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Underpricing and actual return in IPOs

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Abstract

In IPOs, both the firm and its underwriter might have incentives to underprice the shares. This has caused a perception that investing in IPOs is an easy way to achieve abnormal returns. According to an article published by *Kevin Rock* however, investors should not expect abnormal returns when subscribing for shares in IPOs after adjusting for expected rationing. He refers it to a winner's- curse problem where investors gets full allocation in overpriced IPOs and limited allocation in underpriced ones. We attacked this issue to investigate whether the expected return in an IPO is in fact positive after adjusting for expected allocation. We found that the unadjusted return between 1994 and 2016 was substantially high but after adjusting for expected allocation, the return dropped dramatically. Our result did not allow us to reject that the expected return when subscribing for shares in an IPO might in fact be zero.

Table of content

Introduction	3
2. Theory	6
2.1 Rock's model	7
2.3 Applying of Rock's model	12
2.4. Our analysis	13
3. Data and Method	14
3.1 Data	14
3.2 Method	17
4. Result	19
4.1 Robustness analysis	21
5. Analysis and discussion	24
6. Conclusion	27
References	29
Appendix	32

1. Introduction

The crucial goal for every company is growth and expansion and to achieve this, the company needs to raise funds to allocate in different investment opportunities that generate a positive net value. The most preferable way of investing is with funds that have been raised internally as it is the cheapest way of financing and does not involve external sources. Though at some point, most companies need to turn to external sources of financing when it arises an investment opportunity for which their own internal raised money is not sufficient. The capital needed can be borrowed from a bank or another creditor, but there will be some point where either you are not creditworthy enough to raise more capital that way or you need to raise a substantial amount. At this point, going public could be an option. The benefits of going public is that it is relatively easy and there is no upper limit of how much money that could be raised and could be done at several stages whenever there is a need for further financing and in this way enable further and quicker expansion. (Myers & Majluf, 1984).

When a private company decides to become a publicly traded company it does so by undergoing a so called initial public offering, IPO, which means that their shares will be publicly offered to everyone on a public market. In the prospectus for the IPO, beyond general information about the company and its future projects, they state how many new shares they will issue and to what price. This prospectus is thereafter presented to the public investors. When the stock starts trading, a common reaction is that the stock price increases a lot during its first day of trading (Ibbotson, 1975). This could for the single case signal that the market has a different view on the company, but its commonness indicates that the stock has in fact been underpriced intentionally (Logue, 1973), (Jegadeesh, Weinstein & Welch, 1993). The level of underpricing, that is defined as the difference between the IPO-price and the closing price on the first day of trading (Ritter, 1984), seems to be on average substantially higher than the market return and could be seen as a very attractive investment opportunity for investors.

The average underpricing of IPOs in the US between 1960 and 2011 measured in absolute terms was as high as 17% (Berk & De Marzo, 2014). Last year, the average underpricing on Swedish IPOs was around 10.9 % (see figure 4). This interesting phenomena is not something

that has appeared in the last couple of years but has been a subject of research for a long time and it has been tested for and proven by e.g. Ibbotson (1975) and Ritter (1984).

There are a number of different theories why new issues are underpriced. However, research disagree on why the underpricing occurs. The main idea is that there are different parties involved in the process. They are the issuing firm, the investment bank and the investors. All of these parties have different incentives.

Underwriters incentive for underpricing: Selling all the shares is prestigious for the investment bank as it might be the result of good promoting and marketing of the IPO which can strengthen their reputation and lead to future deals. This naturally gives the investment bank incentives to underprice the shares intentionally to simplify the selling process (Pang & Klein, 1993).

Further, the investment bank wants to give the best offer possible to their own clients (Beatty & Ritter, 1986). A moral hazard problem arises for the investment banks as they have two parties to handle simultaneously, both with goals that contradict each other. On one side they have the firm that plans to go public, and on the other side the potential investors, the clients. The investment bank wants to offer the shares at a price as low as possible in order to satisfy their clients on the investing side and in turn sell all the shares, while on the other hand the firm wants the shares to sell for a high price to raise as much money as possible. The larger the increase in the share price the first day of trading, the higher the level of underpricing. The higher the underpricing, the more money is “left on the table”, that is, the investment bank could have set the offer price higher and in turn raised more money to the firm (Loughran & Ritter, 2002). A skilled investment bank manages to sell all the shares at a price as close to the market price as possible.

Firm incentives for underpricing: Investors who participate in underpriced IPOs see the underpricing as a signal that the firm is of good quality. This makes the investors more likely to participate in later seasoned equity offerings. Firms are willing to leave some money on the table if it makes it easier to raise more money in the future (Jegadeesh, Weinstein & Welch, 1993).

Investors incentive for underpricing: To be able to sell all the shares at the IPO, the firm in turn needs to give investors an incentive to buy shares and often does so by underpricing the offering. Since there is no market for the shares, there is a large uncertainty in the true value of the firm. Therefore the issue has to be underpriced to compensate the investors for this uncertainty and the risk of a bad investment. This is this point of view that we will have throughout our essay. The higher the uncertainty about a firm's *true* value, the higher the underpricing and in turn the higher the aggregated demand for shares as investors who knows the firm's true value will increase their investments in an IPO (Rock, 1986).

The phenomenon first caught our attention when we noticed a pattern in that many IPOs seems to appreciate a lot the first day of trading and we wanted to figure out the reason for this. After some searching we found that there was already a lot of research done in this area. Almost all research has shown that IPOs are underpriced, but some of the also state that there is no abnormal expected return (Ibbotson 1974), (Ritter 1984). This is what we wanted to investigate. Is it not possible to profit from this pattern? The conclusion is easily drawn by just looking on historical average first day returns. But if it was this simple it would go against the theory of efficient markets (Fama 1965).

Our view is that there is a wide perception among the public that IPOs are always a good investment and that it is possible to make money on the first-day return. A perception that makes it acceptable for financial journalists to write things like:

- "Paradox is too expensive, but the subscribe-sell strategy could be an option." (Börsveckan, 2016).
- "High growth and grand building projects stand against thin margins and poor cash flow... .. subscribe and sell immediately." (Dagens industri, 2016).
- "The prospect is whitewashed and the balance sheet is in need of a renovation. The recommendation is to subscribe and sell the shares immediately." (Dagens industri, 2015)

These three examples shows how contradicting the strategy is. The IPO is overvalued, but you should subscribe anyway.

A crucial factor is probably overlooked when drawing these conclusions of abnormal returns

from IPOs. The earlier discussed expected abnormal returns from IPOs are all calculated and measured in absolute terms and does not take *the expected level of allocation* into account and possibly this is the answer to why many earlier findings suggests abnormal returns. Our theory that builds on the work done by Rock (1986) states that once there is underpricing in an IPO the demand from *informed investors*, that is investors who knows the firm's true value, will increase. Since the uninformed investors do not know the true value of the company, their demand remains constant regardless of the pricing of the IPO. This means that whether there is an excess or deficit demand is determined entirely by the informed investors. There will be an excess demand in underpriced IPOs, since demand increases for informed investors, and vice versa. This will in turn lead to the shares being rationed in cases of underpricing and will result in the investors not receiving the number of shares they subscribe for. The expected return will drop in cases of underpricing while in cases of overpricing the investor will suffer the full loss.

Our purpose is to test Kevin Rock's winner's curse hypothesis that states that the winner in an IPO, that is the uninformed investors that gets his orders filled, will in fact suffer an expected negative return. We believe that if we correct the historical return for the expected level of subscription, the expected returns will drop significantly and maybe not even be abnormal at all. In our essay we will test whether the strategy where you subscribe for shares in IPOs and then sell them at the closing price on the first day of trading is a strategy that will generate abnormal returns. Ibbotson was writing about this in his paper from 1974, but we will use Kevin Rock's model (1986) and backtest it on Swedish IPOs between 1994 and 2016. With Rock's model, we are adjusting the first day return with respect to the fact that investors get rationed when subscribing in underpriced IPOs while receiving all stocks subscribed for in overpriced IPOs. This test has not been performed on Swedish exchanges before.

2. Theory

Our theory is built upon testing the work of Kevin Rock's from 1986, where he states that the expected return when subscribing for shares in an IPO for an *uninformed* investor is not above the risk-free rate. The counterpart to the uninformed investor is the informed investor, which is an investor with superior information who is considered to know the true value of

the firm. The higher the asymmetric information between investors, the lower the underwriters of an IPO has to put the price to be able to attract uninformed investors as they demand a lower price to compensate for their uncertainty (Rock, 1986), (Hoque, 2014). As the informed investors know the “true value” of the firm, they benefit more the higher the asymmetric information between investors as it leads to a larger discount from the underwriter. The investors will be rationed when the issue is underpriced compared to when it is overpriced because the underpricing will also attract the informed investors. This will result in a smaller profit for uninformed investors when investing in underpriced issues, while experiencing the full loss when the issue is overpriced.

2.1 Rock's model

Rock and his theory is our main reference. In Rock's model, he considers two different investment opportunities. One that is safe with a normalized return of 1, and one risky whose value per share, v , is uncertain. The underwriter, the investment bank, then selects an offer price and quantity, p and Q , respectively. Once these are determined, the investment bank receives offers from investors in different quantities depending on the preferences of the investor. Since both the price and the quantity are predetermined and can not be re-adjusted, the demand could be both in excess but also below the supplied shares. When demand is above the supply, this is called an “oversubscription” and is assumed to occur entirely due to large subscriptions from the “informed investors” who has superior information about the IPO and knows the “true” value of the firm. All other investors, even the underwriter, are categorised as “uninformed”.

At first glance it could seem strange to consider the investment bank as “uninformed” due to the fact that it is the agent of the firm and probably has considerably higher information about the firm than the average investor. They negotiate with the firm to come up with a price that reflects the firm's value and should have greater insight than any other single investor. However, Rock argues that they should be considered as uninformed for a couple of reasons; firstly, the information that they share between each other is revealed to everyone on the market through the prospectus, not only the issuer, and so their informational advantage is sacrificed. Secondly, even though the firm and the issuer probably knows more than any single investor on the market, their knowledge about the firm and the market in particular is

probably less than of all the other investors pooled. In reality, the firm and its issuer might even be in an informational disadvantage compared to the market, which can be seen in that the difference between the price set by the issuer and the market within the first weeks of public trading are often *substantially* high. To underline the assumption that the firm and its underwriter has less information than the whole market, he further makes the five following assumptions:

1. The ‘informed investor’ knows the true value of the new issue and they place orders whenever this value, v , exceeds the offer price p .
2. From the fact that the shares are not public yet, the informed investor cannot borrow or short-sell the securities and their private information cannot be sold. So the investors orders shares for their full wealth, 1.
3. ‘Informed demand’, I , is equal to or below the value of the shares offered, pq . The demand is:
 - I when $p < v$, and
 - 0 when $p > v$.
4. Uninformed investors have similar expectations about the distribution of the value of each share, p .
5. All investors, both informed and uninformed, have the same wealth (=1) and utility.

Moreover, the firm is assumed to set the price and to bear the risk of the IPO being undersubscribed, rather than the underwriter.

The amount of ‘uninformed investors’ is denoted N and since they do not know the value v , every investor wants to amount the same fraction of their wealth T , which is equal to 1, for every new issue. This leads to a submission T^* from the uninformed investor of either 0 or T (=1). This leads to a combined demand of:

- $NT^* + I$ when $p < v$, and
- NT^* when $p > v$.

The demand will be determined whether the price p is below or above the true value v which will lead to either excess demand or excess supply. In the state where $p < v$, we let the probability of a fulfilled order be b , and in the opposite case where $p > v$ the probability of a

filled order be b' . Further are the shares rationed so that the value of the issue equals the value of the orders filled: $\tilde{N}_u T^* + \tilde{N}_i = pQ$, where \tilde{N}_u equals the number of uninformed orders and \tilde{N}_i the number of informed orders filled. This means that b is the lowest of $(pQ)/(NT^* + I)$ and 1, and b' is the lowest of $(pQ)/(NT^*)$ and 1, depending if the shares are rationed or not. To clarify, the highest number of issues you can get are the ones you subscribe for, 1, and in other cases the shares are rationed.

From this we can see that $b < b'$ for any level of informed investment (apart from 0), which means that the probability, b , of receiving an allocation of underpriced issues, $p < v$, are equal to or lower than the probability, b' , of receiving overpriced issues, $p > v$. This leads to the uninformed investors down-adjusting their valuation of IPOs and forces the firm to set a discount to compensate for the risk of a proportionally high allocation of overpriced shares in order to attract these investors. When the price decreases, the demand from uninformed investors increases, but is diminished from the decreased probability of full allocation as the demand from informed investors will also increase. As the market grows infinitely large, the probability of allocation approaches zero, leading to the demand from the investors also getting close to zero, approaching the 'zero demand probability' which is the lowest probability of allocation the investor will accept before withdrawing from the new issue market. It is further assumed that the expectations from the investors are rational. That is, the expectation equals the actual probability of allocation.

This model is meant as a way to picture how the rationing- mechanism works. That is, the higher the underpricing, the higher the demand from the informed investors and in turn the bigger the rationing for uninformed investors and a smaller allocation. Rock states that this model should not be used to test for underpricing, even though it is the focus of the model. The ultimate, or the 'crucial' test as he refers it to, involves observing to which degree shares are rationed in an IPO and weighting the probabilities of allocation to the return. If the model is accurate, the investor should earn the risk-free rate.

The difficulties when testing Rock's model is to find evidence for the degree of rationing in every single case. This difficulty is something that Rock also points at in his article. He states that this is hard for numerous reasons, one being that the underwriter needs to weigh the fairness of the rationing with what is most preferable to the firm, which could in turn lead to

no rationing at all. Another influential factor is that the level of subscription directly shows the underwriters ability. If there is an undersubscription, this could imply that the price was set too high or that they have not promoted the IPO well enough, and if there is a heavy oversubscription, it could indicate that they have set the price too low in order to sell all the shares and thereby leaves money on the table.

It is relatively easy to tell whether the question of rationing has even been considered, if there has been an undersubscription, the investor gets full allocation, which the model states. For the case of oversubscription, we need to look at each case and try to find to which extent there has been an oversubscription and adjust the level of rationing thereafter.

2.2 Further findings on the underpricing phenomenon

Except for Rock, several authors argues that new issues are underpriced due to asymmetric information between investors (Ritter, 1984) (Parsons and Raviv, 1985), (Hoque, 2014). Several other authors have also early found new issues to be underpriced, in particular:

Reilly (1977) - This article investigates the price changes following IPOs in the U.S between 1972-1975 to find the relative returns for investors participating in the offering. His findings proves that investors who acquire shares in an unseasoned new issue *at the offering price* generates excess returns compared to the aggregate market as a result of the underwriters underpricing the new issues. He also argues that this result provides strong evidence for the efficient market hypothesis as the market adjusts the price of the underpriced issue quickly, almost instantly, and the returns the weeks following this correction are zero or even negative. This is what Rock's argument builds on but Rock takes it one step further and provides a model for rationing that can be used to correct the expected returns. The *excess returns* over the aggregate market that Reilly refers to is the absolute return that you get on the shares that you manage to acquire in one single offering. This works as ground in Rock's model that we are testing as it underlies the fact of underpricing in many IPOs, although there has been no correction for rationing so this alone does not give a fair picture what return you should expect as an investor.

Logue (1973) - This paper investigates factors that affects the pricing decision of the investment banks and looks at the short-term performance of new issues to conclude the level

of underpricing. His research focus on that investors who buy shares in IPOs will get large systematic abnormal returns. The reason for this being either the inability or the unwillingness of the underwriter to set the price for new issues at market-price and further focuses on different incentives for this. Rather than only pointing the level of underpricing to the inability for the investment bank to set a price that is close to the market price, he argues that there might be incentives for the investment bank to do this intentionally. This would in the case of Rock's model indicate that the larger the underpricing could be explained by higher incentives for underpricing by the underwriter and in turn a higher demand for shares by the informed investors, I , and as a result a higher rationing.

McDonald and Fisher (1972) - In this article they investigate the pattern of the price of new issues following the offering and one year ahead on 142 offerings between 1969 and 1970. In their study they find that initial subscribers in IPOs get significant returns in the first week. These findings strengthens the efficient market idea of the share price reflecting all information available, as the returns after the first week of trading up to a year does not differ between issues, underpriced or not. Even in this case, what is observed is the return on each share and says what return an investor gets on the shares that he manages to acquire. That this return is proven to be significant, again underlies that there is an underpricing on average which is a conclusion that could be used for further testing. This is again a conclusion that Rock builds his model upon but does not however say anything about the *expected* return as it does not take the possibility of rationing into account.

Reilly and Hatfield (1969) - This study compares how investors in new issues perform to the overall market and an index of randomly selected OTC stocks. This study goes in line with earlier ones and proves that investors subscribing for stocks in an IPO on average experiences abnormal short- and long-term returns compared to the general market. This result in turn is attributable to that the relative gain was always higher than the relative loss, rather than the fact that the shares are being more often underpriced than not. What is interesting about this finding and in particular for the study that we are doing, is that not only do they conclude that an underpricing is proven to be the case *on average*, but they also draw the conclusion that an investor should *expect* abnormal returns that *equals* this average underpricing. In terms of Rock this would mean that as an investor one should never have to be rationed but rather you would achieve the same level of return as the level of underpricing.

Relating this abnormal return to the fact that the average gain is higher than the average loss means that they have not adjusted the return for probability of rationing either. Thus this article not only tests and proves the underpricing which Rock's model is built upon, but by drawing the conclusion that investors should expect abnormal returns also enlightens the problematic situation of investors expecting their returns to equal the level of underpricing.

Rock himself refers to these articles to underlie the underpricing- assumption. All articles focuses on investigating whether there is in fact an underpricing in IPOs and what it depends on, but none takes the probability of rationing into account. Kevin Rock takes it one step further and focuses on explaining this now well-known phenomenon through his proposed model that states that one should take the returns from IPOs and adjust them for the level of rationing. He clarifies that this model should be used for further testing as he expects the average return to drop when adjusting for rationing, but it is only after applying it one can conclude that it can be seen as a definite explanation.

2.3 Applying of Rock's model

The performance of IPOs have been a subject for empirical studies for decades. The earlier studies aimed at determining if and why IPOs are underpriced (Ibbotson 1975, Beatty & Ritter 1984). Later research however, has focused on calculating the expected return on IPOs and we have found four different papers applying a similar research to the one we are performing, examining the first day return adjusted for rationing with Rock's model:

Francis Koh and Terry Walter (1989). They tested the model on the Singapore stock exchange on IPOs between 1973 and 1987. The population during these years consisted of 70 IPOs. Koh and Walter were able to find the relevant information on 66 of them. They reached the conclusion that uninformed investors return not significantly differed from the risk-free rate. The average return before adjusting for allocation was around 27.5%, but after adjusting the result fell to between 1.6% and 0.4% depending on the level of subscription. None of the adjusted returns were significantly different from zero. The explanation for this was in line with the one of Kevin Rock which was underpriced IPOs have larger subscriptions and therefore investors get rationed leading to a lower return, while investors experience most of the loss in overpriced issues.

Mario Levis (1990), tested the model on the London stock exchange on IPOs between 1985 and 1988. 123 IPOs were included in his sample which represented 85% of the whole population. 99 issues were listed on the main market and 24 were listed on the OTC-market. The IPOs excluded were the ones that the details on allocation to investors was not available. When Levis adjusted the return for the allocation the return fell from 8.77% to 1.67% (significant on a 5% level) for the smallest subscribers and 1.44% (not significant on a 5% level) for the largest subscribers. Although the result was not significant for the largest subscribers, every number for all intermediate levels of subscription was significant.

Matti Keloharju (1993). Matti tested the model on the Helsinki stock exchange on IPOs between 1984-1989. Of the 91 issues that were made between these years, Matti could find relevant information on 80 of them. Out of these 80, 27 were listed on the Helsinki stock exchange, 49 were listed on the OTC-market and three were listed on the stockbroker's list. One was unlisted at the time of the research. Matti also had data on how big the orders were from investors. The average return on the IPOs were 8.7%, but when adjusting for the allocation the returns fell to 5.1% (not significantly different from zero on a 5% level) for small subscriptions to -4.9% (significantly different from zero on a 5% level) for large subscriptions.

Yakov Amihud, Shmuel Hauser, and Amir Kirsh (2002). They tested the model on the Tel Aviv stock exchange on IPOs between 1989-1993. 284 IPOs were examined and the average initial return was 11.99%. When they adjusted for the allocation the return was -1.18% (not significant at a 5% level). This does not go in line with Rock's model.

Koh and Walter wrote the paper that covers the longest time span and we believe that it is important to do that to get the ups and downs in the market. The first-day returns are highly cyclical (Ibbotson & Jaffe, 1975) and if you only test for a short period of time the sample size will probably be too small. If the other tests were made during so called "hot issue" periods or "cold issue" markets (Ibbotson & Jaffe, 1975) the result are likely to be biased. No similar test has been done on the Swedish market. In our thesis we will do this and test whether an uninformed investor should expect an adjusted return that is statistically significant different from zero when subscribing for all or a random selection of IPOs. The null- and the alternate hypothesis will be, respectively:

H_0 : The expected first- day return for uninformed investors when subscribing in IPOs is zero.

H_a : The expected first- day return for uninformed investors when subscribing in IPOs differs from zero.

Rejection of the null hypothesis would underlie the widespread view of IPOs being an easy way to achieve abnormal returns, or a way of gaining “free money”, no matter the knowledge you possess as an investor. Inability to reject the null could indicate that one should not expect abnormal returns by subscribing shares in IPOs, due to rationing of underpriced issues.

3. Data and Method

3.1 Data

For our research, we downloaded data of all Swedish IPOs between 1994 and 2016 from Bloomberg. We wanted to collect a sample as big as possible to catch as many tops and bottoms in IPO waves as possible to eliminate the effect of fluctuating market conditions. There were 373 IPOs between these years for which we could find the data on the first day performance on the stock, that is the level of under- or overpricing.

How the IPOs are allocated between 1994 and 2016 is shown in *figure 1*. Other authors have established that the IPO market is cyclical (Ibbotson & Jaffe, 1975) and so appears our sample to be. The underlying force for this is the general market condition. In bad times the IPO count drop significantly, and in better times they increase, probably due to a higher probability of a successful IPO during better times and more risk-taking investors (Ritter 1984).

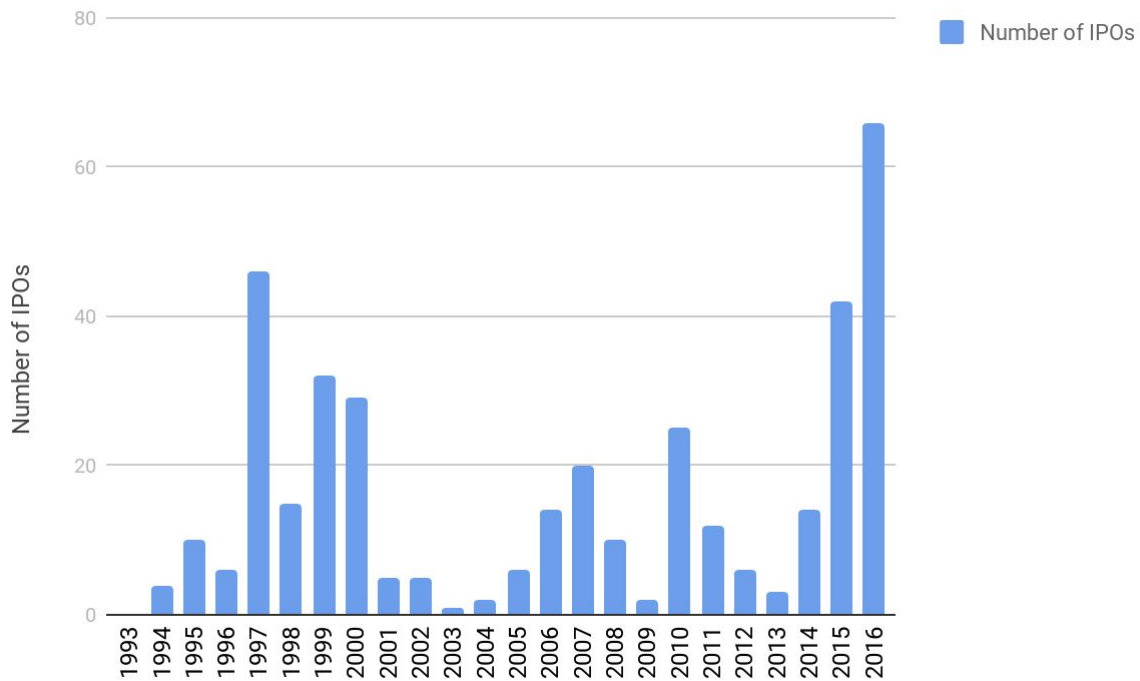


Figure 1. The figure illustrates how the IPOs are allocated between 1994 and 2016.

Bloomberg could not supply us with the data on subscription rate, so in order to get this data we had to find other sources. As mentioned by Rock, the difficulties in the testing of his model is going to be to find the level of rationing in each IPO as it varies from case to case and are often not even communicated at all. Especially in the early IPOs in the sample (when the companies did not even have a website). We originally found how the IPO was subscribed in 158 of the IPOs. However, in 48 of them it was only mentioned in terms of “oversubscribed multiple times” or “heavily oversubscribed”. Primarily, we looked at the different firms press releases in connection to the issue. We found subscription rates for 90 of the firms by looking on press releases. Secondly, we used information from newspapers at the time of the issue. We found 20 subscription rates from articles in newspapers. To be able to use our model, we need both the level of underpricing and the level of oversubscription. We chose to exclude the IPOs that we could not find the level of subscription on. That leaves us with 110 IPOs in our sample. Since the information on exactly how the shares are allocated among the subscribing investors are not public and differs from case to case, we have made the assumption that if an issue is oversubscribed X times, the investors will receive a proportional amount of shares which is $(1/X)$ of the shares the investor subscribed for.

Table 1

Number of IPOs	Underpriced	Overpriced	Fairly priced
373	231	120	22
Subscription observable	Undersubscribed	Oversubscribed	
158*	33	125	

The table shows the properties of the IPOs in our sample. Fairly priced IPOs closing price the first day was the same as the offering price.

**there were only 110 firms that communicated a level of subscription. The other 48 has referred to that their IPO was “oversubscribed” or similar.*

To show the distribution of the 110 IPOs and to visualize that there is a tendency for overpriced shares to be rationed and underpriced shares to give full or almost full allocation, we did this by separating the two different groups (over- and underpriced IPOs) and summarized the following numbers for allocation in *table 2*.

Table 2

	Min	1st quartile	Median	Mean	3rd quartile	Max
Overpriced	12.27%	53.84%	100.00%	76.25%	100.00%	100.00%
Underpriced	2.50%	10.56%	19.31%	35.95%	66.96%	100.00%

The table shows the allocation of shares for underpriced and overpriced IPOs. For example, in the group with underpriced IPOs, in the offer that was rationed the most, the chance of receiving shares was 2.5%.

As we are just using 110 of the IPOs collected from Bloomberg, we present the first-day return and how the shares were allocated in percent, based on the assumption we make about how oversubscribed shares are allocated among the investors, in *figure 2*.

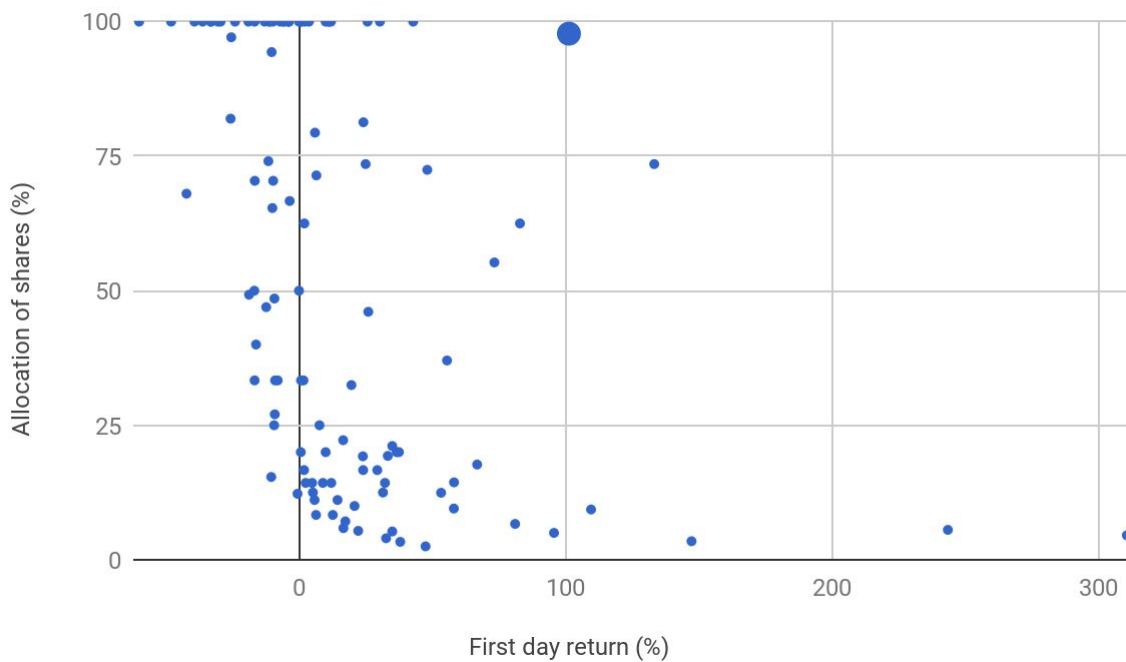


Figure 2. The figure shows the relationship between the first-day return against the allocation of shares on the shares that we were able to observe a subscription rate. Our assumption about allocation of shares states that if an IPO is oversubscribed X times, the investors receive $(1/X)$ of the shares subscribed for.

3.2 Method

We will backtest if an uninformed investor has an expected return that statistically differ from zero. The uninformed investor is an investor that does not know the true value of the company. Another way of looking at it is that whether the uninformed investor believes in the company or not, is uncorrelated with if the company is underpriced or overpriced. In our model, the investor is subscribing for a number of shares representing an equal amount of cash in every IPO in the sample ($T=1$). This is in line with how Rock is describing the model in his paper.

To calculate the expected return for the investor, we need to adjust the first day returns with how the investor gets rationed when the issue is oversubscribed. *Table 3* shows the formulas we have used to calculate the adjusted return from subscribing in IPOs as uninformed investors.

Table 3

IPO returns	
Subscription rate	X
First day return	$p^{-1}v$
Allocation	X^{-1}
Adjusted return	$p^{-1}vX^{-1}$

X is the subscription rate for the IPO. p is the IPO price and v is the closing price on the first day of trading.

When we have adjusted the first-day return for the allocation of shares in every single IPO, we will simply calculate the average in the whole sample with *formula 1*. Since we are using a method where the investor is investing a fixed amount of money in every IPO we are using the Arithmetic mean. To test for significance in our result we are performing a one sample t-test.

$$\sum_n [AR]n^{-1} \quad (1)$$

These methods are similar to Rock's and other previous researchers testing Rock's model except for a few differences. Our method is restricted to IPOs that we can get the data on allocation. For example, Koh and Walter had data on exactly how the allocation was so they extended the method to calculate the different returns depending on how large the subscription was by the investor. They also included the risk-free rate in the formula which we have not done. Matti Keloharju also included the transaction cost in the formula. We choose not to include the transaction cost because we do not think that it will make that huge difference.

4. Result

We ran our test on our sample. *Table 4* shows the average return when investing in IPOs as an uninformed investor. After calculating the adjusted returns for every single IPO we simply took the average adjusted return which led to the result in *table 4*. The mean adjusted return is slightly positive, but there is no significance for a positive return at any reasonable level. That is, we can not draw any conclusions from the result. *Figure 3* illustrates how the first-day return in absolute numbers differs from the return after adjusting for allocation, the *actual* return, that you can expect when investing in IPOs as an uninformed investor over the years in our sample.

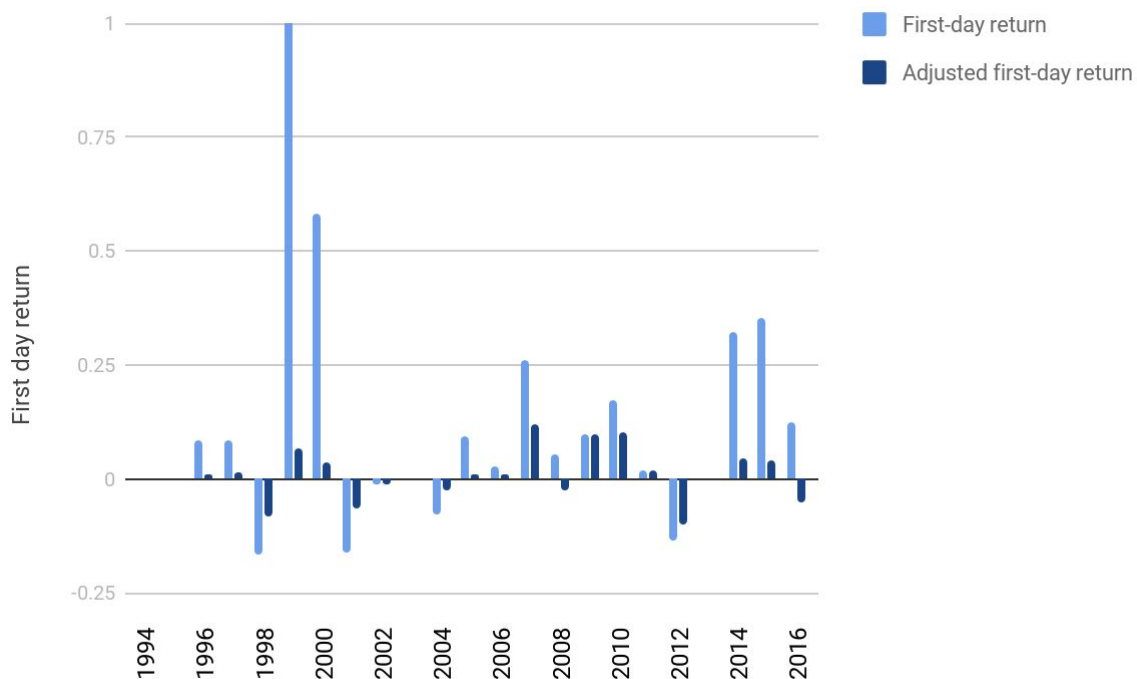


Figure 3. The figure shows the average return for each year in absolute numbers (light blue) and the average return adjusted for rationing among investors (dark blue) in our sample.

As can be clearly seen in *figure 3*, the returns drop significantly once we adjust for allocation. Just by looking at the initial return explains how an investor can easily interpret that subscribing in IPOs leads to abnormal returns. If you only look at the returns in absolute terms, it looks like you as an investor achieve significant positive returns when subscribing

for shares in an IPO, while you rarely suffer losses. After adjustment though, your expected return reduces dramatically and is even negative for certain periods.

Table 4

Average return	Mean adjusted return	Standard Error	T-statistics	P-value
16.58%	0.22%	1.8%	0.1227	0.9025

The table shows the average adjusted return in the sample. Adjusted return is 0.22% on average, but it is not significantly different from zero.

The average return when unadjusted for allocation is 16.58%, but drops significantly when adjusting for allocation. The reason for this is that the investors get full allocation of shares in overpriced IPOs suffering the entire negative return while being rationed in underpriced IPOs and not enjoying the full positive return. Our result shows that the mean adjusted return in the sample is 0.22% and that it does not statistically differ from zero at any reasonable level of significance. This means that we *fail* to reject our null hypothesis:

H₀: The first- day expected return for uninformed investors in an IPO is zero

We can not draw any conclusions from this test because we could not reject the null. This finding is in line with Matti Keloharju's (1993) analysis on the Finnish market who also tests Kevin Rock's winner's curse hypothesis in the same manner as we did. He did it on 80 IPOs between 1984 and 1989 and came up with the same conclusion and showed that IPO firms substantially underperformed the Helsinki Stock Exchange value-weighted index in the long run. Also Francis Koh and Terry Walter (1989) came up with a similar conclusion on the Singapore stock exchange that the return drops significantly once adjusted for expected allocation. Their adjusted returns were as in our case not statistically different from zero.

One difference between our finding and the finding by Keloharju was that his adjusted return varied depending on how big the orders were placed by the uninformed investors. Investors that placed small orders had a greater proportional allocation than investors placing large orders. Thereby the average return is a function of the size of the order; smaller orders lead to insignificantly small positive allocation-adjusted returns while big orders lead to larger

negative returns. This could be true for our case as well, although it builds on the assumption that you have a higher chance of allocation if you place small orders than larger orders. This would mean that in some IPOs the shares are rationed in the way that each investor gets the same amount of shares, even if some investors subscribed for more shares than others, leading to investors with small orders getting a proportional higher allocation than investors with bigger orders. In our analysis however, we made the assumption that the investor puts his whole wealth in each IPO and that the shares are rationed the same linear way for each case, independent on the size of the order. We could not test whether the returns differ depending on the size of the order because we were only able to find how large the total subscription was and not how large every single investors orders were. This means that small and big orders are rationed the same way so each investor gets the same percentage allocation of their original orders. Which approach you use depends on how you assume that the shares are rationed. We found it more realistic and probably more common on average that every order are rationed to the same extent no matter the size of it. No matter which approach, the result is still clear. Once adjusting for allocation, the returns drops significantly.

4.1 Robustness analysis

Underpriced issues tend to be oversubscribed and overpriced issues tend to be undersubscribed (Rock 1986). Our sample also has this tendency (see table 5). Since we could only use 110 of the 373 IPOs that we downloaded from Bloomberg, we would like to see how the result differ if we apply a subscription rate, depending on the subscription rate on the IPOs where we have the data, for the other IPOs and do the same analysis. This gives us a measurement of the accuracy in our original analysis. If we place a subscription rate on the IPOs for which subscription is unknown and do the same analysis as before, the return should hopefully be close to our original analysis, giving weight to our result. Our sample will therefore contain of the 263 IPOs without the level of subscription and the robust- analysis building on the following assumptions:

- *Underpriced* IPOs are *oversubscribed* and the allocation of shares will be *rationed*. The higher the underpricing, the more the shares are rationed and in turn the lower the allocation. We see this as a reasonable assumption through our own analysis as well

as Ibbotson and Jaffe (1975) has also shown this correlation between underpricing and oversubscription and this is also what Rock shows through his model.

- In overpriced and undersubscribed IPOs, we assume that the subscribers receive all shares that they subscribed for. This conclusion is drawn from the result showing how the allocation is closely centered around 100% for these cases and will therefore be our best estimation.
- Looking at how the allocation is skewed in each case of under- and overpricing, the median probably shows the most representative number since outliers in a relatively small sample like this will have an unproportionally large effect if looking at the average. The median better shows where the numbers are centered and its numbers suggests what we earlier assumed that underpriced IPOs will be rationed and you could expect full allocation in overpriced ones.

Based on these assumptions we use the following numbers from *Table 2* when we apply the allocation to the different IPOs:

- For overpriced IPOs - the dataset is strongly skewed towards 100% (*figure 2*) allocation and has a median of 100%. As the sample is relatively small, outliers will have an unproportional big effect on the average so we use the median as our allocation for overpriced IPOs as it will be more representative.
- For underpriced IPOs - the dataset is skewed towards 0% (*figure 2*) allocation and has a median of 19.31%. With the same argument as for overpriced IPOs we will use the median allocation for underpriced IPOs.

In order to be able to use these numbers that suggests that the higher the underpricing, the lower the allocation, we also want to show this relationship to be statistically significant in our sample. This would give weight to Rock's model of rationing and our assumption that if the IPO is oversubscribed, the shares are rationed proportionally to the extent of the oversubscription. So we want to prove that there is in fact a correlation between the level of subscription and underpricing in our sample in the same manner as Ibbotson and Jaffe (1975) did. To do this, we used the gathered data on all 110 IPOs that we could find this relevant data on and ran a regression with level of oversubscription as the dependent variable and the

underpricing as the independent variable. The model is shown in formula 2 and the result from the regression is shown in *table 5*.

$$ALLOC = \beta_0 + \beta_1 PRICING \quad (2)$$

Table 5

	Coefficients	Standard error	t-stat	p-value	Lower 95%	Upper 95%
Constant	0.5816	0.0345	17.862	5.02E-32	0.5132	0.6499
Pricing	-0.3435	0.0659	-5.2098	9.132E-9	-0.4742	-0.2128
R^2	0.2008					

The table shows the correlation between underpricing expected allocation of shares. When there is no underpricing (or overpricing) the expected allocation of shares is 58%. The high t-statistics shows that the more the underpricing, the more rationing for investors.

The table can be interpreted as for every 1 percentage point increase in underpricing, investors are expected to get 0.3435 percentage points less shares. With a p-value close to 0 this is in turn significant at a 95% level which means that this relationship is true in our sample, the higher the level of underpricing, the higher the oversubscription will be.

We can now apply these allocation rates on our 263 IPOs of 19.31% on the underpriced IPOs and 100% on the overpriced and run our tests. When doing this we get the result in *table 6*.

Table 6

Average return	Adjusted return	Standard error	t-stat	p-value
12.46%	-0.19%	1.01%	-0.19	0.8495

The table shows the average and adjusted return when we include all IPOs in our sample by applying the subscription rates to all observation. 100% allocation for overpriced issues and 19.3% for underpriced issues.

How the return differs for each year in all the IPOs once we adjust the first-day return for allocation is illustrated in *figure 4*.

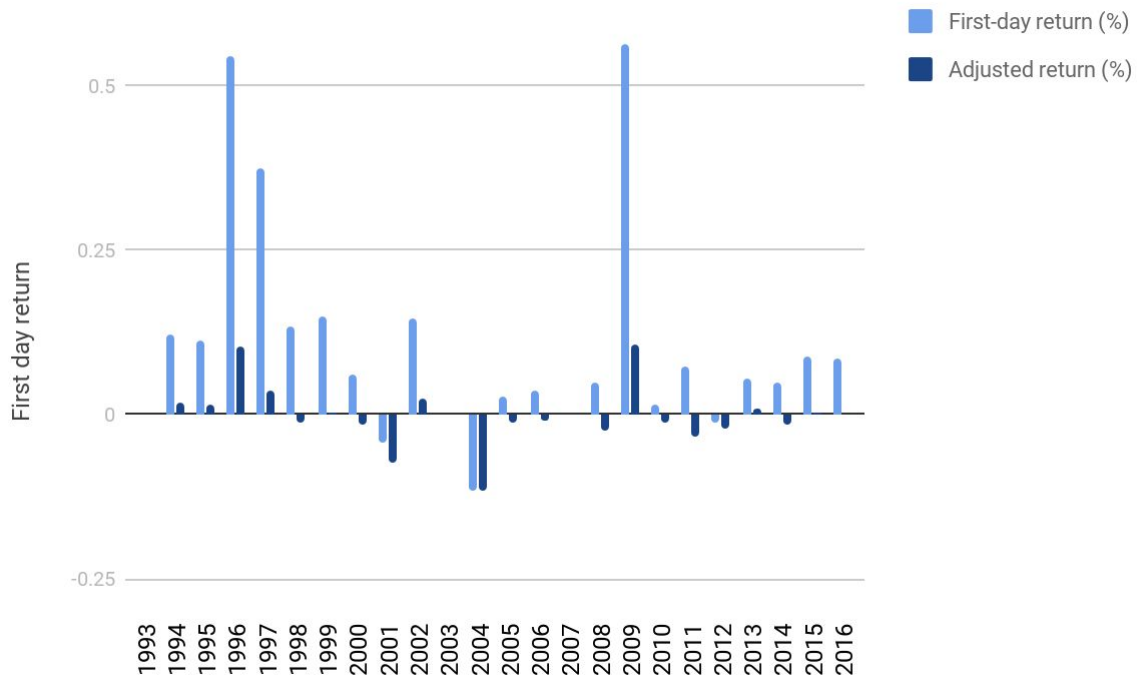


Figure 4. The figure shows the return for each year in absolute numbers (light blue) and the return adjusted for rationing among investors (dark blue) in our sample.

As for the case when we looked at the 110 IPOs it is clear that once we adjust for allocation the return from each year drops significantly, both in the way that the adjusted positive returns are lower in absolute terms, while the adjusted negative returns are higher.

Also in this analysis the return suffer a significant drop after adjusting for allocation. *Table 6* shows that the return is not statistically different from zero in this case either, giving robustness to our result in our original analysis.

5. Analysis and discussion

The general view on IPOs, as we see it, is that it carries a bit of over-trust. Uninformed investors believes that subscribing for shares in IPOs gives you abnormal returns with a high probability and the setbacks are few. Especially in good times. This view has caught attention and has become a huge topic for research with different approaches for many decades. Its

simplicity and as it often is communicated, an easy way of earning abnormal returns, leads to the question whether there is a market-error that everyone seems to be able to see but no one is able explain. In an efficient market there should be no such way for anyone to earn abnormal returns by simply following a two- step method that is subscribing shares in every IPO and sell them at the closing price on the first day of trading. An efficient market should somehow force the return towards equilibrium, that is zero or at least not higher than the market- return, rather than guarantee an average abnormal return that is substantially higher. Usually when there are opportunities like this, the market immediately corrects it. It makes no sense in an efficient market and somehow it should be possible to show that the expected return, even though it seems as if it is highly positive, is in fact significantly lower, zero or maybe even negative.

What most investors do not think about is that the average return is measured in absolute terms, which means that it is rather a measurement of the average level of *underpricing* than an indication of the level of return an investor should expect. Kevin Rock shows how the allocation of shares are distributed in cases of over- and underpriced shares. He shows his reasonings of rationing in a simple model and concludes that if you take into account that you get full allocation in IPOs that are overpriced and your shares are rationed in underpriced IPOs, the return suffers a large negative recession compared to the absolute return. We found this very interesting and as he claims himself is only a pointer in this certain direction rather than an absolute evidence. The ‘crucial’ test is to apply this model of rationing onto real IPOs and test for the returns. Even though it is likely to involve some difficulties in finding rationing for each case, one can not draw any conclusion until it has been done. Other researchers decided to do this, some who’s result points in Kevin Rock’s direction of no abnormal returns, while some pointing in the opposite direction. The reason for this difference could be that they have made different assumptions regarding the rationing or perhaps that the market- fundamentals are different between countries and markets.

We could show a big effect on returns after adjusting for allocation as it dropped significantly, showing only a slight positive return of 0.22% rather than the average unadjusted return of 16.58%. As our result led to failing to reject the null, we can not draw

any conclusions about the return in our result because the expected return when subscribing shares in IPOs except for that is not statistically different from zero.

This research is and has to be based upon some simplifications and estimates. For example we assumed that the shares are never rationed in the case of overpricing and are always rationed in the case of underpricing, in cases where we could not find the exact level of subscription. This might of course not be true for every case, but on average we concluded that this is probably what is closest to reality. The same argument goes for the level of allocation. The assumption we did was that the higher the underpricing, the lower the subscription of shares. This also goes in line with earlier findings (Ibbotson & Jaffe, 1975) and is something we could find statistical significance in within our sample of IPOs as well in our robust analysis, so we assumed this too to be our best guess. As long as these assumptions are not completely flawed, which is doubtful since they both are frequently observed as well as carry significance in statistical testing, our result shows that an investor can in fact not expect a first-day return in IPOs that is different from zero. Even if it can be argued not to be an absolute evidence, our result suggests our hypothesis was right and that the expected return for an uninformed investor in an IPO is in fact zero.

It should be said though, that this research is based upon the “uninformed investor’s” point of view. This means that one should not expect the average return to differ from zero in the case of the investor being uninformed, that is, acting in the way that we have formalized for one. We have stated that the uninformed investor does not know whether an IPO is under- or overpriced, so he simply subscribes for shares in *every* or a *random* collection of IPOs. In this way he can not expect abnormal returns or not even expect returns to be other than zero. This does not mean however that it is *impossible* for an investor to achieve abnormal returns in IPOs, which was not the scope for our research either. This research holds if, and only if, an investor is classified as uninformed. In other cases the investor can do his own research and carefully choose between IPOs and which to subscribe for and then potentially achieve abnormal returns if chosen successfully. One can argue whether calling an investor uninformed is realistic in any sense, if it is likely that the investor does not put any weight in choosing which IPOs to subscribe for at all. The answer is yes, probably. The average investor probably is uninformed and it is not the same investors that is informed in different IPOs. Some investors certainly pick their IPOs with great care and are *almost* aware of the

true value of a certain IPO and is close to be considered one of the informed investors, while some investors are the complete opposite. They simply just subscribe for IPOs by chance, as a bet, or they blindly listen to a recommendation of subscribing for shares without doing any own research or maybe even let someone else do it for him. Pooled together, except for the few investors that are considered informed, the average investor is most likely to be uninformed. This is why this model and our result holds and in turn could be used to reach the conclusion that the expected return from IPOs does not statistically differ from zero.

6. Conclusion

Stating that the average returns in IPOs historically has been abnormal and referring to the average underpricing is misleading. Usually shares are rationed in cases of underpricing and the returns are in fact much lower. How the shares are rationed however is harder to explain and is probably why it is not as frequently mentioned. Kevin Rock shows a way to explain the rationing that we think is realistic and decided to test his hypothesis. Due to the higher aggregate demand in underpriced IPOs driven by an increased demand from informed investors the return is lower in underpriced issues. However, in overpriced IPOs the uninformed investor is suffering the full loss due to the absence of informed demand. The higher the underpricing, the more the shares are rationed. We could see this relationship in our sample thus is Rock's model a reasonable model to explain the way shares are rationed and could in turn be used to test for the actual return in IPOs.

Our conclusion is that thanks to the rationing, the uninformed investor's return will drop due to rationing and the return does not significantly differ from zero. Therefore we can not draw any conclusion about the actual return. To blindly subscribe for IPOs hoping for abnormal returns is probably not a good idea. If investors want to achieve abnormal returns by participating in IPOs, one should as with any kind of investments do some research to become more informed and carefully pick which IPOs to subscribe for.

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Appendix

This is a list of the IPOs included in our sample.

Date	Issuing company	Return	Allocation	Adjusted return
1996-04-01	Scania AB	1,67%	33,33%	0,56%
1996-06-04	Dahl International AB	14,46%	11,11%	1,61%
1996-12-17	Scandic Hotels AB	8,95%	14,29%	1,28%
1997-01-16	Biora AB	17,39%	7,14%	1,24%
1997-03-06	Vostok Gas Ltd	37,50%	20,00%	7,50%
1997-04-07	Sardus AB	0,68%	20,00%	0,14%
1997-06-12	Partnertech AB	1,89%	16,67%	0,31%
1997-06-17	Binar AB	-3,51%	66,67%	-2,34%
1997-08-18	Prosolvia AB	5,22%	12,50%	0,65%
1997-06-19	Profilgruppen AB	10,00%	20,00%	2,00%
1997-06-19	Johnson Pump International AB	7,69%	25,00%	1,92%
1997-10-27	Wilkenson Handsmakar'n AB	0,77%	33,33%	0,26%
1998-06-04	Tryckinvest I Norden AB	-16,77%	50,00%	-8,39%
1999-03-18	Kungsleden AB	0,00%	50,00%	0,00%
1999-11-09	Cybercom Group AB	243,55%	5,56%	13,53%
2000-02-07	Mycronic AB	95,71%	5,00%	4,79%
2000-09-27	Orc group AB	20,83%	10,00%	2,08%
2001-05-17	Bioinvent International AB	-16,13%	40,00%	-6,45%
2002-05-17	Intrum Justitia AB	6,38%	8,33%	0,53%
2002-05-30	Nobia AB	-8,97%	33,33%	-2,99%
2004-05-26	Note AB	-8,00%	33,33%	-2,67%
2005-05-10	ICA Gruppen AB	5,84%	11,11%	0,65%
2005-09-19	Indutrade AB	12,69%	8,33%	1,06%
2006-02-09	Kappahl AB	4,91%	14,29%	0,70%
2006-04-27	AlphaHelix Molecular Diagnosti	2,19%	100,00%	2,19%
2006-11-20	Lindab International AB	2,50%	14,29%	0,36%
2006-11-26	Nordic Mines AB	2,00%	62,50%	1,25%
2007-03-07	Y.C.O Businesspartners AB	26,00%	46,08%	11,98%
2007-05-03	Water Jet Sweden AB	33,33%	19,31%	6,44%

2007-05-21	C-Rad AB	82,93%	62,50%	51,83%
2007-11-15	Eriksson Development and inno	-7,00%	100,00%	-7,00%
2007-12-04	IGE Nordic AB	-4,00%	100,00%	-4,00%
2008-01-18	GlobalFun AB	-12,90%	100,00%	-12,90%
2008-04-28	eWork Group AB	16,58%	22,22%	3,68%
2008-05-12	DGC One AB	12,12%	14,29%	1,73%
2009-05-26	Arctic Gold AB	10,00%	100,00%	10,00%
2010-01-11	Sportjohan AB	11,11%	100,00%	11,11%
2010-02-15	Hartellex AB	12,00%	100,00%	12,00%
2010-02-15	Lunchexpress i Sverige AB	-33,17%	100,00%	-33,17%
2010-02-19	Ekomarine AB	-5,56%	100,00%	-5,56%
2010-03-04	Layerlab AB	-3,70%	100,00%	-3,70%
2010-03-05	True Heading AB	-36,17%	100,00%	-36,17%
2010-04-26	Challenger Mobile AB	-60,00%	100,00%	-60,00%
2010-05-17	Lynn AB	42,86%	100,00%	42,86%
2010-05-25	PharmaLundensis AB	73,33%	55,25%	40,52%
2010-10-13	WntResearch AB	24,17%	81,30%	19,65%
2010-11-19	Cefour Wine & Beverage Partiha	48,15%	72,46%	34,89%
2010-12-15	ECOMB AB	133,33%	73,53%	98,04%
2011-03-02	FX International AB	3,73%	100,00%	3,73%
2011-06-13	Brighter AB	0,00%	100,00%	0,00%
2012-04-10	Gullberg & Jansson AB	11,25%	100,00%	11,25%
2012-05-15	Respiratorius AB	-48,00%	100,00%	-48,00%
2012-05-28	Envirologic AB	-42,22%	68,03%	-28,72%
2012-11-05	Recyctec Holding AB	25,72%	100,00%	25,72%
2014-10-27	Lifco AB	32,26%	14,29%	4,61%
2015-01-20	RhoVac AB	66,87%	17,70%	11,83%
2015-03-06	Vibrosense Dynamics AB	-9,70%	70,42%	-6,83%
2015-03-11	Hancap AB publ	6,00%	79,37%	4,76%
2015-03-24	Tobii AB	38,00%	3,33%	1,27%
2015-05-25	Nobina AB	-5,88%	100,00%	-5,88%
2015-06-04	Footway Group AB	1,00%	100,00%	1,00%
2015-09-01	Capacent Holding AB	24,07%	16,67%	4,01%
2015-09-03	Hamlet Pharma AB	55,56%	37,04%	20,58%

2015-09-29	Minesto AB	30,36%	100,00%	30,36%
2015-10-19	Zenergy AB	-11,25%	100,00%	-11,25%
2015-10-21	Toleranzia AB	23,97%	19,23%	4,61%
2015-11-12	Raybased AB	310,71%	4,55%	14,12%
2015-11-18	Sleepo AB	-12,31%	46,95%	-5,78%
2015-11-26	FastOut Int AB	-10,00%	65,36%	-6,54%
2015-12-23	Invent Medic Sweden AB	19,67%	32,47%	6,39%
2016-01-05	Sjostrand Coffee Int AB	-10,27%	94,34%	-9,69%
2016-01-08	Dividend Sweden AB	-4,00%	100,00%	-4,00%
2016-01-19	Xintela AB	-16,60%	70,42%	-11,69%
2016-02-22	Plejd AB	81,10%	6,67%	5,41%
2016-03-24	Simris Alg AB	-25,68%	81,97%	-21,05%
2016-04-04	Vadsbo SwitchTech Group AB	-0,56%	12,27%	-0,07%
2016-04-06	Litium Affarskommunikation AB	-11,00%	100,00%	-11,00%
2016-04-11	Clean Motion AB	29,38%	16,67%	4,90%
2016-04-13	Nepa AB	43,41%	25,00%	10,85%
2016-04-13	Enorama Pharma AB	-39,23%	100,00%	-39,23%
2016-04-15	Cereno Scientific AB	-16,67%	33,33%	-5,56%
2016-05-10	Provide IT Sweden AB	22,22%	5,38%	1,19%
2016-05-11	A Uni-light LED AB	-18,99%	100,00%	-18,99%
2016-05-13	Redwood Pharma AB	-29,44%	100,00%	-29,44%
2016-05-16	Shortcut Media AB	-9,09%	27,03%	-2,46%
2016-05-18	GS Sweden AB	-30,40%	100,00%	-30,40%
2016-05-24	SynAct Pharma AB	-18,75%	49,26%	-9,24%
2016-05-25	Dignita Systems AB	-25,42%	97,09%	-24,68%
2016-05-27	AcadeMedia AB	47,50%	2,50%	1,19%
2016-05-27	Videobur Sthlm Int AB	-11,50%	74,07%	-8,52%
2016-05-30	Nordic Waterproofing Holding A	0,70%	100,00%	0,70%
2016-05-31	Maha Energy AB	-24,00%	100,00%	-24,00%
2016-06-20	PEN Concept Group AB	6,52%	71,43%	4,66%
2016-08-29	Willak AB	35,00%	21,14%	7,40%
2016-09-08	Gasporox AB	36,67%	20,00%	7,33%
2016-09-13	Index Pharmaceuticals Holding	-16,67%	100,00%	-16,67%
2016-09-19	Internationella Engelska Skola	32,69%	4,00%	1,31%

2016-09-26	Ripasso Energy AB	25,00%	73,53%	18,38%
2016-10-06	CELLINK AB	109,62%	9,35%	10,24%
2016-10-07	Crunchfish AB	147,33%	3,45%	5,08%
2016-10-07	Adderacare AB	53,33%	12,45%	6,64%
2016-10-16	Finepart Sweden AB	58,12%	9,52%	5,54%
2016-11-02	Rethinking Care Sweden AB	-32,93%	100,00%	-32,93%
2016-11-04	Scandinavian ChemoTech AB	-10,42%	15,38%	-1,60%
2016-11-07	THQ Nordic AB	35,00%	5,26%	1,84%
2016-11-09	AcouSort AB	58,18%	14,39%	8,37%
2016-11-10	Smart Eye AB	31,52%	12,50%	3,94%
2016-11-15	Appspotr AB	16,67%	5,88%	0,98%
2016-11-27	Aino Health AB	-9,23%	48,54%	-4,48%
2016-12-08	MenuCard AB	-9,78%	100,00%	-9,78%