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IPO HOLDING PERIOD PERFORMANCE

From Flipping to Longer-term IPO Investing in the United States

Master's Thesis in Finance

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ABSTRACT

This thesis studies IPOs listed in the United States during 1998–2017. Points of inspection include prelisting underpricing and aftermarket performance. Underpricing is measured as price increase from the offer price to the opening price of the first trading day. Aftermarket returns are measured daily, starting from the opening price of the first trading day and span one year from the listings.

The well-documented and widely studied anomaly of IPO underpricing does not show signs of disappearing. The equally-weighted underpricing is 18,93% and proceeds-weighted average underpricing is 17,26% during 1998–2017 in the final sample, proving issuers still leave money on the table. The activity of IPO listing is higher when the economy has higher GDP growth. During times of high IPO activity, underpricing is also higher.

In the aftermarket, first-day returns average 2,65% and second-day returns average 1,07% for all the IPOs in the final sample. The positive initial aftermarket returns suggest that not all of the price increase is realized in the listing, but there is partial adjustment during the first days of trading. The average daily aftermarket returns of IPOs remain mostly positive until the expiration of the standard lockup period of 180 days. During the expiration of the lockup period. IPOs experience significant negative abnormal returns. The optimal holding period for IPOs is shorter than 180 days. A longer-term portfolio model including all IPOs is not able to create statistically significant returns when controlled with the Fama & French 3-factor and 5-factor models.

Business sectors with the best overall IPO returns include retail trade and services. Technology companies have high underpricing, but also high aftermarket returns, providing superior IPO returns compared to non-technology companies on average. Technology companies often achieve larger attention, coverage and expectations than IPOs of more traditional business sectors.

KEYWORDS: IPO, Underpricing, IPO aftermarket performance

1. INTRODUCTION

After the boom of initial public offerings (IPOs) by Internet companies during the years 1999 and 2000, and the entry of Chinese companies to international IPO markets about ten years later, we are currently experiencing another interesting period in the field of companies going public (Ritter 2019). Out of the ten biggest IPOs of all time, six have been issued since the start of the year 2010. The low interest rates recorded worldwide since 2008 and the financial crisis of have generated a large supply of money on the stock markets. The global economy has experienced a rise since the financial crisis, and many markets have recorded all-time highs recently. The advancement of technology has brought on a new industry of internet companies that have hundreds of millions or even billions of users worldwide. Together these factors have made IPOs a current topic of interest and research again.

In the early stages of development of a company, it is usually funded by only a few owners or investors with no liquid marketplace for trading the company's shares. When the company grows bigger, expands its business, and its capital needs increase, it will have to decide to get additional funding either through borrowing money or selling its shares. Selling shares for the first time is called issuing them, and when it is done publicly including a listing to a stock exchange by a formerly private company, the listing is called an initial public offering. The pricing and initial performance of unseasoned stocks in the process of initial public offerings, is a crucial event in the timeline of a company going public. There are certain anomalies and phenomena that continue to arouse researchers, investors, analysts and other parties involved with initial public offerings. (Pagano, Panetta & Zingales 1998: 27–64.)

Companies aiming to raise funding from public stock exchanges that choose to go public hire an investment bank to act as a lead underwriter. The objective of the underwriter is to gather information about the company and potential investors in order to find a suitable price for the IPO shares. Investors can submit their bids for the number of shares they are willing to buy for the price set by the underwriter, that is called the offer price. The offer price is also the price that the issuing company gets from the shares it sells in an IPO.

When there occurs a difference where the price increases right away in the public secondary market compared to the offer price, the phenomenon is called underpricing. Companies whose IPOs experience strong underpricing are said to "leave money on the table", as they could have raised a larger proceed with a higher offer price. (Bodie, Kane & Marcus 2014: 59–63.)

Conducting an IPO has its benefits but also brings more regulations and obligations to the company. Going public brings many opportunities to a company, like the access to public equity markets, the lowered costs of capital and the enhanced liquidity of the company's stocks. There are also several other less direct benefits with going public like attracting better employees and more prominent investors, reduced risk of asymmetric information, and better overall acknowledgement of the company by potential stakeholders. With these benefits, however, serious disadvantages come along as well, such as greater administrative and auditing costs due to tighter regulation, and the loss of privacy which may prove to be harmful to the competitive advantages. (Ljungqvist 2007: 375–422.)

1.1. The Purpose and Contribution of the Thesis

The purpose of this thesis is to study the chronological aspect of IPO returns. The underpricing anomaly has been widely studied and debated for decades, but according to several studies it does not show robust signs of disappearing (see Ritter 1991; Loughran & Ritter 2002; Ljungqvist 2007). In addition to IPO underpricing, the relatively poor long-term performance and the distinct cycles when both IPO volume, and initial returns are at an abnormally high level simultaneously, have attracted interest and been studied with varying results (see Bhabra & Pettway 2003; Ritter 1991). Periods of high number of IPOs occurring together with high initial IPO returns are referred to as hot issue markets (Ljungqvist, Nanda & Singh 2006).

The ideal holding period is an interesting and potentially existing concept because of the initial positive returns and the long-term poor performance documented by previous

literature. Most IPOs include a lockup period, during which the owners of the shares not sold in the IPO are not allowed to sell their shares. The expiration of the holding period has previously been documented to create negative abnormal returns by Brau (2004). The negative shock implied by the expiration of the lockup period may be a factor in finding an optimal holding period for IPOs. Together the amount of underpricing, the aftermarket performance, and the expiration of lockup periods of IPOs may provide useful insights for investors based on the market situation or certain industries.

Motivated by previous literature, the following hypotheses are created:

H1: IPOs are underpriced, showing positive short-term returns on average.

H2: IPOs do not outperform the market in the long-term.

H3: The expiration of the lockup period has a negative shock to the issued stock.

This thesis aims to provide contribution towards the investment period of initial public offerings. There have been several studies on investment periods using certain investment strategies, such as value stocks (Bird and Casavecchia 2007) but not strictly on initial public offerings. This paper studies the up-to-date statistics of IPO returns between different time periods, market cycles and business sectors in the United States. Finding relations between IPO returns and the characteristics of the company or the business cycle could provide investors a way to increase their profits without a scrutinizing in-depth analysis of each company.

1.2. Structure of the Thesis

The introductory chapter presents the subject of initial public offerings, why they have prevailed their position as objects of wide interest and have generated such a large literature. The objectives and hypotheses of the thesis are also presented in the first chapter. The second chapter goes through the special characteristics of IPOs in more

detail. The listing process and the effects of going public are discussed in the second chapter together with the limitations to taking part in an initial public offering. The third chapter includes the literature review, discussing the topics of IPO anomalies, theories explaining them, and holding periods. The fourth chapter introduces the data and methodology used in the empirical part of this thesis. The fifth chapter goes through the empirical results obtained in this study. Main conclusions of the thesis are discussed in the sixth chapter together with the limitations and further ideas for research.

2. INITIAL PUBLIC OFFERINGS

The process of going public is often considered as a natural phase in the growth of a company needing a broader range for capital sources. Being publicly listed, however, is not always mandatory. Pagano, Panetta and Zingales (1998: 27–64) argue that the decision to go public is one of the most important decisions to be made by a company, but at the same time one of the least studied aspects in corporate finance. According to Pagano et al. (1998: 27–64) the studies in corporate finance focus on the institutions and the listing process, rather than the motives behind the decision to go public. Pagano et al. (1998: 27–64) point out that there are numerous private companies among the largest companies worldwide, enforcing the fact that public listing is a choice, not a mandatory growth phase.

Issuing companies hire investment banks as underwriters, to manage the initial sale of the shares to investors in what is referred to as the primary market. After investors start trading the shares with other investors, the trading occurs in the secondary market. Offerings can also be sold privately, if the company wishes not to go public. Bodie, Kane and Marcus (2014) claim that these private placements tend to be cheaper for the listing company than the public ones. Public companies are also regulated more strictly and need to provide accurate reports more frequently, potentially dissolving business secrets or parts of them. However, the disadvantages of a smaller number of stockholders and potential investors with no public secondary marketplace for trading, result in liquidity risk and therefore decrease the price of the privately issued stock. Privately owned companies currently need to limit the number of their shareholders to under 500 in the United States, or they will be required to disclose the same financial information to the Securities and Exchange Commission (SEC) as publicly listed companies. The 500-investor regulation severely limits their ability to collect funds from a large number of investors. Thus, most large or rapidly growing corporations choose to go public to expand their investor base further, as they would be obligated to disclose their financial information to the SEC anyway. (Bodie et al. 2014: 59–63.)

2.1. The Listing Process

Once the company has decided to conduct an initial public offering, it is referred to as the issuer. The first and most important decisions the issuer makes, are the method of the IPO and the choice of lead underwriter. Depending on the size and desirability, there can be several or just one investment bank willing to act as the lead underwriter, also called bookrunner and book manager. The issuer may choose other interested underwriters to act as co-underwriters for the issue. When there are several underwriters managing an issue, the group of under-writers is called a syndicate. The number of underwriters participating in an IPO has been growing during the last few decades. Until the mid-1980's, most IPOs had only one underwriter, but from 2010 to 2018 the average number of underwriters has risen to 6,5 (Ritter 2019: 31–33). The lead underwriter can advise or suggest the issuer in the choice of potential co-underwriters, or co-managers, based on numerous different motives. (Corwin & Schultz 2005: 443–486.)

Choosing the contract type is the next important decision for the issuer. Usually companies going public make either a firm commitment or a best efforts contract with the underwriter companies. In a firm commitment contract the underwriter or underwriters will guarantee to buy all the shares issued. Firm commitment agreement allocates the risk from the issuer to the underwriter and because of this, it usually includes a higher commission paid to the underwriter by the issuer. The best efforts contract means that the underwriter will try to sell forward as many of the shares as possible. In a best efforts contract, the issuer bears the risk making it a cheaper but riskier contract for the issuer. In addition of the commission prices paid for the listing, the initial underpricing which is also referred to as leaving money on the table is an expense for the issuer. The amount of money left on the table can be calculated by multiplying the shares sold and the difference between the offer price and first day closing price. Leaving money on the table means that the issuer did not manage to realize all the potential money available and the issue was underpriced. (Cho 2001: 347–364.)

The contracts can have constraints or options included in them that become active in certain situations and may also affect the commission fees paid to the underwriter. Best

efforts contracts often include minimum sales constraints, that give the issuer the possibility to withdraw the offering if the underwriter is not able to sell a certain number of shares. Minimum sales constraints can be a factor when the demand for the issued shares is not very high. Firm commitment offerings usually have an over-allotment option which allows the underwriter to receive up to 15% more shares from the issuer to sell. The over-allotment options are used when the demand for the shares appears to be high. Besides the best-efforts and firm commitment contracts, a third less common contract type is an all-or-none contract. In an all-or-nothing contract all of the shares have to be bought by investors, or else the issuer will cancel the whole offering. A study by Welch (1991) found that minimum sales constraints are more often connected to the financing need, rather than the risk associated with the IPO. Underwriters receive greater compensation through commission fees when the minimum sales constraints are higher. On the other hand, the underwriter fees are lower when the contract includes over-allotment options. (Welch 1991: 497–518.)

When conducting an IPO, it is required to compile a detailed initial registration statement and file it to the SEC. When the final form of the statement has been formed and accepted by the SEC, it is referred to as the prospectus. A prospectus contains up-to-date information about the history of the company and its development, financial information, the structure of ownership and possible risks related to an investment in the company's shares. The prospectus has to be accurate in order to gain the approval of the SEC, and thus it usually contains the most precise and exact information about the company that is available for outsiders. Management and owners may try to make their company look better on paper than actually is the case, making investors have to react skeptically towards the absolute information provided in the prospectus. (Bhabra & Pettway 2003: 369–397.)

In order to prevent the cashing in by company owners through IPOs, most IPOs include a lock-up agreement. The lock-up agreement prohibits pre-IPO shareholders to sell their shares during the lock-up period, that typically lasts for 180 days but may vary. The purpose of the lock-up period is to assure the markets that the insiders are not attempting to cash in before negative news about the company surface. The lock-up period also

guarantees that employees will continue to be committed to the company for the next six months. Field and Hanka (2001) suggest that lock-up periods also serve as a part of the underwriter's price stabilization process by limiting the supply of the shares on the market. The terms considering the lock-up period are explained in detail in the prospectus. (Field & Hanka 2001: 471–500.)

Higher uncertainty between the company going public and investors results in higher underpricing, as investors need to be compensated for their information asymmetry. Arthurs, Busenitz, Hoskisson and Johnson (2009) show that there are three ways to reduce underpricing and thus to increase the overall money the company raises from the IPO. Underwriter reputation is a strong indicator to investors signaling that the IPO is not merely about the founder cashing in. A prestigious underwriter is a signal of trust as the history of the underwriter can be studied and the underwriter may participate in the support purchasing operation after the listing. Another way to reduce underpricing is to have venture capital backing. If an outside venture capital company owns a share of the issuing company, it signals a positive message to potential new investors. In a case where the company does not have a prestigious underwriter nor venture capital investors, the lockup period has a substituting role. The acceptance of a longer lockup period acts as a sign of quality towards the investors. (Arthurs, Busenitz, Hoskisson & Johnson 2009: 360–372.)

The primary method for executing IPOs in the United States is the book building method that has also increased its popularity worldwide. Book building is conducted by the underwriters by gathering information from potential investors about the interest towards the issue in a process commonly referred to as the roadshow. Book building has caused controversy among investors for decades because it lets the underwriter allocate the shares preferentially. Generally, underwriters allocate more shares to investors that are well-known, take part in IPO issues frequently, or offer to buy a large quantity of shares, in order to compensate the time used to evaluate the values of the stocks. Institutional investors usually best fulfill the mentioned requirements. An alternative way to execute the IPO is to organize an auction. According to Choo (2005) auctions limit the influence of the investment banks' discriminative allocation, resulting in a more democratic

offering where small investors have a better probability of getting shares. The most common types of auctions are uniform price, discriminatory price, and Dutch auction. Probably the most famous IPO conducted through the auction method is Google's NASDAQ listing in 2004 that was done using a modified Dutch auction. (Choo 2005: 405–441; Sherman 2005: 615–649.)

IPOs are not required to start trading on their listing day at the same time the stock exchanges start trading. Underwriters are free to choose the time trading starts with a notice that can occur only minutes before the start of trading. Before actual trading opens, it is preceded by a preopening period lasting a maximum of five minutes. During this period the lead underwriter and market makers make quotes that can differ from the opening price range. The preopening period quotes are not binding, and they are revised with a fast pace before trading starts at the final quotes of the preopening period. (Aggarwal & Conroy 2000: 2903–2913.)

2.2. Benefits and Disadvantages of a Public Listing

The factors behind the decision whether to go public or not, are complex and require vast amounts of research by the company executives. Pagano, Panetta and Zingales (1998) study the positive and negative effects resulting from going public and the underlying factors. Overall their study concludes that the size of the company and the stock market appreciation of the industry are positively correlated with the probability of going public. Another finding made in the study states that companies going public in the United States are on average significantly younger and smaller than in Europe. This finding means new companies gain momentum faster in the United States and also advantage from the public equity markets in their earlier growth phases. (Pagano et al. 1998: 27–64.)

According to several studies about the topic, (see e.g. Pagano et al. 1998; Cho 2001; Loughran et al. 2002) the greatest advantage of going public is reaching an alternative source of financing in addition to banks. Banks have relatively strict regulation considering their lending to businesses with much debt. Companies growing rapidly

usually have a high leverage and potential investments with good returns, but they may lack the required capital to execute these investments. Although banks may not refuse loans completely, they will raise the interests on companies which possess large debts already. Early investors are quite often the founders of the company, employees or some smaller investors who may not have the ability or willingness to increase their investment in the company. When banks and early investors are not willing to participate in further funding the company with reasonable interest rates anymore, the public capital markets offer a good option. By going public and having access to virtually limitless number of investors, companies improve their position in getting loans with favorable terms by simply introducing competition to the bank. Going public improves the liquidity and investment diversification possibilities of the company's owners. Selling shares of a private company can be difficult, time-consuming and expensive. In the case of shares listed in a stock exchange, trading is quick, fast, easy and also cheap due to a public marketplace resulting in increased trading volumes. The owners can also take advantage of the portfolio theory more easily when the company becomes public, by selling their more liquid shares and investing in other assets. (Pagano et al. 1998: 38–40.)

The principal-agent problem has been recognized as a common conflict of interest between the shareholders and the management of a company for over 40 years. Possible solutions to decrease agency costs, and to have better monitoring of the management during and after an IPO include indexing the managers' salaries to the now public and constantly revised stock prices or offering them stock options of the liquid shares as incentives to maximize the company's value. A private company with a large potential investment would face more scrutinizing monitoring than a similar public company, because the investors in private companies are usually fewer in number and larger in ownership equity of the company. The increased monitoring can even turn into excessive monitoring, which will decrease the agility of the company's decision making. (Pagano et al. 1998: 40.)

Since the public exchanges provide information that is quantitatively superior, more accurate, reliable, up-to-date, and scheduled about the companies listed on them, it is easier for investors to get information about the publicly listed companies than those

trading on over-the-counter (OTC) markets. Going public guarantees more media and analyst coverage about the company, making it more familiar, and furthermore, attractive to potential investors. A higher number of investors aware of the company, results consequently in a higher stock price as the overall demand for the stock increases. The higher information acquiring costs often reduce the willingness to invest in private companies, compared to similar public companies. (Merton 1987: 483–510.)

Ritter (1991) presents the idea that periodic deviations in initial returns offer issuers a chance to raise larger equities. When owners notice other companies on their industry are being overpriced on the markets, they may grasp this window of opportunity and take their company public in the hope of higher proceeds. Hot issue markets may serve a window of opportunity if the large initial returns are caused by the investors' overoptimistic expectations, rather than issuers underpricing the shares under the realistic value. A high market-to-book ratio may signal overpricing in a certain industry, or alternatively indicate there are high growth expectations towards the industry in the future. Poor long-run performance of IPOs issued during a period of high volume of IPOs may serve as an evidence of issuers successfully taking advantage of their windows of opportunity. Ritter did find that the long-run underperformance is in fact concentrated on young growth companies during the high IPO volume years, suggesting the issuers were able to utilize the overoptimistic expectations present. Entrepreneurs may have superior inside information regarding the near future of the development of the industry, letting them benefit from the overvaluation (Ritter 1991: 3–27.)

The most prominent disadvantages of going public include leaving money on the table, the administrative costs, and the decreased privacy. Leaving a large quantity of money on the table in the listing process can be considered a loss of potential income, as the offer price could have been set higher. There are many expenses included in the IPO process like the underwriter fees, stock exchange payments, and the increased costs in auditing and reporting.

The underwriter fees are defined percentages of the IPO proceeds, and the standard fee for moderate size IPOs is 7%. During the years of 2001–2018, 96% of the IPOs in the

United States raising between 25 and 100 million dollars had an underwriter fee of exactly 7%. In IPOs that raise more than 100 million dollars, the fee is evenly divided between under 7% and exactly 7%. (Ritter 2019: 30.)

The loss of privacy resulting from listing can have a negative effect on companies because of the stricter rules considering for example research and development reporting. Disclosing information about the R&D activity may result in losing some comparative advantages the company has compared to its competition. (Pagano et al. 1998: 36–38.)

3. LITERATURE REVIEW

The greatest amount of the previous IPO studies has concentrated on presenting and testing theories explaining the anomalies around IPOs. Only a relatively small portion of studies have concentrated on proving that the three IPO anomalies, underpricing, hot issue markets, and long-term underperformance, actually exist. The explanation for the concentration of previous IPO literature on the theories explaining IPO anomalies is because the existence of the anomalies has been confirmed numerous times and they have continued to have an established position long after the were first introduced.

3.1. IPO Anomalies

There are three general anomalies associated with initial public offerings: underpricing, long-term underperformance and the hot issue market anomaly (Ritter 1991). The underpricing anomaly means the initial abnormal price increase of the stock during the first day or days of public trading. Long-term underperformance indicates that the IPOs are outperformed by the market during their first few years. The hot issue market means different periodic business cycles with increased volumes and initial returns of the IPO listings.

3.1.1. IPO Underpricing

The amount of underpricing is most often calculated as the initial return percentage, between the closing price after first day of trading and the offer price of the issue. The initial return percentage can be mathematically formulated as follows,

(1) $$IR_i = \frac{(P_i - E_i)}{E_i} * 100$$

where the IR_i stands for the initial return of the share *i*. P_i stands for the closing price of the issue after the first day of trading and E_i refers to the offer price of the issue. It has

been proved in a vast number of studies, that IPOs are on average underpriced, meaning the first day closing market prices of the issues are greater than the offer prices. For the investors to whom the IPO shares are allocated, underpricing provides a strategy of gaining certain profits by investing in IPOs, which violates the conditions of effective markets by providing a continuous anomaly of abnormal returns. Issuers, on the other hand, seem to act irrationally by clearly leaving money on the table and not maximizing their proceeds that would be available from the IPO.

The first literature stating IPO underpricing was a SEC report mainly focusing in market regulation in 1963. In its Cohen Report the SEC found that the initial returns of companies going public were, on average, positive. Reilly and Hatfield (1967) were one of the first researchers to study and confirm IPO underpricing. They found that in their sample it was not the greater number of IPOs with positive returns that result in average positive initial returns, but the relatively bigger profits compared to the losses. Reilly and Hatfield's study concluded the first week, first month, and first year returns of only 53 IPOs, making it arguably too concise to draw more general conclusions from. (Reilly & Hatfield 1967: 73–80.) IPOs started to truly generate literature in the United States in the late 1960's and through the 1970's, resulting in continuously better developed methods and the adoption of new variables and theories.

The general acknowledgement of underpricing has generated the activity among investors called flipping, which was studied by Aggarwal (2003). When participating in flipping, investors take part in IPO bidding and sell the shares allocated to them soon on the secondary market. Because the IPO shares often experience a considerable increase from the offer price during the first day, flipping is a profitable strategy to exercise. The stabilization activities performed by underwriters tend to decrease the probability and the amount of negative initial returns. These activities include over-allotment options, purchasing the shares to support the market price, and penalizing flipping. Flipping causes pressure for the price to fall and because of this, underwriters try to discourage flipping. A large proportion of IPO shares is usually allocated to institutional investors, but the reason is not that they would be less prone to flip the shares immediately. In fact, Aggarwal's study shows that institutional investors tend to flip their shares more often

than individual investors. All investors flip hot IPOs with good initial returns more often than cold IPOs which do not provide initial returns during the first days. This may stem from the reluctance of investors to realize their losses, even though it often is stabilization that keeps the cold IPOs' returns close to zero. Bigger losses could be avoided if the shares were flipped when the price stabilization still keeps the losses small, but instead investors tend to remain hopeful that their investments will turn out profitable later. (Aggarwal 2003: 111–135.)

3.1.2. Cycles in IPO Volume and Underpricing

The IPO cycles in volume and underpricing are studied by Yung, Çolak and Wang (2008). They find a positive correlation between IPO volume and underpricing in their sample of 8536 IPOs during the years 1970–2004. During times of high IPO activity, IPO underpricing is on a high level simultaneously. These periods are also referred as hot issue markets. It appears as irrational activity by the issuers to go public when the underpricing is at a high level throughout the market. As the explanation for this Yung et al. find, that investment opportunities are influenced by exogenous shocks that cause adverse selection in the companies going public. Positive shocks result in more companies going public as some companies see a window of opportunity to gain good proceeds when the IPO market is hot. This is consistent with the earlier study by Ritter (1991). The marginal companies listing, which would not go public without the hot market are relatively worse quality than the companies going public anyways. Investors then require higher underpricing because their views of the companies or their possibly higher lack of information.
(Yung, Çolak & Wang 2008: 192–208.)

The cyclic patterns in IPO volume and return levels are presented originally by Ritter (1991). His observations include that the stock market performance of IPOs from the first day closing price up to three years in the aftermarket is poorer than the performance of matching seasoned companies. Matching was done by comparing the IPO companies with seasoned companies with matching size and industry. Ritter studied 1526 IPO listings during 1975–1984 and documented the existence of high periodical variation in the IPO

volume and underpricing. He notes that companies that went public during periods of high IPO volume, have the worst long-term aftermarket returns. Underpricing and IPO volumes have been proved to be positively related already before and thus underpricing and long-term performance are negatively related. Ritter concludes that the obtained results are consistent with investors' periodical overoptimism and companies taking advantage of these periods and taking their companies public while attracting more investors with a higher offer price and without a fear of price decline in the aftermarket.

Ljungqvist and Wilhelm (2003) claim that even though *"IPO underpricing reached astronomical levels during 1999 and 2000"*, the difference is mainly due to the unique firm characteristics. According to Ljungqvist et al. (2003), even though there was a vast difference between underpricing levels during (≈ 50%) and outside (< 20%) the "dot-com bubble", it was mainly ownership structure and insider selling behavior that were accountable for the difference. During the bubble, CEO ownership was only half of what it used to be in preceding years. The ownership fragmentation was also greater and there were less directed share programs, where shares were purchased with the offer prices by insiders' friends and family. Because of these reasons, Ljungqvist et al. (2003) claim that there was an increase in the principal-agent problem with less motivation by the owners to monitor the underwriter and the pricing of the IPO shares. It is still rather far-fetched to account the increased returns during the dot-com bubble solely on these factors. It is clear that, the market sentiment was on a completely different level during these years, attracting new investors regardless of the company characteristics. Ljungqvist et al. (2003) also admit that these rational firm characteristics might not have been the only explanation for the increased IPO returns, and investor behavior could have played a part in forming and growing the bubble.

3.1.3. Long-term IPO Underperformance

Ritter (1991) presented a third IPO anomaly to exist in addition to underpricing and the hot markets: long-run IPO underperformance. In his study Ritter shows that the companies that went public, underperform similar companies not performing an IPO,

during their first three years of being public. The sample included 1526 IPOs in the United States during the span of ten years from 1975 to 1984. The returns were measured from the closing price of the first day and the IPO-companies underperformed their non-IPO counterparts by 17%. Being a young company or going public during years when there was a high volume of IPOs resulted in even worse long-term performance. Ritter suggests that the offer prices reflect the true value of the companies, but the initial returns skew the prices so much that IPOs would appear to be underperforming on a longer run. The sample used by Ritter consists of the years of early 1980's when IPO markets were considered hot and the volumes grew significantly from the much quieter 1970's. From his sample of 1526 IPOs, only 143 took place in the first half of his sample period. With over 90% of listings in Ritter's sample happening during the years he himself described as hot issue market years (Ritter 1984), there are limitations in generalizing these results further. (Ritter 1991: 3–27.)

Eckbo and Norli (2005) study the long-term performance of IPOs listed on Nasdaq during 1973–2002 by expanding the holding period up to five years. Based on their data, IPOs do not have average long-run abnormal returns deviating from zero, but there are other interesting insights behind the averages. They observe that IPOs do not have higher probabilities of -100% returns, or losing all their value, than seasoned companies matched by size and book-to-market ratios. IPO companies also do not have a higher risk of delisting than other Nasdaq companies. However, IPO companies have a higher probability of returns of 1000% or more than seasoned companies. According to the findings by Eckbo et al. (2005), typical IPOs have similar equity sizes but lower book-to market values than other Nasdaq companies on average. Additionally, IPOs have clearly higher liquidity and smaller leverage ratios compared to matching seasoned companies.

Carter, Dark and Singh (1998) examine the role of underwriter reputation in IPO long-term returns using a holding period of three years. Overall IPOs seem to have negative market-adjusted long-term returns. They find out that IPO companies with prestigious underwriters experience less severe negative returns than those IPO companies with low-reputation underwriters. Carter et al. (1998) conclude that when observing the long-term

returns, only the Carter-Manaster underwriter reputation measure is able to provide statistically significant results.

3.2. Theories Explaining IPO Anomalies

There are numerous different hypotheses and theories explaining the reasons for IPO underpricing. It is close to impossible to define which aspects have effect on a particular IPO and by which amount, since most of the different theories are not mutually exclusive. The theories explaining underpricing have been categorized by Ljungqvist (2007) into four different main groups: asymmetric information, controlling ownership and power in the company, institutional, and behavioral explanations. Some theories are in effect only in certain markets because of the differences in legislation, practices or characteristics of the particular countries and their stock exchanges. (Ljungqvist 2007: 375–422.)

3.2.1. Asymmetric information theories

Probably the most well-known theory included in the asymmetric information explanations is the **winner's curse** theory by Rock (1986: 187–212). Rock assumes there are informed and uninformed investors on the market. The uninformed investors do not have any other information than what the market offers them in the form of prices, and they bid on all offerings. The informed investors, however, have superior information and bid only on the good offerings, crowding out the uninformed investors. Being the only ones bidding on the worse shares and due to the rationing and allocation of the better shares, the shares bought by the uninformed investors are mostly the worse ones. So, if the offerings would not be underpriced on average, the uninformed investors would quickly stop participating in IPOs and invest in alternative instruments.

Another theory stemming from asymmetric information, the **information revelation** theory suggested by Benveniste and Spindt (1989: 343–361), considers the book building method as the predominant way of conducting IPOs. The book building provides great

discretion for the lead underwriter considering the allocation of the shares. It induces potential investors to reveal truthful information about their interest towards the offering. Otherwise investors would belittle their interest and their views of the value, pushing the price down and maximizing their own profits. Using book building prevents this because offering to buy shares with modest prices results in not getting any, or only few shares. Underpricing therefore is a compensation to the investors for revealing their genuine interest.

Hanley (1993: 231–250) describes the **partial adjustment** phenomenon consistent with the information revelation theory by Benveniste et al. (1989). Partial adjustment happens when only some of the positive interest is reflected in the increase of the offer price, and the rest is realized in a price increase on the aftermarket. Partial adjustment does not let the issuer and underwriter raise the offer price as high as the investor interest would suggest, because then investors would not reveal their intentions in the first place. There must be some incentive in the form of underpricing left to reward the investors for disclosing their authentic information. Hanley documents that in IPOs, where the final offer price is increased above the initial offer price range, underpricing is stronger. Price revisions upwards within the offer price range are also often only partial adjustments, letting the price rise further when trading begins in the aftermarket.

Aspects of the **principal-agent problem** are present also in IPOs according to Loughran and Ritter (2002: 413–444). The underwriter fees are usually a set percentage of the total IPO proceed and therefore do not induce the underwriter towards underpricing. Sometimes the underwriter's private interests are against the issuing company's interests and the benefits from its private causes are greater, making underpricing desirable. Typically, in IPOs wealth is transferred from the issuer to the investors which may induce investors to make side-payments to the under-writers in order to promote their chances of share allocation. Also, a practice called spinning (or laddering) induces the underwriter to underprice the shares. Spinning works so that underpriced shares are allocated to executives of other companies in the hope to ensure the role as the investment bank and possible underwriter for those companies in the future.

Fifth of the possible explanations for underpricing due to asymmetric information is the **signaling** theory originally presented by Ibbotson (1975: 235–272). Ibbotson (1975) assumes that issuers have superior information compared to investors and companies of high quality want to stand out from the worse ones. Companies with a good economic situation can afford to underprice their stock and show in this way that it is not merely trying to cash in with the IPO. According to Ibbotson (1975), issuers underprice to also generate a good feeling among investors towards the company and therefore ensure a positive future for the performance of its stock and possible seasoned offerings in the future.

3.2.2. Maintaining control and ownership theories

IPOs often signal the start of a more powerful separation of ownership and management. Mikkelson, Partch and Shah (1997: 281–307) show that on average in the United States, company management owns 66% of the shares prior to IPOs, 44% immediately after them, and only 29% five years after the IPO. Mikkelson et al. (1997) also present that during these five years, the control turnover for companies older than five years is more than double (29%) the equivalent number for younger companies (13%). According to their personal interests, it is preferable for company executives to **maintain the control of the company** as big, and the monitoring as small, as possible.

Underpricing makes it easier for the executives **to maintain monitoring on a minimal level** according to Brennan and Franks (1997: 391–413). Underpricing an IPO generates excess demand for its shares and there are more investors willing to bid for the shares. The shares can thus be allocated to a larger number of investors in smaller proportions of equity. Owning only a relatively small percentage of the company's shares, reduces inducement for monitoring it because of the public good nature of public shares. The current managers also will have a smaller threat of hostile takeovers of the company due to their non-profit maximizing activities. These activities can comprise for example perquisites and actions decreasing the company risks, thus insuring the positions of the executives.

3.2.3. Institutional theories

There are three institutional theories explaining underpricing: lawsuit avoidance, stabilization, and tax advantage theory. **The lawsuit (or legal liability) avoidance** theory has mainly been associated with the United States, due to the aggressive litigation culture compared to most other nations. Lowry and Shu (2002: 309–335) estimate that almost 6% of the companies that went public in the U.S. between the years 1988 and 1995, were sued for IPO regulation violations. Adding to the direct costs of 11% of the IPO proceeds on average paid as damages, lawsuits generate numerous indirect costs to companies. Attorney fees, management time used to deal with the lawsuits, settlement costs, and reputation costs are a big threat for the companies. Underpricing serves as an insurance against the potential lawsuits by unsatisfied investors in the future. It is difficult to prove if underpricing is an efficient way of preventing lawsuits because greater probability of getting sued leads to larger underpricing which reduces the litigation risk. It is therefore problematic to point out the estimated lawsuit probability before any underpricing to prevent it. Lowry and Shu (2002) provide some evidence towards higher litigation risk leading in higher underpricing.

The initial returns of IPOs are rarely negative, and a large quantity of the offerings has returns around zero. This is often seen as the result of **price stabilization** activities by the underwriter. Ruud (1993: 135–151) claimed underpricing to be caused by price stabilization eliminating the negative figures from the samples making even the overpriced IPOs to show initial returns close to zero instead of being clearly negative. Ruud's (1993) statements were later negated by studies on unsupported IPOs, which were also underpriced. Benveniste, Busaba and Wilhelm (1996: 223–255) studied the reasons for price stabilization. They considered price stabilization as a bonding activity between the issuer and the underwriter. An underwriter participating in stabilization signals investors that it is not deliberately overpricing the IPO's offer price, because it would lead in costly aftermarket price stabilization.

Taranto (2003) studied the role of **tax advantages** as a reason for IPO underpricing in the United States, quite similarly as earlier studied by Rydqvist (1997) in the Swedish market.

Managerial stock options are taxed twice and as different source of incomes. When acquiring the shares through the options, managers are taxed the difference of the fair market value and strike price as income. Later when selling the shares, the difference of the price sold and the fair market value is taxed as capital gains. Capital gains taxes are generally lower in the U.S. and U.S. tax laws state options exercised during the IPO to have a fair market value equaling the IPO offer price. These reasons make it profitable for individuals owning managerial stocks to have the fair market value also meaning the offer price as low as possible, leading in underpricing. Taranto (2003) admits tax benefits certainly are not the main reason for underpricing, but they could act as a factor strengthening the aggregate underpricing effect.

3.2.4. Behavioral theories

Welch (1992: 695–732) introduces a behavioral explanation, **informational cascades**, as a factor for underpricing. Investors may disregard their personal information and views of the issue, choosing to rather follow earlier investors' opinions and decisions. This causes cascades, where there is either excess demand of the IPO, or only little interest towards the IPO. Because of this, issuers may deliberately underprice the issue to foster initial investor demand, hoping for a snowball effect. Welch (1992) suggests that issuers with accurate positive information about investor information might fail their IPO because of cascades. Issuers may raise the offering prices when they have knowledge of investor willingness to purchase the shares, but even investors with interest might refuse to buy the shares if they interpret the low demand as negative information possessed by other investors. This type of herd behavior might therefore recommend issuers and underwriters to underprice the IPO. Large underwriters with wider markets may be able to divide the IPO into different areas, complicating and preventing communication between investors. With decreased investor communication, the investors will not be able to confirm and spread their private information and they will more probably follow the behavior of other investors. However, cascades only have effect when the IPOs are sold sequentially and publicly. Using the book building method prevents cascades because

underwriters can keep all information considering the sale numbers private before the IPO.

Another interesting behavioral theory explaining underpricing and linking it together with the hot issue market and long-term underperformance anomalies, is the **investor sentiment** theory proposed by Ljungqvist et al. (2006: 1667–1702). There reportedly are time periods when the volume and initial returns of IPOs are larger, and during these periods investor sentiment towards IPOs is on a higher level. The investors' exaggerated optimism, resulting also in irrationality, is strongly present with IPOs because of the difficulties in valuing them accurately. Retail investors might feel like they have a special relationship towards a company they invest in early on and might have biased views of the company's outlook. The overall investor sentiment will drop sooner or later from the abnormally high level, resulting in underperformance on a longer period for the IPOs underpriced because of generally positive investor sentiment.

Loughran and Ritter (2002: 413–444) suggest a behavioral reason for underpricing considering the issuing company, rather than investors, called the **prospect** theory. The most heavily underpriced IPOs are usually the ones where the offer price is revised upwards, making issuers wealthier while simultaneously leaving some of the potential wealth gain on the table. Even though a clear wealth loss ensues from leaving money on the table due underpricing, issuers tend to relate this to the wealth gain from raising stock prices. The sum of these wealth changes depends on the portions of shares sold and retained, and the adjustment of the offer price. Issuers may be perfectly satisfied with an IPO, even though they might be leaving millions of dollars on the table. The loss from underpricing falls solely on the original shareholders, which in many cases in the United States consist mainly from the executives and founders of the company. The gains from initial returns, on the other hand, benefit also the first shareholders acquiring their shares from the IPO and would most probably be gained even if the issue was less underpriced. This fact may be partially neglected by issuing companies since they do not seem to have a problem with leaving significant amounts of money on the table.

3.3. IPO Aftermarket Performance

The vast majority of IPO literature focuses on the price differences between the offer price and the first-day closing price. However, this inspection includes two separate parts of price behavior: the pre-listing part from the offer price to first-day open price, and the first trading day price behavior from open to close.

Bradley, Gonas, Highfield and Roskelley (2009) study the secondary market returns of IPOs. They use a sample of IPOs listed in the United States between 1993 and 2003. Bradley et al. (2009) find a positive statistically significant average return of 2,3 % during the first trading day. They also discover the price movement does not stabilize immediately at the market opening, but during the first two hours of trading. Bradley et al. (2009) suggest that the reasons behind positive open-to-close returns are caused by several factors: the lead underwriter's price support, laddering, IPO sentiment, and information asymmetry. Price support is only present at IPOs that experience low demand on the secondary market, while IPO sentiment increases the prices of IPOs with a high aftermarket demand. There is, however, no statistical background to the effects of laddering due to its illegality and unavailability of data. The positive open-to-close returns did not disappear during the years 2001–2003 when the SEC increased the scrutiny of its supervision. One finding supporting information asymmetry is the negative relation between open-to-close returns and company size.

Aggarwal and Conroy (2000) study the opening moments of trading for IPOs. Using a sample of IPOs listed in 1997, they find that even for IPOs that experience high market demand, the majority of the initial price increase is utilized by the lead underwriter during the preopening period lasting for a maximum of five minutes. Their empirical results show that the average offer-to-close return was 19,47 %, of which 17,66 % consists of offer-to-open returns and 1,54 % of the open-to-close returns. During the preopening period underwriters and market makers revise their quotes based on other quotes they observe. Underwriters are free to choose the time when IPO trading begins, and Aggarwal et al. find evidence showing that IPOs with later opening times for trading experience a stronger price increase.

Barry and Jennings (1993) study the initial returns of IPOs by dividing the initial returns into prelisting returns and aftermarket returns and using intraday price data. They find out that short-term IPO price increases mainly take place before trading starts and during the opening trades. Barry and Jennings (1993) conclude that investors who are not able to participate in IPOs with the offer prices, are not able to make worthwhile profits when taking taxes and transaction costs into consideration.

Zhang (2004) studies the use of IPO over-allotment options by underwriters. He suggests that underwriters exercise over-allotment options even in cold IPOs that have low demand, in order to increase the aftermarket price, using over-allotment as a price stabilization tool. Over-allotment in cold IPOs forces the underwriter to buy back some of the shares, but in cold IPOs the price does not rise significantly and enable over-allotments.

3.4. Prior Explanations for IPO Underpricing

Ibbotson, Sindelar and Ritter (1994: 66–74) claim that the short-term underpricing is often overstated in the United States because the average initial returns are calculated using equal weights. According to them, measuring underpricing using equally-weighted averages skews the data because smaller offerings tend to be more heavily underpriced than bigger ones. Alternatively, data using proceeds-weighted means or medians would show a smaller percentage of underpricing. The money left on the table, or the proceeds-weighted average underpricing, during the sample period of Ibbotson et al. (1994) is 18,3% of the total proceeds raised. During the hot IPO years both the underpricing and IPO volume, and consequently the aggregate proceeds, are on a very high level. Using the proceeds-weighted averages, instead of the equally-weighted averages, still shows clear evidence of underpricing. The amount of underpricing has fluctuated annually mainly between 5% and 20% in the United States.

The IPO underpricing increased clearly from the 1980's to the change of the millennium. The average equally weighted (proceeds-weighted) first-day returns of IPOs in the United States markets were 7.3% (6.1%) in the years 1980–1989, 14.8% (13.3%) during 1990–1998, and 64.5% (51.6%) during the internet boom in 1999–2000. From the year 2001 until 2018 underpricing averaged 13.9% when calculated with equal weights, and 12.6% by using proceeds-weighted averages. See figure 1 for annual details of initial returns and volume of IPOs. The years of 1999 and 2000 stand out as having extremely large underpricing, skewing the whole IPO statistics on their own. If the internet bubble years of 1999 and 2000 were excluded from the sample data, the average equally-weighted initial return during 1980–2018 would be 12.5%, which is considerably lower than the 18% initial return including the hot-issue markets of the dot-com bubble. (Ritter 2019: 3.)

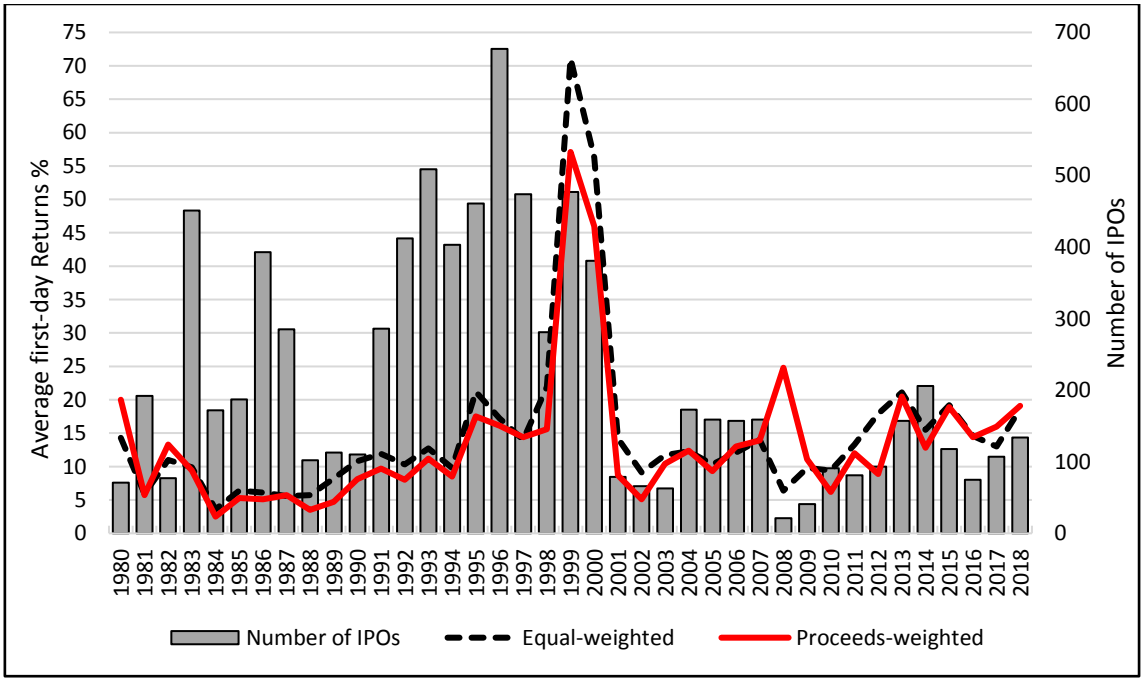

Figure 1. The equal- and proceeds-weighted first-day returns, and the number of IPOs listed in the United States during 1980–2018 (Ritter 2019: 3).

Loughran and Ritter (2003) claim that the strong increase in IPO underpricing was due to changes in the explanations of underpricing. In the 1980's the winner's curse and

information acquisition hypotheses were the fundamental causes for the first-day returns. The riskier the companies going public are, the higher will the underpricing also be because of the general equilibrium between risk and profit. Loughran and Ritter (2003) state that besides the increase in the universal risk level of companies going public, there were also new reasons that caused underpricing. The changing issuer objective and the realignment of incentives hypotheses account for the noteworthy increase of underpricing. The reasons behind changing issuer objective are the preference shift of underwriter analyst prestige over underwriter pricing accuracy, and the practice of underwriters organizing side payments by allocating hot issues to investors and company executives, also known as spinning. The realignment of incentives has happened because of the increase in insider share allocation and decreases in CEO ownership and secondary share volume. Loughran and Ritter admit their evidence to be indirect but claim their hypotheses to be consistent with the increased underpricing.

The contract type between the issuer and the underwriter has an effect on the costs of going public as Ritter (1987: 269–281) shows in his study of the U.S. IPO markets during 1977–1982. There are two main factors composing the costs, the commission fee paid to the underwriter, and the money left on the table due to underpricing. The aggregate sums of the costs for firm commitment contracts and best efforts contracts were in Ritter's study, respectively 21.2% and 31.9% of the total proceeds raised. The issuer's risk in a best efforts contract is also significantly higher as described in chapter 2.1. Often, IPOs using firm commitment contracts are larger, making the commission percentages needed to pay for the underwriter lower and the investor uncertainty towards the company smaller. The direct costs of IPOs are also higher using the best efforts contract, raising a question about the issuers' rationality who still choose the costlier best efforts contract. Ritter (1987) does, however, show evidence that the companies choosing the best efforts contract are riskier, and would they choose to use the firm commitment contract, the required underpricing would be even higher. Consequently, the uncertainty of the company value before the IPO affects the type of contract chosen, making the groups of companies using the two different contract types heterogenic.

Welch (1991: 497–518) tested the effects different minimum sales constraints and over-allotment options have on the pricing of IPOs. When best efforts contracts include higher minimum sales constraints, the issued shares experience stronger underpricing. The underwriter may need to induce investors to buy larger amounts of shares than they initially wanted, by underpricing them more. This way the underwriter ensures the minimum sales constraints are exceeded and the IPO will not be canceled. The over-allotment options have the opposite effect on underpricing than minimum sales constraints, reducing underpricing. Over-allotment options serve as signals to the investors, that the underwriter does not expect the stock prices to drop during the option time. This increases the investors' interest and the prices they are willing to pay for the issued shares, consequently raising the offer price and reducing underpricing.

Megginson and Weiss (1991: 879–903) studied the effects venture-capitalists have on the issuing companies. Megginson and Weiss (1991) compare matching IPOs with and without venture backing and found significantly less underpricing in those issues which had venture capital backing. Their findings are consistent with a recognized role for the venture capitalists as monitors. Megginson and Weiss suggest venture capitalists may have established firm relationships and trust with underwriters, attracting more prestigious underwriters, reducing information asymmetry, and also consequently underpricing. Venture capitalists may also act as certifications to outsiders of the quality of the company by having their own financial and reputational capital invested in the issuing company.

Field and Hanka (2001: 471–500) show that IPOs react to the expiration of lock-up periods by having a negative abnormal return of –1.5% during the time of lock-up expiration. Field and Hanka (2001) also show that the volume of trading has a more permanent increase of 40% after the lock-up period expires, typically after 180 days. Both, the negative return and increased volume, are greater when the company is financed by venture capitalists, because they are keener to sell their shares than other company insiders. Shareholders often find it desirable for company executives to maintain shares to induce them in maximizing the value rather than pursuing their own interests. The

aspects of the principle-agent problem and its effects on underpricing were discussed earlier in section 3.2.1.

On the basis of Rock's (1986) study of the winner's curse and information asymmetry, Michaely and Shaw (1994: 279–319) tested the underpricing among investors with equal information. They segmented their sample to consist only master limited partnerships (MLPs), which are avoided by institutional investors due to several taxation reasons. When assumed that informed investors are institutional investors, and uninformed investors are retail investors, we can further assume the information to be on a highly symmetrical level among the investors. In fact, there was no underpricing among this sample of MLPs during 1984–1988.

The underpricing caused by the principal-agent problem of the issuer and underwriter can be reduced, as Ljungqvist and Wilhelm (2003: 723–752) indicate, by introducing incentives for the company executives to monitor the underwriter's pricing process. Stronger executive monitoring incentives mean a bigger number of shares owned, and equity sold in the IPO.

Another solution for controlling the agent cause of underpricing is introduced by Ljungqvist (2007: 398). Higher commission fee percentages paid to the underwriter diminishes the conflict of interests between the issuer and the underwriter, thus decreasing the initial day returns significantly.

Field and Lowry (2009) study the impact of institutional ownership on IPO performance using a sample of IPOs during 1980 – 2000. They find out IPOs that have a larger portion of institutional investors outperform IPOs that have little or no institutional investors participating in them. Additional findings show that venture capital -backing, underwriter quality and positive earnings before the listing all have a positive impact of IPO returns on a period from 3 months to 3 years. Field and Lowry (2009) suggest that institutional investors are able to screen the worst quality IPOs using the above-mentioned factors. Individual investors are less likely to require VC-backing, a prestigious underwriter, and positive earnings from IPOs they invest in.

Boehmer (2006) focuses on IPO allocation to institutional investors in her study. She documents that underwriters provide institutional investors IPOs with higher first-day returns in their allocations. Most institutional investors hold their IPO investments for more than two days, and IPOs with greater institutional investment also have a better long-term performance. These results are consistent with Field et al. (2009) as institutional investors analyze the companies using their previous earnings, VC-backing and underwriter reputation with more detail and precision than individual investors.

Hahl, Vähämaa and Äijö (2014) study Finnish IPOs listed during 1994–2006. They divide the IPOs into value and growth categories. Hahl et al. find that growth stock IPOs experience higher underpricing and short-term returns by a minor margin. In the long-run, value stock IPOs clearly outperform growth stock IPOs and perform similarly to the market index. In the sample of Hahl et al., the poor long-term performance of IPOs is mainly caused by growth stock IPOs. However, these growth stock IPOs perform correspondingly to their seasoned counterpart companies with matching characteristics. Hahl et al. (2014) conclude that the poor long-run performance of IPOs is mainly explained by size and momentum factors.

3.5. Holding Periods

The holding period, or investment horizon, describes the time an asset is owned by a certain investor. Holding periods may vary from fractions of a second when executed by algorithm trading computers, to several decades or as long as the company and investor exist.

Atkins and Dyl (1997: 309–325) study the factors behind holding periods using a two-stage least squares regression on a sample from the NYSE and NASDAQ. They calculate the average holding period as follows:

(2) $$Average\ holding\ period\ _{iT} = \frac{Shares\ Outstanding_{iT}}{Trading\ Volume_{iT}}$$

where the number of outstanding shares for company i during year T is divided by the respective trading volume. Atkins and Dyl (1997) find out the bid-ask spread, and market value have a significant positive effect on the holding period. These results support the rational conclusion that high transactions costs make investors more reluctant to adjust their portfolios often. They also find that stocks belonging to companies with large market capitalization have longer investment periods. This is consistent with yet another finding showing holding periods are negatively correlated to daily volatilities of the stock. Larger companies are analyzed widely and the expectations towards them are more homogenous and unambiguous than those of smaller companies. The spectrum of expectations together with the smaller overall risk of large companies reduce trading activity and increase holding periods.

The transaction of instantly selling the shares acquired through IPOs is called flipping. In the case of "hot IPOs" where the shares are significantly oversubscribed and the price increases rapidly during the first trading days, some investors take advantage of this and immediately liquidate their shares to capitalize their profits. In the case of "cold IPOs", where demand for the shares is low on the market and the price does not experience an immediate increase, flippers are able to benefit from the price stabilization of the underwriter. Because the lead underwriter usually agrees to support buys to keep the price from decreasing during the start of trading, flippers are relatively safe from large price decreases. The holding periods of flippers may be as short as some hours and their invested capital is away from their deposal for only a short period of time. Flipping several IPOs consecutively provides the opportunity to gain multiple large returns within a short period of time. When a considerable number of investors decide to flip the shares they were allocated, the share price of the IPO may experience a reduction due to increased supply of the share. A negative aftermarket return quickly after listing gives negative signals to the market and repels investors, suggesting the IPO was priced too high. Thus, flipping is seen as an unwelcome action by the issuing company and the underwriter, and they may introduce restrictions for selling the shares. (Ellis 2006: 340–343).

Gaspar, Massa and Matos (2005) study the holding periods of institutional investors. They show that the average holding period for institutional investors based on trading volume and number of shares outstanding is 15 months. Gaspar et al. (2005) also document that longer-term investors are more prone to reduce the principal-agent problem than short-term investors. Long-term investors prevent managers from value-reducing actions such as job-security enhancement and imperium building that would be beneficial to the managers but not for the company.

Optimal and typical holding periods depend on the styles and strategies of the investors and underlying assets. For real estate investment portfolios, Baroni, Barthélémy and Mokrane (2007) found an optimal holding period to be between 10 and 20 years, depending on several factors. Because of the long time period, real estate investing in extremely sensitive to the changes of interest rates and the trends in the real estate market.

Bird and Casavecchia (2007) found in their research, that the holding period of assets plays a major role in the performance of the value investment strategy. The holding period and value strategy returns are positively correlated, meaning longer holding periods to some extent result in larger returns. Bird et al. (2007) found the optimal holding period for value investing to be roughly 3 years. Holding periods of less than a year were not able to generate abnormal returns. Similar results are also documented by De Long, Shleifer, Summers and Waldmann (1990) stating too short holding periods prevent some investors from utilizing the value premium.

The momentum strategy simply betting on past winners and shorting or avoiding past losers has a relatively short optimal holding period. In Novy-Marx's studies (2012, 2015) the estimation period spans a year prior to the investment period and the momentum portfolios are reconstructed every month. Another well- working alteration is to limit the estimation period to 12 to 6 months before the investment period begins. There is negative autocorrelation found with the most recent month, and therefore it is skipped from the momentum strategies throughout the momentum-literature. In a momentum portfolio created this way, the shortest holding periods can be limited to one month, but the maximum holding period is not limited. For example, a company performing consistently

in the highest decile of stocks, could be included in the portfolio for several years. A study by Hulbert (2018) suggests that the estimation period and holding period together should be between 12 to 18 months for the best possible results. There are no unambiguous guidelines for either the estimation or the investment period, but they are negatively related to each other.

The holding periods for investors participating in IPO flipping activity is limited to a maximum of a couple days by definition. Flipping investors take advantage of the initial price increases and liquidate their IPO shares quickly after the stock lists on a public exchange. The requirement for flipping to be possible is to participate in IPO offerings and to be allocated shares in the book building method performed by the underwriter. If a certain investor tends to always flip their IPO shares, underwriters will start to decrease their share allocations. (Che-Yahya & Abdul-Rahim 2015.)

The shortest holding periods can be experienced when programmed algorithms make transactions on an electronic trading platform. This is called high-frequency trading. The volume of algorithm trading also consists a large share of trading on modern public exchanges. The holding periods between automated quotes being sent to the electronic trading platforms are counted in fractions of a second, and there is constant technological development and competition to further decrease the trading latency. High-frequency traders take advantage of small price margins and use large volumes to. make substantial profits. (Hendershott & Jones 2011.)

4. DATA AND METHODOLOGY

This chapter describes the data and methods used in the empirical research. The data obtaining is discussed alongside the analysis methods that are conducted. Descriptive data of the final sample is presented in this chapter.

4.1. Research Data

Measured by trading volume, the most active stock exchanges in the world are the New York Stock Exchange (NYSE) and NASDAQ, both having their headquarters located in the United States. Other major stock exchanges include the Chinese Shenzhen and Shanghai exchanges, the stock exchanges of London, Tokyo and Hong Kong, and the European Union's Euronext stock exchange. The NYSE and NASDAQ make up the most active and largest stock exchanges in a single country compared to the other stock exchanges in other countries. Because of the size of these markets and uniformity of regulations and customs, this study focuses on stocks listed on the NYSE and NASDAQ stock exchanges. (The World Federation of Exchanges.)

The data used in this study is daily stock price data provided by Thomson Reuters Worldscope database. Because this study examines the different possible holding periods, it is required to use daily data in order to include holding periods as short as a single day. The original list of initial public offerings is fetched from NASDAQ's database of IPOs in the United States. The data sample includes initial public offerings from 1998 to 2017. This period includes many different business cycle trends providing a good comparison of IPO activity and performance during different economic situations. Some interesting events during the sample period include the strong growth years during the 1990's, the tech bubble around the change of the millennium, the financial crisis of 2007–2009, years of zero-interests after the financial crisis, and the most recent years of positive economic growth.

The data used is limited to the New York Stock Exchange and NASDAQ stock exchanges. Initial public listings conducted on other stock exchanges like American Stock Exchange and the OTCBB are therefore excluded from the data. The listings of unit offerings, shares with missing market price data, days of zero trading volume, or seasoned offerings during the sample period are excluded from the final sample.

4.1.1. Descriptive data

The final sample consists of 1315 initial public offerings issued during the years 1998-2017. The number of IPOs and the average first day returns vary quite strongly between the sample years as can be seen from the descriptive data in table 1.

Table 1. Descriptive statistics of the final sample. Offer size is measured as $ millions and underpricing is measured as price change from the offer price to opening price on the first trading day. Aftermarket returns are measured as price changes from the opening price of the first trading day to the closing prices of the first and 253th trading days.

	Average	**Median**	**Maximum**	**Minimum**
IPOs per year	66	63	148	18
Offer size $ (millions)	122	71	16 007	3
Underpricing %	18,93%	6,25%	1100,00%	-97,92%
One-day aftermarket return %	2,65%	0,00%	238,57%	-52,00%
One-year aftermarket return %	12,47%	-5,41%	1427,13%	-99,98%

This paper includes the comparison of IPO returns of companies from different industries. The companies are categorized based on their primary SIC-codes as previously done by Cartorelli and Strahan (2006: 443–446). The first two digits of the four-digit SIC-code determine which main category the company belongs to. The companies in the sample

are divided into 9 main industries that are not represented evenly, as can be seen from figure 2.

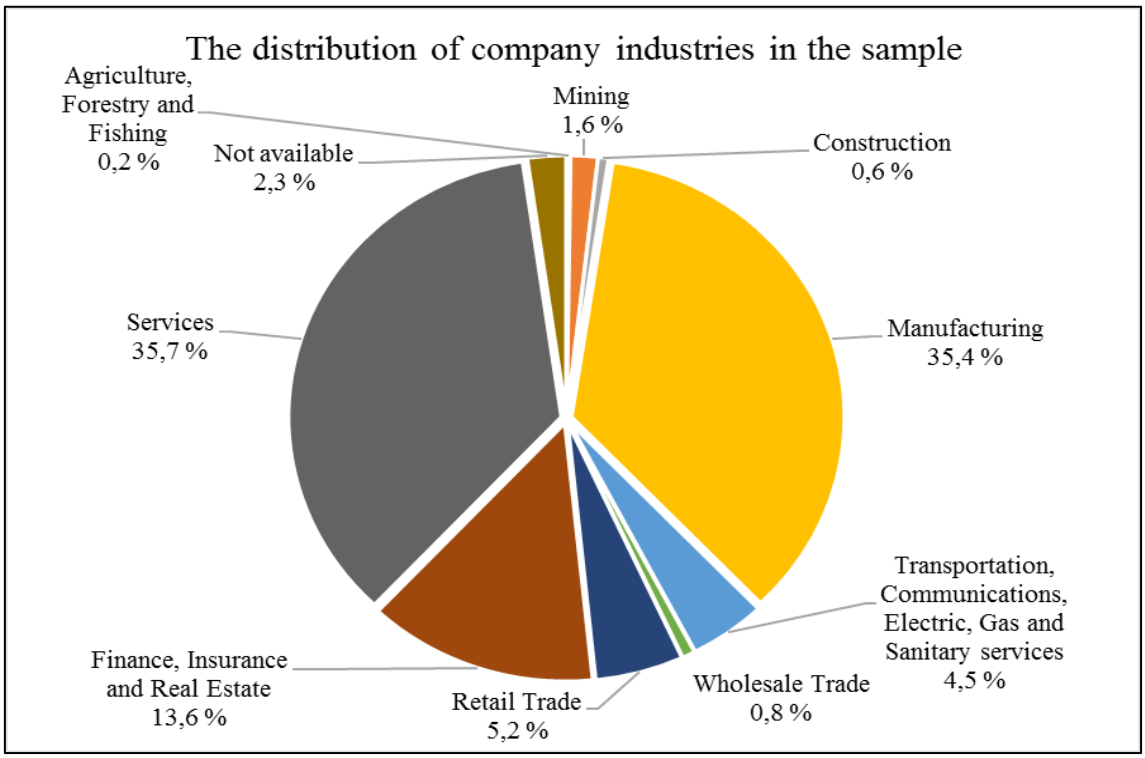

Figure 2. The proportion of each industry group in the final sample of 1315 companies. The proportions are presented as a pie chart and the percentage shares are showed for each industry group.

Further analysis is done by using a more accurate SIC-code classification. The business sectors studied more accurately include companies operating in the high technology industries. These industries may behave very differently in extreme market sentiments. Companies are classified as high technology companies using the SIC-code classification analogous to the method by Loughran and Ritter (2004: 35) and developed further by Saade (2015). The SIC-codes included in the technology industry group are listed in appendix 1.

Industry analysis is conducted because of earlier documentation of certain industries experiencing abnormal sentiment (for example the dot-com bubble of the internet

companied in 1999–2000). These market-wide industry sentiments may have explanatory power in the returns of listing companies active in these industries. The sentiments and expectations of individual and institutional investors towards companies they know little about is strongly influenced by the overall industry sentiment. Companies going public in times of high investor sentiment towards an industry may experience stronger underpricing and weaker long-term performance as the aftermarket price reverts towards its fundamental price. (Ofek and Richardson 2003; Ljungqvist et al. 2003.)

4.2. Methodology

The returns are compared using daily returns of initial public offerings. The returns are calculated from the difference between the opening price of the first trading day and the following closing prices for up to one year. Both equal-weighted and proceeds-weighted averages are used in the average return comparison to simulate investing in every single IPO and to show the overall IPO market performance. Both methods are used because there is documentation that smaller offerings are more heavily underpriced, and it may prove to be more difficult to participate in a smaller IPO with limited shares being offered and due to allocation limits. (Ibbotson, Sindelar & Ritter 1994).

An event-study is conducted to observe the effects of the lockup period expiration. Even though event-studies are commonly used to study the effect of unanticipated news announcements, an event-study will also be a practical tool to examine the effects the expiration of an IPO lockup period. The entry of large sellers to the market on a specific day could cause a negative shock to the share price. The standard lockup period expiration happens 180 days from the listing and it is used as the event date. The event-study uses average abnormal returns obtained from the market-model ordinary least squares (OLS) regression. The significance of these results is studied using the t-statistics of the average abnormal returns during the event window.

IPO returns are compared to the market returns using the Russell 3000 price index. All the IPOs in the sample are being listed on stock markets located in the United States,

making a country-specific index a reasonable market comparison index. The Russell 3000 index measures the performance of the largest 3000 companies measured by market capitalization. It is a market-value-weighted index including approximately 98 % of the public equity market in the United States, compared to 75 % represented by the S&P 500. The Russell 3000 index is selected over the popular S&P 500 benchmark in order to have a comprehensive market benchmark representing the whole market including the the 2500 smaller companies that are excluded from the S&P 500. (FTSE Russell.)

Initial public offerings have no readily available market beta at the moment they list because of the lack of public price data. Therefore, a market beta proxy is created in the same way as in the paper by Bradley et al. (2009). An ex-post market beta is calculated using the returns of the IPOs and the Russell 3000 benchmark index during the six months succeeding the listing. The betas are calculated as follows:

(3) $$\beta_i = \frac{covariance\ (r_i, r_m)}{variance\ (r_m)}$$

where r_i is the daily return of the IPO share, r_m is the daily return of the Russell 300 market index, and the covariance and variance are measured using daily observations for six months. Table 2 shows the descriptive statistics of the market betas created.

Table 2. Descriptive statistics of ex-post betas calculated using the daily returns of the IPO shares and the Russell 3000 market index for six months post-listing. The number of shares having betas less than zero, between zero and one, and greater than one is also reported.

Count	1315	
Average	0,91	
Median	0,79	
Maximum	6,69	
Minimum	-2,7	
Betas	Count	Share
$\beta < 0$	101	(7,67 %)
$0 < \beta < 1$	698	(53,00 %)
$\beta > 1$	518	(39,33 %)

4.2.1. Regression analyses for underpricing and first-day returns

The returns between the IPO offer price and first-day opening price, and between the first day opening and closing prices, are measured using regression analyses. The price difference between the offer and opening prices is called underpricing and the price difference between the opening and closing prices of the first trading day is referred as the first-day return. The regression method used is the ordinary least squares regression and different independent variables are used to analyze underpricing and the first-day returns.

As the offer price is announced several days before the opening of trading, the underpricing returns do not originate from a single day, but the whole period from the offer price announcement to the opening of trading. Therefore, the dependent variables selected are chosen from the IPO issue and chronological characteristics. Lowry (2003: 3–40) studies the determinants of IPO activity. He concludes that GDP growth acts as a determinant of market sentiment and has a positive effect on the number of new IPOs. Saade (2015) studies the IPO returns of technology companies. Saade's (2015) results show that technology companies have higher initial IPO returns compared to other listing companies. Ibbotson et al. (1994) claim that on average, smaller IPOs are more underpriced than large IPOs. Based on the mentioned previous studies we examine underpricing using the following equation:

$$R_U = \alpha + \beta_1 Offer\ size + \beta_2 Tech + \beta_3 IPOs\ per\ year + e \quad (4)$$

where R_U is the actual underpricing return between the offer and opening prices, Offer size is the offer amount in billion dollars, Tech is a dummy variable that gets the value 1 if the company is classified as an technology firm and 0 otherwise (see appendix A for technology firm classification details), and IPOs per year is the number of IPOs listing in the original sample before exclusions.

The first-day returns occur accurately on specific days, and therefore they can be controlled with the daily Fama & French factors obtained directly from Kenneth French's

data archive. This thesis analyzes the first-day returns using both, the 3-factor model by Fama & French (1993) and the 5-factor model by Fama & French (2015). The inspection is set to focus on the first day due to the highest trading volumes and listing effect. Analyzing the aftermarket returns using only the one-day returns has previously been done by Ruud (1993) and Mok & Hui (1998). All the portfolio differences presented in the models are based on diversified portfolios. The 3-factor pricing model is defined as:

$$R_{i,t} - R_{F,t} = \alpha_i + \beta_1\left(R_{M,t} - R_{F,t}\right) + \beta_2 SMB_t + \beta_3 HML_t + e_t \quad (5)$$

where $R_{i,t}$ is the actual return at time t, $R_{F,t}$ is the risk-free rate at time t, $R_{M,t}$ is the market return of the Russell 3000 at time t, SMB is the return of a portfolio consisting of small shares minus the return of a portfolio consisting of big shares, HML is the return of a portfolio containing high book-to-market shares minus the return of a portfolio containing low book-to-market shares, and e is a zero-mean residual. (Fama et al. 1993.)

The studies by Novy-Marx (2013), and Titman, Wei and Xie (2004) show that the 3-factor model described in equation (5) lacks the ability to explain returns because it does not take the company-specific profitability and investment factors into account. This motivated Fama and French to develop a new 5-factor model shown in equation (6), by updating their 3-factor model with two additional factors considering earnings and investment activity. Even though the GRS test rejects the 5-factor model as a comprehensive asset pricing model, it is able to explain from 71% to 94% of the cross-section variance of expected returns for the factor portfolios. The 5-factor model is an upgrade to the widely-used 3-factor model, showing more explanatory power than its successor. The 5-factor model equation is presented as follows:

$$R_t - R_{F,t} = \alpha + \beta_1\left(R_{M,t} - R_{F,t}\right) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 RMW_t + \beta_5 CMA_t + e_t \quad (6)$$

where RMW is the difference between portfolios made up from companies having robust and weak profitability respectively, and CMA is the difference in returns of portfolios

constructed from conservatively and aggressively investing companies respectively. (Fama et al. 2015.)

4.2.2. Event-study for lockup expiration

An event-study is conducted to observe the effects of the expiration of the lockup period of IPOs. The length of the lockup period is individual for each IPO, but the duration used most often is 180 days. The expected returns are created using the single-factor OLS-regression equation (7) (market model equation) developed originally by Fama, Fisher, Jensen and Roll (1969),

(7) $$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \epsilon_{i,t}$$

where $R_{i,t}$ is the actual return of share i and $R_{m,t}$ the return of the market index over time t, α_i is the regression intercept, β_i is the regression coefficient for the market return, and $\varepsilon_{i,t}$ is the error term. Using the known returns of the shares and the market and the equation (7) above we get the expected returns of the market model. The abnormal returns are then calculated as

(8) $$AR_{i,t} = R_{i,t} - (\alpha_i + \beta_i R_{m,t})$$

where over time t $AR_{i,t}$ is the abnormal return of share i, $R_{i,t}$ is the actual return of asset i, and $(\alpha_i + \beta_i R_{m,t})$ is the expected return of the market model. The average abnormal returns for the testing period are calculated from the abnormal returns using the following formula

(9) $$AAR_t = \frac{1}{N} \sum_{i=1}^{N} AR_{i,t}$$

where N is the number of shares in the final sample (1315). Cumulative average abnormal returns (CAAR) are also calculated by aggregating the AARs of the event windows. Two event windows are selected for the event-study, using the 180th day after the listing as a

solid reference and stretching the event window 5 and 10 day prior and after. The used event windows are similar to those used by Brau (2004). The shorter event window includes days T= -5 to T= +5 where T= 0 is the 180th day after the listing. The longer event window stretches an additional 5 days into both ways including the days T= -10 to T= 10 when T= 0 is the 180th day after the listing. Thus, the shorter event window includes a total of 11 days and the longer event window includes a total of 21 days.

4.2.3. IPO portfolios

Two portfolios are created by simulating an equal investment in each of the listing IPOs in the aftermarket with holding periods of one year and 153 days. The portfolio models are constructed in order to examine the longer-term performance of IPO shares. The portfolio returns are then controlled with the Fama & French 3- and 5-factor models specified earlier in equations 5 and 6 to see if the portfolios are able to provide abnormal returns and to evaluate whether investing on IPOs merely on the secondary market proves to be a profitable investment strategy. The investments are made with the opening prices of the first trading day to exclude the restrictions and limits of share allocation in the IPOs. Even though Ibbotson et al. (1994) claim that proceeds-weighted IPO returns are significantly lower than equal-weighted IPO returns, the sample data only shows a small difference. The equally-weighted average underpricing is 18,93% while the proceeds-weighted average underpricing is 17,26% throughout the sample.

All the shares in the one-year portfolio are held for one year, after which they are excluded from the portfolio. The selling price of individual IPOs is the closing price on the 253th trading day . The minimum number of shares in the portfolio at any time is 1, and the most shares held in the portfolio simultaneously is 148 shares.

In addition to the one-year holding period, the holding period of 153 days is also calculated. This holding period is determined by the individual returns of the IPOs, that showed the highest raw return within a year of listing, occurring on average 108 trading days after the listing, as can be seen from figure 3. 108 trading days is transformed into

actual days, resulting in 153 days or about 5 months. Using 5-month holding periods for IPOs makes the number of IPOs in the portfolio range from 1 to 78.

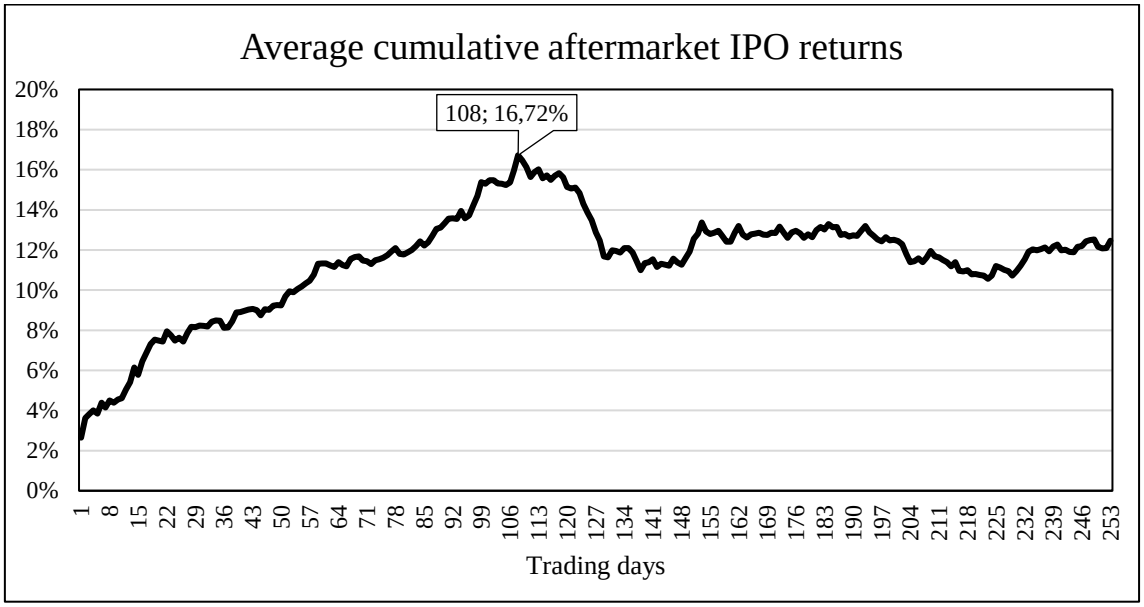

Figure 3. The cumulative equally-weighted average aftermarket returns of IPO shares on a one year-span using trading days. The returns are calculated from the opening price of the first trading day and the closing prices of each trading day during the 253 first trading days. The listing date is day 1 and the final observation is taken on trading day 253.

Figure 3 shows the cumulative equally-weighted average aftermarket returns of all IPOs in the sample using trading days. The prices are compared to the opening prices of listing days. As figure 3 shows, the highest peak in returns occurs already at 108 trading days (153 actual days from listing). There is a clear drop in average cumulative returns between 120 and 130 trading days, during which the cumulative average returns drop from 15,14% to 11,64%. The norm for the expiration of the lockup period is at 180 days, which transforms into 125 trading days. Figure 3 suggests that around the time of the lockup period, there is a clear drop in IPO prices on average. After the decline around the lockup period, the cumulative average returns remain on a fairly stable level around 12% until the end of the observation period.

The portfolio performance is also analyzed using the Sharpe-ratio in addition to the Fama & French factor model regressions. The Sharpe-ratio can be written as follows:

(10) $$Sharpe_{Pf} = \frac{R_{Pf} - Rf}{Std_{Pf}}$$

where R_{Pf} is the portfolio return, R_f is the risk-free rate, and Std_{Pf} is the standard deviation of the portfolio returns. (Sharpe 1994).

5. EMPIRICAL RESULTS

This chapter presents the empirical results obtained from the sample. Analysis will be conducted on IPO returns using different time periods ranging between one day and one year. The objects of analysis include IPO underpricing as the price difference between the offer price and opening price of the first trading day, and the aftermarket performance using daily closing prices. IPOs are analyzed using several different categorizations. IPOs are divided into groups using their listing years and their business sectors. These groups are then compared to analyze possible differences between years and industries. IPOs categorized as technology companies are inspected individually.

5.1. Underpricing and IPO Activity

Previous literature has reported IPO underpricing using both, equally-weighted and proceeds-weighted averages. The purpose of using proceeds-weighted averages has been to control greater underpricing of small IPOs. The allocations for smaller IPOs are limited and not all interested investors are able to participate in the IPOs with offer prices and their intended number of shares. Table 3 presents the raw average returns of IPOs per year. Equally-weighted averages are reported together with proceeds-weighted averages. The reported returns include the underpricing (difference between offer price and opening price), the first trading day aftermarket return, and the one-year aftermarket return.

As table 3 documents, there is great annual variation in the number of IPOs, the underpricing, and the aftermarket returns. The equally-weighted underpricing is 18,93 %, and the proceeds-weighted average 17,26 %. A similar difference is documented in the aftermarket with equally-weighted average returns being slightly greater than proceeds-weighted average returns. The average size of IPOs has increased during the sample, in 1998 the average proceeds raised by a single IPO were $ 53 million, which has increased to average offer sizes around $ 100 million during the most recent years.

The dot-com bubble of 1999–2000 can be quite clearly observed from the large underpricing during those years, the large one-year returns during 1998–1999, and the poor 1-year aftermarket returns in 2000 and 2001. The financial crisis has also had clear effect on the IPO markets. The number of IPOs is very small during the financially tough times of 2008 and 2009, and the one-year aftermarket performance is poor for several years starting in 2007.

Table 3. IPO average raw returns per listing year. Number of initial public offering listings per year are presented in the second column and the total dollar amount raised by the IPOs in billions U.S. dollars in the third column. Returns are presented separately for equally-weighted and proceeds-weighted averages. Returns presented include offer price to first-day open price return, one-day open price to close price aftermarket return, and the one-year aftermarket return including the first day.

			Equally-weighted averages			Proceeds-weighted averages		
Year	Number of IPOs	Proceeds (billion dollars)	Under-pricing	1-Day Return	1-Year Return	Under-pricing	1-Day Return	1-Year Return
1998	62	3,291	17,97 %	-1,45 %	42,82 %	14,99 %	-1,97 %	45,14 %
1999	99	6,532	40,95 %	7,38 %	59,96 %	44,66 %	8,15 %	68,75 %
2000	88	6,242	37,75 %	6,84 %	-31,78 %	52,98 %	3,78 %	-29,63 %
2001	19	1,416	3,07 %	3,30 %	-13,98 %	10,88 %	2,97 %	-24,94 %
2002	22	1,588	-13,97 %	4,13 %	11,64 %	-12,67 %	3,36 %	21,71 %
2003	24	2,231	0,50 %	3,50 %	7,98 %	3,35 %	2,41 %	25,96 %
2004	63	3,975	26,86 %	1,96 %	10,52 %	25,33 %	1,90 %	14,31 %
2005	60	4,726	17,03 %	1,97 %	20,92 %	15,84 %	1,60 %	38,69 %
2006	73	8,148	7,36 %	4,32 %	29,30 %	8,79 %	0,15 %	38,47 %
2007	74	9,553	16,22 %	2,14 %	-19,52 %	17,74 %	3,19 %	-11,82 %
2008	18	2,706	4,53 %	-1,76 %	-7,75 %	-3,74 %	4,10 %	-4,78 %
2009	28	4,733	4,21 %	1,40 %	3,68 %	12,18 %	2,53 %	1,51 %
2010	57	4,648	11,14 %	0,74 %	-4,09 %	4,47 %	3,73 %	11,21 %
2011	47	7,340	45,19 %	1,33 %	-13,03 %	30,95 %	0,58 %	-25,08 %
2012	44	19,797	8,82 %	2,11 %	45,81 %	10,72 %	-6,90 %	-18,30 %
2013	91	11,594	16,49 %	2,26 %	17,64 %	17,36 %	2,29 %	24,75 %
2014	148	15,018	18,54 %	0,53 %	14,82 %	13,73 %	0,60 %	27,51 %
2015	120	11,131	19,86 %	2,95 %	-22,27 %	20,32 %	0,27 %	-26,87 %
2016	74	6,859	16,68 %	2,96 %	22,82 %	14,47 %	1,43 %	13,51 %
2017	104	9,605	12,18 %	2,16 %	37,12 %	10,83 %	2,38 %	43,00 %
Total	**1315**	**141,130**	**18,93 %**	**2,65 %**	**12,47 %**	**17,26 %**	**0,79 %**	**9,33 %**

IPO activity seems to have clear cycles in activity as pointed out by Yung et al. (2008). To inspect these cycles, we take the number of annual IPOs from the original sample before the exclusion. The economic factor of national GDP growth in the United States is obtained in order to analyze the possible connection between the market-wide sentiment and the activity in IPO listings. Figure 4 illustrates the IPO activity and GDP growth in the USA during 1998–2017. Besides the visible comovement of these two variables, the connection is studied using an OLS-regression, where GDP growth in the USA is set as the independent variable and the number of IPOs is set as the dependent variable. The regression results show a statistically significant connection, as the coefficient of the GDP growth is positive with a t-value of 4,81.

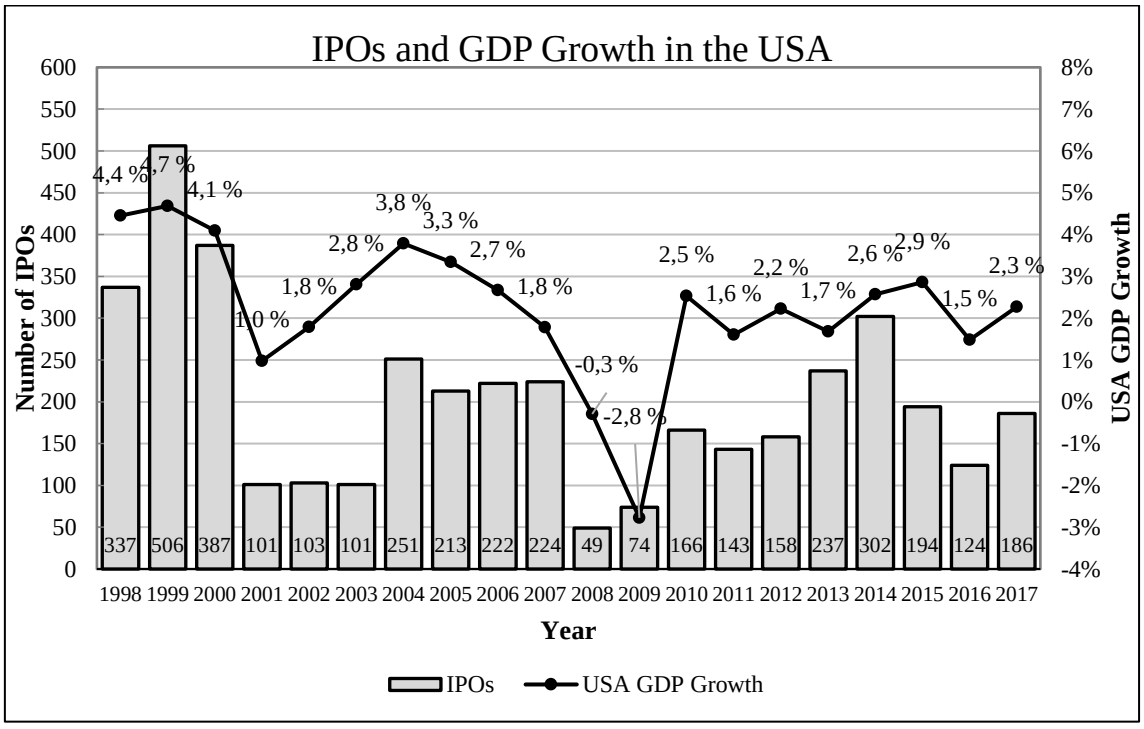

Figure 4. The annual number of IPOs from 1998 to 2017 in the original sample of this thesis and the annual growth of the gross-domestic product in the United States. The bars represent the number of IPOs and the black line describes the growth of the GDP in the USA.

The IPO underpricing, calculated as the price difference between the offer price and opening price, was 18,93% when calculated as equally-weighted and 17,26% when

calculated as proceeds-weighted. These results are in line with previous studies and statistics (e.g. Loughran & Ritter 2004). The underpricing is further studied using the OLS-regression defined in equation (4). The regression results are presented in table 4.

Table 4. IPO underpricing regression using equation (4). The underpricing of IPOs is measured as returns from the offer price to the opening price. Coefficients are bolded and t-statistics are presented in parentheses. Statistical significance is marked as ***, **, * representing statistical significance at the 1%, 5%, and 10% levels respectively.

Variable	Coefficient
Alpha (Underpricing)	**-0,006**
	(-0,14)
Offer size ($ billions)	**-0,003**
	(-0,08)
Technology company	**0,050***
	(1,72)
IPOs per year (thousands)	**0,565*****
	(3,67)

The model specified in equation 4 manages to explain the IPO underpricing, leaving a statistically insignificant alpha to the regression results. The offer size of the IPOs appears to have no significant effect on the level of underpricing. The technology company dummy variable has a positive coefficient, meaning technology companies experience higher underpricing on a 10% confidence level. In this model, IPO underpricing is mostly explained by the number of IPOs during the listing year. A positive connection which is statistically significant on a 1% confidence level is documented. This effect is referred to as hot IPO markets presented previously by Ljungqvist et al. (2006). Periods of high underpricing occur when investor sentiment is positive and public listing becomes more attractive to companies hoping to raise more money in an IPO. Listing companies are able to set a higher offer price in times of hot issue markets and still provide investors positive returns, making them happy with their investment.

5.2. IPO Aftermarket Returns

The first-day aftermarket returns provided an equally-weighted average return of 2,65% and a proceeds-weighted average of 0,79 %. The fact that the equally-weighted average return is over three times the proceeds-weighted average return, signals that large IPOs do not experience such a strong first-day aftermarket return as smaller IPOs. This could be due to the partial adjustment suggested first by Hanley (1993). Usually companies with larger offer amounts are larger overall and there is more available information on them because there are more analysts covering them. Larger IPOs also get larger media attention which works as advertisement. Smaller IPOs may not be on the radar of all investors immediately in the book building phase and investors might only notice them when the trading begins and acquire them on the aftermarket. While the average IPO first-day aftermarket return was +2,65%, the median was 0,00%. This suggests that the price increases of IPOs are of larger magnitude than the price decreases during the first day.

An interesting interconnection is found between underpricing, the first-day aftermarket returns, and the one-year aftermarket returns. A regression using the one-year returns as dependent variables and underpricing together with the one-day returns as independent variables gives results shown in table 5. The one-year aftermarket return is not completely explained by underpricing and the one-day return, having a positive coefficient of 0,13 significant on the 1% confidence level. IPO underpricing has a significant negative and the one-day returns a significant positive coefficient towards the one-year aftermarket returns. The one-day return is included in the one-year returns and the result is not surprising – initial aftermarket performance has an effect on the long-term aftermarket perform. However, the negative relation between underpricing and the one-year returns is more interesting. This could imply that companies with strong positive sentiment during their IPOs and high underpricing revert to their fundamental values during the year after listing, as market participants gain more information about the company. The same effect is possible also in the other direction, as the shares of companies with cold IPOs start to eventually approach the insider valuation of the management and the underwriter.

Table 5. The regression results of underpricing and first trading day returns on the one-year aftermarket returns. The one-year returns act as the dependent variable and underpricing together with the one-day aftermarket returns are the independent variables. Statistical significance is marked as ***, **, * representing statistical significance at the 1%, 5%, and 10% levels respectively.

Variable	Coefficient
Alpha (One-year aftermarket return)	**0,132***** (4,68)
Underpricing	**-0,138***** (-3,11)
One-day aftermarket return	**0,652*** (3,93)

The first-day returns of all the IPOs were controlled with the 3-factor and 5-factor models by Fama & French. The first trading dates were used to find the right variables occurring on the matching dates. The results of the regressions where the first-day aftermarket returns minus the daily risk-free rates are dependent variables and the factors of the 3- and 5-factor models are the independent variables can be seen from table 6.

Table 6. The first-day aftermarket returns of the IPOs controlled by the 3-factor and 5-factor models created by Fama & French. Coefficients are bolded and t-statistics are presented in parentheses. Statistical significance is marked as ***, **, * representing statistical significance at the 1%, 5%, and 10% levels respectively.

Variable	FF3	FF5
Alpha (1-day aftermarket return)	**0,025*** (5,65)	**0,026*** (5,69)
Rm-Rf	**0,883**** (1,83)	**0,732** (1,42)
SMB	**-0,906** (-0,91)	**-1,652*** (-1,70)
HML	**0,361** (0,44)	**0,449** (0,41)
RMW		**-2,180*** (-1,77)
CMA		**0,854** (0,57)

Table 6 presents the results of the OLS-regressions for the first-day returns using the Fama & French 3-factor and 5-factor models. Both models are unable to explain all the first-day returns, having positive and statistically significant alphas on a 1% confidence level. In the 3-factor model, the market premium of the day also has a positive connection to the IPO listing day return on a 5% confidence level. The SMB factor has a negative and the HML factor a positive loading on the first-day returns, however neither of them are statistically significant.

The 5-factor model provides rather similar results as the 3-factor model. The alpha is positive with a similar coefficient and statistical significance. The market premium coefficient is slightly smaller but has lost its statistical significance. The size and profitability factors, SMB and RMW, are both negative and statistically significant on a 10% level. The HML and CMA factors are positive, but nowhere near being statistically significant with p-values of over 0,5.

An event-study is conducted to observe the possible negative price reaction caused by the expiration of the lockup period documented by Brau (2004). The expected returns are calculated using the market-model defined in equation (7) and taking the average of all shares. The cumulated actual returns, expected returns, and abnormal returns are listed in table 7. As can be seen from table 7, for both event windows the cumulated actual returns were negative, and the expected returns were positive. The cumulated abnormal returns are both negative and statistically significant at the 0,01-confidence level.

Table 7. The cumulative average returns of the two event windows. Statistical significance of the cumulative average abnormal returns is marked as ***, **, * representing statistical significance at the 1%, 5%, and 10% levels respectively.

Event window	Actual return	Expected return	Abnormal return
[-5; +5]	-1,801 %	5,655 %	-7,456 % (5,27)***
[-10; +10]	-0,936 %	7,511 %	-8,447 % (3,21)***

Section 4.2.3. illustrated the creation of the portfolio model. The average one-year return for all 1315 IPOs included in the sample is 12,47% while the median is -5,41%. This implies that the majority of IPOs provide negative returns but then again, some IPOs provide extremely large profits when the investment period is one year. The average annual return of the one-year holding period portfolio is 2,91%. With a standard deviation of 28,82% the Sharpe-ratio equals a modest 0,039.

The portfolio is then set to hold each share for 153 days (108 trading days), a period that provided the highest raw returns on average for the individual shares. The average raw holding period return for the IPOs is now 16,72%. The median of the IPO returns has also risen to a positive 0,25%. The average annual return for the 153 holding period IPO portfolio during the whole sample period is 8,54%. The standard deviation for the shorter holding period portfolio is higher than for the one-year portfolio, 39,22%. The Sharpe-ratio results a value of 0,172, which is clearly higher than for the one-year portfolio, but still not on an excellent level.

The distributions for the returns of the IPOs is shown in figure 5. The number of IPOs in both portfolios is 1315. The figure shows how the alteration of the holding period has a strong effect on the return histograms. The number of IPOs providing positive returns is 610 (46,4%) for the one-year portfolio and 663 (50,4%) for the 153-day IPO portfolio. Another big difference is the number of IPOs providing a return of over 150%. When the holding period is shortened from one year to 153 days, the number of IPOs providing an annualized return of over 150% more than doubles from 60 to 145. Using raw returns, the number of IPOs returning a profit of over 150% during the first 153 days after listing is 51, only 9 less than when the holding period is extended to a full year.

These results imply that most IPOs experience the strongest returns already during the first six months after their listing. After the first half-year, the performance of IPOs gets worse on average. Only a few IPOs are able to further increase their aftermarket returns during the latter half of their listing year, while many IPO shares start to slip towards negative returns. The expiration of the lockup period and the termination of the

underwriter's price stabilization program stand out as the most credible factors for the poorer performance of the second half of the listing year for IPOs.

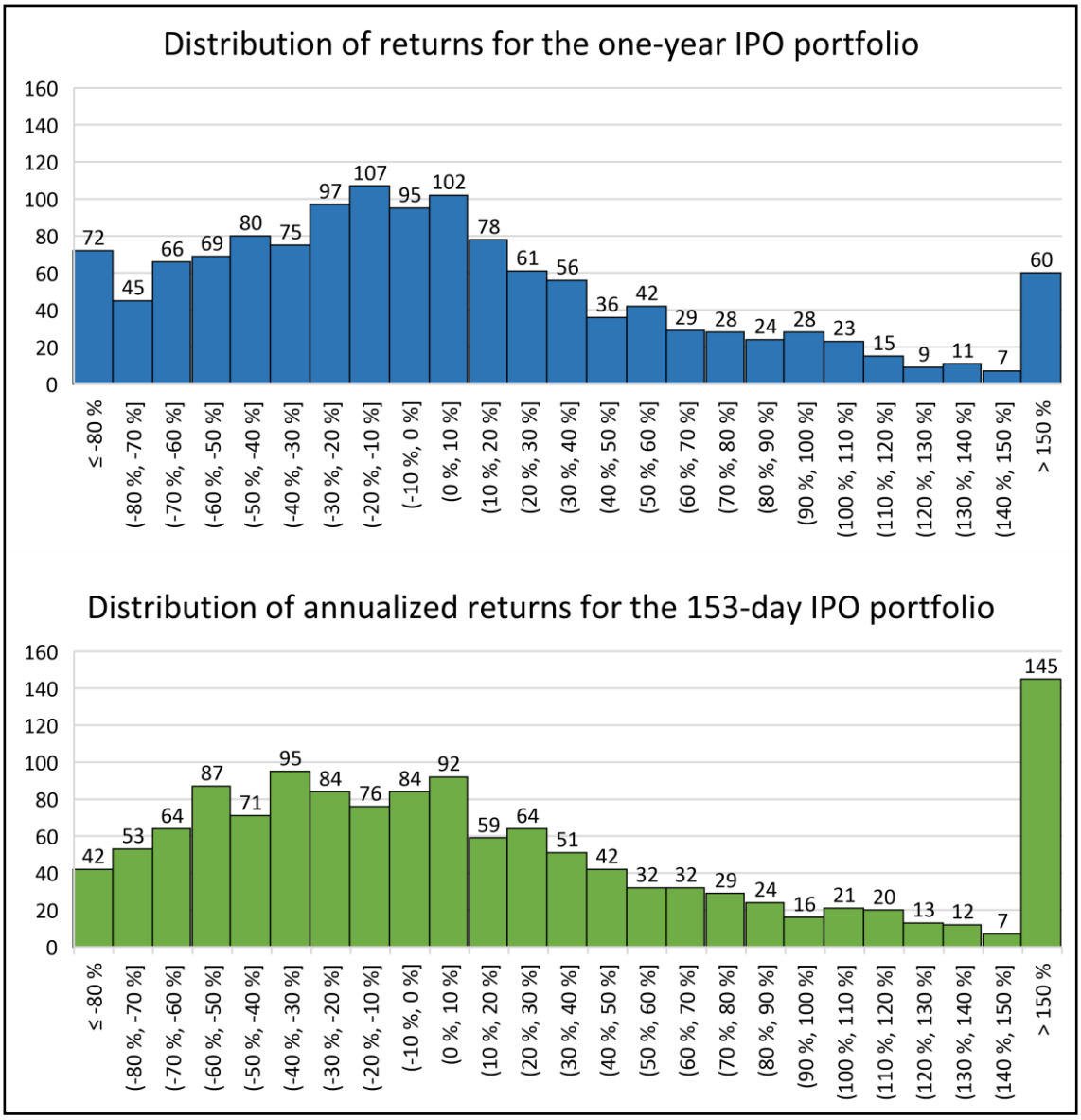

Figure 5. Histograms presenting the distribution of the individual IPOs in the portfolios. The number of IPOs is shown over the distribution bars. The returns in the 153-day portfolio are annualized.

The portfolio returns are controlled using the Fama & French 3-factor and 5-factor models. The daily returns of the portfolio and the factor loadings are regressed using OLS-

regressions specified in equations (5) and (6), using the portfolio returns as the dependent value. All the regressions provide similar results: the IPO portfolios have statistically insignificant alphas close to zero and the FF3 and FF5 models are able to explain all the returns of the IPO portfolios. Throughout both holding periods and factor models, the market return and the size factor (SMB) are positive and statistically significant, while the value (HML), profitability (RMW), and investment (CMA) factors are negative and statistically significant.

The results of the factor loadings are rational and in line with previous literature (see eg. Pagano et al. 1998; Cho 2001; Loughran et al. 2002), since typically companies go public when they are seeking additional financing and are looking to expand. The positive SMB- and market return factors imply IPO companies are on average small relative to the market but not safe from the systematic risk. The negative HML-factor implies IPO companies are growth companies with a low book-to-market ratio and more of the value consists of growth expectations than of the current business, relative to the market. Negative and unstable profitability (RMW) is normal for companies going through strong expansion and growth, like IPO companies. The negative investment factor means IPOs are aggressive, rather than conservative, investors. Lowry (2003) points out that 64% of the companies in his study conducted an IPO in order to raise money for further investments. When a growth company is expanding rapidly, investing aggressively, has high expectations and is looking for additional funds, it often chooses to go public, explaining the results of these FF-factor models.

5.3. Industry Analysis

The industries of the IPOs are separated into nine business sector categories based on the two first digits of their primary SIC-codes as in the study of Cartorelli and Strahan (2006: 443–446). The number, average underpricing (offer price to open price return), average first trading day aftermarket return, and the average 1-year aftermarket return of each IPO category is reported in table 8. The last row shows the averages for the whole sample.

Table 8. IPO returns sorted by company industries using SIC-codes. The columns show the number of issuing companies in each business sector, the average offer price to opening price return (underpricing), and the average one-day and one-year aftermarket returns of the industry groups.

Industry	Count	Average Underpricing	Average 1-day Return	Average 1-Year Return
Agriculture, Forestry and Fishing	3	91,24 %	-9,24 %	-23,19 %
Mining	21	5,01 %	0,71 %	-14,33 %
Construction	8	2,46 %	0,93 %	9,52 %
Manufacturing	466	18,66 %	3,14 %	6,75 %
Transportation, Communications, Electric, Gas and Sanitary services	60	10,83 %	-0,38 %	4,36 %
Wholesale Trade	10	-6,33 %	1,44 %	24,07 %
Retail Trade	69	22,25 %	0,23 %	16,09 %
Finance, Insurance and Real Estate	180	9,07 %	1,05 %	13,79 %
Services	470	24,79 %	3,36 %	20,66 %
Not available	28	6,29 %	8,80 %	-9,19 %
Total	**1315**	**18,83 %**	**2,65 %**	**12,47%**

Table 8 shows how the number of IPOs and the returns deviate strongly between the industry groups. The number of IPOs is the highest in the manufacturing and services groups, together amounting 71% of the total final sample. The Agriculture, Forestry and Fishing (AFF) industry group together with construction and wholesale trade are the least-represented industry groups, added together they amount under 2% of the IPOs in the final sample.

The average underpricing in the final sample is 18,83%, signaling that the underpricing anomaly is still alive and well. Underpricing is the largest among the three AFF IPOs, averaging a vast 91,24%, but the number of IPOs belonging to this industry group is only 3, and the massive average underpricing is constituted by a single IPO having an offer-to-open return of 333%. Retail Trade and Services are larger industry groups both averaging an underpricing percent of over 20%.

The average first trading day return among the whole sample is 2,65%, which is a hefty return when taking into account it only includes the returns of a single day. The largest issuing day return, 8,80%, is in the group that had no SIC-codes available in the data. The

first trading day returns are larger than average in the two most numerous industry groups, Manufacturing and Services with first-day returns of 3,14% and 3,36% respectively.

Counting the underpricing and one-year returns together amounts the total one-year returns per industry group for investors participating in the IPOs. Taking the underpricing into account, the total one-year average price increase for all IPOs is 33,65%. Excluding the AFF group due to their small number, the largest total returns are provided by the Services (50,57%) and Retail Trade (41,92%) industry groups.

Technology companies are then inspected individually using a classification by Loughran and Ritter (2004: 35) and developed further by Saade (2015). The SIC-codes classified as technology companies are listed in appendix 1. Figure 6 shows a more precise classification of industries among the technology companies. The industries with most IPOs within the technology companies are Pharmaceutical and Biotechnical Companies (185), Software (188), and Commercial Physical and Biological Research (151). Together they make up three quarters of the technology company IPOs.

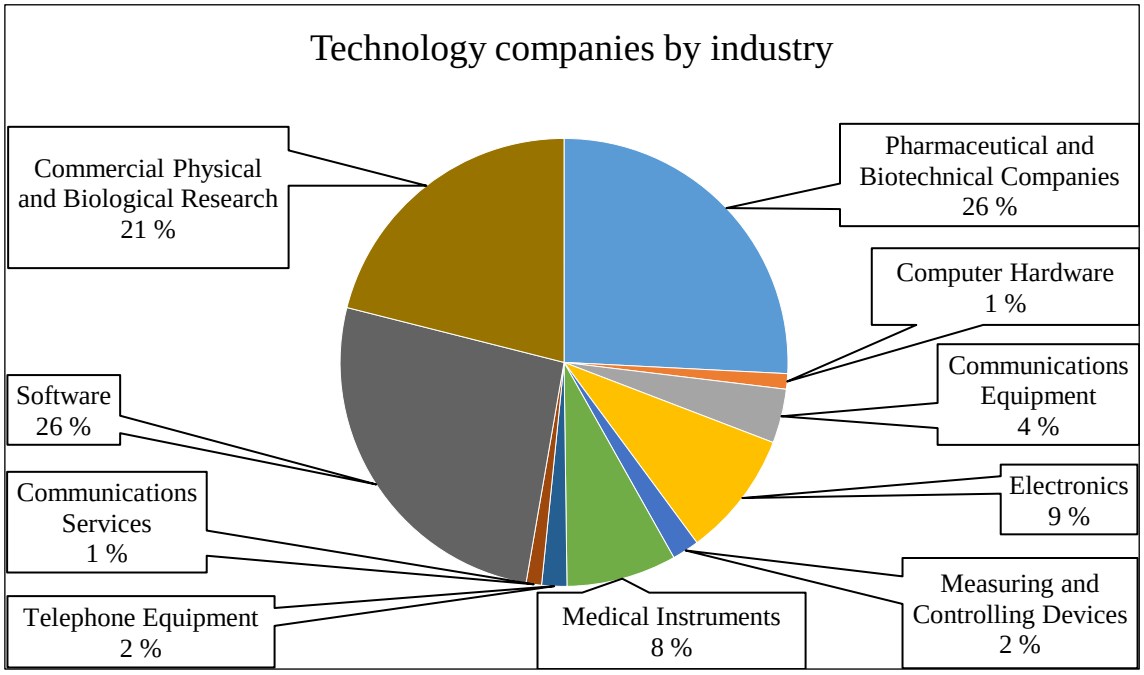

Figure 6. The industries of the companies classified as technology IPOs and their relative shares out of all the technology companies.

The corresponding return figures to table 8 are presented for technology companies in table 9 below. All technology companies are included on the first row, and technology companies during the tech-bubble years of 1999–2000 are presented separately on the second row.

Table 9. IPO returns for technology companies. The columns show the number of issuing technology companies, the average offer price to opening price return (underpricing), and the average one-day and one-year aftermarket returns. Results are shown separately for all technology companies and technology companies listed during the tech-bubble years of 1999–2000.

Industry	Count	Average Underpricing	Average 1-day Return	Average 1-Year Return
Technology companies	717	22,74 %	2,75 %	15,71 %
Tech bubble 1999–2000	111	46,79 %	8,85 %	35,00 %

As table 9 shows, the share of technology companies makes up over 50% of the whole sample of IPOs, including 717 IPOs out of 1315 total IPOs in the sample. The number of technology companies listed during the two tech bubble years is relatively high, amounting 8,4% of the whole sample of IPOs. Underpricing and aftermarket returns of the technology companies are all higher than the averages of the whole sample. During the tech-bubble, underpricing and listing day returns were on an extremely high level. On the other hand, the longer-term one-year returns were significantly lower than for all technology companies. The average one-year return for technology IPOs throughout the sample period was 15,71%, only slightly larger than the average and smaller than the one-year returns for wholesale trade and services. Based on these results, technology IPOs seem to excel the non-technology IPOs in returns for both short-term and long-term periods.

6. CONCLUSIONS

The short-term anomalies associated with IPOs, including underpricing and hot issue markets, have been studied widely since the 1970's. Most of the prominent theories explaining the anomalies have been introduced decades ago, but researchers still have very different opinions of them. Most of the theories explaining the anomalies are not mutually exclusive, making it difficult to distinguish which factors have effect on short-term IPO returns, and by what extent.

The underpricing of IPOs has not disappeared despite the large volume of IPO underpricing anomaly literature by researchers during the past decades. The average equally-weighted average return between the offer price and opening price was 18,93% for companies going public between 1998 and 2017. The proceeds-weighted average underpricing was only slightly smaller, 17,26%, proving that issuing companies still leave money on the table. These levels of underpricing are similar to those documented by Ritter (2019).

The aftermarket returns of IPOs are also providing positive returns. The average issuing day aftermarket return between the opening and closing prices is 2,65% using equally-weighted averages and 0,79% using proceeds-weighted averages. The 1-day aftermarket return of IPOs are mostly explained by the IPO market sentiment. During the years when more companies go public, the 1-day aftermarket return is higher. Seeing positive aftermarket returns makes investors keener to invest on IPOs and company management more prone to take their firms to the public stock exchanges without a fear of IPO failure, resulting in hot issue markets. Technology companies experience a higher 1-day aftermarket profit on a 10% confidence level. Technology companies going public usually gain more media attention and expectations of high growth than companies on traditional and more stable business sectors (Saade 2015).

The longer-term aftermarket performance of IPO shares also provides positive returns on average. The equally-weighted one-year average return of IPOs on the aftermarket was 12,47% and the proceeds-weighted average was 9,33%. Underpricing correlates

negatively with long-term aftermarket returns. This phenomenon could be explained by the sentiment effect during the listing of IPOs and the reversal towards fundamental prices. The aftermarket return of the first trading day can be a good signal on the longer-term aftermarket performance as well.

The holding period within a year of the IPO providing the highest average raw returns is 153 days (16,72%). The majority of IPOs experience the largest part of their aftermarket price increases before the start of the lockup expiration. With the holding period set to 153 days, there are more IPOs with positive than negative aftermarket returns with the median return being +0,25%. When the holding period is extended to one year, the number of IPOs with negative aftermarket returns is greater than half of the sample and the median return has dropped to -5,41% .

There is positive correlation found between the volume and the initial returns of IPOs, linking the underpricing and hot issue market anomalies together. Strong underpricing usually happens simultaneously with high IPO volumes. The economic situation is also linked to IPO activity, as national GDP growth affects the IPO volume positively in the United States. The most credible theories explaining the anomalies include adverse selection of companies going public (Ritter 1991), the winner's curse (Rock 1986), the information revelation theory (Benveniste et al. 1989), and the investor sentiment theory (Ljungqvist et al. 2006). According to these studies, the amount of accurate and certain information available about the company reduces underpricing. Information symmetry among investors, and between the investors and the issuer also decrease underpricing.

Most IPOs include a lockup period, during which company insiders and early investors and owners are restricted from selling their shares. The practice is implied to protect investors from being victim to most severe cash-out attempts and to give time for investors and analysts to reduce information asymmetry. The expiration of the lockup period, usually occurring 180 days after the listing, has a negative effect on the share price. There are negative abnormal returns during the event window of the standard lockup period expiration of 180 days. Due to the entry of new large sellers who were

formerly restricted to sell their shares, the supply of the share increases on the market applying downwards pressure on the share price.

IPO returns are fairly time- and market-sensitive. During times of optimistic market sentiment, IPOs are issued in larger numbers and their returns before and after trading starts are greater. During years of economic hardships, the IPO activity drops clearly. Investors may seek safer investment opportunities than the high-risk IPO market in a bear market.

The optimal holding period for IPOs seems to be somewhere between 1-170 days. The greatest raw returns occur pre-market between the offer-and opening prices and during the first two days after listing. A distinct decline in IPO returns is experienced around the standard expiration of the lockup period of 180 days. The average aftermarket returns increase to levels of over 16% about 5 months after issuing, before dropping to around 11% during the lockup-expiration window. After the lockup expiration period decline, the IPO returns remain fairly stable for the following six months. Flipping appears like a profitable investment style but in longer-term the share allocations received by constantly flipping investors may drop.

The daily portfolio returns of the one-year and 153-day portfolios are controlled with the Fama & French 3- and 5-factor models. The models are able to explain the daily returns with significant factor coefficients and statistically insignificant alphas close to 0 on both portfolios regardless of the holding period.

Business sector analysis shows some industries have clearly better IPO performance than others. Retail trade and services provide the best overall IPO returns in the sample of this thesis. Wholesale trade IPOs have the best returns on the aftermarket, but they experience overpricing in the issuing stage. Technology companies are studied individually, and they provide superior IPO returns particularly in the aftermarket compared to the individual business sectors.

6.1. Limitations

The study focuses on the IPO returns of merely two stock exchanges in a single country during a limited time period, and therefore the results cannot be generalizable universally through time. However, due to the international nature of these major stock exchanges, and investors' possible entry to foreign markets, this should not be seen as a major problem. The legislation concerning IPOs may have large differences between countries and should always be analyzed individually with every country.

This study does not take taxes or transaction costs into account when calculating returns. The role of taxes and transaction costs may be decisive when calculating the smaller aftermarket returns and forming the IPO portfolio models, although a paper by Frazzini, Israel and Moskowitz (2018) suggests that trading costs are not as high as previous literature suggests (e.g. Novy-Marx & Velikov 2017). Dividends are also excluded from the scope of this thesis.

The requirements for IPOs to be included in the final sample of this thesis contain the requirement of a full year of price data. The long-term investment period is also a year, and so any companies possibly going bankrupt within a year from their listing are excluded from the sample. This applies also to companies that were acquired by private investors and taken off the public stock markets within a year from their listing. The above-mentioned cases are somewhat rare and at least partially offsetting due to the exclusion of negative returns in the case of bankruptcy and excluded positive returns of a private acquisition premium.

6.2. Further Topics of Investigation

The literature regarding IPOs is already extensive, but there are always new possible aspects to be studied. The anomalies around IPOs have been under active research, but better understanding can still be achieved through further studies with more precise focus on a certain subject. The world is changing with ever-accelerating speed, and the business

circumstances with it. The new characteristics of business and even totally new industries emerging bring their own challenge to established institutions like the stock market. Quick learning and understanding are required in order to understand the value and growth opportunities of companies operating on new industries, for example wireless connectivity together with virtual and augmented reality and biotechnology and their ways of building on previous technological breakthroughs.

This thesis focuses on IPO performance of new issues on the major stock exchanges in the United States from the beginning of the issuing process up to a year in the aftermarket. Further investigation of smaller exchanges outside the United States could provide advice for international investors around the world. Country- or continent-specific analyses could provide evidence for regional differences in the IPO markets. The rise of IPO activity and the changing regulations and government intervention on the Chinese stock markets (Shanghai, Shenzhen and Hong Kong) will present new interesting aspects of inspection in the field of IPOs (Rumokoy, Neupane, Chung & Vithanage 2017).

A more-detailed investigation of the optimal holding period and business sectors could provide accurate advice for large investors actively participating in IPOs. The size, age and pre-IPO financial performance of the listing company together with venture capital participation, underwriter reputation and underwriter syndicate size are some factors previously included in IPO studies but not included in the empirical part of this thesis.

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APPENDIX 1

Companies with the following SIC-codes are defined as technology companies in the thesis. The tech-industry classification is done in style of Loughran & Ritter (2004) and Saade (2015).

2833, 2834, 2835, 2836 Pharmaceutical and Biotechnical Companies
3571, 3572, 3575, 3577, 3578 Computer Hardware
3661, 3663, 3669 Communications Equipment
3671, 3672, 3674 ,3675, 3677, 3678, 3679 Electronics
3823, 3825, 3826, 3827, 3829 Measuring and Controlling Devices
3841, 3845 Medical Instruments
4812, 4813 Telephone Equipment
4899 Communications Services
7371, 7372, 7373, 7374, 7375, 7378, 7379 Software
8731 Commercial Physical and Biological Research