



**HAL**  
open science

## Dissecting IPO returns

Zoran Filipovic, Biljana Seistratkova

► **To cite this version:**

Zoran Filipovic, Biljana Seistratkova. Dissecting IPO returns. FMA (Financial Management Association International) 2023 European Conference, Jun 2023, Aalborg, Denmark. pp.37. hal-04579888

**HAL Id: hal-04579888**

**<https://hal.science/hal-04579888>**

Submitted on 18 May 2024

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

# Dissecting IPO Returns

Biljana Seistrajkova and Zoran M. Filipović\*

May 20, 2023

## Abstract

This paper examines the first-day returns and subsequent (under)performance of initial public offerings (IPOs). We provide an alternative explanation of the IPO underpricing puzzle and show that the first-day market price is not a good proxy for the intrinsic value of the company. We find that IPOs are overpriced both by the underwriters in the primary market and the investors in the secondary market relative to their peers. To test our hypotheses we focus on the behavior of sophisticated participants in the secondary market: short sellers and analysts. The main driver of the first-day return is the overreaction of less informed investors to hot IPOs in the secondary market, while pressure from sophisticated investors to find lendable securities is pushing the price of the newly issued stock even to a higher level. Short interest on the first trading day is negatively linked to subsequent long-run stock returns and accounting performance of the IPOs. Our findings are consistent with the behavioural theories that assume presence of irrational (sentiment) investors.

*JEL Classification:* G12; G24; G14; M41

*Keywords:* Initial public offerings; IPO performance; Short Selling; Analysts Recommendations

---

\*Seistrajkova: Università della Svizzera Italiana and Center for Climate Finance and Sustainability CCFS, Via Buffi 13, 6900 Lugano, Switzerland; biljana.seistrajkova@usi.ch; Filipović: Université Paris Dauphine Paris-Dauphine and PSL Research University, DRM, 75016 Paris, France; zoran.filipovic@dauphine.psl.eu. We thank Eric Nowak, Michel Habib, Francois Degeorge, and the participants of the Brown Bag Seminar at USI Institute of Finance and the seminars at Université Paris Dauphine Paris-Dauphine and Université Catholique de Louvain for helpful comments. – The authors declare that they have no relevant or material financial interests that relate to the research described in this paper.

# 1 Introduction

First-day returns and long-run underperformance of initial public offerings are a well documented phenomena in the financial literature ([Ritter \(1984\)](#), [Stern and Bornstein \(1985\)](#), [Ritter \(1991\)](#), [Loughran and Ritter \(1995\)](#), [Loughran and Ritter \(2002\)](#), [Ritter and Welch \(2002a\)](#)). They have been the focus of a large theoretical and empirical research for decades and still there is no consensus on the reasons why new issues experience large first-day returns and underperform different benchmarks in the long run.

Most of the theoretical models ([Baron \(1982\)](#), [Rock \(1986\)](#), [Allen and Faulhaber \(1989\)](#), [Welch \(1989\)](#), among others) assume that asymmetric information is the primary driver of the IPO phenomena and they are focused on the primary market mechanism, i.e. setting the offer price which according to their predictions is lower than the true value of the newly issued stock. According to [Ritter and Welch \(2002b\)](#) the solution to the underpricing puzzle has to lie in the process of setting the offer price, where the normal interplay of supply and demand is suppressed by the underwriter. We do not find an empirical evidence of such predictions.

Contrary, like [Purnanandam and Swaminathan \(2004\)](#), we find that the offer price is set too high relative to the stock price of the industry peers. Furthermore, we provide evidence that the main driver of high first day returns is actually the first day closing price itself (and not the low offer price). In our study, we are not trying to invalidate the previously discovered mechanisms, but rather identify the dominant factor that contributes the most to the unusually high first day returns. Given the information asymmetry and the complexity in the valuation of IPOs, peer companies come as a natural and simple choice.

In our sample of 1123 IPOs from 2009 to 2019 listed on US stock exchanges we find that an average IPO is overpriced both by the underwriters (offer price) and the investors (first day trading price). The offer price is on average set 24.8% higher than the price of the industry peers while the closing market price on the first trading day is on average 40.5% higher compared to the industry peers. The first day return in our sample is 15.7% and it is mainly explained by the deviations from fundamentals of the first day market price. Our results suggests that the solution to the puzzle lies mainly in the first day market price. We offer an alternative explanation of the IPO phenomena in a low information asymmetry context and with a focus

on the prices in the secondary market.

To test our hypotheses for presence of irrational trading in the secondary market we don't measure directly the optimism bias. Instead, we detected and measured the action of the rational traders who trade against the irrational ones. We analyze the most sophisticated players in the IPO secondary market, short sellers and analysts, who are better informed than the other investors. In this way we try to minimize the information asymmetry problem. IPOs represent potential examples of deviations of stock prices from fundamental values. We provide an empirical evidence of informed trading by short sellers immediately on the first trading day of the IPO. They take advantage of the mispricing driven by the overreaction of less sophisticated investors, acting on time and making profits, ultimately bringing back stock prices to their fundamental values.

There has been high interest in short selling in the academic literature in the past decade. Academics generally share the view that short sellers help correct deviations of stock prices from the fundamental value. It is widely accepted that if short selling is costly and there are heterogeneous investors beliefs, a stock can be overpriced by the market and generate low subsequent returns. This hypothesis originated with [Miller \(1977\)](#) and his predictions have motivated many recent empirical studies. He argues that there are restrictions on short selling following an IPO that result in pricing inefficiencies in the short term which are subsequently reversed in the long term as these constraints are relaxed. [Derrien \(2005\)](#), [Ljungqvist et al. \(2006\)](#) model an IPO company's optimal response to the presence of sentiment investors and short sale constraints. For a long time it was believed that there are restrictions on short selling of IPOs. However, [Edwards and Hanley \(2010\)](#) showed that short selling occurs simultaneously with the opening of trading in the US (in 99.5% of IPOs) and without delay as previously thought, implying that other factors may account for the high first day return of IPOs.

Our findings suggest that investors in the secondary market overreact to the new issues on the first trading day. Short sellers go against investor sentiment and are picking hot issues with high demand and high first day returns. Recently, [Boulton et al. \(2020\)](#) argue that IPO underpricing tends to be greater in countries that ban short selling or security lending and in countries where short selling is not common.

We decompose the first-day return into two components: the offer price underpricing

and the market price overpricing. The components are measured as a deviation of the offer price and the first-day closing price from the intrinsic value, respectively. We calculate the intrinsic value of the stock price using multiples method and industry peers following a similar procedure as in [Purnanandam and Swaminathan \(2004\)](#).

For example, when Printerest Inc. went public on April 18, 2019 on New York Stock Exchange, the offer price was set at \$19 by the leading underwriter Citigroup Global Markets Inc. which was above the initial price range of \$15-\$17 (suggesting a high demand). The share price closed at \$24.4 at the end of the first trading day implying a first-day return of 28.4%. At the same time 13.9% of the offered shares (around 2% of the total shares outstanding) were shorted on the first trading day qualifying Printerest's IPO as a heavily-shortened IPO. According to our multiples valuation on industry peers, the offer price should have been \$16.7, which is within the price range of the offer price set by the underwriters. In one year Printerest stock lost 30.3% of its initial value. The offer price undervaluation measure for Printerest is -12.3% ( $= (16.7 - 19) / 19$ ), where the negative sign implies that the stock was overpriced by the underwriters. While the market price overpricing measure for Printerest is 40.7% ( $= (24.4 - 16.7) / 19$ ). Both suggest overpricing. Taken together (-12.3%+40.7%), the two components give exactly the first-day return of 28.4%.

We use daily short sale data available from the Financial Industry Regulatory Authority (FINRA). Pursuant to Securities and Exchange Commission (SEC) request, FINRA has agreed to make reported short sale trade data publicly accessible beginning September 30, 2009 (Regulation SHO). For the sample period from September 30, 2009 to December 31, 2019 heavily-shortened IPOs are overpriced at the end of the first trading day on average by 75.5% relative to their industry peers while lightly-shortened IPOs are overpriced by 27%. We find strong positive statistically significant relationship between the first-day return and short interest (both calculated as a percentage of the shares offered and shares outstanding). In particular, the market price overpricing is a significant explanatory variable of the short interest. This finding suggests that short sellers go against the sentiment of investors for hot issues. On the other hand it seems to be against the common belief that short sellers correct observed mispricing. In fact, short sellers of IPOs have a longer length of time between opening and unwinding their positions relative to short sellers of other securities reported in the previous literature. The approximate duration of the position in this sample of IPOs is around 83 trading days. IPO prices need

more time to stabilize and return to the fundamentals after the initial boost. In line with this reasoning we find that the prices goes back to the fundamentals (close to the industry peers) after 6 months. This finding is in the line with the theoretical model of [Duffie and Pedersen \(2002\)](#) which states that if lendable securities are difficult to locate (as IPOs among others) the prospect of lending fees may push the initial price of a security above even the most optimistic buyer's valuation. A higher price can thus be obtained with some shorting than if shorting is disallowed.

We identify two channels for unrealistic first-day market price: overreaction by investors on the initial day of trading, consistent with the behavioural theories of capital markets by [Daniel et al. \(1998\)](#) and [De Long et al. \(1990\)](#), and pressure from short sellers consistent with [Duffie and Pedersen \(2002\)](#). The unrealistic first day market price then is reverted resulting in long-run underperformance of the IPOs which were heavily shorted.

Consistent with the short selling literature we find that the short interest on the first trading day is significantly negatively linked to subsequent long-run stock returns and accounting performance of the IPOs. Previous literature finds that high short interest ratios forecast low returns ([Asquith and Meulbroek \(1995\)](#) and [Desai \(2002\)](#)). [Dechow \(2001\)](#) documents that short sellers position themselves in stocks with low ratios of fundamentals (earnings and book value) to market values and cover their positions when ratios revert. [Diether and Werner \(2008\)](#) show that a trading strategy that buys stocks with low short selling activity and sells short stocks with high short selling activity generates an abnormal return of roughly 1.4% per month.

We partitioned the sample into 4 quartiles based on the short interest on the first trading day (1-lightly shorted; 2 and 3-medium shorted and 4-heavily shorted). IPOs that were the most shorted on the first trading day have significantly negative BHAR of 13% with a one year window using daily returns. In the cross section BHAR is also negatively related to the short sale interest on the first trading day and it is explained by the deviation of the first day trading price from the fundamentals. The stock returns are robust to alternative specifications of abnormal returns.

To circumvent the joint hypotheses problem present in the long-term event studies, we measure the effect of initial overpricing on the accounting returns (return on assets and return on equity, or ROA and ROE). Changes in accounting returns are negatively associated with

the initial overpricing by primary and secondary market. We find that ROA and ROE decline significantly in one year after the IPO for companies that were most shorted on the first trading day. The main driver of this result is the first day trading price of the newly issued stock. A decline in the accounting returns following the IPO of companies that were heavily shorted should capture only the decline in real performance without having the joint hypothesis problem of a misspecified model.

Further, we look at other well informed players in the secondary market, analysts. The semi-strong form of market efficiency theory states that investors should not be able to trade profitably on the basis of publicly available information, such as analysts' recommendations. The possibility that profitable investment strategies based on publicly available information could exist is suggested by the early findings of [Stickel \(1995\)](#) and [Womack \(1996\)](#). [Barber \(2001\)](#) documents that selling short stocks with the least favourable consensus recommendations and buying stocks with the most favourable recommendations yields abnormal returns. All these findings suggest that investors can profit from publicly available analysts' recommendations and that these recommendations possess additional information about the true value of securities. We show that there is a positive statistically significant relationship between the short interest on the first trading day and the first consensus analysts' recommendation (between 1 (Strong Buy) and 5 (Strong Sale)). Heavily-shorted IPOs get the least favourable initiation of analysts' recommendations. Further, we show that heavily-shorted IPOs have the highest probability of downgrade by analysts within the first year after the IPO. A probit model shows that the predicted probability of a downgrade increases with the short selling interest on the first trading day. Heavily-shorted IPOs have the highest predicted probability to be downgraded within the first year after the IPO.

Last, we exclude the possibility that underwriters are affecting the first day market price by shorting the newly issued stock. Namely underwriters in case of overallocation can sell additional shares without exercising the over-allotment option, by covering their position with open market purchase (so-called syndicate short covering). Starting from February 28, 2011 FINRA reports separately short sale volumes that are exempted from the restriction (Rule 201)

of short selling.<sup>1</sup> Transactions that are exempted from the restrictions of Rule 201 involve activities such as arbitrage of positions on options exchanges or foreign markets, hedging of derivatives due within a few days and the distribution by an underwriter of an IPO i.e. syndicate short covering. Syndicate short covering is regulated by another rule by the SEC called Rule 104 of Regulation M and it is exempted from Rule 201.

By restricting the sample to start from February 28, 2011 we are able to test which trades are more informative. Only transactions that are subject to the restrictions of Rule 201 are trades in which short sellers anticipate subsequent underperformance. The results reveal that only these transactions are significantly negatively linked to the market price overpricing, i.e. the second component of the secondary market return. Trades that are exempted from restrictions (short selling of underwriters among others) are not informative about the fundamental value of the respective IPO and its future return on the long run and they don't anticipate future underperformance.

All our findings suggest that the solution to the underpricing puzzle of IPOs lies in the first day market price rather than in the offer price as most of the previous literature argues. We identified two channels which are driving the first day market price: overreaction of less informed investors to hot IPOs and pressure from sophisticated investors to find lendable securities which are initially increasing the price for the newly issued stock even at a higher level.

The rest of the paper is structured as follows. Section 2 discusses the sample and the methodology in more details. In section 3 we decompose the first day return and we discuss the connection between different IPO characteristics and the short selling interest on the offer day. Section 4 examines the long-run stock market and accounting performance of the IPOs. Section 5 provides tests of the relationship between the short selling interest, initial overpricing and consensus analysts' recommendations. Section 6 concludes.

---

<sup>1</sup>The SEC adopted Rule 201, so-called "Alternative Up-tick Rule" in February 2010, which imposed restrictions on short selling. This rule is a variation of the 70-year-old "Up-tick Rule" that was eliminated in 2007. The rule applies to securities following an intra-day price decline of more than 10% from the previous day's closing price. For such stocks, the SEC allows short selling only if the transaction price is above the national best bid.



## 2 Data and Methodology

The sample of IPOs and their offering characteristics is collected from Thomson Reuters Eikon database. Only U.S. issues with offer prices higher than five dollars are taken into consideration, excluding units offerings and closed-end funds. An IPO is included in the final sample only if it has prices available on CRSP (Center for Research in Security Prices) and has available financial statements in the Compustat database.

We use daily short sale data from the Financial Industry Regulatory Authority (FINRA) which became publicly available in September 2009. We restrict the sample to December 2019 to avoid unexpected shocks like Covid-19 pandemic. The sample period is characterized as a decade of low IPO activity and low first day return. If there is an evidence for irrational optimism of the investors in the secondary market in such quite period, we can argue that it is more pronounced during periods with higher IPO activity and higher first day returns.

[Figure 1 ABOUT HERE]

The data from FINRA include ticker, date, total short sale volume, short volume that is exempted from short sale restrictions and reporting facility identifier (NASDAQ, NYSE, ADF – Alternative Display Facility and ORF – Over-the-counter Reporting Facility). We aggregate individual short sale transactions for each day and company into daily short sale volume for each IPO on the first trading day. Daily short sales volume is scaled by the number of shares offered<sup>2</sup>. We defined short selling interest for each IPO on the first trading day as:

$$SV_{\text{tot}}/SO(\%) = \frac{\text{SharesShorted}}{\text{SharesOffered}} * 100 \quad (1)$$

After merging all four databases (FINRA, Eikon, CRSP and Compustat), the final sample has 1123 IPOs. Additional IPO characteristics, like a negative price revision dummy and an internet IPO dummy, are retrieved from Jay Ritter's webpage.<sup>3</sup> Mean analysts' recommendation for each IPO are taken from I/B/E/S U.S. Recommendation database. All recommendations are between 1 (Strong Buy) and 5 (Strong Sale).

<sup>2</sup>All results are robust when scaling with shares outstanding.

<sup>3</sup>We thank Jay Ritter for making these data publicly available. See <http://bear.warrington.ufl.edu/ritter/ipodata.htm>.

## 2.1 Main Variables Definition

Following the literature, we define the first-day return as the percentage difference between the first-day secondary market closing price and the offer price:

$$FirstDayReturn = \frac{FirstDayClosingPrice - OfferPrice}{OfferPrice} * 100 \quad (2)$$

A positive first-day return is a result of the following possibilities: either the offer price is set too low, the first-day closing market price is too high or both. In order to be able to see which part is driving the first-day return and how it is connected to short sale volume on the offer day and initial analysts' recommendations, we decompose the first-day return into two parts. The first step is to find a measure of a "fair" price of the offering. We compute the intrinsic (fair) price of each IPO by finding the most similar industry peer that did not go public in the respective year. We are restricted to using only price-to-sales ratios (P/S) because only sales figures are available for all companies. For each matching firm we compute the P/S ratio as follows:

$$\left(\frac{P}{S}\right)_{Match} = \frac{MarketPrice * SharesOutstanding}{PriorFiscalYearSales} \quad (3)$$

where the market price is the CRSP stock price for the matching firm at the close of the respective IPO offer date of the company. The intrinsic (fair) value of each IPO is computed by multiplying the P/S ratio of the industry peer with the prior year fiscal sales of the appropriate IPO:

$$IntrinsicValue = \left(\frac{P}{S}\right)_{Match} * Sales_{t-1}, \quad (4)$$

while intrinsic price of the IPO is:

$$IntrinsicPrice = \frac{IntrinsicValue}{SharesOutstanding}. \quad (5)$$

We use the intrinsic (fair) price as a benchmark to compare the offer price and the first-day market price. We decompose the first-day return into its two drivers: offer price undervaluation (coming from a low offer price) and market overpricing (coming from an overoptimistic first-day closing market price):

$$OfferPriceUndervaluation = \frac{IntrinsicPrice - OfferPrice}{OfferPrice} * 100 \quad (6)$$

$$\text{MarketOverpricing} = \frac{\text{FirstDayClosingPrice} - \text{IntrinsicPrice}}{\text{OfferPrice}} * 100 \quad (7)$$

Figure 2 shows the graphical representation of the decomposition of the first day return.

[Figure 2 ABOUT HERE]

To identify peer companies, we match each company from our sample with publicly listed companies in the same Fama-French 48 industry and require that total assets do not differ more than 50% in size from those of the company being listed. Then we select the comparable company that has the most similar asset size. In the robustness check reported in Table 11 we provide 3 alternative matching procedures that yield qualitatively similar results. First, we modify the previous matching procedure and calculate the mean offer price undervaluation and the mean market price overpricing keeping all comparable companies that meet the 50% difference threshold. Second, we identify a peer company following a similar procedure as in Purnanandam and Swaminathan (2004): we match companies on Fama-French 48 industry, then we require that revenue does not differ more than 50% and that profitability (defined as EBITDA/Revenues) does not differ more than 100%, and finally we select the peer company that has the most similar revenue. Third, we modify the previous procedure and calculate the mean offer price undervaluation and the mean market price overpricing keeping all comparable companies that meet the revenue and profitability thresholds.

[Table 11 ABOUT HERE]

Table 1 reports the average first-day return (row 1) and its two components (rows 2 and 3) for the full sample (column 1) and for the quartiles formed based on the short sale volume on the offer day (from column 2 to column 5). All variables are winsorized at 5% in order to make sure that extreme values of the distribution are not driving the results. Differences in the first-day return and its two components between the heavily-shortaged IPOs (quartile 4) and lightly-shortaged IPOs (quartile 1) are in column 6, while column 7 reports the t-statistics of these differences. The average first-day return increases with the short sale interest on the offer day. Heavily-shortaged IPOs have the highest first-day return (averaging 37.8%), while lightly-shortaged IPOs are the ones with the lowest first-day return (only 4.14%). The offer prices of the

IPOs in our sample are set on average 24.8% higher than their industry peers. Heavily-shorter IPOs have offer prices higher than the prices of their industry peers on average by 37.7%, while lightly shorted IPOs have offer price set closer to the prices of the peers.

[Table 1 ABOUT HERE]

The close price on the first trading day deviates significantly from the prices of their industry peers, on average by 40.5% for the entire sample, and is likely the driving force behind the magnitude of the first-day return. This finding indicates that investors are overoptimistic about new issues and exhibit a high demand for them. Figure 3 shows the graphical representation of the decomposition of the first day return using sample averages and it's notable that the distance of the first day market price on the secondary market is the main driver of the magnitude of the first day return, while the distance of the offer price is decreasing the first day return because on average the offer price is set higher than the prices of the industry peers.

[Figure 3 ABOUT HERE]

Heavily-shorter IPOs have the highest overpricing relative to their industry peers (averaging 75.5%), while lightly-shorter IPOs have the lowest deviation of the closing price on the first trading day relative to their industry peers (average 40.5%). The differences between the heavily-shorter IPOs and lightly-shorter IPOs are always statistically significant.

## 2.2 Summary statistics

Summary statistics for the full sample are presented in Column 1 of Table 2. In the next four columns, the sample is partitioned into quartiles based on the short sale interest on the offer day. Panel A of Table 2 presents summary statistics of the main variables described in Section 2 and the short sale interest on the offer day of the 1123 IPOs analyzed in this paper. On average 4.55% of the shares offered are shorted on the offer day. This corresponds to 1.21% of the total shares outstanding. If we assume that shareholders are homogeneous and short interest is constant, the length of time between opening and unwinding the position (D- duration of the

position) can be approximated by using this formula:

$$D = \frac{1}{ShortSaleTurnover}; ShortSaleTurnover = \frac{SharesShorted}{SharesOutstanding} \quad (8)$$

Using the average number of 1.21% short sale turnover on the offer day and assuming that 1.21% of the shares will be shorted each day, it would then take 83 trading days for the entire stock of outstanding shares to turn over. The average holding period of the short sellers of the IPOs in our sample is 83 trading days. This is significantly higher than reported by [Boehmer et al. \(2008\)](#), who find an average trading duration of 37 days for the positions of short sales in 2004 at NYSE.

[Table 2 ABOUT HERE]

Panel B of [Table 2](#) presents initial statistics on the IPO characteristics for the full sample (column 1) and each quartile based on the short sale interest on the offer day (columns 2-5). Heavily-shorted IPOs (quartile 4) are bigger by all means: market capitalization, offer price, number of shares offered and gross proceeds.

### 3 First Day Return and Short Selling Interest

First [Ritter and Welch \(2002a\)](#) and then [Cornelli and Ljungqvist \(2006\)](#) argue that overoptimism among retail investors may explain the much-documented price jumps once trading in newly listed stocks begins, as well as the subsequent low returns over the longer run.

IPOs with the highest first-day returns are considered to be hot issues with the highest demand and they are overpriced by the market at the end of the first trading day. As short sellers are more sophisticated than other retail investors, they note the overpricing and go against the behavioral biases such as overoptimism that surround hot issues in order to make profits on the longer run. This finding is robust to the regression framework reported in [Table 3](#).

We regress the short sale interest on the offer day on the two components of the first day return: deviation of the closing first-day price relative to the industry peers (market overpricing) and deviation of the offer price relative to the industry peers (offer price undervaluation).

Short selling on the offer day increases with the deviation of the closing first day trading price relative to the industry peers (market overpricing). The market overpricing variable has a positive and statistically significant coefficient, as reported in the first three columns of [Table 3](#). Short sellers are shorting IPOs which are overpriced by investors in the secondary market. The results show that short sellers go against the sentiment of investors in the secondary market, whose overoptimism about hot issues on the first trading day leads to overpriced securities.

[[Table 3](#) ABOUT HERE]

The deviation of the offer price relative to the industry peers (offer price undervaluation), as expected, has a negative statistically significant coefficient, as reported in columns 4, 5 and 6. Short selling is decreasing as underpricing by the underwriters increases. Notably, market overpricing variable has higher magnitude and impact on the short interest compared to the offer price undervaluation variable, resulting in positive statistically significant relationship between the first day return and short interest.

Striking result is that the first-day return is positively related to the short sale interest on the offer day in all specifications in [Table 3](#). IPOs with the highest first-day return are the ones that are the most shorted on the offer day. This finding is also confirmed by [Hanley \(1993\)](#). IPOs with the highest first-day return are hot issues with high demand. These IPOs are overpriced by the market at the end of the first trading day. Short sellers are more sophisticated than other types of investors, and they go against the behavioural biases, such as overoptimism, that surrounds hot issues in order to profit in the longer run. In the longer run, IPOs with the highest first-day return underperform relative to the market and other IPOs, as shown by [Ritter \(1991\)](#).

As controlling variables we use the following IPO characteristics: gross proceeds, number of shares offered, size, issue price range, over-allotment shares sold, over-allotment amount, negative price revision, Nasdaq dummy and the internet IPO dummy. We control for year and industry fixed effects. In terms of statistical significance, the most relevant IPO characteristics that influence the short sale interest on the offer day are: gross proceeds, issue price range, over-allotment shares sold and the internet IPO dummy. Short sale interest on the offer day increases with the gross proceeds. Bigger issues are more likely to be shorted on the offer

day. Issue price range has a positive and significant coefficient, meaning that, for IPOs with offer prices set above the initial price range, short sale volume on the offer day is higher. Our interpretation of this result is that short sellers go against the rest of the market for IPOs that exhibit strong demand prior to going public (their price is usually set above the initial price range).<sup>4</sup> The internet IPO dummy is also positive and statistically significant. Internet IPOs are considered to be hot issues with high demand and short sellers are more likely to short these types of IPOs.

Next, we exclude the possibility that underwriters are affecting the first day market price by shorting the newly issued stock. Namely underwriters in case of overallocation can sell additional shares without exercising the over-allotment option, by covering their position with open market purchase (so-called syndicate short covering). Starting from February 28, 2011 FINRA reports separately short sale volumes that are exempted from the restriction (Rule 201) of short selling. Transactions that are exempted from the restrictions of Rule 201 involve activities such as arbitrage of positions on options exchanges or foreign markets, hedging of derivatives due within a few days and the distribution by an underwriter of an IPO i.e. syndicate short covering.

By restricting the sample to start from February 28, 2011 we show that transactions that are exempted from restrictions (short selling of underwriters among others) are not informative about the fundamental value of the respective IPO and its future return on the long run and they don't anticipate future underperformance. In [Table 10](#) the dependant variable is short selling exempt interest on the offer day defined as the number of shares shorted that are exempted from the restriction (Rule 201) of short selling over number of shares offered.

[[Table 10](#) ABOUT HERE]

---

<sup>4</sup>See [Hanley \(1993\)](#) for reference.

## 4 Long-run IPO Returns

### 4.1 Long-run Market Performance

We measure the long-run market performance of IPOs conditioned on short selling interest on the offer day over different windows following the IPO: one month, three months, six months and one year.

Figure 4 shows row returns for the four quartiles created on the bases of the short interest on the first trading day. Heavily shorted IPOs (Quartile 4) experience the worst performance in one year window.

[Figure 4 ABOUT HERE]

There is no consensus in the literature about which method is better: use of cumulative abnormal returns (CARs) or buy-and-hold returns (BHAR). Some of the works, for example Fama (1998), justify the use of cumulative abnormal returns (CARs). However, in case of IPOs it's very difficult to estimate alpha and beta due to the lack of data in the estimation window before the IPO because these stocks were not publicly traded before the event. Further, Barber and Lyon (1997) emphasize the advantage of BHARs for measuring an investor's experience, because the use of mean calendar-time returns or their sum (cumulative returns) does not adequately measure the returns obtained by an investor who holds a stock for a long period of time. According to these authors, the returns obtained by an investor in the long run are better approximated by compounding short-run simple returns. Given these reasons, we use buy-and-hold returns (BHAR) approach.

We calculate long-run returns for each quartile by compounding daily return over 252, 121, 60 and 20 trading days, starting on the offer day. We adjust them by the normal return approximated by the CRSP value-weighted index:

$$BHAR = \sum_{i=1}^N w_i \left[ \prod_{t=t_i}^{T_i} (1 + R_{it}) - 1 \right] - \sum_{i=1}^N \left[ \prod_{t=t_i}^{T_i} (1 + E(R_{it})) - 1 \right], \quad (9)$$

where  $R_{it}$  is the return of security  $i$  on day  $t$ ,  $N$  is the number of securities,  $T$  is the number of



days (252, 121, 60 or 20 trading days),  $t_i$  is the first day of trading and  $E(R_{it})$  is the expected or normal return (CRSP value-weighted index). Weights ( $w_i$ ) are defined as the ratio of issuer  $i$ 's common stock market value and sum of the market values of all stocks. [Table 4](#) report the results.

[[Table 4](#) ABOUT HERE]

We find negative and statistically significant buy-and-hold returns for all time windows for heavily-shorted IPOs on the offer day (quartile 4). Thus, firm performance, measured using buy-and-hold compounded stock return data, is lower for IPOs that were heavily shorted on the offer day of the IPO. If an investor buys and holds a security that was heavily shorted on the offer day, he will lose on average 13% in one year, while holding lightly-shorted IPOs would have yield a negative return of 4.1%. The difference between heavily-shorted IPOs (quartile 4) and lightly-shorted IPOs (quartile 1) on the offer day is always positive and statistically significant. We conclude that heavily-shorted IPOs on the offer day underperform both relative to the overall market and relative to a sample of IPOs that were lightly shorted on the offer day. [Figure 5](#) demonstrates the underperformance of heavily-shorted IPOs.

[[Figure 5](#) ABOUT HERE]

#### 4.1.1 Cross-section of Market Returns

To address whether overpricing both by the underwriters in the primary market and the investors in the secondary market on the offer day can explain cross-sectional differences in future abnormal returns of IPOs, we regress one-year post-issue buy-and-hold abnormal return of each IPO.

The results are presented in [Table 5](#). In first two columns, we show that short selling interest on the first trading day significantly and negatively predicts BHAR. This result indicates that higher short selling interest on the offer day predicts a future decline in abnormal returns. In terms of economic significance, a 1% increase in short interest on the offer day predicts 0.66% decline in one-year abnormal return. We control for industry and year fixed effects. In

the second column we add controls for different IPOs characteristics: gross proceeds, number of shares offered, size, issue price range, over-allotment shares sold, over-allotment amount, negative price revision, Nasdaq dummy and the internet IPO dummy.

[Table 5 ABOUT HERE]

In columns 3 to 6 we show that higher overpricing both by the secondary and primary market predicts lower one year abnormal return. Only the portion of the first-day return which is associated to the secondary market price (market overpricing) is statistically significant which is in line with our main finding. In the last two columns in Table 5 there is an evidence that first day return is negatively associated with the BHAR. 1% increase in first day return predicts 0.1% decline in one-year abnormal return.

## 4.2 Long-run Accounting Performance

Next, we consider whether there is a similar decline in performance following the IPO for companies that were initially overpriced, hence heavily shorted on the offer day, by using accounting data (instead of stock returns). Specifically, we consider whether return on asset (ROA) and return on equity (ROE) decline one year following the IPO. Measuring the effect using accounting data should capture only the decline in real performance, mitigating the joint hypothesis problem.

The first four columns of Table 6 report results from a regression where dependent variable is the annual change in ROA, calculated as net income over total assets. In the last four columns dependent variable is the annual change in ROE calculated as net income over the shareholders' equity.

[Table 6 ABOUT HERE]

Initial overpricing, both by primary and secondary market, predicts decline in accounting returns one year after the IPO. After using accounting data instead of stock market data, we conclude that performance of IPOs is declining in one year window with the overpricing by the underwriters and the investors in the secondary market.

## 5 Analysts' Recommendations, Initial Overpricing and Short Selling

The semi-strong form of market efficiency theory states that investors should not be able to trade profitably on the basis of publicly available information, such as analysts' recommendations. However, research departments of brokerage houses spend large sums of money on security analysis, presumably because these firms and their clients believe that it can generate superior returns. The possibility that profitable investment strategies based on publicly available information could exist is suggested by the early findings of [Stickel \(1995\)](#) and [Womack \(1996\)](#). Furthermore, [Barber \(2001\)](#) documents that selling short stocks with the least favorable consensus recommendations and buying stocks with the most favorable recommendations yields abnormal returns. All these findings suggest that investors can profit from publicly available analysts' recommendations and that these recommendations possess additional information about the true value of securities.

In the case of IPOs, there is a so-called "quiet period" for a period of 25 trading days following the IPO, when the issuing firm and the members of the underwriting syndicate are not allowed to issue opinions concerning valuation, including research recommendations. In our sample of IPOs the first initiation of recommendations on average appears 42 calendar days after the offer day. This corresponds to 28 trading days, similar to the quiet period.

Since the first initiation of recommendations after the IPO starts after the quiet period, we assume that most of the analysts that initiate the recommendations of IPOs in our sample are affiliated analysts that were part of the underwriting syndicate. These analysts are considered to have superior information over unaffiliated analysts and the rest of the market.

We hypothesize that there should be a relationship between short sale interest on the first trading day and the analysts' initiation of recommendations that occur after the quiet period. Our goal is to show that heavily-shortened IPOs on the offer day receive the least favorable consensus recommendations.

To test this hypothesis we regress the first mean analysts' recommendation of a company that went public on the short selling interest on the offer day. Mean analysts' recommendations

are retrieved from the I/B/E/S U.S. Recommendation database. All recommendations are between 1 - Strong Buy and 5 - Strong Sale. After merging with the recommendations database our sample decreases to 1089 IPOs that are present in I/B/E/S database.

In summary statistics [Table 2](#) heavily-shorter IPOs on the offer day have an average initiation of consensus recommendation of 2.05, that is, between Buy and Hold, while lightly-shorter IPOs on the offer day have an average initiation of 1.74, that is, between Strong Buy and Buy. This provides initial evidence that short sellers are good at picking overvalued IPOs relative to undervalued ones. This evidence is also robust to more rigorous regression framework reported in [Table 7](#). It show results from a cross-sectional regression in which the dependent variable is the first consensus (mean) analysts' recommendation for each IPO. The variable of interest is the short sale interest on the offer day, after controlling for different IPO characteristics and time and industry fixed effects. The first column considers the full sample, while in the next four columns the sample is partitioned into quartiles based on short selling interest on the offer day.

[[Table 7](#) ABOUT HERE]

We find a positive statistically significant relationship between the value of the first analyst recommendation after the IPO and the short sale interest on the offer day in the full sample. This result is mainly driven by the heavily-shorter IPOs (quartile 4), which are the only IPOs to have a positive statistically significant relationship with mean analysts recommendations.<sup>5</sup> The positive relationship means that heavily-shorter IPOs on the offer day afterwards receive less favourable analysis recommendations. For each 1% increase in short selling interest on the offer day, the first consensus recommendation is higher (meaning less favourable) by 0.015.

Short selling interest on the offer day and the initiations of analysts' recommendations are driven by the deviations of the security prices from their fundamental values on the first trading day on the secondary market. In [Table 8](#) in column 3 and 4 we show that overpricing on the first trading day predicts less favourable initial consensus recommendation. Further in column 7 and 8 in [Table 8](#) we show that higher first-day return is associated with less favourable

---

<sup>5</sup>The consensus analysts' recommendation is bounded dependent variable taking continuous values from 1 to 5. For simplicity we use and present the ordinary least squares (OLS) model because the predicted values are always in the range from 1 to 5. However, the results are robust also when using a tobit model or an ordered logit model

recommendation. Offer price doesn't predict the first consensus recommendations as shown in column 5 and 6 in the same table.

[Table 8 ABOUT HERE]

Further goal is to show that heavily-shorter IPOs are also bad investments in the longer run of one year. We hypothesize that, if short sellers are good at picking overvalued IPOs on the offer day and if they contribute to bringing prices back to their fundamental values, consequently these stocks should be downgraded by analysts. For this purpose we use a logit model in which the dependent variable is equal to 1 if the IPO firm was downgraded within one year. Results from the probit model are reported in Table 9. The probability for downgrading increases with short selling interest on the offer day. Heavily-shorter IPOs have highest probability for being downgraded in period of one year. The distance of the first day market price from the fundamental value of the stock increases the probability for downgrade.

[Table 9 ABOUT HERE]

## 6 Conclusion

IPOs are major corporate events surrounded by much noise and pricing inefficiencies. We find that the first day market price is not a good proxy of the fundamental value of the company. On the other hand, it is the main driver of the first day return and the long-run underperformance of IPOs.

We identified two channels which are driving the first day market price: overreaction of less informed investors for hot issues and pressure from sophisticated investors to find lendable securities which are initially increasing the price for the newly issued stock even at a higher level followed by long run underperformance.

In our sample, which spans over ten years, IPOs are overpriced both by the underwriters in the primary market and the investors in the secondary market compared to their peers. Overoptimism among retail investors may explain the much-documented price jumps once trading in newly listed stocks begins, as well as the subsequent low returns over the longer run. We

use as a tool the behaviour of the most sophisticated players in the IPO secondary market, short sellers and analysts, who are more informed than the other investors, and we show that they go against the sentiment of investors in the secondary market. Hot IPOs with the highest first day returns are the ones that are the most shorted and subsequently downgraded by the analysts. Those IPOs are experiencing the poorest long-run performance.

Our findings are consistent with the behavioural theories for presence of irrational (sentiment) investors who drive the initial price of new issues above their true value, resulting in subsequent underperformance.

Our paper contributes to the vast literature of the underpricing puzzle and long-run underperformance of IPOs by offering an alternative explanation of the IPO phenomena in a low information asymmetry context and with a focus on the first day price in the secondary market.

## References

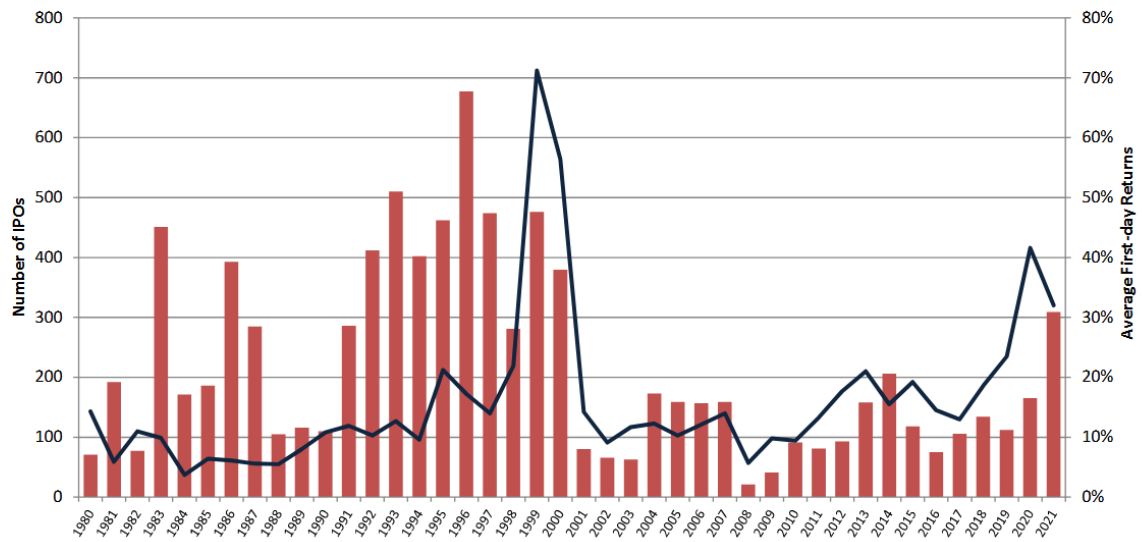
- Allen, Franklin, and Gerald R Faulhaber, 1989, Signalling by underpricing in the ipo market, *Journal of financial Economics* 23, 303–323.
- Asquith, Paul, and Lisa K. Meulbroek, 1995, An empirical investigation of short interest, *Division of Research, Harvard Business School* .
- Barber, Brad M., and John D. Lyon, 1997, Detecting long-run abnormal stock returns: The empirical power and specification of test statistics, *Journal of financial economics* 43.3: 341-372 .
- Barber, et al., Brad, 2001, Can investors profit from the prophets? security analyst recommendations and stock returns, *The Journal of Finance* 56.2: 531-563 .
- Baron, David P, 1982, A model of the demand for investment banking advising and distribution services for new issues, *The journal of finance* 37, 955–976.
- Boehmer, Ekkehart, Charles M Jones, and Xiaoyan Zhang, 2008, Which shorts are informed?, *The Journal of Finance* 63, 491–527.
- Boulton, Thomas J, Scott B Smart, and Chad J Zutter, 2020, Worldwide short selling regulations and ipo underpricing, *Journal of Corporate Finance* 62, 101596.
- Cornelli, Goldreich, and Alexander Ljungqvist, 2006, Investor sentiment and preipo markets, *The Journal of Finance* 61.3: 1187-1216 .
- Daniel, Kent, David Hirshleifer, and Avanidhar Subrahmanyam, 1998, Investor psychology and security market under-and overreactions, *the Journal of Finance* 53, 1839–1885.
- De Long, J Bradford, Andrei Shleifer, Lawrence H Summers, and Robert J Waldmann, 1990, Positive feedback investment strategies and destabilizing rational speculation, *the Journal of Finance* 45, 379–395.
- Dechow, et al., Patricia M., 2001, Short-sellers, fundamental analysis, and stock returns, *Journal of Financial Economics* 61.1: 77-106 .
- Derrien, Francois, 2005, Ipo pricing in “hot” market conditions: who leaves money on the table?, *The journal of finance* 60, 487–521.
- Desai, et al., Hemang, 2002, An investigation of the informational role of short interest in the nasdaq market, *The Journal of Finance* 57.5: 2263-2287 .
- Diether, Kuan-Hui Lee, Karl B., and Ingrid M. Werner, 2008, Short-sale strategies and return predictability., *The Review of Financial Studies* 22.2: 575-607 .
- Duffie, Nicolae Garleanu, Darrell, and Lasse Heje Pedersen, 2002, Securities lending, shorting, and pricing, *Journal of Financial Economics* 66.2-3: 307-339 .
- Edwards, Amy K., and Kathleen Weiss Hanley, 2010, Short selling in initial public offerings, *Journal of Financial Economics* 98.1: 21-39 .
- Fama, Eugene F., 1998, Market efficiency, long-term returns, and behavioral finance, *Journal of financial economics* 49.3: 283-306 .

- Hanley, Kathleen Weiss, 1993, The underpricing of initial public offerings and the partial adjustment phenomenon, *Journal of financial economics* 34.2: 231-250. .
- Ljungqvist, Alexander, Vikram Nanda, and Rajdeep Singh, 2006, Hot markets, investor sentiment, and ipo pricing, *the Journal of Business* 79, 1667–1702.
- Loughran, Tim, and Jay R. Ritter, 1995, The new issues puzzle, *The Journal of finance* 50.1 .
- Loughran, Tim, and Jay R. Ritter, 2002, Why don't issuers get upset about leaving money on the table in ipos?, *Review of financial studies* 15.2 .
- Miller, Edward M., 1977, Risk, uncertainty, and divergence of opinion, *The Journal of finance* 32.4: 1151-1168 .
- Purnanandam, Amiyatosh K, and Bhaskaran Swaminathan, 2004, Are ipos really underpriced?, *The Review of Financial Studies* 17, 811–848.
- Ritter, Jay, and Ivo Welch, 2002a, A review of ipo activity, pricing, and allocations, *No. w8805. National bureau of economic research* .
- Ritter, Jay R., 1984, The "hot issue" market of 1980, *Journal of Business* .
- Ritter, Jay R., 1991, The long run performance of initial public offerings, *The Journal of Finance* 46.1 .
- Ritter, Jay R, and Ivo Welch, 2002b, A review of ipo activity, pricing, and allocations, *The journal of Finance* 57, 1795–1828.
- Rock, Kevin, 1986, Why new issues are underpriced, *Journal of financial economics* 15.1 .
- Stern, Richard L., and Paul Bornstein, 1985, Why new issues are lousy investments, *Forbes* 136 .
- Stickel, Scott E., 1995, The anatomy of the performance of buy and sell recommendations, *Financial Analysts Journal* 51.5: 25-39 .
- Welch, Ivo, 1989, Seasoned offerings, imitation costs, and the underpricing of initial public offerings, *The Journal of Finance* 44, 421–449.
- Womack, Kent L., 1996, Do brokerage analysts' recommendations have investment value?, *The Journal of Finance* 51.1: 137-167 .



## IPO volume has been very low in the U.S. since 2000

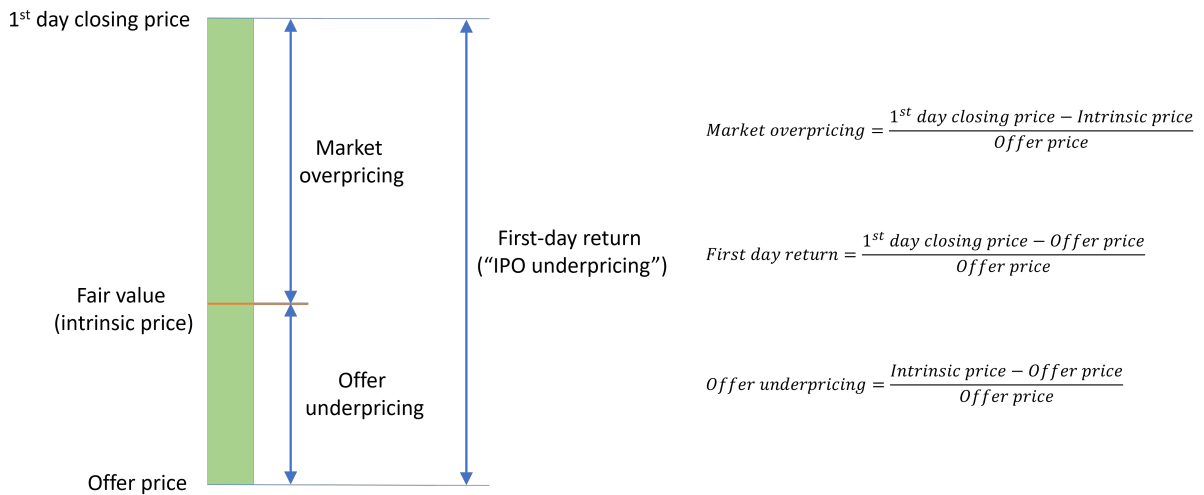
In 1980-2000, an average of 310 operating companies went public every year  
In 2001-2021, an average of 122 operating companies went public every year



Number of Offerings (bars) and Average First-day Returns (line) on US IPOs, 1980-2021

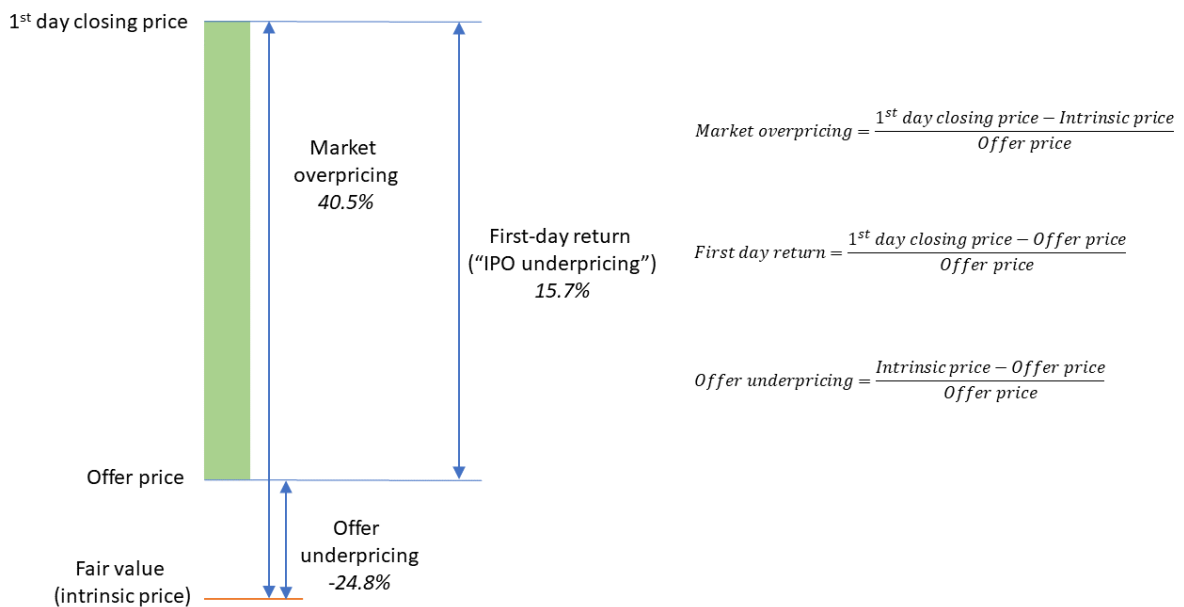
### Figure 1: IPO Activity 1980-2021

The figure plots number of offerings (bars) and the first day return (line) in the U.S. from 1980 until 2021. Our sample period spans from 2009 until 2019 when both number of offerings and the first day return are at the lowest historical values.



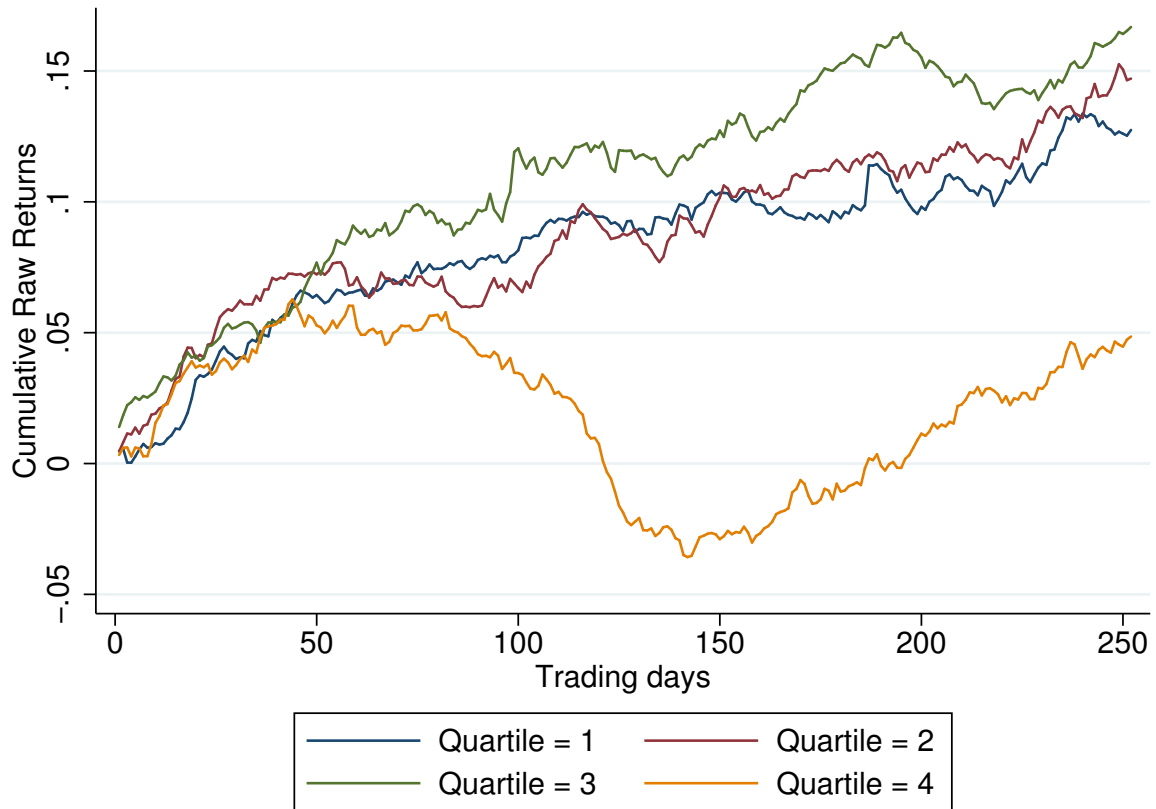
**Figure 2: Decomposed First Day Return**

This figure plots the two measures used to decompose the first day return. Market overpricing measure is the distance of the first day market price from the intrinsic price calculated by using most similar peer company. Offer underpricing is the distance of the offer price from the intrinsic price. Both measures are standardized with the offer price. The sum of the two measures is the first day return.



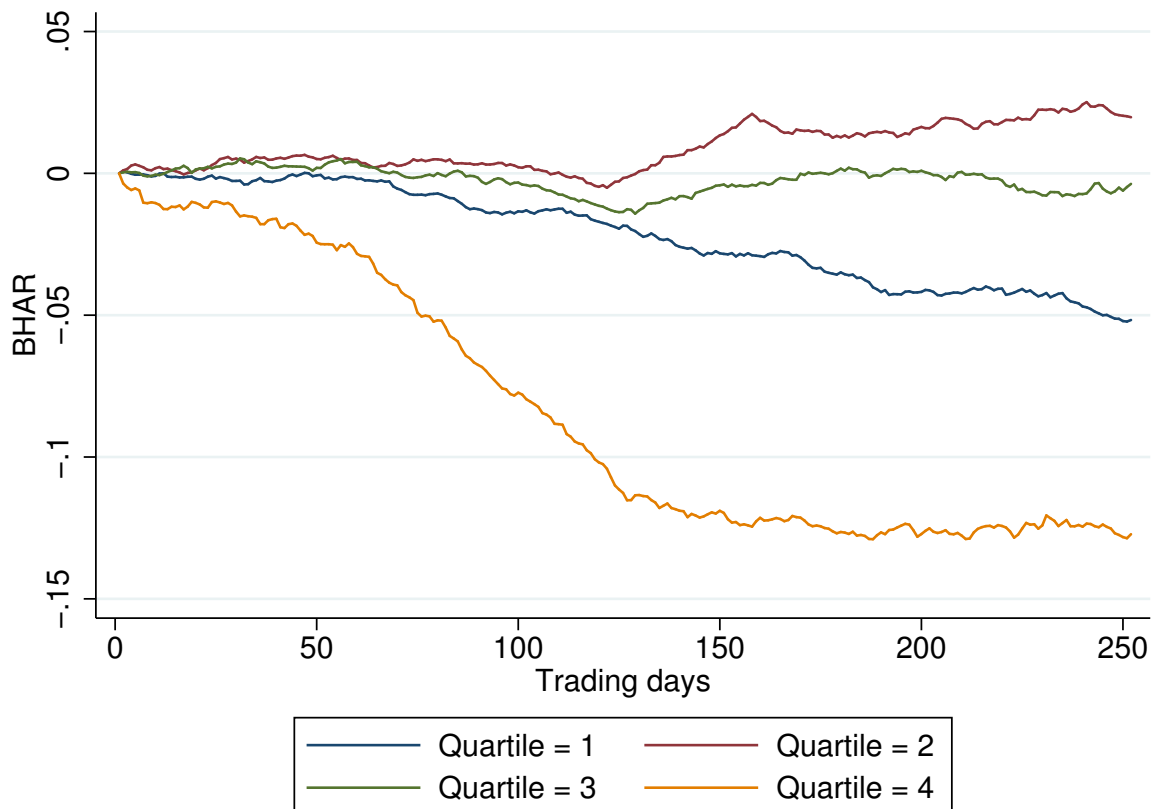
**Figure 3: Decomposed First Day Return Sample Data**

This figure plots the two measures used to decompose the first day return using the sample averages of 1123 IPOs from 2009 to 2019 listed on US stock exchanges. Market overpricing measure is the distance of the first day market price from the intrinsic price calculated by using most similar peer company. On average IPOs in our sample are overpriced on the first trading day by 40.5% compared to the most similar peer. Offer underpricing is the distance of the offer price from the intrinsic price. On average, in our sample IPOs are overpriced by the underwriters by 24.8%. The sum of the two measures is 15.7% which is exactly the first day return of our sample.



**Figure 4: Stock market performance - Cumulative raw eturns**

The figure shows raw returns of 1123 IPOs partitioned into 4 quartiles based on short interest on the offer day.



**Figure 5: Stock market performance - BHAR**

The figure shows buy-and-hold returns of 1123 IPOs partitioned into 4 quartiles based on short interest on the offer day.

**Table 1: Decomposition of the first day return**

The first row shows results for the first-day return defined as a percentage difference between the first-day closing market price and the offer price of the full sample that runs from September 2009 to December 2019. Second row shows results for the secondary market overpricing defined as a percentage difference between the first-day closing market price and the intrinsic price, while in the third row is the offer price undervaluation defined as the percentage difference between the intrinsic price and the offer price. Intrinsic price is computed as the value of the price-to-sales ratio of the most similar industry peer at the IPO date multiplied by the sales of the respective IPO. Column 1 reports the means of the variables of interest for the full sample. The sample is partitioned into quartiles from column 2 to column 5 based on short selling interest on the offer day. Column 6 reports differences between heavily-shorter IPOs (quartile 4) and lightly-shorter IPOs (quartile 1) while column 7 reports the t-statistics of these differences.

	Whole sample	Quartile 1	Quartile 2	Quartile 3	Quartile 4	Difference Q4-Q1	
	Mean	Mean	Mean	Mean	Mean	Diff.	t-stat
First-day Return	15.7	4.14	5.60	15.4	37.8	-33.71***	-14.13
Market Overpricing (%)	40.5	27.0	22.6	37.2	75.5	-48.55***	-6.25
Offer Price Undervaluation (%)	-24.8	-22.8	-17.0	-21.8	-37.7	14.85*	2.06
Observations	1123	281	281	281	280	561	

**Table 2: Summary Statistics**

The sample runs from September 2009 until December 2019. The first column shows summary statistics for the full sample of IPOs. In the next four columns IPOs are ranked and split into quartiles based on short selling interest on the first trading day. Panel A. reports the decomposed first-day return and short selling interest on the first trading day computed as number of shares shorted over number of shares offered. Panel B. reports statistics of different IPO characteristics.

	Whole sample		Quartile 1		Quartile 2		Quartile 3		Quartile 4	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
<i>Panel A</i>										
First Day Return (%)	15.72	28.19	4.14	15.79	5.60	15.73	15.38	24.80	37.85	36.74
Market Overpricing (%)	40.53	96.81	26.95	93.48	22.57	95.53	37.20	98.92	75.51	90.51
Offer Price Undervaluation (%)	-24.80	90.92	-22.81	92.16	-16.96	95.69	-21.83	95.88	-37.66	77.87
SV <sub>tot</sub> /SO (%)	4.55	6.32	0.59	0.41	1.93	0.42	3.92	0.71	11.79	9.16
Mean Recommendation	1.87	0.52	1.74	0.47	1.82	0.48	1.87	0.52	2.05	0.57
<i>Panel B</i>										
Market Cap. (mil.)	1067.94	3362.46	769.43	3114.27	997.59	1938.87	1021.35	1824.89	1484.90	5324.27
# Shares Outstanding at IPO (mil.)	54.72	106.01	43.28	103.38	56.87	87.61	56.99	84.46	61.77	139.36
# Shares Offered (mil.)	14.58	27.79	13.09	30.44	14.92	18.98	15.14	21.96	15.18	36.43
Offer Price	15.33	6.30	13.42	5.62	14.54	5.60	15.59	5.25	17.76	7.64
Gross Proceeds (mil.)	285.62	1024.32	226.90	964.38	264.32	453.54	263.49	433.04	388.15	1696.02
Observations	1123		281		281		281		280	

**Table 3: Decomposed returns and short selling interest**

The table below shows results from regressions in which the dependent variable is short selling interest ( $SV_{tot}/SO$ ) on the offer day defined as number of shares shorted over number of shares offered. Offer price undervaluation is defined as the percentage difference between the intrinsic price and the offer price, while market overpricing is defined as the percentage difference between the first-day closing market price and the intrinsic price. Intrinsic price is computed as the value of the price-to-sales ratio of the most similar industry peer on the IPO date multiplied by the sales of the respective IPO. First-day return is defined as the percentage difference between the first-day closing market price and the offer price. Gross proceeds are in millions of dollars. Size is defined as the natural logarithm of the market value of the company at the day of the IPO. Above price range is a dummy variable equal to 0 if the offer price is set within the initial price range, 1 if the offer price is set above the initial price range and -1 if it is below the price range. Negative price revision is a dummy variable equal to 1 if the offer price was revised downwards and 0 otherwise. Nasdaq dummy is set to 1 if the company was initially listed on the Nasdaq stock exchange and 0 otherwise. Internet IPO dummy is equal to 1 if the IPO is categorized as an internet firm on Jay Ritter's webpage and 0 otherwise. Year of the IPO and 48 Fama and French industry fixed effects are included in all regressions. The standard errors (reported in parentheses) are clustered by year and are robust to heteroskedasticity. Significance levels: \* - 10%, \*\* - 5%, \*\*\* - 1%

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Market Overpricing	0.014*** (0.003)	0.010*** (0.002)	0.003** (0.001)					
Offer Price Undervaluation				-0.006*** (0.002)	-0.004** (0.001)	-0.003** (0.001)		
First-day Return			0.083*** (0.012)			0.087*** (0.012)	0.097*** (0.012)	0.087*** (0.013)
Gross Proceeds		0.002** (0.001)	0.001 (0.001)		0.002** (0.001)	0.001 (0.001)		0.001 (0.001)
Shares Offered		-0.077** (0.028)	-0.025 (0.026)		-0.087** (0.029)	-0.025 (0.026)		-0.027 (0.027)
ln(MV)		0.131 (0.152)	0.067 (0.173)		0.175 (0.149)	0.067 (0.173)		0.086 (0.173)
Above Price Range		2.551*** (0.576)	0.549 (0.544)		2.875*** (0.613)	0.549 (0.544)		0.575 (0.545)
Overallotment Shares Sold		0.442* (0.214)	0.078 (0.196)		0.483* (0.217)	0.078 (0.196)		0.074 (0.196)
Overallotment Amount		-0.011* (0.005)	-0.003 (0.005)		-0.012** (0.005)	-0.003 (0.005)		-0.003 (0.005)
Negative Price Revision		1.287* (0.708)	-0.203 (0.711)		1.507* (0.732)	-0.203 (0.711)		-0.194 (0.718)
Nasdaq IPO		0.544 (0.537)	0.527 (0.568)		0.700 (0.555)	0.527 (0.568)		0.609 (0.564)
Internet IPO		3.041** (1.121)	2.324* (1.054)		3.186** (1.139)	2.324* (1.054)		2.349** (1.053)
Constant	2.012*** (0.518)	1.693 (1.560)	1.288 (1.222)	1.705*** (0.244)	1.199 (1.143)	1.288 (1.222)	1.555 (1.061)	0.998 (1.092)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted $R^2$	0.24	0.29	0.38	0.21	0.28	0.38	0.37	0.38
Observations	1123	1123	1123	1123	1123	1123	1123	1123

**Table 4: Buy-and-Hold returns**

The sample runs from September 2009 to December 2019. The event dates are the issue dates of the appropriate IPOs. IPOs are ranked and split into quartiles based on short sale interest on the first trading day. Buy-and-hold abnormal returns and t-statistics are presented below.

$$BHAR = \sum_{i=1}^N w_i \left[ \prod_{t=t_i}^{T_i} (1 + R_{it}) - 1 \right] - \sum_{i=1}^N \left[ \prod_{t=t_i}^{T_i} (1 + E(R_{it})) - 1 \right],$$

where  $R_{it}$  is the return of security  $i$  on day  $t$ ,  $N$  is the number of securities,  $T$  is the number of trading days (252, 121, 60 or 20 trading days),  $t_i$  is the first day of trading and  $E(R_{it})$  is the expected or normal return (CRSP value-weighted index). Weights ( $w_i$ ) are defined as the ratio of issuer  $i$ 's common stock market value and sum of the market values of all stocks.

<b>(a)</b>			<b>(b)</b>		
	BHAR252	N		BHAR121	N
All	-0.041*** (0.0061)	1117	All	-0.034*** (0.0040)	1122
Q1	-0.049*** (0.0092)	280	Q1	-0.018** (0.0062)	281
Q2	0.019* (0.0086)	279	Q2	-0.0039 (0.0065)	280
Q3	-0.0038 (0.012)	279	Q3	-0.012 (0.0070)	281
Q4	-0.13*** (0.015)	279	Q4	-0.10*** (0.0099)	280
Q1Q4	0.078*** (0.018)	559	Q1Q4	0.085*** (0.012)	561

<b>(c)</b>			<b>(d)</b>		
	BHAR60	N		BHAR20	N
All	-0.0054 (0.0031)	1122	All	-0.0025 (0.0017)	1122
Q1	-0.0021 (0.0050)	281	Q1	-0.0019 (0.0026)	281
Q2	0.0049 (0.0048)	280	Q2	0.00100 (0.0027)	280
Q3	0.0041 (0.0054)	281	Q3	0.0014 (0.0029)	281
Q4	-0.028*** (0.0084)	280	Q4	-0.010* (0.0048)	280
Q1Q4	0.026** (0.0098)	561	Q1Q4	0.0085 (0.0054)	561

**Table 5: Cross-section of abnormal returns (daily data)**

The sample runs from September 2009 to December 2019. The dependent variable is the average one-year buy-and-hold abnormal return as a percentage using daily returns, Short selling interest ( $SV_{tot}/SO$ ) is the aggregate reported share volume on the first trading day over the number of shares offered. Offer price undervaluation is defined as the percentage difference between the intrinsic price and the offer price, while market overpricing is defined as the percentage difference between the first-day closing market price and the intrinsic price. Intrinsic price is computed as the value of the price-to-sales ratio of the most similar industry peer on the IPO date multiplied by the sales of the respective IPO. First-day return is defined as the percentage difference between the first-day closing market price and the offer price. Gross proceeds are in millions of dollars. We use the standard control variables as in the previous tables. The standard errors (reported in parentheses) are clustered by year and are robust to heteroskedasticity. Significance levels: \* - 10%, \*\* - 5%, \*\*\* - 1%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$SV_{tot}/SO$ (%)	-0.657** (0.220)	-0.557** (0.198)						
Market Overpricing (%)			-0.023** (0.009)	-0.019* (0.010)				
Offer Price Undervaluation (%)					0.015 (0.009)	0.013 (0.010)		
First-day Return							-0.121*** (0.030)	-0.099*** (0.025)
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted $R^2$	0.21	0.22	0.19	0.21	0.18	0.21	0.20	0.22
Observations	1117	1117	1117	1117	1117	1117	1117	1117



**Table 6: Accounting performance**

The sample runs from September 2009 to December 2019. The dependent variables are post-IPO one-year increase in return on assets and one-year increase in return on equity. Short selling interest ( $SV_{tot}/SO$ ) is the aggregate reported share volume on the first trading day over the number of shares offered. Offer price undervaluation is defined as the percentage difference between the intrinsic price and the offer price, while market overpricing is defined as the percentage difference between the first-day closing market price and the intrinsic price. Intrinsic price is computed as the value of the price-to-sales ratio of the most similar industry peer on the IPO date multiplied by the sales of the respective IPO. First-day return is defined as the percentage difference between the first-day closing market price and the offer price. Gross proceeds are in millions of dollars. We use the standard control variables as in the previous tables. The standard errors (reported in parentheses) are clustered by year and are robust to heteroskedasticity. Significance levels: \* - 10%, \*\* - 5%, \*\*\* - 1%.

	$\Delta ROA$				$\Delta ROE$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Market Overpricing (%)	-0.001*				-0.002*			
	(0.001)				(0.001)			
Offer Price Undervaluation (%)		0.002**				0.002**		
		(0.001)				(0.001)		
First-day Return			-0.001				-0.002	
			(0.003)				(0.005)	
$SV_{tot}/SO$ (%)				-0.008				-0.015
				(0.011)				(0.023)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted $R^2$	0.07	0.07	0.06	0.06	0.02	0.02	0.02	0.02
Observations	1030	1030	1030	1030	1074	1074	1074	1074

**Table 7: Mean analysts recommendation**

The table shows results from regression in which the dependent variables is mean (consensus) analysts' initial recommendation for each IPO taken from I/B/E/S Recommendation database. All recommendations are between 1 (Strong Buy) and 5(Strong Sale). The first column shows results for the full sample, while in the next four columns the sample is partitioned into quartiles based on short selling interest on the offer day. Short selling interest ( $SV_{tot}/SO$ ) is the aggregate reported share volume on the first trading day over the number of shares offered. First-day return is defined as the percentage difference between first-day closing market price and the offer price. Gross proceeds are in millions of dollars. Size is defined as the natural logarithm of the market value of the company at the day of the IPO. Above price range is a dummy variable taking 0 if the offer price is set within the initial price range, 1 if the offer price is set above the initial price range and -1 if it is below the price range. Over-allotment amount is in millions of dollars. Negative price revision is a dummy variable taking value 1 if the offer price was revised downwards and 0 otherwise. Nasdaq dummy is set to 1 if the company was initially listed on the Nasdaq stock exchange and 0 otherwise. Internet IPO dummy is taking value of 1 if the IPO is categorized as an internet firm on Jay Ritter's webpage and 0 otherwise. Year of the IPO and 48 Fama and French industry fixed effects are included in all regressions. The standard errors (reported in parentheses) are clustered by year and are robust to heteroskedasticity. Significance levels: \* - 10%, \*\* - 5%, \*\*\* - 1%.

	Full Sample	Quartile 4	Quartile 3	Quartile 2	Quartile 1
	(1)	(2)	(3)	(4)	(5)
$SV_{tot}/SO$ (%)	0.015*** (0.003)	0.015*** (0.005)	-0.080 (0.048)	-0.047 (0.081)	-0.002 (0.059)
First-day Return	0.001 (0.001)	0.001 (0.002)	0.003* (0.002)	0.000 (0.002)	0.003 (0.002)
Gross Proceeds	-0.000 (0.000)	-0.001*** (0.000)	0.000 (0.001)	-0.000 (0.001)	-0.000 (0.000)
Shares Offered	0.003 (0.005)	0.021*** (0.005)	-0.008 (0.009)	0.000 (0.014)	0.001 (0.008)
$\ln(MV)$	0.068** (0.027)	-0.007 (0.032)	0.136*** (0.033)	-0.006 (0.053)	0.127*** (0.034)
Above Price Range	0.065 (0.055)	0.070 (0.054)	0.055 (0.119)	0.168* (0.079)	-0.124 (0.147)
Overallotment Shares Sold	-0.000 (0.030)	-0.073* (0.033)	0.039 (0.085)	-0.004 (0.085)	-0.018 (0.089)
Overallotment Amount	0.000 (0.001)	0.002** (0.001)	-0.002 (0.005)	0.003 (0.004)	0.001 (0.003)
Negative Price Revision	-0.016 (0.080)	-0.046 (0.077)	-0.002 (0.151)	0.103 (0.099)	-0.195 (0.194)
Nasdaq IPO	-0.035 (0.030)	-0.044 (0.066)	0.019 (0.098)	-0.130 (0.075)	-0.053 (0.063)
Internet IPO	0.119 (0.069)	0.141 (0.145)	-0.069 (0.079)	0.021 (0.097)	0.256 (0.202)
Constant	2.416*** (0.202)	1.669*** (0.228)	3.205*** (0.460)	1.725*** (0.432)	1.704*** (0.216)
Year FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Adjusted $R^2$	0.22	0.33	0.16	0.28	0.13
Observations	1089	272	272	272	273

**Table 8: Mean analysts recommendation and decomposed first-day returns**

The table shows results from regression in which the dependent variables is mean (consensus) analysts' initial recommendation for each IPO taken from I/B/E/S Recommendation database. All recommendations are between 1 (Strong Buy) and 5(Strong Sale). Short selling interest ( $SV_{tot}/SO$ ) is the aggregate reported share volume on the first trading day over the number of shares offered. First-day return is defined as the percentage difference between first-day closing market price and the offer price. Offer price undervaluation is defined as the percentage difference between the intrinsic price and the offer price, while market overpricing is defined as the percentage difference between the first-day closing market price and the intrinsic price. Intrinsic price is computed as the value of the price-to-sales ratio of the most similar industry peer on the IPO date multiplied by the sales of the respective IPO. We use the standard control variables as in the previous tables. Year of the IPO and 48 Fama and French industry fixed effects are included in all regressions. The standard errors (reported in parentheses) are clustered by year and are robust to heteroskedasticity. Significance levels: \* - 10%, \*\* - 5%, \*\*\* - 1%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$SV_{tot}/SO$ (%)	0.020*** (0.003)	0.017*** (0.004)						
Market Overpricing (%)			0.000** (0.000)	0.000* (0.000)				
Offer Price Undervaluation (%)					-0.000 (0.000)	-0.000 (0.000)		
First-day Return							0.004*** (0.001)	0.002*** (0.001)
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted $R^2$	0.18	0.22	0.13	0.19	0.13	0.19	0.16	0.20
Observations	1089	1089	1089	1089	1089	1089	1089	1089

**Table 9: Mean analysts recommendation downgrading**

The table reports the probit regression results where the dependent variable is a dummy equal to one when the analyst consensus recommendation decreases one year after the IPO. Analysts' initial recommendation for each IPO are taken from I/B/E/S Recommendation database. All recommendations are between 1 (Strong Buy) and 5(Strong Sale). Short selling interest ( $SV_{tot}/SO$ ) is the aggregate reported share volume on the first trading day over the number of shares offered. First-day return is defined as the percentage difference between first-day closing market price and the offer price. Offer price undervaluation is defined as the percentage difference between the intrinsic price and the offer price, while market overpricing is defined as the percentage difference between the first-day closing market price and the intrinsic price. Intrinsic price is computed as the value of the price-to-sales ratio of the most similar industry peer on the IPO date multiplied by the sales of the respective IPO. We use the standard control variables as in the previous tables. Year of the IPO and 48 Fama and French industry fixed effects are included in all regressions. The standard errors (reported in parentheses) are clustered by year and are robust to heteroskedasticity. Significance levels: \* - 10%, \*\* - 5%, \*\*\* - 1%.

	All				Q4			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$SV_{tot}/SO$ (%)	0.015*** (0.006)				0.023*** (0.006)			
Market Overpricing (%)		-0.000 (0.001)				0.002* (0.001)		
Offer Price Undervaluation (%)			0.000 (0.001)				-0.002 (0.001)	
First-day Return				0.004** (0.002)				0.004* (0.002)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo $R^2$	0.08	0.08	0.08	0.09	0.16	0.15	0.15	0.15
Observations	1089	1089	1089	1089	272	272	272	272

**Table 10: Robustness: Decomposed returns and short selling interest of underwriters**

The table below shows results from regressions in which the dependent variables is short selling exempt interest on the offer day defined as the number of shares shorted that are exempted from the restriction (Rule 201) of short selling over number of shares offered. Offer price undervaluation is defined as the percentage difference between the intrinsic price and the offer price, while market overpricing is defined as the percentage difference between the first-day closing market price and the intrinsic price. Intrinsic price is computed as the value of the price-to-sales ratio of the most similar industry peer on the IPO date multiplied by the sales of the respective IPO. First-day return is defined as the percentage difference between the first-day closing market price and the offer price. Gross proceeds are in millions of dollars. Size is defined as the natural logarithm of the market value of the company at the day of the IPO. Above price range is a dummy variable equal to 0 if the offer price is set within the initial price range, 1 if the offer price is set above the initial price range and -1 if it is below the price range. Negative price revision is a dummy variable equal to 1 if the offer price was revised downwards and 0 otherwise. Nasdaq dummy is set to 1 if the company was initially listed on the Nasdaq stock exchange and 0 otherwise. Internet IPO dummy is equal to 1 if the IPO is categorized as an internet firm on Jay Ritter's webpage and 0 otherwise. Year of the IPO and 48 Fama and French industry fixed effects are included in all regressions. The standard errors (reported in parentheses) are clustered by year and are robust to heteroskedasticity. Significance levels: \* - 10%, \*\* - 5%, \*\*\* - 1%

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Market Overpricing	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)					
Offer Price Undervaluation				-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)		
First-day Return			0.001** (0.000)			0.001** (0.000)	0.001** (0.000)	0.001** (0.000)
Gross Proceeds		-0.000 (0.000)	-0.000 (0.000)		-0.000 (0.000)	-0.000 (0.000)		-0.000 (0.000)
Shares Offered		-0.000 (0.000)	0.000 (0.000)		-0.000 (0.000)	0.000 (0.000)		0.000 (0.000)
ln(MV)		0.004 (0.004)	0.003 (0.003)		0.004 (0.004)	0.003 (0.003)		0.003 (0.004)
Above Price Range		0.005 (0.006)	-0.008 (0.010)		0.007 (0.005)	-0.008 (0.010)		-0.008 (0.010)
Overallotment Shares Sold		0.002 (0.003)	0.000 (0.003)		0.003 (0.003)	0.000 (0.003)		0.000 (0.003)
Overallotment Amount		-0.000 (0.000)	0.000 (0.000)		-0.000 (0.000)	0.000 (0.000)		0.000 (0.000)
Negative Price Revision		0.001 (0.006)	-0.009 (0.009)		0.002 (0.006)	-0.009 (0.009)		-0.009 (0.009)
Nasdaq IPO		0.006 (0.007)	0.006 (0.007)		0.007 (0.008)	0.006 (0.007)		0.007 (0.007)
Internet IPO		0.020 (0.024)	0.015 (0.022)		0.021 (0.024)	0.015 (0.022)		0.015 (0.022)
Constant	-0.001 (0.006)	-0.026 (0.018)	-0.029 (0.017)	-0.002 (0.003)	-0.030 (0.018)	-0.029 (0.017)	-0.003 (0.004)	-0.031 (0.019)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R <sup>2</sup>	0.20	0.20	0.21	0.20	0.20	0.21	0.21	0.21
Observations	1123	1123	1123	1123	1123	1123	1123	1123

**Table 11: Robustness: Decomposed returns with different matching procedures**

This table shows results of three different matching procedures. In first 4 columns, we calculate the mean offer price undervaluation and the mean market price overpricing keeping all comparable companies that meet the 50% difference threshold. Results from the second matching procedure are in column 5 to 8, where we identify a peer company following a similar procedure as in Purnanandam and Swaminathan (2004): we match companies on Fama-French 48 industry, then we require that revenue does not differ more than 50% and that profitability (defined as EBITDA/Revenues) does not differ more than 100%, and finally we select the peer company that has the most similar revenue. Results from the third matching procedure are in the last 4 columns (9-12), we calculate the mean offer price undervaluation and the mean market price overpricing keeping all comparable companies that meet the revenue and profitability thresholds

	AT + med				Sales & Profitability				Sales & Profitability + med			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Market Overpricing	0.019*** (0.005)	0.013** (0.005)			0.011*** (0.002)	0.005* (0.003)			0.022*** (0.004)	0.015*** (0.004)		
Offer Price Undervaluation			-0.006* (0.003)	-0.002 (0.003)			-0.001 (0.003)	0.003 (0.003)			-0.010*** (0.002)	-0.003 (0.003)
Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted $R^2$	0.25	0.29	0.21	0.27	0.17	0.24	0.15	0.24	0.23	0.27	0.18	0.24
Observations	921	921	921	921	859	859	859	859	823	823	823	823