autocorrelation when the estimated $\rho > 0$ ($\rho < 0$). As shown in the table below, we cannot reject the null hypothesis of no autocorrelation in any of the six cases.

Sorted by (Descending order)	Dobs	estimated ρ	Test for	Decision Rule			Decision		
				Reject if	No Decision if	Do not reject if	Reject	No decision	Not reject
Subscription_Rate	1.81	0.095	positive autocorrelation	$0 < \text{Dobs} < \text{DL}$	$\text{DL} \leq \text{Dobs} \leq \text{DU}$	$\text{DU} < \text{Dobs} < 4 - \text{DU}$			X
ln(Sales)	2.013	-0.0065	negative autocorrelation	$4 - \text{DL} < \text{Dobs} < 4$	$4 - \text{DU} \leq \text{Dobs} \leq 4 - \text{DL}$	$\text{DU} < \text{Dobs} < 4 - \text{DU}$			X
OAA_Dummy	2.135	-0.0675	negative autocorrelation	$4 - \text{DL} < \text{Dobs} < 4$	$4 - \text{DU} \leq \text{Dobs} \leq 4 - \text{DL}$	$\text{DU} < \text{Dobs} < 4 - \text{DU}$			X
Bookbuild_Dummy	2.103	-0.0515	negative autocorrelation	$4 - \text{DL} < \text{Dobs} < 4$	$4 - \text{DU} \leq \text{Dobs} \leq 4 - \text{DL}$	$\text{DU} < \text{Dobs} < 4 - \text{DU}$			X
ln(Age)	2.158	-0.079	negative autocorrelation	$4 - \text{DL} < \text{Dobs} < 4$	$4 - \text{DU} \leq \text{Dobs} \leq 4 - \text{DL}$	$\text{DU} < \text{Dobs} < 4 - \text{DU}$			X
ln(OMXS30_prev)	1.98	0.01	positive autocorrelation	$0 < \text{Dobs} < \text{DL}$	$\text{DL} \leq \text{Dobs} \leq \text{DU}$	$\text{DU} < \text{Dobs} < 4 - \text{DU}$			X
DL	1.462		4-DL		2.538				
DU	1.801		4-DU		2.199				

Note: DL and DU at 5% significance level

D. White's general heteroscedasticity test

Table D.1: Output from auxiliary regression

In order to test for heteroscedasticity we run an auxiliary regression with the squared residuals from the base case regression as the dependent variable and the original explanatory variables, their squared values and the cross products of the explanatory variables as regressors. (Gujarati, 2003) Squared values of the dummy variables cannot be used as this would introduce perfect multicollinearity between the dummy variables and their squared values. Hence we have a total of 25 regressors (6 original explanatory variables, 4 squared values, and 15 cross products of the explanatory variables).

Under the null hypothesis that there is no heteroscedasticity (i.e. a homoscedastic error term) the sample size (n) multiplied by the coefficient of determination (R^2) from the auxiliary regression asymptotically follows the chi-square distribution with 25 degrees of freedom (the number of explanatory variables). The critical chi-square value with 25 degrees of freedom and a significance level of 5 percent is 37.6525. From table D.1 below, we can thus reject the null hypothesis of no heteroscedasticity.

R^2	n	$R^2 \times n$	Decision Rule		Decision	
			Reject if	Crit. chi-square	Reject	Not Reject
0,578	76	43,928	$R^2 \times n > \text{Crit. Chi-square}$	37,6525	X	

Note: Critical chi-square value at 5% significance level

E. Multiple regressions

Table E.1: Initial regression result

Table E.1 outlines the regression result for the base case regression with all observations in the database, apart from the IPO of East Capital Explorer.

Variable	Coef.	White's Std. Error	White's t value	White's p value
Constant	0.03199	0.10336	0.3095	0.758
Subscription_Rate	0.01341	0.00465	2.88356	0.005
ln(Sales)	-0.00543	0.00912	-0.59547	0.553
OAA_Dummy	-0.01026	0.04081	-0.25151	0.802
Bookbuild_Dummy	-0.00975	0.06076	-0.16044	0.873
ln(Age)	0.00308	0.02101	0.14648	0.884
ln(OMXS30_prev)	0.56948	0.32244	1.76617	0.082
Adj R ²	0.336			
# Observations	76			

Table E.2: Practical example of regression result

The table outlines the practical implication of the estimated variable coefficients using the IPO of Oriflame as an example. Oriflame's IPO had a total subscription rate of 11x, sales and the company's latest available 12 month sales figure at the time of the offering was some SEK 650.1 million. The IPO included an overallotment option and was priced through the book building pricing mechanism. At the time of the offering Oriflame had existed for 37 years, and OMXS30 was down 0.29 percent the past 40 days the day prior to the listing. With these inputs, the predicted underpricing in nominal figures was 10.11 percent, slightly above the actual underpricing of 9.7 percent.

Oriflame	Variable size	Predicted ln(1+IR ₁)	Predicted IR ₁
Constant	-	0.032	3.25%
Subscription_Rate	11x	0.148	15.89%
ln(Sales)	13.39	-0.073	-7.01%
OAA_Dummy	1	-0.010	-1.02%
Bookbuild_Dummy	1	-0.010	-0.97%
ln(Age)	3.611	0.011	1.12%
ln(OMXS30_prev)	-0.003	-0.002	-0.16%
Predicted Underpricing		0.096	10.11%
Actual Underpricing		0.093	9.74%
Residual		-0.003	-0.37%

Table E.3: Regression result excluding Cybercom- and Connecta observations

The table outlines the regression result after excluding the IPO of Cybercom and Connecta from the dataset. Removing the two observations does not have any apparent effect on the coefficients and the significance level when comparing the result with the Base Case regression.

Variable	Coef.	White's Std. Error	White's t value	White's p value
Constant	-0.00366	0.07805	-0.04691	0.963
Subscription_Rate	0.00859	0.00175	4.91537	0.000
ln(Sales)	-0.00422	0.00716	-0.5892	0.558
OAA_Dummy	-0.02208	0.03299	-0.66948	0.505
Bookbuild_Dummy	-0.00426	0.03717	-0.11449	0.909
ln(Age)	0.02214	0.01337	1.65544	0.103
ln(OMXS30_prev)	0.43265	0.23502	1.84091	0.070
Adj R ²	0.346			
# Observations	74			

F. Figures

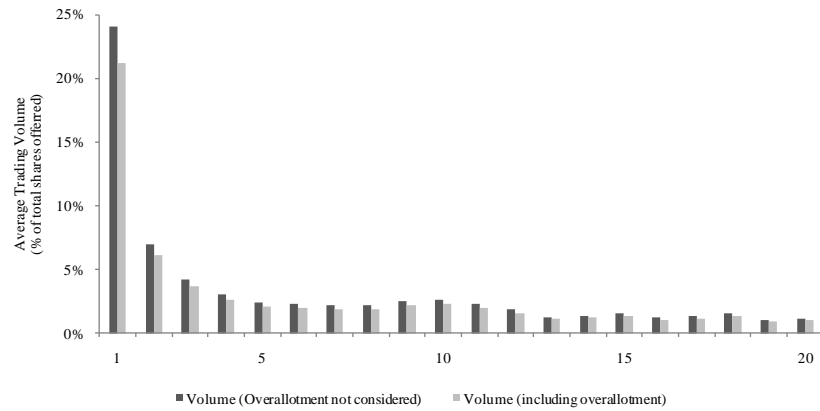


Figure F.1: Average trading volume as percentage of total offering (excluding and including overallotted shares) for IPOs including the overallotment option during the first 20 trading days.

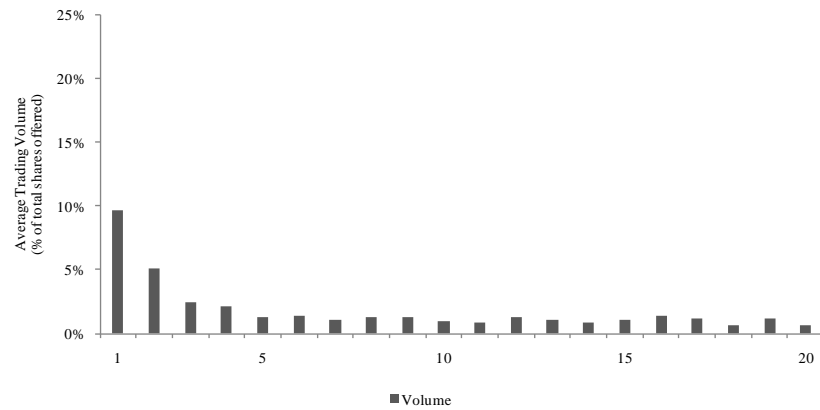


Figure F.2 : Average trading volume as percentage of total offering (excluding and including overallotted shares) for IPOs excluding the overallotment option during the first 20 trading days.

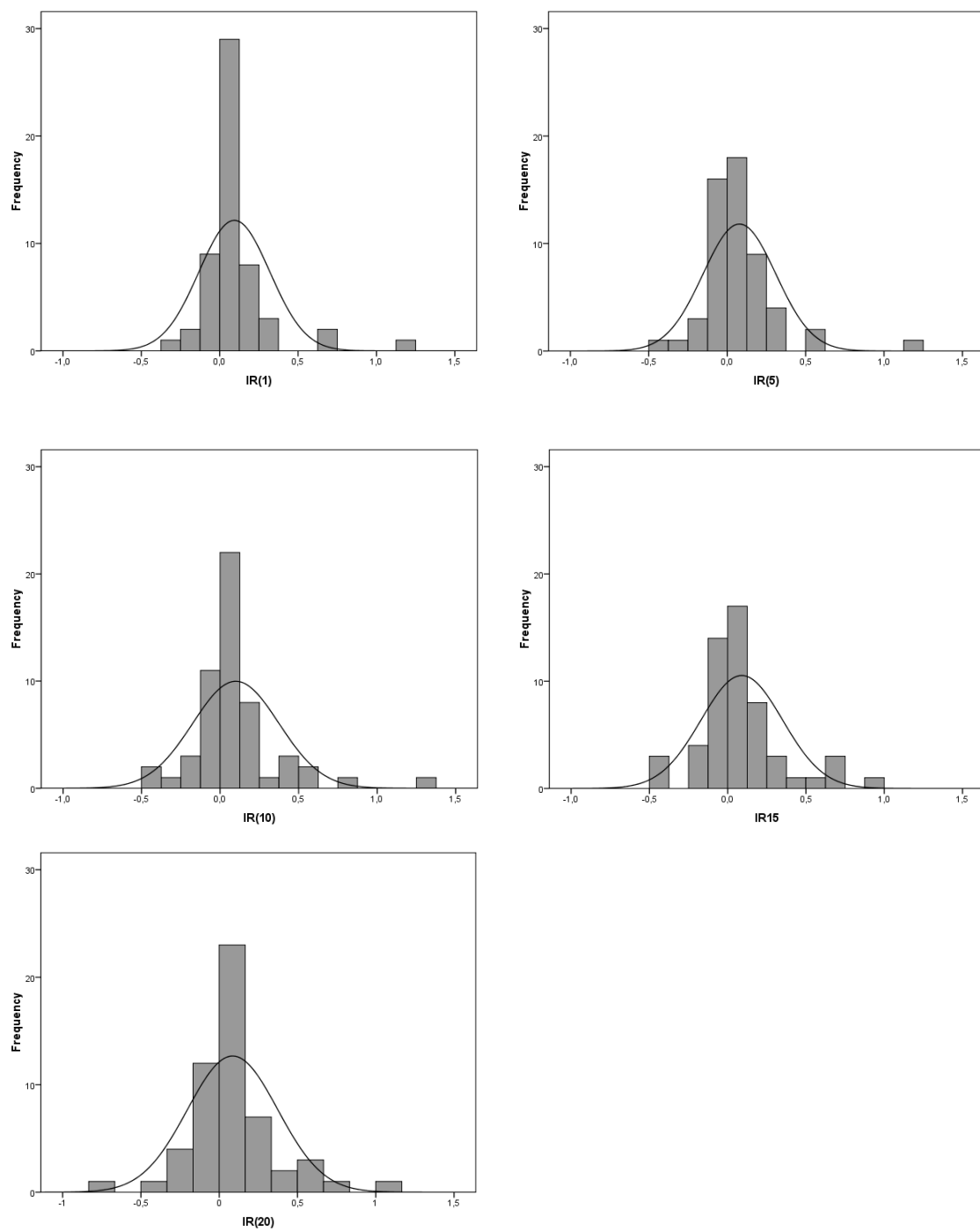


Figure F.3: Histograms of log returns 1st-20th trading day for the 55 IPOs including an overallotment arrangement

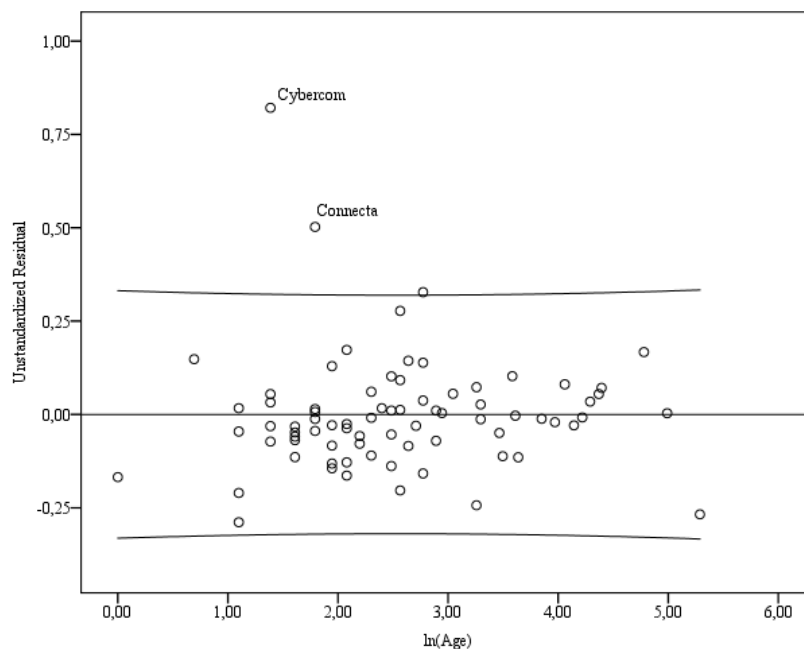


Figure F.4: Plot of IPO underpricing over $\ln(\text{Age})$ for all 76 observations

The figure plots the first day return of all 76 IPO's considered in the initial regression over company age. The IPO of Cybercom and Connecta stands out as outliers, outside the 95 percent confidence interval. The IPO of Micronic is precisely within the confidence interval.

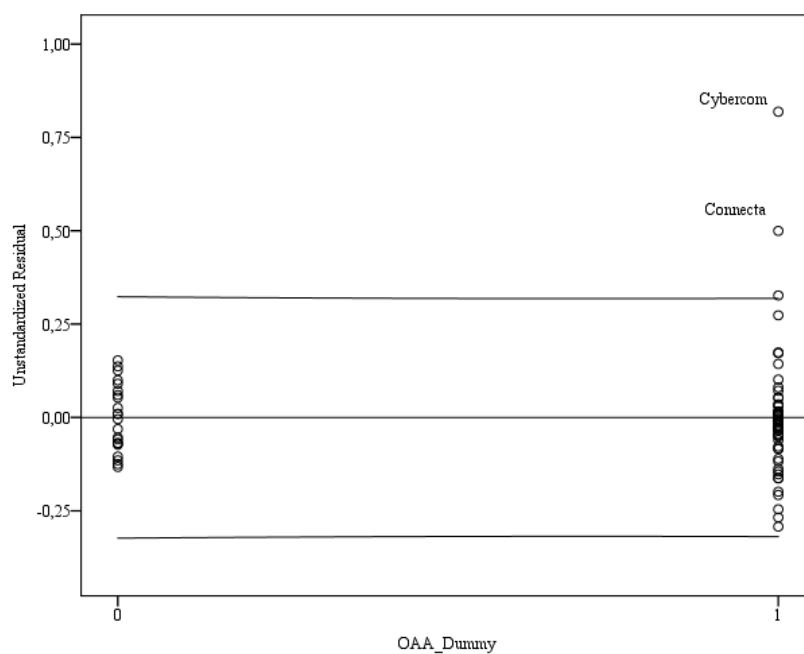


Figure F.5: Plot of unstandardized residual over OAA_Dummy for all 76 observations

Cybercom and Connecta are outside the 95 percent confidence interval for the unstandardized residuals and they both included an overallotment arrangement, thus plausibly “lifting” up the coefficient of the dummy variable for the overallotment arrangement.