

First-day overperformance of IPOs

An empirical research of U.S. IPOs between 2001 and 2014

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Abstract

In this research, I test the relationship between first-day overperformance and underpricing of U.S. IPOs between 2001 and 2014. Moreover, I review the role of underwriters in the process of share allocation and underpricing. Through a literature overview and empirical testing, I found significant first-day overperformance for the sample period. Moreover, by showing greater underpricing and higher total proceeds when final offer price exceeds the original file price range, I found evidence that supports the theory of bookbuilding. However, I did not find evidence that indicates a positive relation between underpricing and number of shares offered. Further, I found evidence that suggests that offer prices are not fully adjusted according to publicly available information, which indicates motives for underwriters, investors and pre-issue shareholders.

This thesis is part of the master's program 'Economics and Business: Financial Economics' at the Erasmus University Rotterdam.

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Keywords:

Initial public offering, underpricing, first-day overperformance, share allocation, bookbuilding theory, partial adjustment phenomenon

1. Introduction

Since the 1980s, the number of Initial Public Offerings (IPOs) in the United States has been growing by one every business day. With the exception of some years, the number of firms going public has grown steadily every year. Further, recent literature shows significantly high first-day overperformance of IPOs. The average first-day stock returns of these companies was 18.8 percent higher than the price at which the issuer sold them (Ritter & Welch, 2002).

In this research, I will examine the role of underwriters in the IPO process. More specifically, I will review the relationship between first-day overperformance and underpricing of IPOs. By using the research of Ritter and Welch (2002) as benchmark paper, I will build a literature overview of the process of share allocation and underpricing done by underwriters. In line with many predecessors, I will concentrate on the underlying motives of underwriters for their role in offer price adjustments.

Next to a literature overview, I will use additional papers to empirically test IPO underpricing and various motives of underwriters, issuers, investors and pre-issue shareholders for a period between 2001 and 2014. I will use the researches of Loughran & Ritter (2002) and Hanley (1993) as benchmark papers for empirical testing. I will test if underpricing is caused solely by mispricing or if there is evidence that suggests that underwriters deliberately leave money on the table. Moreover, I will use regression analysis to test the relation between underpricing and the number of shares issued. Furthermore, I will test for evidence of the bookbuilding theory and the partial adjustment phenomenon, as documented by Hanley (1993). My overall research question will be:

First-day overperformance of IPOs is caused by the role of underwriters in share underpricing and allocation to investors.

To help answering the research question stated above, I have formulated the following three hypotheses:

H1: First-day overperformance of IPOs is caused by deliberate underpricing instead of solely mispricing and risk premia.

H2: Similar to the bookbuilding theory:

2A: There is greater underpricing when final offer price exceeds the original file price range.

2B: An increase in the number of shares offered will result in greater underpricing.

H3: Similar to the partial adjustment phenomenon, underwriters do not fully adjust the offer price with respect to public information prior to the offering.

To test these hypotheses, I will construct a methodology similar to those used in recent papers. For the first hypotheses, I will use the paper by Loughran and Ritter (2002). For the second hypothesis, I will use the paper by Hanley (1993). For the third hypothesis, I will combine the papers by Loughran and Ritter (2002) and Hanley (1993). To make a contribution to this field of research, I will combine the datasets used in both papers, but for a period between 2001 and 2014.

By constructing a literature overview and performing empirical tests, I aim to provide new information and insights in the field of first-day overperformance of IPOs. Moreover, I aim to reveal the position of power that underwriters have created and display the role of underwriters in share underpricing and allocation in IPOs. Furthermore, I aim to indicate various underpricing motives for underwriters, issuers, investors, and pre-issue shareholders.

This paper is structured as follows. In chapter 2, I will build an overview that discusses recent literature and provides a solid theory about IPO underpricing, share allocation, and motives for underwriters to leave money on the table. In chapter 3, I will describe the hypotheses chosen to test the main problem statement, and discuss the methodology used to test each hypothesis. In chapter 4, I will define descriptive statistics and data used to test the hypotheses. In chapter 5, I will discuss the empirical results and implications of the model. In chapter 6, I will provide conclusions, limitations, and further implications of the research.

2. Literature overview

The purpose of this overview is to give insight in recent literature on IPO underpricing, share allocation, and the involvement of underwriters in the process. I will combine and structure the perspectives of relevant papers so that the subject and relevance of testing becomes evident. This overview is structured as follows. Firstly, I will focus on IPOs in general. Moreover, I will elaborate on the decision whether to go public and post-IPO ownership structure, and introduce the phenomenon of first-day overperformance. Secondly, I will introduce several theories on IPO underpricing. I will focus on asymmetric information, in which either the issuer or investors knows more, and symmetric information. Thirdly, the effect of share allocation will be discussed. I will focus on discrimination as a method to induce information revelation, reasons for issuers to choose between institutional and individual investors, and the importance of ownership structure. Moreover, I will discuss the agency problems of share allocation. Lastly, I will focus on the motives of underwriters for both IPO underpricing and share allocation. I will discuss the underwriter's position of power, encouragement of ongoing business relations, and evidence of share allocation done by underwriters in the past. Table I shows a summary of all reviewed literature and its contribution.

Table I

Reviewed literature and its contribution concerning the literature overview

Initial public offerings	
Brealey, Myers & Allen (2010)	General information on initial public offerings
Berk & DeMarzo (2007)	General information on initial public offerings
Zingales (1995)	Decision of going public is trade-off between cash flow and control rights
Chemmanur & Fulghieri (1999)	Three crucial differences between public and private ownership
Brau, Francis & Kohers (2003)	Four reasons for a business to prefer a takeover to an IPO
Ritter & Welch (2002)	Going public is trade-off between the company's life cycle and market timing
Lucas & McDonald (1990)	Market timing is about overestimation market performance and industry shocks
Mello & Parsons (1998)	Staged process of financing to optimise post-IPO ownership structure
Field & Sheehan (2004)	No significant relation between IPO underpricing and ownership structure
Lowry (2003)	First-day overperformance is due to deliberate underpricing of the offer price
Ibbotson (1975)	Empirical evidence for a systematic higher closing price than offer price
Reilly (1973)	Stocks show remarkable short-run increases after an IPO
Logue (1973)	Factor to influence investment banks in their pricing decisions
Stoll & Curley (1970)	Research on the relation between small business IPOs and underpricing
Chambers & Dimson (2009)	Empirical evidence for increasing IPO underpricing over the past
IPO underpricing	
Welch (1989)	High-value firms underprice their IPOs to signal their quality
Allen & Faulhaber (1989)	Issuers know more about their future value than anyone else
Grinblatt & Hwang (1989)	Number of retained shares and level of underpricing are positively related
Loughran & Ritter (2001)	Two reasons why issuers have become more open towards underpricing
Chemmanur (1993)	Firms seek for underwriters that are notorious for their underpricing
Michaely & Shaw (1994)	Firms that underprice more, engage in re-issues less frequently
Rock (1986)	Underpricing is consisted with the winner's curse theory

Welch (1992)	Underpricing is due to the fear for an informational cascade
Benveniste & Spindt (1989)	The bookbuilding theory that argues investors know more than the issuer
Benveniste & Wilhelm (1990)	Underwriters use both price and allocation discrimination among investors
Hanley (1993)	The partial adjustment phenomenon argues that the offer price is not fully adjusted to publicly available information
Baron (1982)	Underwriters are likely to withhold information from issuer and investors
Schenone (2004)	Less underpricing if the issuer has a pre-IPO relationship with underwriter
Muscarella & Vetsuypens (1989)	Monitoring by the underwriter has no significant influence on underpricing
Habib & Ljungqvist (2001)	Excessive underpricing as compensation for expensive road shows
Barry (1989)	Underpricing equals the wealth transfer from old shareholders to investors
Loughran et al. (1994)	Empirical evidence for the existence of underpricing in 25 countries
Loughran & Ritter (2001)	Money on the table is equal to numbers of shares sold times first-day return
Schultz & Zaman (1994)	Aftermarket transactions indicate deliberate underpricing
Ellul & Pagano (2006)	Aftermarket liquidity is the main determinant for underpricing
Ibbotson (1975)	IPO entails an additional portion of systematic risk
Tinic (1988)	Empirical evidence for underpricing being the additional risk of an IPO
Hughes & Taylor (1992)	Underwriters underprice to maximise their personal interests
Lowry & Shu (2002)	Underpricing is done to cover litigation risks and a potentially failed IPO
Boehmer & Fishe (2001)	Underwriters deliberately underprice to earn fees from aftermarket trading
Booth & Chua (1996)	The incentive to underprice is created by the issuer
Ritter & Welch (2002)	Underpricing can be related to overoptimism during bubbles
IPO share allocation	
Benveniste et al. (1996)	Underwriter's regular clients are favoured through share allocation
Sherman (2000)	Underwriters use share allocation to build long-term relationships
Sherman & Titman (2002)	Investors' costs of information acquisition is fully covered by underpricing
Hanley & Wilhelm (1995)	Institutions are preferred for the information revelation and participation in less attractive IPOs
Neupane & Poshakwale (2012)	Empirical evidence in favour of participation of small investors in IPOs
Aggarwal et al. (2002)	More institutions result in higher first-day returns, consistent with bookbuilding theory
Cornelli & Goldreich (2001)	Underwriters allocate more shares to investors that reveal more information
Stoughton & Zechner (1998)	Blockholders (often institutions) are necessary to monitor the business
Mello & Parsons (1998)	The issuer should do a private placement before offering to the public
Brennan & Franks (1997)	Small investors are valuable in terms of owner share retention
Booth & Chua (1996)	Small investors create more aftermarket trading than institutions
Reuter (2006)	Business relationships with the underwriter result in more share allocation
Benveniste & Spindt (1989)	Underwriters have the ability but not the tendency to decrease underpricing when more information is extracted
Loughran & Ritter (2002)	The unfairness process of shifting profits from the issuer to investors
Loughran & Ritter (2001)	Issuer's executives play a major role in the acceptance of underpricing
Siconolfi (1997)	Executives accept more underpricing in case of a personal wealth gain
Lowry & Murphy (2007)	In one-third of U.S. IPOs, executive received underpriced stock options
The motives for underwriters	
Ritter & Welch (2002)	The agency problem between the issuer and underwriters
Loughran & Ritter (2002)	Reasons for the underwriter to deliberately leave money on the table
Beatty & Ritter (1986)	IPO underpricing is due to enforcement of the underwriter
Pulliam & Smith (2001)	Underwriters use their ability to allocate shares in favour of investors
Siconolfi (1997)	Spinning favour executives as they receive part of the new issue
Nimalendran et al. (2004)	There is a relation between IPO allocation and compensation by investors
Carter & Manaster (1990)	Research on the relation between underwriter reputation and investors
Reuter (2006)	Empirical evidence for the effect of money being left on the table and aftermarket trading volume
Fang (2005)	Research on the relation between investment bank reputation and underwriting
Tucker & Bierne (2004)	Evidence of the unfairness of a Goldman Sachs underwritten IPO
Corwin & Schultz (2005)	Underwriters do not fully adjust their price in response to information
Ljungqvist (2007)	The agency problem between underwriters and issuer is due underwriters favouring the interests of their regular clients

2.1 Initial public offerings

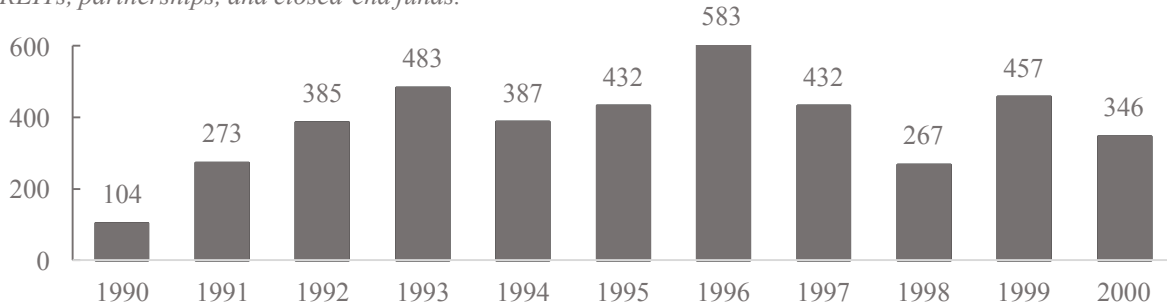
An initial public offering is the first time a company offers shares to the public. Berk & DeMarzo (2007) categorise IPOs in several different offerings. In primary offerings, new shares are issued to the public. In secondary offerings, pre-issue shareholders sell a part of existing shares to the public. Moreover, they also distinguish between three different procedures of selling. First, best-efforts IPOs are offerings where the underwriter agrees to sell shares for the best price possible. The underwriter does not guarantee that all stock will be sold. Mostly, these IPOs have an all-or-nothing agreement, in which either all shares or no shares are sold. Second, firm commitment IPOs are offerings where an underwriter agrees and guarantees to sell all offered stock at the offer price. If not all shares are sold, the underwriter has to sell the shares at a lower price and take the loss. Third, auction IPOs are offerings where the offer price is determined by bids of investors. Demand as well as offer price are gauged by underwriters.

Going public has various advantages for companies. Brealey, Myers and Allen (1980) describe several of these advantages in their work. First, going public is an opportunity to raise new capital, and is sometimes used when the company does not want to take on more debt. Moreover, going public improves the company's access to capital, as the public market for capital is larger than the private market. Figure 1 shows the number of U.S. IPOs for a period between 1990 and 2000. It becomes evident that the number of IPOs increase in times of an economic upswing, as companies and investors are confident about the market in general. Second, it offers the opportunity for current shareholders to cash out or exit completely. This also increases liquidity as these investors have the possibility to diversify (Berk & DeMarzo, 2007). Third, the company's stock price is a good indicator of performance. This is advantageous for investors as they can signal if the company is a good investment, and advantageous for the managers of the company as they can be rewarded according to stock performance. Fourth, as the company's information is public and widely available, it can reduce its borrowing costs and diversify its sources of finance (Brealey, Myers & Allen, 1980).

Figure 1

Number of U.S. IPOs for a period between 1990 and 2000

The data was retrieved from Securities Data Company. The sample includes all U.S. IPOs between 1990 and 2000. The sample excludes all companies with an offer price below \$5, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds.



Source: Ritter & Welch (2002)

As there are not only advantages to engage in an IPO, not all companies choose to go public. Berk & DeMarzo (2007) present several disadvantages to going public. First, going public results in a lack of ownership as initial investors will diversify their holdings. Therefore, there will be less monitoring and investors will discount the price they are willing to pay because of a loss of control. Second, a company is attached to many additional legal concerns when going public. Greater accountability and more regulations were designed to improve protection for investors, but are in general time-consuming and costly for companies that have gone public. However, it is not said that, once public, a company never returns to being privately owned (Brealey, Myers and Allen, 1980). The decision whether to go public will be discussed more thoroughly in 2.1.1.

Brealey, Myers and Allen (1980) and Berk and DeMarzo (2007) describe the process of going public step-by-step. First, the issuing company must hire banks, or underwriters, to assist and advice in the process of the offering. Many companies hire several underwriters to assist in conducting an IPO. Often, there are one or two lead underwriters that are in charge of the IPO, and several additional underwriters that are requested to sell a part of the offered shares. Lead underwriters provide most of the advice. The additional underwriters form a group known as the syndicate. Second, together with the underwriters and law firms, the issuing company has to produce a registration statement, or SEC filing. This statement is a legal document containing financial and other company information for investors. This is presented prior to an IPO, so that underwriters have company information and investors know what they are buying. The SEC reviews the statement to ensure that the issuing company has disclosed all necessary

information for investors. After the SEC's approval, underwriters can offer the shares to the general public. Third, the issuing company and cooperating underwriters will produce a valuation by estimating future cash flows, calculating present value, or using multiples of comparable companies and recent transactions. Using the valuation, a price range for the offer price is set. The midpoint of the original file price range is expected or 'bona fide estimate' offer price (Hanley, 1993). The company's (financial) information and initial offer price range are combined in a prospectus. This prospectus is used by the company's management and underwriters during a roadshow to gauge and enhance investors' demand. As more and more investors are asked for their interest, total demand and the final offer price become more apparent. The process of constructing the final offer price and total investor demand is called bookbuilding (Brealey, Myers & Allen, 1980). Fourth, the deal is priced and possible risks are taken into account. The issuing company agrees to pay a fee to the underwriters for selling shares to investors. An underwriter is exposed to the risk of not selling all shares, and therefore is stuck with unsold shares or it has to sell shares at a lower price than the offer price, thereby suffering a loss.

To protect themselves, after setting the offer price, underwriters appear to use the greenshoe provision that allows underwriters to issue more stock at the offer price. Underwriters tend to short the greenshoe option. The short position is covered when all shares are sold (including greenshoe shares) and pays when share price decreases due to an unsuccessful IPO. A different measure for both underwriters and the issuer to mitigate risks is the lockup mechanism. This service enables investors that bought shares via the IPO to easily trade their shares, as pre-issue shareholders are not allowed to sell shares during the lockup period. This way, underwriters can benefit from aftermarket trading fees from their investors, and the issuer is assured that pre-issue shareholders do not sell their shares which decreases share price (Berk & DeMarzo, 2007). However, underwriters also appear to use intentional underpricing of the offer price to protect themselves against a failed IPO. In this paper, firm i 's underpricing is defined in the following formula (1):

$$Underpricing_i = \frac{(FDC_i - OP_i)}{OP_i} * 100\% \quad (1)$$

where FDC is the first-day closing price, OP is the final offer price, and underpricing is calculated in percentages. Brealey, Myers and Allen (1980) claim that the costs of underpricing

generally exceed all other costs of an IPO. However, there might also be several advantages to underpricing an IPO, which will be discussed in 2.1.3 and 2.2.

In general, there are various aspects to take into consideration before an IPO can be initiated. The next paragraph answers several main questions regarding the decision of engaging in an IPO, such as ‘why should a company go public?’, ‘why do management and company owners consider an IPO for their business?’, and ‘how can a company go public?’. In general, IPOs have been the centre of attention in recent literature. By reviewing various papers and answering the questions stated above, I will construct the first building stone of this overview.

2.1.1 The decision whether to go public

Why does a firm decide to go public instead of seeking for other forms of financing, such as debt financing or private equity? If the owners are inclined to raise funds, why do they choose for a public offering instead of other forms of financing, such as a bank loan or private equity? In general, going public is more than growing a business and allowing outside investors to profit as well. For example, an initial owner profits from selling a part of his stake in the company. In his paper, Zingales (1995) demonstrates a trade-off for the owner. On the one hand, by selling a stake to numerous small investors, the owner is more inclined to sell his cash flow rights. On the other hand, by selling a stake to one investor, the owner is more inclined to sell a part of his voting rights. Further, instead of going public, a company can seek for private financing or conduct a takeover (Brau, Francis & Kohers, 2003). Moreover, the decision between a public offering or a takeover depends on various aspects, including industry-specific factors, market timing of the IPO, deal- and firm-specific aspects, and the height of demand for IPO shares. Most important, without demand for the shares of a company, a public offering will turn into a failure. Investment banks, also known as underwriters, are assigned to sell a part of the shares as they have connections with investors. They assure the issuing company, the company engaging in the IPO, of selling a predetermined part of the shares, which reduces the issuer’s uncertainty about demand. Next, the issuing company can focus on the type of investors (Ritter & Welch, 2002).

To clarify the trade-off between going public or seeking private financing, Chemmanur and Fulghieri (1999) examine three crucial differences between public and private firms. Firstly, they argue that a more dispersed ownership of the company results in increased diversification

between shareholders. Besides, a blockholder, such as a venture capitalist, has much more bargaining power than a large group of investors. This will result in the venture capitalist demanding a higher return on investment. By going public, the firm's management can regain power, either by offering them to small investors or acquiring shares themselves. This can be an advantage of going public. Secondly, when shares are offered to public investors, the firm must accept that it has to convince a larger number of investors for agreeing on future investments. The investors profit from upward potential, but suffer from all downward losses as well. Thirdly, the price of a share in the company is now public information, as is the firm's value. This means that, on average, managers will be monitored less by outside investors. The investors that do not monitor, are those that only want to profit from share price movements, and do not have a long-term vision in mind for the company. This is also known as the free-rider problem in monitoring.

Aside from a company's options of going public or staying private, there is a third outcome that should be discussed. Besides an IPO and selling to a single investor, a company could also agree to a takeover. Brau, Francis, and Kohers (2003) state four factors that could influence the relative attractiveness of IPOs versus takeovers. Firstly, there are several industry-specific factors that could affect a company's decision, such as industry-specific capital structure and debt level. Secondly, market timing of IPOs can influence the decision in two ways. Market timing theory states that IPOs tend to take place more often either when investors overestimate the performance of the market or in times of shocks that lead to industry reorganisation, such as economic or technological shocks. Thirdly, there are deal- and firm-specific aspects that might attract or deter a company from a public offering over a takeover. For example, companies might want to maintain control of the company by selling only small parts to many investors instead of one large part to one investor, and thus prefer an IPO over a takeover. However, companies might be deterred because an IPO usually bears high fixed costs. Fourthly, the height of the demand for funding of a company, determined by company size, future investment opportunities, and the borrowing rate, also influences the decision whether to go public or to engage in a takeover.

Ritter and Welch (2002) discuss two theories that firms can follow when choosing whether to go public. The first theory, as discussed in Zingales (1995) and Chemmanur and Fulghieri (1999), shows that there appears to be a certain moment in a company's life cycle where it can

decide to go public or stay private. The second theory, as formulated in several recent papers (see, e.g., Lucas and McDonald (1990), Brau, Francis & Kohers (2003)), states that market timing theory can play a significant role. Either when investors overestimate the performance of the market or in times of shocks that lead to industry reorganisation, more companies tend to choose for an IPO. In spite of these theories, they argue that it appears to be difficult to find evidence, as only companies that have engaged in an IPO are included in the test, while those who did not engage in an IPO, are left out of the equation.

As underwriters are assigned to find investors who are willing to participate in the IPO, they have the ability to divide the amount of shares among investors. Discrimination in share price as well as allocation among different investors exists in most IPOs, and is often used to reveal information about price and demand. The more information an investor can reveal to the underwriter, the lower his price and larger the amount of shares is allocated to him (Benveniste & Spindt, 1989). Moreover, underwriters seem to discriminate between institutional and individual investors, depending on the degree of ownership dispersion and influence of underwriters (Hanley & Wilhelm, 1995). Underwriters have the tendency to work in favour of investors instead of their initial employer, namely the issuer. This creates an agency problem between underwriters and the issuer, as underwriters shift issuer profits to the pockets of investors (Loughran & Ritter, 2002).

The role of underwriters appears to be substantial. As mentioned above, first-day overperformance of IPOs is likely to be a result of either underpricing or allocation done by underwriters involved. While many researchers discuss either a situation where the issuer knows more or a situation where the investors know more, it is not unlikely that there is a situation where the underwriter knows more. This suggests a strong position of power of underwriters involved in initial offerings. In theory, underwriters should have the incentive to maximise total deal value of an IPO, as they receive a percentage of the deal value from the issuer. However, it has become evident that underwriters have several other incentives, such as establishing long-term relationships and receiving commissions in future deals or aftermarket trading (Beatty & Ritter, 1986). These incentives, given by investors, contradict the incentives given by the issuer. This results in a situation where underwriters have the ability to underprice in disadvantage of the issuer and allocate shares in disadvantage of investors that are less valuable to underwriters for whatever reason.

Overall, a firm has several considerations when deciding whether to go public or seek a different form of financing. Next, I will focus on the ownership structure after an IPO, a key aspect for deciding whether and how to go public.

2.1.2 Post-IPO ownership structure

Who buys the shares? Determining what type of investor should buy the new issue shares is important for the company. Namely, post-IPO ownership structure is important to maximise the pre-issue shareholder value (Mello & Parsons, 1998). However, different types of investors result in a different ownership structure and often a different company strategy. The issuer often considers either (small) individual investors or institutional investors, such as pension funds, other companies or banks. Institutional investors are preferred for their ability to take a large stake in the company and act as blockholders to monitor the firm's management (Hanley & Wilhelm, 1995). Individual investors create more ownership dispersion (Brennan & Franks, 1997) and aftermarket trading (Booth & Chua, 1996). It is likely that owners of the company prefer small investors, as it is more difficult to vote the entrepreneur out of his own company (Brennan & Franks, 1997). However, the underwriters assisting with the public offering often have connections to investors who are willing to buy shares. These investors, often the underwriter's regular clients, are often large companies that are willing to buy a large portion of the shares to become blockholders (Cornelli & Goldreich, 2001). For the issuing company, it is important to have a certain degree of ownership dispersion as well as sufficient demand to prevent a failed IPO, which can be assured through institutional investors (Mello & Parsons, 1998). This might create friction between the issuing company and the underwriters involved.

In their research, Mello and Parsons (1998) argue that ownership structure after the IPO is important to maximise pre-issue shareholder value when issuing new shares for investors. According to them, the optimal strategy includes a staged process of financing. The company should begin with an IPO for small investors. By showing there is demand for the shares, it should subsequently become easier to sell a large part of shares to an investor that is interested to become a monitoring blockholder. By doing so, the IPO is mainly used for selling dispersed shares to passive shareholders, while there is still a possibility for a blockholder to step in as long as he is willing to monitor. In some cases, additional shares are sold after a blockholder is found. In spite of this theory, Field and Sheehan (2004) find no significant relation between IPO underpricing and ownership structure.

2.1.3 First-day overperformance

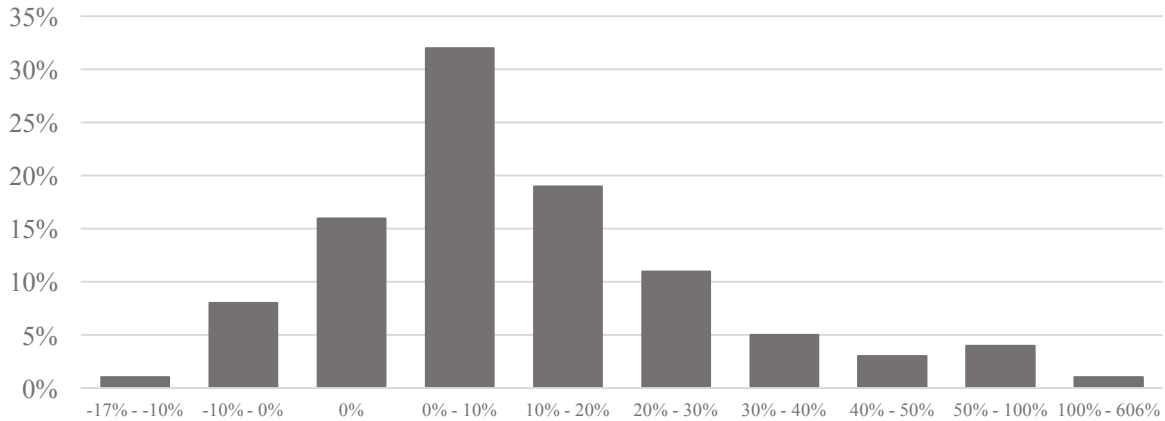
In recent literature, both first-day overperformance and long-term underperformance are reviewed frequently (Ritter, 1991). In this research, I will solely focus on clarifying first-day overperformance of a company's share price. In general, first-day overperformance is likely to be a result of investor sentiment, growth opportunities, adverse selection, information asymmetry, or systematic underpricing of the IPO's offer price (Lowry, 2003). For example, during the internet bubble, the investor sentiment was extremely positive. Companies were generally overvalued which often resulted in first-day overperformance of the share price (Ritter & Welch, 2002). However, especially systematic underpricing, done by underwriters, acts as an incentive for possible investors to buy new issue shares. In other words, by lowering share price, additional demand is generated. This reduces the chance of a failed IPO (Lowry & Shu, 2002). Further, underwriters can use underpricing to encourage firms to go public when general market valuations are high and discourage firms when general valuations are low (Ritter & Welch, 2002). In this paper, I will show that adverse selection and information asymmetry play a significant role in first-day overperformance, as they heavily affect the degree of share underpricing and allocation.

As mentioned above, underpricing of the offer price is one way in which first-day overperformance can occur. From the first day of documentation, researchers have found evidence that suggests that, on average, the closing price is significantly higher than the offer price (Ibbotson, 1975). Moreover, the degree of underpricing has increased since World War I (Chambers & Dimson, 2009). Loughran and Ritter (2002) sorted U.S. IPOs by their degree of underpricing for a period between 1990 and 1998, as shown in figure 2. Whether the issuer knows more, investors know more, or in case of information symmetry, many papers conclude that underpricing of the offer price directly affects first-day returns of IPOs (Ritter & Welch, 2002). Further, some papers provide evidence that suggests that underpricing can be directly related to the underwriters of the IPO, as they have incentives to underprice to maximise personal interests. Through underpricing, underwriters build and maintain long-term relationships with investors, often regarded as their regular clients. However, the issuer loses money as a result of this underpricing.

Figure 2

Distribution of percentage first-day return of U.S. IPOs between 1990 and 1998

The data was retrieved from Securities Data Company. The sample includes all U.S. IPOs between 1990 and 1998. Loughran and Ritter (2002) exclude companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. Average first-day return for the sample period is 14.8%.



Source: Loughran & Ritter (2002)

Although it seems likely for possible investors to appreciate underpricing, Brealey, Myers and Allen (1980) explain that pre-issue shareholders might also have incentives to agree with underpricing. They state that lowering the offer price increases the ability to raise capital in the future, as the IPO will be recognised as successful. However, they also explain that most of these claims about issuers are stated by investment banks and institutional investors. They also point out that underpricing is beneficial mostly to underwriters, to reduce their risk and reward the loyalty of their investors (Brealey, Myers & Allen, 1980).

As can be seen in table II, Ritter & Welch (2002) find that average first-day stock return of U.S. companies for a period between 1990 and 1998 was 14.8 percent higher than the price at which the issuer sold them. Note that the average first-day returns in 1999 and 2000 are significantly higher due to the 'dot-com bubble'. Furthermore, many researches (see, e.g., Stoll and Curley (1970), Reilly (1973), Logue (1973), and Ibbotson (1975)) find a systematic higher closing price than offer price on the first day. More recently, Chambers and Dimson (2009) investigated IPO underpricing in the United Kingdom (U.K.) since World War I. They find that average IPO underpricing rose from 3.80% between the first and second World War, to 9.15% in the post-WWII period ending in 1986. In conclusion, it seems likely that first-day overperformance and underpricing of IPOs is done systematic and that there are multiple explanatory theories for its existence.

Table II

Average percentage first-day performance of U.S. IPOs between 1990 and 2000

The data was retrieved from Securities Data Company. The sample includes all U.S. IPOs between 1990 and 2000. Ritter & Welch (2002) exclude all companies with an offer price below \$5, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds.

	Percentage first-day return
1990	10.80
1991	12.10
1992	10.20
1993	12.80
1994	9.80
1995	21.50
1996	16.70
1997	13.80
1998	22.30
1999	71.70
2000	56.10
1990-1998	14.80
1999-2000	65.00
1990-2000	24.40

Source: Ritter & Welch (2002)

Summarising, this paragraph gives insights on IPOs in general, the importance of post-IPO ownership, and how the decision to go public is constructed. Furthermore, this paragraph defined the existence of first-day overperformance of IPOs. In paragraph 2.2 and 2.3, I will identify the two main approaches for the existence of first-day overperformance according to recent literature, namely IPO underpricing and share allocation.

2.2 IPO underpricing

One approach for the existence of first-day overperformance is underpricing of the offer price. As Ritter and Welch (2002) argue in their research, first-day overperformance is too significant to be explained solely by mispricing and asset-pricing risk premia. This means that first-day overperformance is defined by a different aspect, namely the setting of the offer price. In this process, the usual interaction between demand and supply of shares is ignored by the underwriter to some extent. Next, I will divide the underpricing dilemma into two situations, one in which there is asymmetric information, and one in which there is symmetric information.

2.2.1 Asymmetric information

One would assume that the company engaging in an IPO knows most about the firm's prospects and its value. However, for an IPO to be successful, you need more than a company's expected value. While the issuer knows more about the value and prospects of its firm, investors and

underwriters are likely to know more about the stock market and general investor demand. In recent literature, theories have been developed to explain motives for issuers, investors, and underwriters. All three are reviewed in the next paragraphs.

2.2.1.1 If the issuer knows more

In his paper, Welch (1989) investigates future issuing activity of firms that have recently gone public. He demonstrates that, through underpricing, high-value firms can acquire future seasoned offerings at a higher price. By underpricing at their IPO, the costs of signalling quality become too high for most low-value firms and their imitation is discovered between its IPO and a seasoned offering. In addition to Welch (1989), Grinblatt and Hwang (1989) develop a signalling model with two ways to signal quality. According to them, the fraction of the new issue retained by the issuer and its offer price are both used to convince new investors of a high future value of the firm. Although they did not find evidence that the part of the firm retained by the issuer after the IPO is a signal for quality and future firm value, they found a positive relation between the issuer's holdings and the degree of underpricing. Similar to these researches, Allen and Faulhaber (1989) also argue that firms know more about their future value than anyone else, including investors. Through underpricing, high-value firms signal favourable message to investors, as only high-value firms are able to recover from the loss incurred from initial underpricing. High-value firms are able to guarantee future dividend payments to new investors.

Michaely and Shaw (1994) find little evidence for signalling theories, developed by Allen and Faulhaber (1989) and Welch (1989). These theories imply that companies underprice to signal their quality. Instead, they found that firms that underprice more, engage in re-issues less frequently and for smaller amounts than firms that underprice less. However, firms that underprice less generally have higher earnings and pay higher dividends.

Changes in underpricing over time are due to the willingness of issuers to accept underpricing. According to Loughran and Ritter (2001), there are two reasons why issuers became more open to underpricing over time. Firstly, managers of issuing firms became more concerned with hiring an underwriter with a highly ranked analyst, than troubled with avoiding underwriters that underprice excessively. Complementary, Chemmanur (1993) argues that high-value firms seek for analysts that are notorious for underpricing, as they know they have to pool with low-

value firms. High-value firms use underpricing for signalling quality. Issuing firms thus prefer underwriters that generate excessive demand for new shares to realistic underwriters who set a fair offer price for the issuer. Secondly, the introduction of side payments to decision makers as an incentive to choose for a certain underwriter, motivated issuing firms to prefer, rather than avoid, excessively underpricing investment banks. Moreover, they find little support for the claims that either changes in risk composition of firms or managers being incentivised to leave money on the table being mainly responsible for the changes in underpricing over time.

In general, if assumed that the issuer knows more, it is important for the issuer to signal its quality. Signalling is crucial particularly for high-value firms. They need to be separable from low-value firms, otherwise they will raise too little money for the IPO to succeed. Next, I will discuss theories in which is assumed that the investor knows more.

2.2.1.2 If the investor knows more

In some theories, it is assumed that investors know more than the issuer. According to Michaely and Shaw (1994), underpricing is consistent with the winner's curse theory, developed by Rock (1986). In this case, there exists no underpricing when investors know they do not have to compete with informed investors. However, if the price is too high, uninformed investors worry about being left with the less successful share issues, while informed investors receive the low-price shares. Therefore, uninformed investors will demand a higher rate of return on their investment. This results in underpricing as underwriters are required to compensate uninformed investors.

Besides the fear of a winner's curse, investors can also fear an informational cascade if the price is too high. In this case, investors who are afraid of the IPO to fail completely, will abstain from buying shares. Welch (1992) proves that this will result in investors triggering other investors to hold back on their investment. Consequently, investors will only invest in a hot issue, which is mainly achieved by the issuer through underpricing.

An essential theory about underpricing that assumes that the investor knows more, is the bookbuilding theory. Bookbuilding was first introduced by Benveniste and Spindt (1989). An important part of their theory is based on a form of 'lemons' problem. They argue that investors know more than the issuer, the issuer has to obtain information from investors in order to set

the right offer price for the right demand. Moreover, underwriters know that investors do not enter the market if the IPO is likely to be overpriced. Therefore, when demand is gauged, investors tend to deliberately undervalue the IPO. Moreover, underwriters tend to deliberately set the file price range too low. As a result, when more information becomes available to the underwriters, it is likely that the underwriter revises the final offer price upwards. Benveniste and Spindt (1989) find that this form of underpricing occurs regularly. Their research provides evidence that suggests greater underpricing when final offer price is higher than the original file price range. They also find that, holding the level of pre-sale number of shares offered constant, underpricing is higher when investors' demand indicates good information. This means that underpricing should be higher when the final offer price is higher than its expected value, as this indicates good quality of information. Moreover, they state that underpricing is likely to be directly related to the level of interest and, therefore, the number of shares offered in the pre-market.

In line with bookbuilding, Benveniste and Wilhelm (1990) argue that underwriters use both price and allocation discrimination between institutional and individual investors to maximise personal IPO earnings. They examine the effect of restricting underwriters in their marketing effort and find that institutional restrictions on the offer price and IPO allocation are negatively related to the amount of information underwriters are able to extract from investors.

Complementary to the bookbuilding theory, Hanley (1993) introduces the theory that offer prices are not fully adjusted according to information. During the filing period of an IPO, the offer price should theoretically be revised whenever the underwriter has gained information from investors about the demand. In general, the offer price is set too low, but is revised upwards when demand increases. Therefore, as found in Benveniste and Spindt (1989), there tends to be higher underpricing when final offer price is higher than the file price range. More importantly, he finds that underpricing results in an increase in the number of shares issued. In theory, the lower the price of initial shares, the more shares will be offered to investors. Increasing the number of shares increases the amount of money left on the table. This means that not only underpricing shifts money to the pockets of investors, but the sale in additional shares as well. Both aspects are likely to be initiated by the underwriter (Hanley, 1993). This is also in line with the findings of Benveniste and Spindt (1989). Moreover, it is believed that additional underpricing is used as a reward for investors willing to expose their demand for

shares. This is called the partial adjustment phenomenon, which was introduced in the paper by Hanley (1993).

2.2.1.3 Agency-based theories

Until this point, I have assumed that either the investors know more than the issuer, or vice versa. Underwriters must sell all issued shares to investors, while both assuring easier subsequent issues and mitigating the risks of fully underwritten deals (Brealey, Myers and Allen, 1980). However, it is likely that underwriters do not solely act on behalf on the issuer, but also aim to maximise their own earnings and keep investors, often their loyal clients, satisfied. Therefore, it is likely that underwriters withhold certain information from both issuer and investors. This problem is addressed by Baron (1982). As the issuer is aware of the fact that the underwriter knows more about the demand for shares, the company allows the underwriter to underprice to some extent. The degree of underpricing is a result of the weak monitoring abilities of the issuer, and is regarded as a form of compensation for the underwriter's superior knowledge. In contradiction to Baron's work, Schenone (2004) finds evidence that suggests that if the issuer had a relationship with the underwriter prior to the IPO, the issuer faces significantly less underpricing. In addition, Muscarella and Vetsuypens (1989) dedicated a research to test his IPO underpricing model, and find that monitoring does not play a significant role in underpricing. Namely, when underwriters go public themselves, the degree of underpricing is equally large, while one can assume that the underwriter does not lack monitoring qualities. In spite of the discovery by Muscarella and Vetsuypens (1989), one could still argue that this is a trick done by investment banks to try and convince issuers that underpricing is a necessary cost of going public.

Habib and Ljungqvist (2001) stress that excessive underpricing is used to compensate for expensive road shows. Although they admit that underpricing could be influenced by information asymmetry, valuation uncertainty, and legal liabilities, Habib and Ljungqvist place their finger on the fact that some IPOs are underpriced simply because the issuer cares less about underpricing. In fact, the owners of the issuing company care more about their personal wealth gain than the loss in their stake in the company. This will result in owners seeking for underwriters who are notorious for selling the most shares, for the simple reason that the more the owners sell, the higher their personal wealth gains are. Also, underwriters will have to put

more effort into selling the owners' shares, which results in higher marketing costs. Habib and Ljungqvist (2001) argue that underwriters are compensated through higher underpricing.

In his paper, Barry (1989) considers the wealth gain of the new investors to be due to the losses made by pre-issue shareholders because of underpricing. From a perspective of wealth, the degree of underpricing is defined by the wealth that pre-issue shareholders give to new investors. This wealth transfer is equal to the number of shares sold times the difference between the first-day closing price and the final offer price. For the initial owners, this is also known as the cost of going public.

In addition to the paper of Barry (1989), money left on the table can also be defined as the number of shares sold multiplied by the first-day price gain. Loughran and Ritter (2002) introduce the following formula (2) to express the choice for pre-issue shareholders between information revelation and their share of money being left on the table, where pre-issue shareholder value due to information revelation is larger than his share of money being left on the table if:

$$[Ret_i + Sec_i][OP - MP] + Ret_i[P - OP] > [P - OP][Sec_i + Prim \left(\frac{Ret_i}{Ret} \right)] \quad (2)$$

where OP is the final offer price, MP is the midpoint or expected offer price, P is the closing price, Ret is the shares retained by shareholder i , $Prim$ is the primary shares sold by the company, Sec is the secondary shares sold by pre-issue shareholder i . Moreover, they find that between 1990 and 1998, the total amount of \$27 billion that was left on the table is more than twice as large as the \$13 billion that investment banks received in the form of fees from the issuing firms. Further, Ritter and Welch (2002) compute average money left on the table for a period between 1990 and 2000, as displayed in table III. However, the company losing money does not seem to bother pre-issue shareholders. Loughran and Ritter's prospect theory explains that these shareholders care more about their total wealth gain than their total stake in the company. Even with this underpricing, pre-issue shareholder value often increases as a result of the sudden price jump after an IPO.

Table III**Average money left on the table in U.S. IPOs between 1990 and 2000**

The data was retrieved from Securities Data Company. The sample includes all U.S. IPOs between 1990 and 2000. Ritter & Welch (2002) exclude all companies with an offer price below \$5, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. Average money left on the table is calculated by the difference between the final offer price and first-day closing price, multiplied by the total number of issued shares. In this table, average money left on the table is the aggregate money left on the table, as displayed by Ritter & Welch (2002), and divided by the total number of U.S. IPOs per year.

	Average money left on the table, in U.S. \$
1990	4,400,000
1991	6,500,000
1992	5,600,000
1993	8,100,000
1994	4,300,000
1995	11,700,000
1996	11,900,000
1997	10,800,000
1998	20,000,000
1999	83,000,000
2000	80,000,000

Source: Ritter & Welch (2002)

There has been found evidence consistent with the theory that underwriters support aftermarket transactions of IPOs. By analysing aftermarket transactions of the first three days of trading, Schultz and Zaman (1994) can not only better describe the role of underwriters in IPOs, but also provide indirect results that suggest that IPOs are underpriced deliberately. Namely, the reasons for an underwriter to underprice the initial offer price are likely to be similar to the reasons for the underwriter to support aftermarket trading, as both help to prevent informational cascades. In addition, Ellul and Pagano (2006) present evidence that is consistent with the theory that aftermarket liquidity is the main determinant for underpricing. They argue that underpricing tends to be higher when aftermarket liquidity is less predictable.

To find evidence for underpricing in different countries, empirical research done by Loughran, Ritter and Rydqvist (1994) shows that short-run underpricing is existent in all of the 25 countries used for their dataset. As the degree of underpricing differs per country, their research finds that IPO contracts and firm composition have a significant effect on the size of underpricing in a country. On average, underpricing tends to be higher in case of more regulatory interference, setting the offer price in an early stage in the process, and the riskier the firm is that is engaging in an IPO.

Summarising, the situation of asymmetric information can in general be split into two problems. Either the issuer has more information than the investors, or vice versa. Firstly, if the issuer knows more than the investors, a somewhat lemons problem occurs in which the investors know that they know less, and will use the price to take advantage of this position. With IPOs, if issuers want to signal higher quality, they will sell shares at a lower price. Therefore, only issuers of which the shares have a lower quality than average will sell their shares at the average price. Now, high-quality share issuers will try to signal their quality by underpricing their shares. Secondly, if the investors know more than the issuer, the issuer and underwriters encounter an unknown demand for shares. This results in difficulties setting the right offer price. Therefore, as discussed in the bookbuilding theory and partial adjustment phenomenon, offer prices are set deliberately low and are not fully adjusted to available information. Moreover, this results in underpricing, partly to incorporate a certain safe margin by creating additional demand. Other possible reasons for underpricing could be the fear of the winner's curse (Rock, 1986) or a negative informational cascade of investors (Welch, 1992).

In short, all underpricing theories mentioned above suggest that asymmetric information between the issuer and investors in any form has a positive correlation with underpricing (Ritter & Welch, 2002). Next, I will discuss several theories based on symmetric information.

2.2.2 Symmetric information

In case of assumed symmetric situation, often the distinction is made between deliberate underpricing and mispricing. In recent literature, explanations for deliberate underpricing based on symmetric information are often related to additional risk of an IPO and aftermarket trading volume.

One of the first researches on the relation between risk and performance of an IPO was performed by Ibbotson (1975). He states that it is unclear whether issuers encounter losses from a new issue or whether they are compensated by underwriters in a different way. Underwriters would receive this compensation from new investors. Moreover, he shows that the total risk of a new issue is larger than the systematic (market) risk. He also demonstrates that once the company's issues become seasoned, unsystematic risk falls. These two results indicate that an IPO entails an additional portion of risk. However, Ibbotson is not able to directly relate the additional risk to underpricing.

The question is if there is evidence that can relate additional risk of an IPO to underpricing. In general, underpricing can be used as an insurance against various kinds of IPO related risks, such as legal liability of the issuer and reputational damages to underwriters. Moreover, the issuer is less likely to be sued if the stock is underpriced, as the first-day closing price is less likely to fall below the offer price. This will reduce the legal liability of the issuer. Also, as underpricing reduces the chance of the closing price to fall below its offer price, the chances for reputational damages to underwriters become smaller. Tinic (1988) empirically tests this relation. Although his results are significant, he argues that his results are also in line with other, often information asymmetry-based, theories. His findings are thus not necessarily consistent with the relation between risk and underpricing. The first paper that actually finds evidence consistent with this theory, comes from Hughes and Taylor (1992). They believe that underwriters base their pricing decisions on maximising their personal interests. Further, underwriters will, on average, set the offer price too low as they fear being sued in case of overpricing. Hughes and Taylor find evidence that suggests that legal issues are a major consideration in the underpricing decision.

Lowry and Shu (2002) further investigate the relation between underpricing and litigation risk. They argue that the costs for litigation risk can be severely for firms that have recently engaged in an IPO, such as settlement costs, reputation costs, and various fees for attorneys. Their research concludes the following. Firstly, firms with higher litigation risk use underpricing as a form of insurance against the costs of the legal liabilities mentioned above. Secondly, excessive underpricing the offer price lowers the expected litigation costs. To some extent, underpricing covers the potential costs of a failed IPO. Therefore, it reduces the expected costs of legal liabilities.

Besides legal issues and reputational damages, a different symmetric information-based theory is that underwriters will earn more money with underpricing, as trading volume will maintain high in the aftermarket if underpricing is higher. According to Boehmer and Fishe (2001), underwriters create trading in the aftermarket by underpricing the shares. A relatively low share price attracts low-valuation investors who flip their shares to higher-valuation investors, because they were rationed during earlier IPO allocations. The stock is now traded a couple of times in the aftermarket already, which generates extra cash for the underwriter through trading profits and brokerage commissions.

In their research, Booth and Chua (1996) argue that the incentive to underprice is created by the issuer instead of the underwriter. As the issuer requires ownership dispersion, underwriters are urged to increase demand for the company's shares. Through underpricing, the demand for shares will be larger than the amount of shares made available. This oversubscription creates extra aftermarket trading.

A more unsystematic reason for underpricing could be overoptimism during bubbles. Moreover, a specific explanation for underpricing during bubbles is to assure that the company is not taking advantage of temporary overoptimism. It is used either to signal to investors that the issuer does not want to take advantage at the cost of their investors, or to eliminate the risk of losing money when the bubble bursts (Ritter & Welch, 2002).

In general, there seems to be direct causality between first-day overperformance of an IPO and deliberate underpricing done by underwriters. Whether the issuer knows more, investors know more, or researchers assume a situation of information symmetry, there are various theories that strive to explain the relationship between underpricing and first-day overperformance. Further, whether underpricing is done by underwriters to protect against legal liabilities, to leave money on the table for investors, or to gain personally, there seems to be enough evidence that suggests that underpricing IPO shares is done deliberately. However, besides underpricing, underwriters also have incentives to discriminate in share allocation among investors. Even more interesting are the motives for underwriters to do so. Next, I will discuss the second main approach for the existence of first-day overperformance of IPOs according to recent literature, namely share allocation.

2.3 IPO share allocation

Following underpricing, the allocation of shares between investors can also affect the first-day overperformance. In general, share allocation is used to disclose information about the offer price. The more information is revealed, the more accurate the offer price can be set. Further, discrimination between different investors exists in most IPOs, and is often regarded as unfair. Many researches focus on the discrimination between institutional and individual investors in recent years. As most literature investigates the distinction between institutional investors (often blockholders) and small individual investors, some additional information is useful to explain their influence on IPO overperformance. Brennan and Franks (1997) and Booth and

Chua (1996), argue that small investors are more valuable to the company than institutional investors, as the entrepreneur can hold on to a larger part of total shares, and small investors increase liquidity through more aftermarket trading. In the next paragraphs, I will discuss the general characteristics of IPO share allocation, the role of post-IPO ownership structure, and its influence on the agency problem between underwriters and the issuer.

2.3.1 Discrimination to induce information revelation

‘Who buys the IPO shares?’ is an important question in IPO allocation and underpricing. Underwriters are keen to reveal information to investors. To induce this information revelation, underwriters use auctions to find out what price investors are willing to pay. In general, this results in underpricing and underwriter’s regular investors being given priority with allocation (Benveniste & Spindt, 1989). As discussed earlier, this is also known as bookbuilding. In a later research by Benveniste, Busboy and Wilhelm (1996), it becomes evident that regular investors benefit from discrimination during IPO allocation. As underwriters have full control over the process of allocation, they use IPOs to build long-term relationships with regular investors (Sherman, 2000). This discrimination enhances when one focuses on the relation to underpricing. According to Sherman and Titman (2002), the costs of acquiring information for investors is completely compensated by the benefit from underpricing. More specifically, underwriters use underpricing to reimburse their regular investors for revealing information about price and demand.

2.3.2 Institutional versus individual investors

In IPO share allocation, there is made a clear distinction between institutional and individual investors. Moreover, researchers argue that the existence of both large institutions and small retail investors has its effect on allocation as well as underpricing. In theory, the scale of institutional investors implies that they are informed better, which makes them more important clients to underwriters. Although some evidence is found that states the opposite (see, e.g., Lee, Taylor & Walter (1999), Neupane & Poshakwale (2012)), in general, institutional investors are favoured for the ability of information revelation and because they are expected to participate in less attractive IPOs (Hanley & Wilhelm, 1995). Consistent with the bookbuilding theory, Aggarwal, Prabhala and Puri (2002) provide a theory that suggests that higher first-day IPO returns in case of more institutional investors involved, as institutions are allocated more shares

in case of a strong pre-market demand. Underwriters tend to allocate more shares to regular clients and investors that are able to reveal more information (Cornelli & Goldreich, 2001).

2.3.3 Ownership structure

Whether there is a preference for institutional or individual investors when allocating shares is also affected by the issuer's preferred type of ownership structure. In general, institutional investors are often blockholders with the power to replace poorly performing management. Individual investors often have small stakes and are less attached to the company which results in higher aftermarket trading (Ritter & Welch, 2002). Empirical results on this subject differ among papers. On the one hand, large institutions appear to be beneficial to a company. Research done by Stoughton and Zechner (1998) points out the fact that blockholders are necessary for monitoring the business. Underpricing is needed to attract institutions to acquire a large amount of the shares. Subsequently, small investors can profit from this underpricing. However, other researches argue that the issuer should come to a private agreement with a potential blockholder first, before offering shares to the wide public (Mello & Parsons, 1998). On the other hand, Booth and Chua (1996) demonstrate that small investors trigger trading in the aftermarket, which in turn creates extra demand for the new issue and increases the issuer's value. A different advantage of more investor dispersion is described by Brennan and Franks (1997). They believe that the most important reason for the issuer to look for small investors rather than a blockholder, is that it becomes more difficult to vote the entrepreneur out of his own company.

Note that all researches presented above assumed that underpricing results in excess demand for new issue shares. Due to this extra demand, underwriters have several options of placement. Moreover, Reuter (2006) finds empirical evidence that suggests that business relationships with underwriters have a positive effect on share allocation for investors. It is important to take into account that underwriters often use this ability in favour of their regular clients instead of the issuer's preference for a specific type of ownership structure (Ritter & Welch, 2002). This can result in an agency problem between underwriters and the issuer.

2.3.4 The agency problem between underwriters and issuer

“Underwriters use their discretion to extract information from investors, which reduces average underpricing and increases proceeds to the issuers” (Benveniste & Spindt, 1989). In other

words, if underwriters have the power to allocate IPO shares, they need less underpricing to disclose the demand of investors. This will benefit the issuer. However, it is important not to underestimate the power of underwriters in an IPO deal. Each underwriter agrees to sell a certain part of the issue, and has its own favoured clients or investors to sell to.

An agency problem can arise between the issuer and underwriter. To act in favour of investors, underwriters will try to drive down the offer price more than what seems best for the issuer. By doing so, the underwriter is shifting potential profits from the pockets of the issuer to the pockets of investors. In other words, the underwriter is aiming for a higher underpricing than the issuer. Consequently, it could be argued that it is unfair to the issuer that the underwriter can strengthen its relation with personal clients through shifting profits from the issuer to investors (Loughran & Ritter, 2002). This is called the interest conflict theory.

Besides the underwriter's regular investors, the issuer's executives have a major role in the acceptance of underpricing. Loughran and Ritter (2001) argue that the issuer more often accepts excessive underpricing if the owner is an entrepreneur who can increase both personal wealth and company value. More extremely, excessive underpricing creates an incentive for the company's executives to seek rather than avoid underpricing underwriters, as executives often receive a part of the IPO shares and will thus personally benefit at the cost of their company (Siconolfi, 1997). Furthermore, Lowry and Murphy (2007) find that in one-third of U.S. IPOs between 1996 and 2000, executives received underpriced stock options. However, they do not find evidence for a positive relation between IPO underpricing and executive stock options.

2.3.5 The connection between share allocation and underpricing

Both the interest conflict theory (Loughran & Ritter, 2001) and the bookbuilding theory (Benveniste & Spindt, 1989) do not seem to fully explain why underwriters adjust the offer price less than it should if considering information revelation. In comparison, the prospect theory, designed by Loughran & Ritter (2002), explains that there is a lack in price adjustment in response to both private and public information, because the theory makes no distinction with respect to the source of information. They present evidence that, because of road shows, underwriters do not adjust offer prices as much as they could. Moreover, they argue that underwriters have different ways of making profits through an IPO. At first glance,

underwriters earn a percentage of the deal, which creates the incentive to increase the offer price. However, they still keep the offer price lower than what seems profitable for them. That is because they benefit in two different ways. Firstly, they reduce marketing costs because it becomes easier to find buyers with a lower offer price (Baron, 1982). Secondly, investors will overpay their compensation to underwriters to improve their position when shares are being allocated. These factors result in higher underpricing.

In general, both underpricing and share allocation have the ability to influence first-day overperformance of IPOs. It has become evident that the underwriter is able to undermine the interests of the issuer as well as discriminate among investors. Next, I will focus on the motives for underwriters to do so.

2.4 The motives of underwriters

First-day overperformance of an IPO stock issue is likely to be caused by either underpricing or allocation done by the involved underwriters. Over the years, investment banks have enhanced a strong position between them and both issuers and investors. Underwriters have an advantage over the issuer, as they have more knowledge about the demand for shares, and have many connections to investors. Although these underwriters often receive a percentage of the deal value from the issuer, they choose to underprice the IPO in favour of their regular investors. This results in an agency problem between the issuer and underwriters (Ritter & Welch, 2002). However, underwriters themselves have the possibility to benefit indirectly from money left on the table. The well-performing shares that underwriters sell to regular clients create an incentive to increase engagement in future deals. Also, the underwriter benefits from increasing trading fees. In theory, one could argue that an underwriter would only consider leaving money on the table if the money loss from the deal value percentage is less than the gain from higher trading fees from investors or in the form of other benefits, such as an improved future relationship with the investor (Loughran & Ritter, 2002). Below, the position that underwriters have established and several forms of ongoing business relations are reviewed.

2.4.1 A position of power

In their research, Beatty and Ritter (1986) were among the first to claim that IPO underpricing is due to the enforcement of underwriters. An issuing firm is obliged to hire one or more

investment banks for the public offering. Investment banks are required as they have a comparative advantage at allocating share issues due to their connections to many investors, but also because potential investors demand certain investment banks to assure the credibility of information. These investment banks are enforced to underprice as it is believed that they will be disciplined by the market if they underprice by too little or too much. This underpricing eventually results in a shift of profits from the pockets of the issuer to the pockets of the investors, due to the persistence of underwriters.

The powerful position that underwriters have, becomes even more apparent when considering the share allocation. With the ability of allocating IPO shares between investors, Pulliam and Smith (2001) argue that it can not be assumed that underwriters use this discretion in the best interests of the issuer. In fact, underwriters leave more money on the table and allocate the shares of the new issue in a way to favour the investors (Loughran & Ritter, 2002). It is said that not only new investors but also the executives of the issuer are favoured. This is done in the form of ‘spinning’, in which executives receive a part of the new issue as an incentive to accept underpricing and unfair share allocation (Siconolfi, 1997).

2.4.2 Ongoing business relations

In theory, an issuing firm has no incentive of leaving money on the table. The company will go public only once and wants to gain as much as possible from an IPO. On the other hand, investors need some insurance that the price of the new issue shares will increase. As intermediaries, investment banks are incentivised to underprice. By repeating this for many offerings over time, underwriters build a certain reputation of underpricing, incentivised by investors but also by issuers (Carter & Manaster, 1990). As stated above, however, the underwriter must be careful to not underprice too much or too little, as he will possibly upset either the issuer or potential investors. Researches done by Nimalendran, Ritter and Zhang (2004) and Reuter (2006) find evidence consistent with the theory that money left on the table has an effect on the contemporaneous trading volume of an IPO. This indicates a relation between IPO allocation and both the underwriter’s trading fees paid by investors and the strengthening of ongoing business relations between the underwriter and investors.

As stated above, underpricing causes a shift of profits from the issuer to the investors of a new issue. This underpricing is enforced by the investment banks hired by the issuer. As I

emphasised earlier, underwriters receive a certain percentage of the total deal value from the issuer, which creates the incentive to maximise total deal value of the IPO. However, by taking money from the pockets of the issuer through underpricing, the total deal value and thereby the underwriter's compensation decreases. In other words, with this move, underwriters withhold themselves from profits. Conclusively, besides having incentives from the hiring firm in the form of a deal value percentage, underwriters are likely to have incentives for either underpricing the shares of a new issue or allocating them a certain amount of shares (Fang, 2005).

2.4.3 Evidence of share allocation by underwriters

In a paper by Tucker and Bierne (2004), a case of Goldman Sachs is reviewed. In short, the U.S. House of Representatives Financial Services Committee accused Goldman Sachs of deliberately allocating underpriced IPO shares to the issuer's executives, in the hope of constructing a future business relationship. While they present evidence that suggests that Goldman Sachs did in fact significantly underprice more than its competing investment banks, they cannot provide evidence consistent with Goldman Sachs improperly allocating IPO shares.

2.5 Summary

By reviewing recent literature, it has become apparent that both underpricing and share allocation are regular features in public offerings. Underpricing is said to be used as an instrument to gauge demand, and when demand increases or more information is revealed, the offer price is adjusted until a fair offer price is reached. On average, Corwin and Schultz (2005) also find evidence that suggests that offer prices are more likely to be revised upward in response to positive information, and vice versa. However, it has become apparent that underwriters tend to use underpricing as an instrument to either attract more investors or to satisfy their regular clients. On average, there seems to be more underpricing than necessary. Research by Benveniste and Spindt (1989) and Hanley (1993) indicates that underwriters deliberately set the original file price range too low and do not fully adjust the offer price to available information. As mentioned earlier, this creates an agency problem between underwriters and the issuer (Ritter & Welch, 2002). Moreover, the tendency of satisfying regular clients is underlined by the occurrence of share allocation. Discrimination between

investors is used to reveal as much information about the price and demand as possible, but also to deliberately influence the group of investors that will buy the shares.

Until this point, there seems to be no dominant explanation for why IPO shares are underpriced (table IV) and how they are allocated (Ljungqvist, 2007). What is known, is that most theories relate to the role of underwriters in the process. Although motives among underwriters might differ, recent research has shown that, in general, underwriters deliberately set the original file price range too low and do not fully adjust the offer price to available information, as they have more information than the price indicates. Generally, it seems like most underwriters exploit their position of greater information, reputation, and connections. Further, recent research also indicates motives for underwriters, investors, issuers, and pre-issue shareholders.

In the next chapter, I will formulate the hypotheses for answering the problem statement. Further, I will describe the methodology used for each hypothesis. Following, I will empirically test these hypotheses.

Table IV

Main reasons for IPO underpricing

Asymmetric information

If the issuer knows more

- 1 Underpricing is accepted to ensure a succeeded IPO (Ritter & Welch, 2002)
- 2 High-value firms can acquire seasoned offerings at a higher price (Welch, 1989)
- 3 Underpricing is used for signalling the high quality of the firm (Allen & Faulhaber, 1989)
- 4 Underpricing is more accepted because issuer is keen to hire a highly ranked underwriter (Loughran & Ritter, 2001)
- 5 Underpricing is more accepted because issuer needs excessive demand (Chemmanur, 1993)

If the investor knows more

- 1 Underpricing exists because uninformed investors ask for higher rate of return (Rock, 1986)
- 2 Underpricing exists because investors fear an informational cascade (Welch, 1992)
- 3 Underwriters deliberately set file price range too low to attract investors (Benveniste & Spindt, 1989)
- 4 Underwriters do not fully adjust the offer price according to information (Hanley, 1993)

Agency-based theories

- 1 Underpricing occurs due to weak monitoring abilities of the issuer (Baron, 1982)
- 2 Excessive underpricing is used to compensate for expensive road shows (Habib & Ljungqvist, 2001)
- 3 Underpricing is accepted because of a wealth gain for pre-issue shareholders (Loughran & Ritter, 2002)
- 4 Underwriters increase aftermarket trading through higher underpricing (Schultz & Zaman, 1994)

Symmetric information

- 1 Underpricing exists because the risk of an IPO is higher than systematic (market) risk (Ibbotson, 1975)
 - 2 Underpricing is used as an insurance to IPO related risks, such as legal liabilities and reputational damages (Tinic, 1988)
 - 3 Underwriters excessively underprice because they fear being sued in case of overpricing (Hughes & Taylor, 1992)
 - 4 Excessive underpricing decreases expected litigation costs (Lowry & Shu, 2002)
-

3. Problem, hypotheses & methodology statement

Underwriters seem to engage in IPOs as more than advisors to the issuer. By reviewing recent literature, it has become evident that maximising the deal value of the IPO is not the sole goal for an underwriter, as there are several other incentives than the percentage of the deal value rewarded by the issuer. The underwriter also benefits from underpricing the offer price and granting share allocations at a certain price to investors. These benefits are assigned through trading fees from higher aftermarket trading volume, agreements with investors to participate in future deals or other types of ongoing business relationships between the underwriters and investors.

Throughout the past, various literature has been reviewed on the subject of IPO underpricing and allocation. Many papers suggest that underwriters have several incentives to conduct in an IPO besides a percentage of the deal value. Some of these incentives incorporate the occurrence of money being shifted from the issuer to investors. As the issuer is aware of this and often accepts underpricing until a certain point, researches claim that underwriters have their personal motives. And while researchers do not seem to fear to participate as whistle-blowers, it is difficult to find evidence that proves that underwriters are the dominant link in the process of share underpricing and allocation of IPOs.

As mentioned in the introduction, I will examine the role of underwriters in the IPO process. In the previous chapter, I used the research of Ritter and Welch (2002) to build a literature overview about the role of underwriters in share allocation and underpricing. I concentrated on the underlying motives of underwriters for their role in offer price adjustments.

To test the role of underwriters in the IPO process, I will use the researches of Loughran & Ritter (2002) and Hanley (1993) as benchmark papers for empirical testing. I will test the role of underwriters in IPO underpricing and share allocation and motives for underwriters, issuers, investors, and pre-issue shareholders. I will test if underpricing is caused by solely mispricing or if there is evidence that suggests that underwriters deliberately leave money on the table. Moreover, I will use regression analysis to test the relation between underpricing and the number of shares offered at the issue. Furthermore, I will test for evidence of the bookbuilding theory and the partial adjustment phenomenon, as documented by Hanley (1993).

To test the hypotheses, I will describe a methodology for each hypothesis. These methodologies are similar to several tests I have found in recent papers. For the first hypothesis, I will use the paper by Loughran and Ritter (2002). For the second hypothesis, I will use the paper by Hanley (1993). For the third hypothesis, I will use a combination between the papers by Loughran and Ritter (2002) and Hanley (1993). To make a contribution to this field of research, I will combine the datasets used in the three papers, but for a period between 2001 and 2014. I aim to provide new information and insights in the field of first-day overperformance of IPOs. My overall research question will be:

First-day overperformance of IPOs is caused by the role of underwriters in share underpricing and allocation to investors.

To help answering the research question stated above, I have constructed the following hypotheses and methodology:

3.1 Hypothesis 1

First-day overperformance of IPOs is caused by deliberate underpricing instead of solely mispricing and risk premia.

In the paper by Ritter and Welch (2002), it has become evident that underpricing is likely to be done deliberately by underwriters. Moreover, the paper by Loughran and Ritter (2002) discusses the partial adjustment phenomenon and prospect theory model that both suggest that the money left on the table is done deliberately by underwriters involved. They also provide empirical evidence that suggests that underpricing is done deliberately. Their sample consists of 3,025 IPOs in the U.S. for a period between 1990 and 1998. Further, unit offerings, closed-end funds, real estate investment trusts, partnerships, American depository receipts, and withdrawn offerings are not taken into account.

Like in Loughran and Ritter (2002), this hypothesis is designed to illustrate the occurrence and degree of underpricing. To measure IPO underpricing, I will test the following claim:

$$H_0: \mu = 0$$

$$H_A: \mu \neq 0$$

where the null hypothesis states that μ , or average percentage first-day return, is equal to zero, indicating that the offer price is set correctly on average, and deviations from the mean are due

to mispricing and risk premia, like in Loughran and Ritter (2002). I will test this hypothesis with a one-sample t-test. Further, I will calculate the average first-day return of IPOs in the U.S. between 2001 and 2014. Similar to Loughran and Ritter's test, I will report the yearly number of IPOs combined with the average yearly first-day return. Also, I will categorise IPOs according to the height of the offer price compared to the original file price range. Furthermore, I will present a histogram of first-day returns of IPOs for the sample period. In addition to the research of Loughran and Ritter (2002), I will compare the first-day overperformance of several industries.

For the first hypothesis, I will use a methodology similar to the research done by Loughran & Ritter (2002). I will present the number of IPOs in my sample for each year for a period between 2001 and 2014. I will also report average first-day returns, and make a distinction between IPOs priced below, within, and above the initial file price range. Market movements on the first day of the IPO are not taken into account, as they are relatively small and thus have no significant effect on the results. Further, I will display the distribution of first-day returns in a histogram.

To control for robustness of the test, I will conduct a similar test for IPOs in Europe and Western Europe between 2001 and 2014.¹

3.2 Hypothesis 2

Similar to the bookbuilding theory:

2A: There is greater underpricing when final offer price exceeds the original file price range.

2B: An increase in the number of shares offered will result in greater underpricing.

In the paper by Benveniste and Spindt (1989), the bookbuilding theory is introduced. Their research suggests that, holding the level of pre-sale number of shares offered constant, underpricing is likely to be higher when investors' demand indicates good information. In other words, underpricing is greater when the final offer price is higher than expected in the prospectus. Further, they find that underpricing is related to the number of shares offered in the pre-market.

¹ Appendix table A-II – A-VII

In addition to the bookbuilding theory, Hanley (1993) illustrates that offer prices are not fully adjusted according to information. He empirically finds that issues with final offer prices that exceed their original file price range are subject to greater underpricing, as explained in 2.2.1.2. Like Benveniste and Spindt (1989), he also finds evidence that suggests that an increase in the number of shares offered results in greater underpricing. This leads to money being shift from the pockets of the issuer to those of the investors in two ways, not only through underpricing, but through an increase in the number of shares issued as well.

In hypothesis 2A, I aim to empirically proof that underpricing is greater when final offer price exceeds the original file price range for U.S. IPOs for a period between 2001 and 2014. Moreover, hypothesis 2B will test if the relation between underpricing and percentage change in number of shares offered is positive and significant. If I prove this relation to be existent, I can assume that issuing additional IPO shares is an alternative way for underwriters to satisfy investors and thereby building long-term relationships.

To test this, I will report the following results. First, I will display the spread of the original file price range, combined with the expected and final offer price and total proceeds of the deal. As in Hanley (1993), I will illustrate several descriptive statistics on the difference between actual and preliminary IPO figures. Second, I will conduct cross-sectional ordinary least-squares (OLS) regression analysis on first-day return, to test the effect of difference in final and expected offer price and number of shares offered on underpricing. For the cross-sectional OLS regression analysis, I will use the following formula²:

$$FDR_i = \alpha + \beta_1 dOP_i + \beta_2 dSO_i + \beta_3 FRS_i + \beta_4 EDV + \beta_5 PMR_i + \beta_6 FOP_i \quad (3)$$

where *FDR* is percentage first-day return, *dOP* is percentage difference between final and expected offer price, *dSO* is percentage difference in number of shares offered, *FRS* is percentage filing range spread, *EDV* is expected deal value, *PMR* is percentage prior market return, and *FOP* is final offer price, for company *i*.

To control for robustness of the regression, I will use filing range spread, expected deal value, prior market return, and final offer price as control variables, as I assume these variables to

² For detailed variable explanation, see Appendix table A-IX

have a constant, unchanged effect on the dependent variable throughout regression analysis. However, as my research is not focused on the effects of these variables on underpricing, I will use them in my regression for the robustness of my test. Further, I will check for normality, correlation between all variables, multicollinearity, and correct for any heteroscedasticity.³

3.3 Hypothesis 3

Similar to the partial adjustment phenomenon, underwriters do not fully adjust the offer price with respect to public information prior to the offering.

Prior to the IPO, the underwriter will determine a price range for the offer price. This range is called the original file price range, and is adjusted according to both information revelation and market movement. As discussed earlier, both the interest conflict theory (Loughran & Ritter, 2001) and the bookbuilding theory (Benveniste & Spindt, 1989) do not seem to fully explain why underwriters adjust the offer price less than it should be if considering market movement. In theory, the offer price should be adjusted upwards accordingly when the market return has increased. However, many researchers argue that underwriters only partly adjust the offer price with respect to publicly available information. Loughran and Ritter (2002) explain that there is a lack in price adjustment in response to both private and public information, because the theory makes no distinction with respect to the source of information.

In hypothesis 3, I will test this partial adjustment phenomenon, as first documented by Hanley (1993), for U.S. IPOs for a period between 2001 and 2014. To test the hypothesis, I will use a two-sample paired t-test to compare the difference between final and expected offer price of IPOs to the market movement in the 15 trading days prior to the IPO. These 15 trading days are used, as in Loughran & Ritter (2002), because it is the minimal length of time between the setting of the original file price range and the offer date. I will test the following hypothesis:

$$H_0: v = k$$

$$H_A: v \neq k$$

where the null hypothesis states that v , or average difference between final and expected offer price, is equal to k , market movement 15 days prior to IPO. In line with the partial adjustment phenomenon, a significant difference between price adjustments and market movement of the 15 days prior to the IPO must imply that in the process before the IPO date, the underwriter

³ Appendix table A-VIII – A-XII

has not fully adjusted the offer price with respect to all publicly available information. This indicates underpricing of the initial offer price.

For the third hypothesis, I will test the partial adjustment phenomenon, as first introduced by Hanley (1993). For this test, I will sort results by their final offer price relative to the original file price range. As used in the first hypothesis, IPOs are arranged by their prices below, within, and above their initial file price range. To illustrate the results of the partial adjustment phenomenon, I will report average first-day return, average deal value, average money left on the table, and average change in pre-issue shareholder value.

To control for robustness of the test, I will compare the degree of underpricing and average money left on the table for IPOs in Europe and Western Europe between 2001 and 2014.⁴

⁴ Appendix table A-XIII & A-XIV

4. Data & descriptive statistics

In this chapter, I will describe the data I will use for this research. First, I will define the general data characteristics and data source of the sample. Second, I will present descriptive statistics of the research sample. Third, I will explain the reasoning for the time period and several noticeable economic trends of the sample. Fourth, I will describe the data used for specific hypothesis, including calculations.

The research sample contains 1,502 U.S. IPOs conducted in a period between 2001 and 2014. In line with Loughran and Ritter (2002), I exclude all IPOs with a file price range midpoint of USD 8.00 and lower, to minimise the influence of volatile penny stocks. Further, I exclude unit offerings, closed-end funds, real estate investment trusts, partnerships, American depository receipts, and withdrawn offerings. All general IPO data is retrieved from Dealogic. General data includes company name, date, industry, final offer price, first-day closing price, percentage first-day return, original file price range, revised file price range, and current file price range.

Table V

Descriptive statistics for final offer price, first-day closing price, and percentage first-day return of all U.S. IPOs between 2001 and 2014

The data was retrieved from Dealogic. The sample includes all U.S. IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. The final offer price and first-day closing price are presented in U.S. dollars. The first-day return is presented in percentages.

	N	Mean	Median	Std. Dev.	Min.	Max.
Final offer price \$	1,502	15.20998	14.06	6.41638	8.00	91.00
First-day closing price \$	1,502	17.46903	15.45	9.26714	5.00	132.99
% First-day return	1,502	12.71%	6.00%	21.62%	-33.08%	206.67%

Table V provides descriptive statistics for final offer price, first-day closing price, and first-day return of the sample IPOs. In this sample, average final offer price is approximately USD 15.21, and average first-day closing price is approximately USD 17.47, which is higher than the final offer price. This can also be identified by the average first-day return of 12.71%.

Figure 3

Distribution of percentage first-day return of U.S. IPOs between 2001 and 2014

The data was retrieved from Dealogic. The sample includes all U.S. IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds.

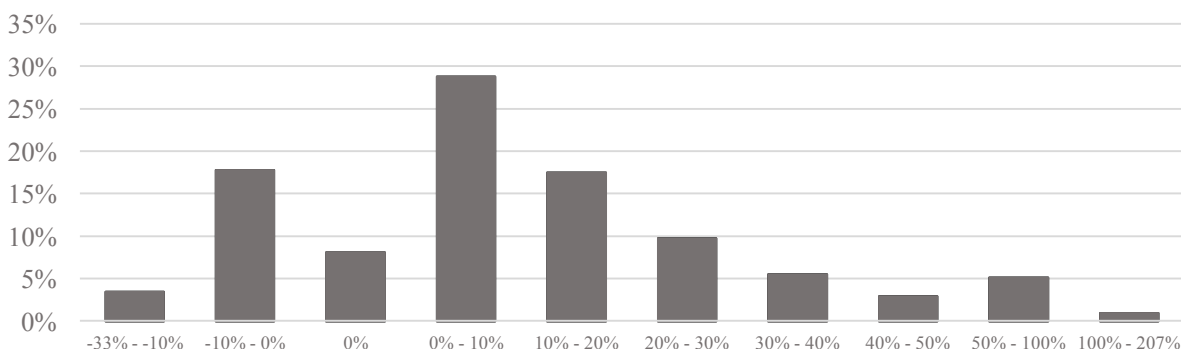


Figure 3 illustrates the distribution of first-day return of the sample IPOs. In the sample, approximately 29 percent of all IPOs result in a first-day return between 0 and 10 percent. Further, approximately 8 percent of the sample IPOs has a closing price equal to the offer price. Approximately 21 percent of all U.S. IPOs for a period between 2001 and 2014 encounter negative first-day returns. Except for less first-day returns of exactly 0.00 percent, the distribution of first-day returns for a period between 2001 and 2004 seems to be fairly similar to the distribution of first-day returns for a period between 1990 and 1998, as shown in figure 2.

Figure 4

Average percentage first-day return of U.S. IPOs between 2001 and 2014, sorted by year

The data was retrieved from Dealogic. The sample includes all U.S. IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds.

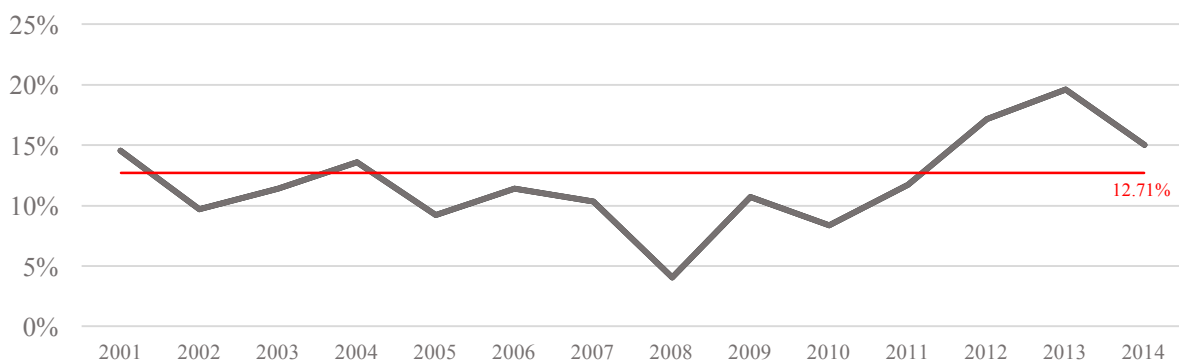


Figure 4 sorts average first-day return of U.S. IPOs between 2001 and 2014 by year. One aspect that stands out immediately, is the increase in average first-day return over the last three years. Further, in the beginning of the financial crisis in 2008, first-day return was exceptionally low. As can be observed in table VI, first-day return in 2008 is not significant, which indicates mispricing or risk premia instead of deliberate underpricing. Furthermore, the yearly distribution of IPOs shows an increase in the number of IPOs prior to the financial crisis in 2008. It also shows the steep rise in the number of IPOs in recent years. These peaks emphasise the belief that companies prefer a public offering when economic conditions are favourable. Also, first-day returns appear to be higher prior to an economic downturn, or in times of economic peaks. I will discuss this more thoroughly in the third hypothesis.

Table VI

The distribution of U.S. IPOs between 2001 and 2014 including average percentage first-day return and revisions from the original file price range, sorted by year

The data was retrieved from Dealogic. The sample includes all U.S. IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. IPOs are categorised based on its offer price compared to the original file price range.

Year	Number of IPOs	Percentage first-day return	Median	Std. Dev.	Min.	Max.	Percentage of		
							IPOs priced below file price range	IPOs priced within file price range	IPOs priced above file price range
2001	69	14.56**	11.93	17.36	-14.06	76.67	18.84	62.32	18.84
2002	57	9.70**	7.50	15.64	-33.08	66.67	31.01	55.18	13.81
2003	60	11.42**	8.84	14.08	-15.55	46.59	11.66	61.67	26.67
2004	144	13.58**	9.24	17.01	-13.50	65.71	28.47	47.92	23.61
2005	148	9.22**	4.50	15.43	-12.50	94.62	27.03	49.32	23.65
2006	157	11.42**	5.29	19.67	-29.55	125.41	29.93	48.41	21.66
2007	194	10.33**	2.00	20.03	-19.69	97.22	21.51	53.33	25.16
2008	26	4.10	-0.83	17.98	-19.92	57.50	23.08	61.54	15.38
2009	39	10.71**	6.58	15.99	-15.10	59.45	38.46	35.90	25.64
2010	84	8.40**	3.35	13.47	-10.78	55.31	48.80	38.10	13.10
2011	80	11.72**	3.68	22.33	-21.50	109.44	28.75	41.25	30.00
2012	96	17.14**	9.84	24.24	-18.33	108.71	31.25	42.71	26.04
2013	153	19.55**	10.95	29.17	-22.56	122.83	23.53	47.71	28.76
2014	195	14.99**	5.36	29.27	-21.35	206.67	35.89	46.67	17.44
Total	1,502	12.71**	6.00	21.62	-33.08	206.67	28.52	48.80	22.68

*Significant at the 0.05 level (two-tailed test)

**Significant at the 0.01 level (two-tailed test)

Table VI presents the number of IPOs, average and median first-day return and the distribution of IPOs priced below, above, or in between their original file price range, for each year between 2001 and 2014. Comparing average and median first-day return per year, it becomes evident that every year has several upper limit outliers, as the median is generally lower than average first-day return. Further, the results show that approximately half of all IPOs is priced within the original file price range. Although the difference is not severe, less than a quarter of all

IPOs is priced above the original file price range, and more than a quarter of all IPOs are priced below their original file price range.

Many researches in the past use data with a period up to 1998, or from 2001. As discussed earlier, I have chosen to limit the dataset of this research to a period from 2001 to 2014. Besides doing research on the most recent IPOs, the explanation for limiting the dataset to this period is the dot-com bubble between 1999 and 2000. The reason that many researches omit dot-com bubble data from their dataset is because this period will produce biased results compared to the regular economic cycle. Table II shows that average first-day returns of 1990 and 2000 are significantly higher in comparison to other years. Ritter & Welch (2002) find that average first-day return in the dot-com bubble was 65.0%. Further, the financial crisis of 2008 will be included in the sample, as this is believed to be an ordinary downturn in the economic cycle. When looking at the number of IPOs between 2001 and 2014, the influence of the economic cycle on the willingness of companies to go public becomes evident. During the first three years after the dot-com bubble, the economy had to restore from an immense downturn and companies were reluctant to go public, afraid for another economic downfall. After 2003, the number of IPOs increased substantial. However, in 2008 the U.S. housing market collapsed, thereby dragging down all other financial markets as most financial institutions had invested large amounts of capital in U.S. mortgages of some kind. The economy as a whole collapsed, and with general trust at its lowest rate in years, companies were extremely hesitant to go public. It is only since a couple of years that companies have again picked up the motivation to conduct an IPO.

To check for normality of the sample, I have performed a Jarque-Bera test on all variables used.⁵ The test concludes no significant skewness or kurtosis of the sample data. Further, to control for the robustness of hypotheses 1 and 3, I will use similar datasets with data from European and Western European IPOs for a period between 2001 and 2014. I use both Europe and Western Europe to examine the difference in first-day returns and number of IPOs. The Europe dataset consists of 875 IPOs and the Western Europe dataset consists of 701 IPOs. In both datasets, I exclude all IPOs with a file price range midpoint of USD 8.00 and lower, to minimise microcap stock influence. Moreover, I exclude unit offerings, closed-end funds, real estate investment trusts, partnerships, American depository receipts, and withdrawn offerings.

⁵ Appendix table A-I

All European IPO data is retrieved from Dealogic. To control for robustness of the regression in hypothesis 2, I will check for correlation between all variables, correct for heteroscedasticity, and add control variables to check for similar results.

For hypothesis 1, I will use percentage first-day return, final offer price, and first-day closing price to test for significant first-day overperformance and the degree of underpricing. I will use final offer price in combination with original file price range, revised file price range, and current file price range to generate a dummy that categorises IPOs based on its final offer price in relation to the original file price range. This dummy contains three groups, IPOs with its final offer price below original file price range, IPOs with its final offer price above original file price range, and in between.

For hypothesis 2, I will use original file price range, final offer price, the midpoint of the original file price range or expected offer price (also stated in the prospectus), final number of shares offered, and total proceeds. This data is retrieved from Dealogic. The data for the number of shares initially offered is retrieved from Securities Data Company. For the analysis of this variable, 134 observations are used. To ensure this number is representative to the entire sample, I use a sample that has both equal distribution and average first-day returns to a large extent, sorted by the final offer price relative to the original file price range midpoint. To test for normality, I have performed a Jarque-Bera test on the sample and found no significant skewness and kurtosis.⁶ Moreover, I have tested for correlation and multicollinearity between variables and found no significant values.⁷ Further, for the sample used for regression analysis, I found no heteroscedasticity. Using this data, I will calculate mean (percentage) differences between final and expected offer price, final offer price and upper or lower limit of the original file price range, and shares offered. Further, I will use this data to perform cross-sectional OLS regression analysis on the difference between final and expected offer price, percentage difference in number of shares offered, and initial return. The independent variables are discussed in the next chapter, and all variables are retrieved from Dealogic.

For hypothesis 3, I will test the partial adjustment phenomenon for U.S. IPOs for a period between 2001 and 2014, as addressed by Hanley (1993). I will compare the difference between

⁶ Appendix table A-VIII

⁷ Appendix table A-X & A-XI

final and expected offer price to market movement 15 days prior to each issue. Therefore, I will use S&P500 value-weighted daily market returns which I will compound into returns 15 days prior to each issue. S&P500 value-weighted daily market returns are retrieved from CRSP database. Further, I will display IPO proceeds data which is retrieved from Dealogic. Money left on the table is calculated by the difference between final offer price and first-day closing price, multiplied by the total number of issued shares, which is retrieved from Dealogic. Revaluation, or pre-issue shareholder value, is equal to the difference between the original file price range midpoint and first-day closing price, multiplied by the number of shares retained. This data is also retrieved from Dealogic.

In the next chapter, I will test the hypotheses. For every hypothesis, I will present the results and provide implications of these results for this research.

5. Empirical results

In this chapter I will discuss the empirical results of this research. First, I will present the results of each hypothesis. Second, in addition to these results, I will provide implications for this research for each hypothesis.

5.1 Hypothesis 1

In recent literature, the likeliness of the involvement of underwriters in underpricing IPOs has become evident. This hypothesis is designed to indicate the occurrence and degree of underpricing in U.S. IPOs for a period between 2001 and 2014. First, I will conduct a t-test to test the significance of first-day return. If the result indicates that first-day return significantly differs from zero, I can reject the null hypothesis and assume that first-day overperformance is caused by deliberate underpricing instead of only mispricing and risk premia. Second, I will sort all IPOs by industry to identify differences in public offerings per industry and indicate differences in involvement of underwriters per industry. For this research, I assume underpricing is done deliberately by underwriters if the change in offer price is significant for the sample. If the sample shows insignificant underpricing, I must conclude that first-day overperformance is not the result of underpricing, but is due to mispricing or done as a risk premium. To test this, I have conducted a one-sample t-test to test if the percentage change in first-day offer price is equal to zero.

Table VII

One-sample t-test for percentage first-day return of U.S. IPOs between 2001 and 2014

The data was retrieved from Dealogic. The sample includes all U.S. IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. The one-sample t-test was performed on the percentage first-day return.

N	Mean	Std. Error	Std. Deviation	t-value
1,502	12.70793	0.557826	21.61891	22.7812

$H_A: \mu \neq 0$
 $\Pr(|T| > |t|) = 0.0000$

Table VII shows the results of the t-test. For a period between 2001 and 2014, first-day return has been tested significant positive with a mean of 12.7%. I have not included market movements, as they are of insignificant influence on the results (Loughran & Ritter, 2002). An average first-day overperformance of 12.7% is in line with recent studies (see, e.g., Neupane & Poshakwale (2012), Field & Sheehan (2002), Ritter & Welch (2002), Loughran & Ritter

(2002)). To conclude, this means I can reject the null hypothesis and assume that average first-day return is significantly not equal to zero, which indicates deliberate underpricing.

Table VIII

The distribution of U.S. IPOs between 2001 and 2014, sorted by industry

The data was retrieved from Dealogic. The sample includes all U.S. IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. IPOs are categorised based on industry. Other industries include mining, defence, publishing, textile, aerospace, forestry and paper. These industries are not displayed separately as the number of IPOs in these industries is not sufficient for further testing.

	N	Percentage first-day return
Auto/Truck	15	5.99*
Chemicals	27	7.68**
Computers & Electronica	298	23.57**
Construction/Building	34	5.72**
Consumer Products	21	18.80**
Dining & Lodging	36	24.64**
Finance	320	5.33**
Food & Beverage	15	14.04*
Healthcare	296	11.87**
Insurance	46	8.42**
Leisure & Recreation	19	11.50*
Machinery	14	17.98**
Metal & Steel	16	1.51
Oil & Gas	71	5.56**
Professional Services	61	14.29**
Retail	60	21.64**
Telecommunications	45	7.36**
Transportation	36	8.90**
Utility & Energy	24	10.20**
Others	48	10.79**
Total	1,502	12.71**

*Significant at the 0.05 level (two-tailed test)

**Significant at the 0.01 level (two-tailed test)

Table VIII shows the distribution and first-day return of IPOs per industry for a period between 2001 and 2014. Noteworthy are the high average first-day returns of several industries. A possible explanation for high average first-day returns is that some industries, such as machinery and computers and electronica, are more difficult to value for underwriters, as they do not adequately understand the business. Therefore, underwriters tend to be more cautious with valuating the company which results in higher underpricing. However, underpricing is also high in predictable industries, such as dining, food and beverage, and retail. Moreover, average first-day return of the finance industry is relatively low. A possible explanation is that underwriters know their own industry, however, it is more likely that underwriters deliberately not signal underpricing in their own sector. Further, for a period between 2001 and 2014, three industries (i.e. computer, finance, healthcare) have had around

300 IPOs per industry, while all other industries have had between 0 and 80 IPOs per industry. The most straightforward answer to this difference is that these three industries are among the biggest, and still being subject to transformation. For example, the oil and retail industry are among the biggest industries as well, however, these industries have been subject to more stagnation.

To control for robustness, I have conducted a similar test on both European and Western European IPOs for a period between 2001 and 2014. Although average first-day return of both Europe and Western Europe IPOs is significantly lower at respectively 6.0% and 5.1% (compared to 12.7% in the U.S.), results show that average first-day return is positive and significant as well. This means that European IPOs are also subject to deliberate underpricing done by underwriters.⁸

5.1.1 Implications

Table VII shows that, for all U.S. IPOs for a period between 2001 and 2014, average first-day return is significantly positive at a rate of 12.7%. Further, the one-sample t-test indicates that I can reject the null hypothesis which states that average first-day return is zero. Therefore, I can conclude that first-day overperformance is not solely due to mispricing and risk premia. This implies that, besides taking into account several risks of going public and the underwriter's disability to determine the exact value of the company, there are other motives for underpricing the final offer price. As mentioned earlier, there are several motives for companies to not fully adjust the offer price. However, it is not likely that these motives account for the entire occurrence of underpricing.

Table VI, shown in chapter 4, displays the distribution of IPOs per year, including revisions from the original file price range. These results show a relation between first-day overperformance and the general economic state. In the years prior to the financial crisis in 2008, a sharp increase in the number of IPOs and first-day overperformance can be noticed. Moreover, a similar movement can be observed in recent years. A possible explanation for the increase in the number of IPOs is that, in times of economic peaks, the probability of a failed IPO is lower. I will further discuss this aspect in the third hypothesis. Moreover, during economic peaks, valuations are higher in general. This potentially leads to more owners trying

⁸ Appendix table A-II – A-VII

to cash out due to overvaluation. As a result, this could potentially lead to higher first-day overperformance as issuers and underwriters have to convince investors to invest in their company instead the many alternatives during economic peaks. However, a different possible explanation for the increase in the number of IPOs and first-day overperformance is that, according to market timing theory, general valuations are too high in economic peaks, which means that companies can issue IPOs at a higher level than its fundamental value. Further, a healthy economic environment is more attractive for underwriters to increase underpricing. This will be tested in hypothesis 3.

In conclusion, hypothesis 1 tests the significance of first-day overperformance of IPOs between 2001 and 2014. As the null hypothesis can be rejected, I am able to conclude that first-day overperformance is not solely due to mispricing and risk premia, but is caused by deliberate underpricing of the final offer price by underwriters. In hypothesis 2 and 3, I will test several reasons for underwriters to underprice deliberately.

5.2 Hypothesis 2

Hanley (1993) illustrates that offer prices are not fully adjusted according to information. He finds evidence that suggests that underpricing is greater when the final offer price is higher than expected in the prospectus. Also, an increase in the number of shares offered results in greater underpricing. If this is true, I can assume that underwriters not only use underpricing to shift money from the pockets of the issuer to those of investors, but also issue additional IPO shares as an alternative way to satisfy investors and thereby building long-term relationships. In this hypothesis, I will test the relation between IPO underpricing and both offer price revisions and number of shares issued for U.S. IPOs for a period between 2001 and 2014. First, I will display several descriptive statistics about the original file price range spread and differences between the final and expected offer price. Second, I will present average change in several offer price measurements and average change in the number of shares offered, sorted by the final offer price relative to the original file price range midpoint. I will also present several ratios to illustrate differences in deal magnitude of IPOs. Third, I will perform regression analyses on first-day return, as explained in 3.2.

Table IX**Descriptive statistics on the original file price range spreads, expected and final offer price, and total proceeds of U.S. IPOs between 2001 and 2014**

The data was retrieved from Dealogic. The sample includes all U.S. IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. IPOs are categorised based on its offer price compared to the original file price range. The original file price range spread is calculated as the upper limit minus the lower limit of the original file price range. The percentage spread is calculated as the difference between the upper and lower limit, divided by the lower limit. The expected offer price is the initial offer price mentioned in the prospectus, or the midpoint of the original file price range.

	Number of IPOs	Percentage first-day return Mean <i>median</i>	Spread of file price range Mean <i>median</i>	Percentage spread of file price range Mean <i>median</i>	Expected offer price Mean <i>median</i>	Final offer price Mean <i>median</i>	Total proceeds Mean <i>median</i>
OP < LOW	429	2.51 <i>0.42</i>	2.13 <i>2.00</i>	14.31 <i>14.29</i>	16.40 <i>15.00</i>	12.67 <i>12.00</i>	216,000,000 <i>98,800,000</i>
In between	733	8.60 <i>4.69</i>	1.72 <i>2.00</i>	12.62 <i>14.29</i>	14.86 <i>14.50</i>	14.92 <i>15.00</i>	272,000,000 <i>116,000,000</i>
OP > HIGH	340	34.44 <i>28.00</i>	2.03 <i>2.00</i>	14.40 <i>14.29</i>	15.96 <i>15.00</i>	19.03 <i>18.00</i>	443,000,000 <i>171,000,000</i>
Total	1,502	12.71 <i>6.00</i>	1.90 <i>2.00</i>	13.50 <i>14.29</i>	15.55 <i>15.00</i>	15.21 <i>14.06</i>	295,000,000 <i>123,000,000</i>

Table IX presents descriptive statistics about the original file price range spread and differences between the final and expected offer price. First, it becomes evident that average first-day return, or underpricing, is significantly higher when final offer price is priced above its original file price range. As explained earlier, this is a result of a form of ‘lemons’ problem between the underwriter and investors (Benveniste & Spindt, 1989). Second, it appears that underwriters choose for little variation in the spread of the file price range between IPOs, illustrated by both numerous and percentage spread. This can also be observed through equal medians across all positions of the final offer price relative to the original file price range midpoint. Most underwriters choose the industry standard of 2.00 for the spread of original file price range. Third, table IX shows that, on average, IPOs that have been priced higher than the file price range, have greater total proceeds and final offer price. These results are in line with Hanley (1993).

Table X**Percentage changes in offer price and number of shares offered for U.S. IPOs between 2001 and 2014, sorted by the final offer price relative to the original file price range midpoint**

The data was retrieved from Dealogic. The sample includes all U.S. IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. IPOs are categorised based on its offer price compared to the original file price range. The percentage difference between final and expected offer price is given as a percentage of expected offer price. The percentage difference between the upper or lower limit and final offer price is given as a percentage of the final offer price. The percentage difference in the number of shares offered is calculated as the difference between final number of shares offered and initial number of shares offered as given in the prospectus, as a percentage of initial number of shares offered.

		OP < LOW	In between	OP > HIGH	Total
Number of IPOs		429	733	340	1,502
Percentage difference final and expected offer price	Mean	-22.68%	0.31%	21.60%	-1.42%
	median	-21.43%	0.00%	17.65%	0.00%
Percentage difference upper or lower limit and final offer price	Mean	-17.19%	n.a.	14.10%	n.a.
	median	-15.38%	n.a.	9.09%	n.a.
Difference final and expected offer price, USD	Mean	-3.71	0.07	3.07	-0.33
	median	-3.00	0.00	2.50	0.00
Difference upper or lower limit and final offer price, USD	Mean	-2.65	n.a.	1.50	n.a.
	median	-2.00	n.a.	0.00%	n.a.
Percentage difference number of shares offered (n = 134)	Mean	0.20%	4.09%	8.56%	4.13%
	median	0.00%	13.07%	15.00%	12.37%
Expected Deal Value Ratio	Mean	0.77	1.00	1.21	0.96
	median	0.79	1.00	1.18	1.00
Minimum Deal Value Ratio	Mean	0.83	1.07	1.30	1.05
	median	0.85	1.07	1.25	1.05
Maximum Deal Value Ratio	Mean	0.73	0.95	1.14	0.93
	median	0.73	0.96	1.09	0.94

Table X displays average change in several offer price measurements, average change in the number of shares offered, and ratios to indicate differences in deal magnitude of IPOs. Noteworthy are the means and medians of percentage difference between the final and expected offer price. For IPOs with the final offer price both below and above the original file price range, the mean difference differs significantly from the entire sample, while the sample median is zero. IPOs of which the final offer price is priced above the file price range, exceed expected offer price by an average of 21.6%. IPOs of which the final offer price is priced below the file price range, fall behind expected offer price by an average of 22.7%. Moreover, IPOs of which the final offer price is priced above the file price range, exceed the upper limit by 14.1%, while IPOs of which the final offer price is priced below the file price range, fall behind the lower limit by 17.2%. This is in line with the results of Hanley (1993).

As mentioned by Hanley (1993), changes in offer price are likely to be accompanied by changes in the number of shares offered. In this sample, actual number of shares offered is, on average, 8.6% higher than the initial amount of shares offered when the final offer price is above the file price range. Moreover, the final number of shares offered is 4.1% higher when the final offer price is within the file price range, and 0.2% higher when the final offer price is below the file price range. On average, I can assume that every IPO increases the number of shares offered. However, for IPOs priced above the file price range the increase is significantly greater. As for the IPOs priced above the file price range, these findings are in line with Hanley (1993). However, he finds a negative change in number of shares offered when the final offer price is below its original file price range, and approximately no change in number of shares offered when the final offer price is within its original file price range.

Table X also shows several ratios to illustrate differences in deal magnitude of IPOs. These results are very similar to Hanley (1993), as the ratios of the entire sample are close to 1.00, the ratios of IPOs with a relatively high final offer price are significantly higher than 1.00, and the ratios of IPOs with a relatively low final offer price are significantly lower than 1.00.

Table XI**Cross-sectional OLS regression on percentage first-day return for U.S. IPOs between 2001 and 2014**

The data was retrieved from Dealogic. The sample includes all U.S. IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. Expected deal value and final offer price are shown in U.S. dollars.

	<i>Dependent variable</i>	
	First-day return	t-value
Intercept	-0.032	-0.80
Percentage difference final and expected offer price	0.275**	3.04
Percentage difference number of shares offered	0.017	0.90
Percentage filing range spread	0.233	1.43
Expected deal value	-1.98e-11	-0.54
Percentage market return 15 days prior to issue	0.612	1.09
Final offer price	0.006*	2.57
F-value	4.14	
Adjusted R ²	12.4%	
Number of observations	134	

*Significant at the 0.05 level (two-tailed test)

**Significant at the 0.01 level (two-tailed test)

Table XI shows cross-sectional OLS regression on percentage first-day return.⁹ In line with Hanley (1993), the regression with percentage first-day return implies a significant positive effect of the difference between final and expected offer price on first-day return, and a significant positive effect of final offer price on first-day return. However, unlike Hanley's (1993) results, the regression with the change in number of shares offered as dependent variable does not show any significant results.

5.2.1 Implications

Table IX provides evidence that suggests that there is greater underpricing when final offer price exceeds the original file price range. Further, there is a relation between movements in offer price and the amounts of shares offered. By reviewing final and expected offer price and total proceeds, it becomes evident that IPOs with a final offer price higher than the original file price range have significantly higher total proceeds. In line with the bookbuilding theory, this implies that the total value of an IPO is increased by a higher offer price as well as an increased number of shares issued (Hanley, 1993).

The results shown in table X emphasise the assumption that there exists a relation between offer price changes and the number of shares offered. Moreover, while the results of

⁹ For detailed regression analysis, see Appendix table A-XII

Hanley (1993) are more convincing, table X shows that the percentage change in number of shares issued is significantly higher when the final offer price is priced above its original file price range, namely 8.56%. More specifically, average percentage change in number of shares of the entire sample is 4.2%. These results imply that an increase in number of shares issued results in greater underpricing.

The regression in table XI partly provides satisfactory results for the bookbuilding theory. On the one hand, it provides evidence for a positive significant relation between offer price revisions and underpricing. Also, it shows a positive significant relation between final offer price and first-day return. Both the paper of Hanley (1993) and my results in hypothesis 1 and 2 imply these relations. Overall, I can conclude that there is greater underpricing if the final offer price is higher than the expected offer price, and assume that hypothesis 2A is true. On the other hand, I did not find evidence that shows a significant positive relation between number of shares offered and underpricing. Therefore, I have not found evidence that proves hypothesis 2B to be true. A possible explanation for the unsatisfactory results is the sample size. While the sample was tested on normal distribution, heteroscedasticity and correlation between variables, the size might have been too small to find significant results for the relation between change in number of shares offered and underpricing.

5.3 Hypothesis 3

As mentioned by Hanley (1993), underpricing is likely to be due to a lack in offer price adjustment with respect to publicly available information. Loughran and Ritter (2002) discuss an additional lack in adjustment with respect to private information, as theory should make no distinction with respect to the source of information. In their theory, the partial adjustment phenomenon, they attempt to complement the interest conflict theory (Loughran & Ritter, 2001) and bookbuilding theory (Benveniste & Spindt, 1989). In this hypothesis, I will test the partial adjustment phenomenon. First, I will compare the difference between final and expected offer price and market movement 15 days prior to each IPO in a two-sample paired t-test to measure the effect of market movement on adjustments of the offer price. Second, I will display the results of underwriters deliberately not adjusting offer prices to all sorts of information. Third, I will show the effect of market movements 15 days prior to issue on each IPO, and show proof that underwriters do not fully adjust the offer price with respect to information.

Table XII**Two-sample paired t-test for average percentage difference between final and expected offer price of U.S. IPOs and market returns 15 days prior to each IPO between 2001 and 2014**

The data was retrieved from Dealogic. The sample includes all U.S. IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. The two-sample t-test was performed on the difference between average percentage difference between final and expected offer price and market movement 15 days prior to each IPO, shown in percentage.

	N	Mean	Std. Error	Std. Dev.
Percentage difference final and expected offer price	1,502	-0.014%	0.00477	0.18497
Percentage market movement 15 days prior to issue	1,502	0.657%	0.07815	3.02784

t-value = -8.612

$H_A: \nu = k$
 $\Pr(|T| > |t|) = 0.0000$

Table XII shows a two-sample paired t-test that tests if publicly available information, in this sample market movement 15 days prior to issue, is the sole determinant of the offer price. The t-test shows that, prior to issue, total market movement is significantly higher than average difference between final and expected offer price. Therefore, I can reject the null hypothesis and conclude that there are other sources of information or different reasons for underwriters to not fully adjust the offer price according to information. In line with Loughran and Ritter (2002), I do not discriminate between different sources and kinds of information. Therefore, the significant difference between market movement and difference between final and expected offer price implies that underwriters have different reasons to not fully adjust the offer price to information.

Table XIII**Means of proceeds, money left on the table, and revaluations of U.S. IPOs between 2001 and 2014, sorted by the final offer price relative to the original file price range midpoint**

The data was retrieved from Dealogic. The sample includes all U.S. IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. IPOs are categorised based on its offer price compared to the original file price range. The proceeds or total deal values are retrieved from Dealogic. The filing spread range is the spread of the original file price range, as presented in the prospectus. The money left on the table is calculated by the difference between the final offer price and first-day closing price, multiplied by the total number of issued shares. The revaluation is the difference in price from the original file price range midpoint and first-day closing price, multiplied by the retained shares. Proceeds, money left on the table and revaluation are shown in U.S. dollars.

Item	N	Percentage first-day return Mean <i>median</i>	Spread of file price range Mean <i>Median</i>	Percentage positive return	Proceeds Mean <i>median</i>	Money left on the table Mean <i>median</i>	Revaluation Mean <i>median</i>
OP < LOW	429	2.51 <i>0.42</i>	2.13 <i>2.00</i>	54.31	216,000,000 <i>98,800,000</i>	11,400,000 <i>500,000</i>	-121,000,000 <i>-59,800,000</i>
In between	733	8.60 <i>4.69</i>	1.72 <i>2.00</i>	69.21	272,000,000 <i>116,000,000</i>	19,700,000 <i>5,750,000</i>	73,000,000 <i>6,721,067</i>
OP > HIGH	340	34.44 <i>28.00</i>	2.03 <i>2.00</i>	94.43	443,000,000 <i>171,000,000</i>	101,000,000 <i>49,500,000</i>	605,000,000 <i>219,000,000</i>
Total	1,502	12.71 <i>6.00</i>	1.90 <i>2.00</i>	70.68	295,000,000 <i>123,000,000</i>	35,600,000 <i>7,253,385</i>	138,000,000 <i>1,427,303</i>

Table XIII presents the effects of underwriters deliberately not adjusting offer prices to all types of information on total proceeds, money left on the table and revaluation for pre-issue shareholders. This table provides interesting evidence on the partial adjustment phenomenon. First, like in Loughran and Ritter (2002), there is a steep increase in mean first-day return when comparing the IPOs sorted by their offer price with respect to their original file price range. The mean first-day return of IPOs with an offer price below their original file price range is approximately 2.5 percent, while the mean first-day return of IPOs with an offer price above their original file price range is more than 34 percent. Second, mean money left on the table for all U.S. IPOs for the sample period is USD 35.6 million. This results in an aggregate money left on the table of approximately USD 53.5 billion for the sample period. Moreover, table XIII shows that the IPOs with an offer price above the original file price range, approximately 22.6 percent of sample, account for approximately 64.2 percent of total money left on the table. Third, the last column of table XIII discloses a mean revaluation of USD 138 million, which results in an aggregate revaluation of approximately USD 207.3 billion for the sample period. This represents total change in pre-issue shareholder value of U.S. companies that went public between 2001 and 2014. Furthermore, the table presents the spread of the original file price range. Like in Hanley (1993), while the means of the spreads slightly differ, the median U.S. dollar difference is set at USD 2.00, representing an industry standard file price spread.

Table XIV**Percentage first-day return and money left on the table of U.S. IPOs between 2001 and 2014, categorised by prior market movement**

The data was retrieved from Dealogic. The sample includes all U.S. IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. IPOs are categorised based on the compounded market return of the 15 days prior to the offering. S&P500 market returns are retrieved from CRSP. Money left on the table is shown in U.S. dollars as well as a percentage of total deal value.

Item	N	Percentage first-day return Mean <i>median</i>	Money left on the table Mean <i>median</i>	Percentage money left on the table Mean <i>median</i>
Prior < 0.0%	557	10.78592 4.69	37,200,000 5,278,500	10.70 0.20
In between	440	12.88091 6.00	36,800,000 7,848,533	13.67 0.29
Prior > 2.0%	505	14.67713 7.50	32,800,000 9,798,000	14.49 0.25
Total	1,502	12.70793 6.00	35,600,000 7,253,385	12.84 0.25

Table XIV reveals the effect of market movement on first-day return and money left on the table. First, the table shows a positive relation between first-day return and market movement. In other words, average first-day return increases when market movement 15 days prior to issue is more positive. Second, table XIV demonstrates a negative relation between nominal money left on the table and market movement. This contradicts the results of Loughran & Ritter (2002), who find a positive relation between money left on the table and market movement. However, the relation between percentage money left on the table and prior market movement is positive, which indicates the actual positive relation between money left on the table and market movement. Third, like in Loughran and Ritter (2002), I report that an increase in prior market movement of at least 2.0 percent results in an increase in first-day return of approximately 4.0 percent. Even though this is less significant than in Loughran and Ritter (2002) (8.5 percent relative to 2.0 percent), it indicates that the offer price is not fully adjusted with respect to public information.

Table XV

Matrix of the distribution of percentage first-day return in relation to market movement and offer price revisions of U.S. IPOs between 2001 and 2014

The data was retrieved from Dealogic. The sample includes all U.S. IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. IPOs are categorised based on the compounded market return of the 15 days prior to the offering. S&P 500 market returns are retrieved from CRSP. First-day returns are given in percentages.

	Prior < 0.0%	Prior in between	Prior > 2.0%
OP < LOW	2.51	0.41	3.91
In between	8.63	8.57	8.58
OP > HIGH	31.58	33.02	37.88

Table XV illustrates a matrix of first-day returns sorted by both offer price revisions and market movement 15 days prior to issue, also described in table XIV. Again, we observe more substantial differences with respect to changes in offer price revisions than we see with respect to market movement.

To test this hypothesis for robustness, I have conducted a part of this test on both European and Western European IPOs for a period between 2001 and 2014. I have tested the influence of the final offer price, relative to the original file price range midpoint, on average percentage first-day return and average money left on the table. Although both average first-day return and average money left on the table of both European and Western European IPOs is significantly lower at respectively 6.0% and EUR 15.2 million, and 5.1% and EUR 14.3 million (compared to 12.7% and EUR 35.6 million in the U.S.), results show that there exists a positive relation between average first-day return, the final offer price's position, and average money left on the table. This means that European companies that engage in an IPO are subject to deliberate underpricing done to shift money from the pockets of the issuers to those of investors.¹⁰

5.3.1 Implications

Table XII shows that publicly available information, or market movement 15 days prior to each issue, is not the sole determinant of the offer price. This suggests that there are alternative determinants or motives for underwriters to not fully adjust the offer price to publicly available information. As mentioned earlier, alternative determinants such as mispricing and risk premia have been found to be insignificant. This suggests that underwriters (and the issuer) have

¹⁰ Appendix table A-XIII & A-XIV

alternative motives to not fully adjust the offer price. This is in line with the partial adjustment phenomenon, as found by Hanley (1993) and Loughran and Ritter (2002).

As discussed in the literature overview, possible motives of underwriters to underprice IPOs could be to build long-term relationships with their clients to benefit from future business, or to honour their reputation of underpricing. Possible motives of issuers could be to ensure a successful IPO, either by generating sufficient pre-issue demand for shares or to create higher aftermarket trading to ensure a positive first-day return. Table XIII presents the effects of not fully adjusting the offer price to information. Now, the motives for issuers and underwriters become evident. First, underwriters benefit as they successfully shift profits from the pockets of the issuer to those of investors. This enhances their long-term relationships with investors as these investors are likely to conduct their future business using this underwriter. The underwriter profits from fees such as trading fees, deal percentages, etc. Second, pre-issue shareholders of the issuing company gain personally. On average, revaluation is approximately USD 138 million. Moreover, table XIII also shows that revaluation increases with higher underpricing. This suggests that underpricing generates benefits for underwriters and investors, but for owners of issuing companies as well, as pre-issue shareholder value is increased.

Table XIV emphasises the assumption that underwriters do not fully adjust the offer price to publicly available information and therefore suggests that the implications of the partial adjustment phenomenon are correct. First, there exists a positive relationship between market movement 15 days prior to issue and first-day returns. Second, although we observe a negative relation between nominal money left on the table and market movements, the relation appears to be positive when we compare market movement to percentage money left on the table. Table XV illustrates higher first-day returns in case of more positive market movement, which also implies higher average money left on the table. Third, table XIV shows that an increase in market movement of at least 2.0 percent results in a significantly higher increase in first-day return. Therefore, although market movement has a positive effect on the degree of underpricing, both issuers and underwriters are likely to have alternative motives for underpricing.

In conclusion, hypothesis 3 tests whether underwriters fully adjust the offer price of U.S. IPOs between 2001 and 2014 according to available information. As the null hypothesis can be

rejected, I am able to conclude that underwriters do not fully adjust the offer price according to available information. This is in line with the partial adjustment phenomenon.

6. Conclusions, limitations & recommendations for further research

In this research, I have examined the role of underwriters in the IPO process. To do so, I have reviewed the relationship between first-day overperformance and underpricing of IPOs for a period between 2001 and 2014. From the literature overview, it has become evident that share allocation and underpricing are regular features in public offerings. Although there does not seem to be a dominant explanation, many recent papers imply the important role of underwriters in the process.

Next to a literature overview, I have used papers by Loughran and Ritter (2002) and Hanley (1993) to empirically test IPO underpricing and the role of underwriters in this process. Through the first hypothesis, I have shown that first-day overperformance of IPOs is not caused solely by mispricing and risk premia, but mainly by deliberate underpricing of the offer price. The results indicate that there are underlying motives for underwriters, but possibly also for issuers, to deliberately underprice IPOs. The second hypothesis provides evidence that partly supports the bookbuilding theory, presented by Benveniste and Spindt (1989) and further discussed by Hanley (1993). Like in the bookbuilding theory, the results of this hypothesis show greater underpricing and higher total proceeds when final offer price exceeds the original file price range. It also shows that, for this sample, average percentage change in number of shares offered is higher when final offer price exceeds the original file price range. However, regression analysis did not provide sufficient evidence to directly link percentage change in number of shares offered to greater underpricing. In line with my predecessors, it seems difficult to test for unfair share allocation. The third hypothesis supports the partial adjustment phenomenon, discussed in Loughran and Ritter (2002) and Hanley (1993). The results show that the offer price is not fully adjusted according to publicly available information during the filing period. In addition, I have found evidence that higher underpricing results in more money left on the table and higher revaluation for pre-issue shareholders, which indicates motives for underwriters and investors, but also for pre-issue shareholders of the issuer.

Overall, I have shown that underpricing is a regular feature in the IPO process. Moreover, my literature overview and empirical research show that all parties involved have motives to accept or induce underpricing. To conclude, I believe that individual case studies, instead of quantitative research, is the key to indicate motives for underpricing, as they appear to differ amongst individual cases.

In this research, I have shown the existence of deliberate underpricing for U.S. IPOs between 2001 and 2014. Both theoretically and empirically, I have presented several motives for underwriters, investors, issuers, and pre-issue shareholders to accept or induce underpricing. However, I have encountered several issues during this research that I have been unable to solve within the time frame, data availability, resources, and my expertise. First, I have not been able to gather data concerning the number of shares initially offered for my entire sample. To directly contribute to this research, I could have retrieved the initial number of shares offered for each IPO in the sample to test the relation between underpricing and percentage change in number of shares offered for the entire sample. However, this data is often only in the IPO prospectus, which implies time-consuming research for each IPO. Second, I have not been able to gather market return data for the countries in the European sample. Initially, it seemed interesting to compare first-day returns of U.S. IPOs to those European IPOs, as part of my research as well as to test for robustness. However, due to time constraints, I was not able to retrieve and use this data for my research.

Besides the limitations of this research, there are several aspects in the field of IPO underpricing that I have not discussed, but are valuable to examine in further research.

First, as stated in the conclusion, I have not been able to link share allocation to underpricing. Moreover, it has become evident that IPO share allocation in general is difficult to test. However, this feature in IPO issuances is a crucial way in which underwriters can exploit their position of power. Therefore, the relation between share allocation and past deals between the underwriter and investors is an interesting field of research. Like the Goldman Sachs case described in 2.4.3, it seems likely that a trusted investor receives relatively more shares of an IPO. This should be investigated for an individual IPO or by comparing a few IPOs done by the same lead underwriter.

Second, I have not tested the influence of institutional investors on underpricing. As many researches argue that the type of investors has an influence on the degree of IPO underpricing, it seems likely that a higher level of institutional investors results in greater underpricing (see, e.g., Hanley & Wilhelm (1995), Aggarwal, Prabhala & Puri (2002), Cornelli & Goldreich (2001)). Higher underpricing due to the involvement of institutional investors is often said to be caused by institutions being better informed, which makes them more important clients to

underwriters. Also, institutions seem to be more important clients because they invest in less attractive IPOs. However, due to a lack in data availability, most research in this field has been conducted for a narrower time frame.

Third, the issue considering influence of individual investment banks on the degree of underpricing has been unresolved. In their research, Beatty and Ritter (1986) emphasise that underwriters have a position of power through serving as intermediaries in the IPO process. This position of power results in share underpricing and allocation, as they have their reputation at stake. They test and find a significant positive relationship between underpricing and the change in market share of the underwriter. However, due to a lack in data availability, most research in this field has been conducted for a narrower time frame.

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Appendix

Robustness hypothesis 1

Table A-I

Jarque-Bera test for normality for all U.S. IPOs between 2001 and 2014

The data was retrieved from Dealogic. The sample includes all U.S. IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. The Jarque-Bera test is used to measure the existence of skewness and kurtosis. The test is performed on the dataset used in hypothesis 1 and 3.

	Observations	Pr(skewness)	Pr(kurtosis)	joint	
				adj chi2(2)	Prob>chi2
Deal value \$	1,502	0.000	0.000	.	.
Money left on the table \$	1,502	0.000	0.000	.	.
Revaluation \$	1,502	0.000	0.000	.	.
Offer price \$	1,502	0.000	0.000	.	0.000
Closing price \$	1,502	0.000	0.000	.	0.000
Average file price \$	1,502	0.000	0.000	.	.
Shares outstanding	1,502	0.000	0.000	.	.
Shares offered	1,502	0.000	0.000	.	0.000
% Change price 1 day	1,502	0.000	0.000	.	0.000
% Filing range spread	1,502	0.000	0.000	.	0.000
% Difference final and expected offer price	1,502	0.000	0.000	.	.
% Market return 15 days prior	1,502	0.000	0.000	.	0.000

Table A-II

One-sample t-test for percentage first-day return of European IPOs between 2001 and 2014

The data was retrieved from Dealogic. The sample includes all European IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. The one-sample t-test was performed on the percentage change in first-day offer price.

N	Mean	Std. Error	Std. Deviation	t-value
875	6.017234	0.574991	17.00846	10.4649

Ha: mean > 0
Pr(T>t) = 0.0000

Table A-III

One-sample t-test for percentage first-day return of Western European IPOs between 2001 and 2014

The data was retrieved from Dealogic. The sample includes all Western European IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. The one-sample t-test was performed on the percentage change in first-day offer price.

N	Mean	Std. Error	Std. Deviation	t-value
701	5.07535	0.4674047	12.3752	10.8586

Ha: mean > 0
Pr(T>t) = 0.0000

Table A-IV

The distribution of European IPOs between 2001 and 2014 including average percentage first-day return and revisions from the initial file price range, sorted by year

The data was retrieved from Dealogic. The sample includes all European IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. IPOs are categorised based on its offer price compared to the original file price range.

Year	Number of IPOs	Percentage first-day return	Percentage of IPOs priced below file price range	Percentage of IPOs priced within file price range	Percentage of IPOs priced above file price range
2001	41	4.542195**	21.95	58.54	19.51
2002	13	7.060769*	23.08	46.15	30.77
2003	5	14.84*	0.00	20.00	80.00
2004	50	4.0322**	18.00	58.00	24.00
2005	97	6.27134**	12.37	59.79	27.84
2006	191	6.48712**	17.28	59.16	23.56
2007	186	8.932581**	11.29	65.59	23.12
2008	45	2.510444	24.44	51.11	24.44
2009	16	4.21	12.50	62.50	25.00
2010	35	5.526286**	22.86	60.00	17.14
2011	50	6.2212*	24.00	50.00	26.00
2012	23	2.937391	17.39	60.87	21.74
2013	42	5.527857**	23.81	45.24	30.95
2014	81	2.69**	8.64	74.07	7.28
Total	875	6.017234**	16.11	60.00	23.89

*Significant at the 0.05 level (two-tailed test)

**Significant at the 0.01 level (two-tailed test)

Table A-V

The distribution of Western European IPOs between 2001 and 2014 including average percentage first-day return and revisions from the initial file price range, sorted by year

The data was retrieved from Dealogic. The sample includes all Western European IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. IPOs are categorised based on its offer price compared to the original file price range.

Year	Number of IPOs	Percentage first-day return	Percentage of IPOs priced below file price range	Percentage of IPOs priced within file price range	Percentage of IPOs priced above file price range
2001	38	5.234211**	23.68	57.89	18.42
2002	12	5.6875	25.00	50.00	25.00
2003	2	3.81	0.00	0.00	100.00
2004	36	3.212222*	22.22	55.56	22.22
2005	77	6.737792**	10.39	59.74	29.87
2006	169	5.42213**	17.75	60.36	21.89
2007	135	5.970889**	12.59	68.15	19.26
2008	31	2.755806	22.58	58.06	19.35
2009	13	0.4153846	15.38	53.85	30.77
2010	25	4.3964**	16.00	68.00	16.00
2011	34	7.152353*	26.47	58.82	14.71
2012	18	5.007222*	16.67	66.67	16.67
2013	38	5.027368**	26.32	44.74	28.95
2014	73	2.754795**	8.22	78.08	13.70
Total	701	5.07535**	16.55	62.20	21.25

*Significant at the 0.05 level (two-tailed test)

**Significant at the 0.01 level (two-tailed test)

Table A-VI**The distribution of European IPOs between 2001 and 2014, sorted by industry**

The data was retrieved from Dealogic. The sample includes all European IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. IPOs are categorised based on industry. Other industries include mining, defence, publishing, textile, aerospace, forestry and paper. These industries are not displayed separately as the number of IPOs in these industries is not sufficient for further testing.

	N	Percentage first-day return
Auto/Truck	16	7.69*
Chemicals	25	7.2456*
Computers & Electronica	133	5.06188**
Construction/Building	52	10.52077**
Consumer Products	21	5.699524*
Dining & Lodging	6	-0.058
Finance	95	5.351368**
Food & Beverage	19	-0.623158
Healthcare	94	6.864681**
Insurance	14	2.021429
Leisure & Recreation	16	7.870625*
Machinery	27	2.377407
Metal & Steel	22	2.979091
Oil & Gas	27	12.86963*
Professional Services	55	8.661818**
Retail	27	13.10778**
Telecommunications	37	4.10973**
Transportation	55	3.287818**
Utility & Energy	41	6.104146**
Others	94	4.621915**
Total	875	6.017234

*Significant at the 0.05 level (two-tailed test)

**Significant at the 0.01 level (two-tailed test)

Table A-VII**The distribution of Western European IPOs between 2001 and 2014, sorted by industry**

The data was retrieved from Dealogic. The sample includes all Western European IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. IPOs are categorised based on industry. Other industries include mining, defence, publishing, textile, aerospace, forestry and paper. These industries are not displayed separately as the number of IPOs in these industries is not sufficient for further testing.

	N	Percentage first-day return
Auto/Truck	14	8.627857*
Chemicals	21	9.369048*
Computers & Electronica	118	4.126356**
Construction/Building	30	6.802**
Consumer Products	16	4.51*
Dining & Lodging	4	-0.1625
Finance	79	3.891519**
Food & Beverage	10	4.278
Healthcare	87	4.963793**
Insurance	11	2.005455
Leisure & Recreation	15	7.117333*
Machinery	24	6.665833**
Metal & Steel	19	2.396316
Oil & Gas	18	9.728889**
Professional Services	48	6.034375**
Retail	17	9.409412**
Telecommunications	30	3.748**
Transportation	32	4.06875**
Utility & Energy	34	5.597353**
Others	74	4.104459**
Total	701	5.07535**

*Significant at the 0.05 level (two-tailed test)

**Significant at the 0.01 level (two-tailed test)

Robustness regressions hypothesis 2

Table A-VIII

Jarque-Bera test for normality for all U.S. IPOs between 2001 and 2014

The data was retrieved from Dealogic. The sample includes all U.S. IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. The Jarque-Bera test is used to measure the existence of skewness and kurtosis. The test is performed on the dataset used in hypothesis 2.

	Observations	Pr(skewness)	Pr(kurtosis)	joint	
				adj chi2(2)	Prob>chi2
Deal value \$	134	0.000	0.000	.	0.000
Money left on the table \$	134	0.000	0.000	.	0.000
Revaluation \$	134	0.1604	0.000	29.79	0.000
Offer price \$	134	0.000	0.000	.	0.000
Closing price \$	134	0.000	0.000	64.64	0.000
Average file price \$	134	0.000	0.000	.	0.000
Shares outstanding	134	0.000	0.000	.	0.000
Shares offered	134	0.000	0.000	.	0.000
Initial shares offered	134	0.000	0.000	.	0.000
% Change price 1 day	134	0.000	0.000	.	0.000
% Filing range spread	134	0.002	0.3008	9.32	0.01
% Difference final and expected offer price	134	0.000	0.000	37.58	0.000
% Market return 15 days prior	134	0.000	0.001	21.75	0.000

Table A-IX

Overview of variables used in hypothesis 2, tested for U.S. IPOs between 2001 and 2014

The data was retrieved from Dealogic. The sample includes all U.S. IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. The sample consists of 134 observations.

Symbol	Description
Diff offer price	Percentage difference between final and expected offer price
Diff shares offered	Percentage difference between initial and actual number of shares offered
First-day return	Percentage first-day return
Filing range spread	Percentage spread between upper and lower limit of the original file price range
Expected deal value	Midpoint of original file price range times number of shares initially offered
Prior market return	Percentage compounded market return 15 days prior to issue
Final offer price	Final offer price

Table A-X**Correlations of variables, cross-sectional OLS regressions with difference between final and expected offer price and percentage first-day return as proxy, for U.S. IPOs between 2001 and 2014**

The data was retrieved from Dealogic. The sample includes all U.S. IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. The sample consists of 134 observations.

	Percentage difference final and expected offer price	Percentage change number of shares offered	Percentage first-day return	Percentage filing range spread	Expected deal value	Percentage market return 15 days prior to issue	Final offer price
Percentage difference final and expected offer price	1						
Percentage change number of shares offered	-0.3136	1					
Percentage first-day return	0.3016	.0016	1				
Percentage filing range spread	-0.0917	0.1109	0.1078	1			
Expected deal value	-0.2546	0.5574	-0.0124	-0.0371	1		
Percentage market return 15 days prior to issue	0.0534	-0.0174	0.0598	0.0317	-0.0827	1	
Final offer price	0.1994	0.0712	0.2599	-0.0031	0.3120	-0.2233	1

Table A-XI**Multicollinearity test for regression hypothesis 2 with percentage first-day return as dependent variable, tested for U.S. IPOs between 2001 and 2014**

The data was retrieved from Dealogic. The sample includes all U.S. IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. IPOs are categorised based on the difference between the final offer price and original file price range.

	VIF	1/VIF
Expected deal value	1.79	0.560221
Percentage difference number of shares offered	1.62	0.618493
Final offer price	1.30	0.768958
Percentage difference final and expected offer price	1.24	0.805997
Percentage market return 15 days prior to issue	1.07	0.937477
Percentage filing range spread	1.04	0.962642
Mean VIF	1.34	

Table A-XII**Cross-sectional OLS regression of U.S. IPOs between 2001 and 2014 with percentage first-day return as dependent variable**

The data was retrieved from Dealogic. The sample includes all U.S. IPOs between 2001 and 2014 of which the initial number of shares was available at Securities Data Company. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. The sample consists of 134 observations. Expected deal value and final offer price are shown in U.S. dollars.

	1	2	3	4	5	6
Intercept	0.135**	0.079**	0.053*	0.05*	0.048	-0.032
Percentage difference final and expected offer price	0.584**	0.335**	0.343**	0.347**	0.345**	0.275**
Percentage difference number of shares offered		0.019	0.017	0.013	0.013	0.017
Percentage filing range spread			0.254	0.262	0.259	0.233
Expected deal value				1.31e-11	1.45e-11	-1.98e-11
Market return 15 days prior to issue					0.282	0.612
Final offer price						0.006*

*Significant at the 0.05 level (two-tailed test)

**Significant at the 0.01 level (two-tailed test)

Robustness hypothesis 3

See table A-I for the Jarque-Bera test for normality of the dataset used in hypothesis 3.

Table A-XIII

Means of proceeds and money left on the table of European IPOs between 2001 and 2014, sorted by the final offer price relative to the original file price range midpoint

The data was retrieved from Dealogic. The sample includes all European IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. IPOs are categorised based on its offer price compared to the original file price range. The proceeds or total deal values are retrieved from Dealogic. The money left on the table is calculated by the difference between the final offer price and first-day closing price, multiplied by the total number of issued shares. Proceeds and money left on the table are shown in U.S. dollars.

Item	N	Percentage first-day return Mean <i>median</i>	Percentage positive return	Proceeds Mean <i>median</i>	Money left on the table Mean <i>median</i>
OP < LOW	141	0.6329787 <i>0.28</i>	55.32	193,000,000 <i>46,500,000</i>	-886,963 <i>14,418</i>
Middle range	525	4.818057 <i>2.00</i>	70.48	405,000,000 <i>109,000,000</i>	15,800,000 <i>730,358</i>
OP > HIGH	209	12.66196 <i>6.15</i>	81.34	190,000,000 <i>39,300,000</i>	24,800,000 <i>2,000,972</i>
Total	875	6.017234 <i>2.16</i>	70.63	319,000,000 <i>80,800,000</i>	15,200,000 <i>670,795</i>

Table A-XIV

Means of proceeds and money left on the table of Western European IPOs between 2001 and 2014, sorted by the final offer price relative to the original file price range midpoint

The data was retrieved from Dealogic. The sample includes all Western European IPOs between 2001 and 2014. The sample excludes all companies with an offer price below \$8, and excludes unit offerings, ADRs, REITs, partnerships, and closed-end funds. IPOs are categorised based on its offer price compared to the original file price range. The proceeds or total deal values are retrieved from Dealogic. The money left on the table is calculated by the difference between the final offer price and first-day closing price, multiplied by the total number of issued shares. Proceeds and money left on the table are shown in U.S. dollars.

Item	N	Percentage first-day return Mean <i>median</i>	Percentage positive return	Proceeds Mean <i>median</i>	Money left on the table Mean <i>median</i>
OP < LOW	116	1.644655 <i>0.425</i>	56.90	205,000,000 <i>39,800,000</i>	-1,037,791 <i>17,831</i>
Middle range	436	4.566537 <i>1.815</i>	79.19	427,000,000 <i>110,000,000</i>	15,200,000 <i>637,541</i>
OP > HIGH	149	9.235101 <i>5.84</i>	69.95	221,000,000 <i>53,000,000</i>	23,700,000 <i>2,395,374</i>
Total	701	5.07535 <i>2.02</i>	69.99	346,000,000 <i>82,900,000</i>	14,300,000 <i>555,093</i>