Hot Bull or Cold Bear? How Market Cycles Affect IPO Underpricing

AN ANALYSIS ON THE DEGREE AND VARIABILITY OF INITIAL PUBLIC OFFERING UNDERPRICING DURING DIFFERENT STOCK MARKET STATES

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Abstract:

IPO underpricing and its variability is highly cyclical and follows waves, with "hot" and "cold" IPO markets displaying radically different characteristics. Further, during the 21st century, the effect of bear-, and bull markets on stock prices increased. By adjusting IPO returns for market returns, proxied by the S&P 500, we find that during bear markets (i.e., "cold markets"), the underpricing of IPOs, the variability of initial IPO returns, and the number of firms listing is much lower compared to bull markets, with the effects being reduced when adjusting for same-period market returns. We also find that some of the effects can be attributed to adverse selection in the types of firms going public, with generally decreasing information asymmetry during bear markets. While IPOs in bear markets generally are underpriced, IPOs are overpriced on average in the current bear market in 2022, making the future of initial IPO returns uncertain.

Keywords:

IPO Underpricing, bear markets, bull markets, IPO hot waves, variability of IPO underpricing, U.S. stock market, market impact

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Introduction

IPOs have interested researchers for decades, with IPO underpricing being one of the main focal points. IPO underpricing occurs when the price of the stock on the secondary market trades higher than the offer price. IPO underpricing garnered large interest and theoretical literature in the 1980s and '90s, with both Logue (1973) and Ibbotson (1975) initially documenting its existence. Several well-known, published articles such as Ritter (1991), and Lowry, Officer, and Schwert (2010), have extended the initial papers and offered new insights into the subject.

Between 1985 and 2022, the average underpricing of IPOs in the U.S. market was 21%, while only 5% of the initial returns were between 20% and 25%. The standard deviation of the initial return in the sample was 57%. These numbers indicate that measuring IPO underpricing by looking at average return does not reflect the magnitude of the returns since the spread of underpricing is substantial. Further, the number of IPOs and the degree of underpricing has shown to be cyclical. Loughran and Ritter (2004) find that during 1980-2003 the average underpricing in the U.S. stock market ranged from 7% to 65% during different periods. The periods in the market when the underpricing is greater than usual are referred to as "Hot IPO markets". In these hot markets, in addition to the higher degree of underpricing, the IPO volume and the variability of initial returns are significantly higher than usual.[1]

While the systematic underpricing phenomenon is well known, the reasons behind it have been widely debated. Rock (1986) argues that there exists a group of investors with superior information regarding the true value of the company. These informed investors only bid for attractively priced issues, leading to a winner's curse for the uninformed investors. Therefore, deliberate, systematic underpricing is a way for investment banks to ensure continuous participation from uninformed investors, who would otherwise exit the market. Beatty and Ritter (1986) propose that underpricing is caused by investment banks, whose reputation capital is at stake. Investment banks can lose investors and issuers if it underprices too little or too much. The authors also argue that underpricing is linked to the uncertainty of investors as to the value of the issue. A considerable amount of literature has also been devoted to examining how underwriter rank corresponds with underpricing, variability of initial returns and long-run performance (Carter, Dark and Singh, 2002).

Despite the widespread interest in the subject, no studies have yet to examine how general movements in the market affect the initial return of the stocks. For example, in a market crash, IPOs would most likely perform worse in their first month compared to others. Therefore, when comparing the underpricing between different periods, it becomes imperative to remove any systematic outside effects that can have an impact on the result. While an issuance in an upward-moving market could show positive returns, one in a downward-moving market could show the opposite. By calculating the market-adjusted IPO initial return, a more accurate depiction of the inherent underpricing of the issue is derived. This becomes especially important when comparing underpricing during bull and bear markets, as these by definition generally show opposite movements in stock prices. Further, Gonzalez, Powell, Shi, and Wilson (2005) find that the differences in the magnitude of bear and bull markets have increased during the 20th century compared to the 19th century. The

[1] Lowry, Officer, and Schwert (2010)

increased volatility in the market can partly be explained by high-frequency trading (HFT). HFT contributed to over 50% of total equity trading in the United States in 2018. A substantial and growing body of literature has identified HFT as a new breed of intermediary that can improve or harm the price discovery, efficiency, liquidity, and volatility of the market[2]. Thus, the importance of understanding market behaviors during bull and bear markets has become greater in recent years.

This paper aims to contribute to the existing literature on IPO underpricing by providing insights into how the IPO market behaves during "cold markets" in the IPO cycle. We will replicate the model of the initial volatility of IPO returns developed by Lowry, Officer and Schwert (2010), in order to evaluate the magnitude of the pricing errors of IPOs. To extend the existing paper, we are comparing the degree of initial volatility of returns in bear markets to non-bear, i.e. bull markets. Additionally, as both the IPO market and the secondary market follow cycles with hot and cold periods, this article aims to provide additional insights related to isolated IPO performance by also making a comparison of the market-adjusted return of IPOs. This removes the systematic component that stocks are affected by, thus leaving a purely idiosyncratic effect for us to analyze.

Lastly, similar to Lowry et al. (2010), we use Nasdaq and NYSE dummy variables as a proxy for the inherent difficulty of valuing the company. Small, young, high-tech firms tend to list on the Nasdaq exchange while more mature firms tend to choose NYSE. We use this variable to examine how the degree of hard-to-value companies is affected by bear markets.

The first research question we will answer is:

How do bear markets affect the number of IPOs as well as the degree and variability of underpricing?

The results from our regressions suggest that during bear markets, IPOs are priced closer to their market value and the variability of returns is lower compared to bull markets. Furthermore, the number of IPOs also decreases. In general, the negative effect of bear markets seems to be strongest for the average IPO return, second for the number of IPOs and third for the variability of returns (even if the effect is strong overall). Another interesting finding is that, in general, the negative effect bear markets have on the initial returns is larger than the positive effect of bull markets. We also find that some of the effects derive from a decreased share of companies that are inherently more difficult to value , which in turn decreases underpricing and return volatility.

The second research question we will answer is:

How does the secondary market performance affect the degree of underpricing in bear markets?

[2] Khairul Zharif Zahraudin, Martin R. Young, Wei-Huei Hsu, 2021

Our findings imply that on average 1.9% of the underpricing can be explained by market performance. When comparing the unadjusted results with the market-adjusted results, the same effects hold true, even if the degree of underpricing is lower for the adjusted returns.

The remaining parts of this paper are structured as follows. Section 1 will provide a brief overview of previous research most closely related to our research question. Section 2 will describe our hypothesis and provide the theoretical framework it is based upon. Section 3 will detail our data as well as empirical variables. Section 4 will present our hypothesis tests and showcase findings. Finally, section 6 will give our conclusion and final remarks on the results.

1. Literature Review

1.1. IPO Underpricing

Lowry et al. (2010) look at how times series and cross-sectional data impact the underpricing of IPOs, and which factors contribute to more or less underpricing. In the paper, they find that the average initial return is strongly positively associated with the cross-sectional dispersion of IPO initial returns. In other words, the standard deviation of initial returns is positively correlated with average initial returns. Furthermore, they suggest that the correlation partly can be explained by time-clustering of the types of firms that list at different times. The main idea brought forward by Lowry et al. is that some firms going public would be harder to value than others, especially when the information asymmetry between an investor and the company is particularly high. Hence, the variability of the initial return on these companies should be considerably higher than the average, due to higher pricing errors for these companies. Moreover, initial returns should also be higher during these periods to compensate for the greater investor cost of being informed. In their data, the authors find that average initial returns and the variability of these returns are higher in months when the companies listing are younger on average, when the proportion of companies in high-tech industries is higher, and when more firms list on NASDAQ than NYSE.

1.2. IPO Hot markets & Waves

In addition to underpricing, another phenomenon in the pricing of IPOs is the "IPO hot markets" or the "IPO waves" as described in the literature. The number of IPOs varies drastically over time, with large variations occurring between years and even months. Pástor and Veronesi (2005) argue that when deciding whether or not to list, founders prioritize obtaining as high a valuation as possible for their business, as this will allow them to collect the most proceeds from the IPO. This logic would apply to all different IPO scenarios, including an exit of a financial sponsor or a spin-off from an already listed company. Pastor and Veronesi believe that companies obtain a higher valuation not when the market is overvalued as argued by some, e.g. Ritter (1991), but when certain factors are met that contribute to providing higher valuations, especially for newly founded companies. The three factors proposed are:

1) the market return leading up to the IPO, and hence the expected return of stocks

2) the expected aggregate profitability as well as

3) the inherent uncertainty of how new companies' excess profitability will look

Pástor and Veronesi argue that when expected returns are low, when expected aggregate profitability is high, and when uncertainty regarding future performance of new issues is high, valuations for companies are higher, which induces more of them to go public. This then results in the observed IPO-waves, where many firms choose to list simultaneously. Indeed, they find evidence for this in the data where monthly returns leading up to IPO waves

are higher than the average. Thus, the aforementioned indicates a decreased expected return, increased expected profitability and an increased uncertainty regarding the value of new firms, shown by higher than average volatility for newly listed stocks. Additionally, Lowry et al. (2010) mention a potential positive correlation between the variability of secondary market returns and IPO returns, as a factor for explaining the strong cycles. Accordingly, when the uncertainty about prices in the secondary market is especially high, it is plausible that both underwriters and investors experience greater difficulty pricing IPOs as well.

1.3. Bear markets

Bear markets occur when the prices of securities experience a persisting decline in value[3], typically around 20% as depicted in the financial press (Pagan and Sossounov, 2003). The term is commonly used to describe the performance of the S&P 500 index, which includes 500 of the largest trading American firms, and encompasses roughly 80% of available market capitalization.[4]

Gonzalez et al. (2005) first define bull-, and bear markets by finding peaks and troughs and examine the characteristics that define bull- and bear markets from January 1800 - September 2000. They find that, while bear (bull) markets do experience depreciating (appreciating) share prices on average, there is no significant difference in the volatility of bear markets and bull markets, with the effect instead depending on whether the month experiences rising or falling trading volume in the secondary market.

[3] "bear market" Merriam-Webster.com (2022)
[4] S&P 500, S&P Dow Jones Indices (2022)

2. Hypothesis and Research Design

2.1. Hypothesis

We expect fewer IPOs to be completed with less underpricing and with lower variability of returns in bear markets than during bull markets, with the effect decreasing when looking at the market-adjusted returns.

As Pástor and Veronesi (2005) note, IPO hot waves are preceded by sharp increases in share prices (i.e. decreases in expected return), increases in expected aggregate profitability as well as greater prior uncertainty regarding the average profitability of IPOs.

When applying their theory to bear markets, we find that the inverse conditions apply. Firstly, bear markets are defined by decreasing market prices, implying either that the expected return increases or that the expected profitability decreases (Pástor and Veronesi, 2005). Moreover, by combining the findings from Lowry et al. (2010) that the volatility of the IPO- and secondary market are correlated, with the finding from Gonzalez et al. (2005) that bear markets do not experience higher volatility on average, we can conclude that Pástor and Veronesi's uncertainty variable should be either lower or the same during bear markets compared to hot markets.

As such, we would expect valuations to be lower for new companies wishing to IPO during these market conditions, and bear markets should therefore be characterized by far fewer public offerings than average.

Moreover, Lowry et al. (2010) find that similar factors to those discussed in Pástor and Veronesi (2005) also affect the pricing of the stock. Furthermore, Lowry et al. (2010) also find that hot IPO markets showcase both higher underpricing and variability of returns. As the factors creating IPO waves are inverted during bear markets, we expect the underpricing and variability of it to be considerably lower.

Similarly, Edelen and Kadlec (2005) find that rational issuers maximize their surplus of going public. This causes firms to decrease offer prices, i.e. underprice more, when comparable firms' market valuations increase since a decrease in offer price will increase the probability of a successful IPO. In contrast, when market valuations fall, firms tend to price issues more aggressively, i.e. underprice less. The higher price increases the risk of a withdrawal of the IPO by the underwriter, but since the risk already is high, the marginal cost of increasing this probability is low. As a consequence, falling valuations in the market would lead to less underpricing and more withdrawn IPOs during bear markets, consistent with the other literature.

Lowry et al. (2010) also argue that increased ex-ante uncertainty regarding the profitability of issuing firms leads to increased underpricing, as investors need to be compensated for the higher cost of being informed. When the degree of uncertain firms is higher in the sample, one could expect higher pricing errors and greater underpricing. Several studies support this theory that an investment bank's pricing of an IPO is related to the level of information asymmetry. With the underlying expectation that underpricing and variability would be lower in bear markets, some of this effect could likely be attributed to selection bias in the types of firms going public. Fewer technological and younger firms should list during these months,

and as a result, the uncertainty during cold markets should be lower than in hot markets since the average IPO would be easier to price.

Also, while the one-month price of an IPO is a good measurement of its true value given by the market, the return of the market is sure to impact the return given by IPOs. Therefore, while some IPOs are issued in favorable market conditions, with generally rising prices in the market, others are issued alongside depreciating prices. This could impact the analysis, and lead to lower-than-average returns in months with bear markets compared to months without. This would impact stocks with higher betas more. Calculating the market-adjusted return of IPOs will eliminate this effect. Thus, when comparing the relative and actual return, we expect the actual return to have a greater difference between bear and bull markets than the relative return.

2.2. Research Design

Cross-sectional Data Manipulation

Cross-sectional data refers to collecting different data points at one point in time. In our sample, the data points consist of firms listing on the U.S. stock market between 1985 to 2022. We gather firm-specific data of certain IPO-related details that enables us to do our analysis. As our sample includes certain types of firms that do not contribute to the analysis we will manipulate the data in the same manner as by Lowry et al. (2010).

Identifying Bear Markets

In order to appropriately identify the different bear markets in our sample, we will replicate the models used by Gonzalez et al. (2005) and Pagan and Sossounov (2003). These follow the widely accepted NBER business cycle dating method, adjusted for use on stock market data. To ensure correct results from the algorithms, we compare our findings with those of Pagan and Sossounov (2003), Lowry et al. (2005) and Kole and van Dijk (2016).

Data Analysis

In the data analysis we confirm our sample data by comparing the sample characteristics and patterns with those of Lowry et al. (2010). Further, we also analyze the independent bear markets to get an overview of the data.

Linear Regression

In the main regression we test both of our hypotheses. To examine the effect of bear markets, we construct a dummy variable including all bear markets in the sample and then we regress the dummy on our different variables, including the market adjusted variables.

Correlation Analysis

To analyze if the type of firms listing in a bear market differs from bull markets, we will compare the correlation between the percentage of listings on Nasdaq and NYSE during the different market states.

Robustness Check and Time-Series Analysis

Since we test our main regression by using an aggregated dummy variable including all of the bear markets in our sample, the main regression does not tell us if the effect is consistent among the independent bear markets. Thus, in order to check the robustness of our result, we run a second regression including all of the independent bear markets.

3. Data

3.1. Data Sources and Definition

Table 1

Sources of IPO Data, 1985-2022

Initial returns are measured as the percent difference between the aftermarket price 1 month after the offer date and the offer price.

Data Source	Sample Period	Number of IPOs	One-Month Initial Return Available	Excluding SPAC, REIT & Trust	American Exchange	Share Price ≥$5
Securities Data Corporation (SDC)[a]	1985-2022	13 860	4 902*	-	-	-
The Center for Research in Security Prices (CRPS)	1985-1995	(5 716)	3 295	-	-	3 087
S&P Capital IQ[c]	1985-2022	(8 144)	8 069	6 514	5 203	5 097
Total		13 860	11 364	9 809	8 498	8 184

* Not included in the total amount of one-month initial return available.

[a] https://www.refinitiv.com/en/products/sdc-platinum-financial-securities
[b] https://www.crsp.org/
[c] https://www.spglobal.com/en/

To gather our data sample of IPOs between 1985 and 2022, we combine data from three different sources: Securities Data Corporation Platinum (SDC), S&P Capital IQ (S&P) and The Center for Research in Security Prices (CRSP). In Lowry et al. (2010), 7 786 of 11 734 IPOs between 1965 to 2005 were collected from SDC platinum. Further, 6 925 of the IPOs from SDC had data available of the one-month initial return. As shown in Table 1, we have 13 860 IPOs from the SDC database for the period 1985 to 2022. Unfortunately, only 4 902 companies have data available on the one-month return. The reasons behind our relatively small sample of data available for one-month initial return from SDC could be explained by us not having access to the same datasets, or by a recent change in the dataset by the SDC. Thus, to gather more data points on the one-month initial closing price, we assemble data from S&P and CRSP by retrieving the following information from the SDC database: 1) company name, 2) offer date, 3) offer price, 4) exchange, and 5) ticker. From S&P, we collected data on all IPOs from 1/1-1985 until 31/9-2022 (with the latest observation being listed on 29/9-2022). We chose to exclude Special Purpose Acquisition Vehicles (SPACs) since although some uncertainty exists regarding the future of the SPAC, specifically related to the company the SPAC will merge with, its value can be closely tied to the amount of money raised in its IPO, as it is a blank check company. There is therefore no inherent underpricing in these issues, and they were hence excluded. Further, often small, low-growth

and levered firms in volatile markets use SPACs when going public and they often underperform comparable firms, the industry and the market.[5] Regarding Real estate investment trusts (REITs) and investment trusts in general, we chose to exclude them since in general, they are also subject to less uncertainty and thus, less underpricing, this is also done by Lowry et al. (2010).

S&P provides us with 8 069 IPOs with a one-month return available. However, due to the sparse data from S&P in the period 1985-1995, we choose to supplement this data with the SDC data from that period. To get the one-month returns for the listings from SDC in this period, we collect the share prices of all IPOs from the CRSP database using the available tickers obtained from SDC. After matching the companies by ticker and date to calculate the one-month return, we cross-check the data for possible duplicates between the two datasets, i.e. between the S&P dataset and the SDC/CRSP dataset. In total, we find 54 duplicates between the datasets and choose to remove the duplicates based on data availability. Following, we check for double listings in the data and subsequently remove duplicates there as well, also based on data availability. In total, we find 326 duplicates in the data. After including only American exchanges in the data, we are left with a total of 8 498 IPOs with information available on the one-month initial closing price. Further, to prevent the sample from being disproportionately affected by extremely small firms, we exclude all firms with an offer price lower than $5, similar to Lowry et al. (2010). The resulting data sample consists of 8 184 IPOs.

The stock market returns are collected from the S&P and CRSP databases. For comparison with IPO returns, the S&P 500 index is chosen as a proxy for the US equity market as done by other studies (Gonzalez et al. 2005, Pagan and Sossounov, 2003). The return of the S&P 500 is then matched on a company basis over the same timeframe to remove any effects that general movements in the stock market can have on the one-month return of the IPOs. Here, a beta of 1 is assumed for all listings; a simplifying but necessary assumption to enable the analysis. A beta of 1 implies that the stock moves in the same direction, and by the same amount, as the S&P index, enabling us to define the market-adjusted return as the IPO return subtracted by the S&P 500 index return.

Bear markets can most easily be defined in stock market terminology as a market that corresponds to periods of generally decreasing market prices (Pagan and Sossounov, 2003). While there exist several methods of dating bull and bear markets ex-post (Kole and van Dijk, 2016), we utilize the dating methods by Pagan and Sossounov (2003) as well as that of Gonzalez et al. (2005), as they stay relatively close to the business cycle dating algorithm developed by Bry and Boschan (1971) to mimic the widely agreed-upon NBER business cycle dating method. Furthermore, Pagan and Sossounov's (2003) method specifically has been referenced by several articles examining bull and bear markets (Lunde and Timmermann, 2004, Gonzalez et al., 2005, Kole and van Dijk, 2016). While these are slightly different, they have the same basic process. Firstly, the data is not smoothed (as compared to business cycle dating) because the large movements that occur in the market are some of the most interesting data points. Secondly, peaks and troughs in the market, proxied by the S&P 500, are identified within a time window before and after the specific date, 8 and 6 months for Pagan and Sossounov (2003) and Gonzalez et al. (2005) respectively. A cycle (peak to peak or trough to trough) is required to last at least 16 and 15 months respectively, and the

[5] Johannes Kolb, Tereza Tyková (2016)

minimal phase length (peak to trough or trough to peak) is 4 and 5 months, respectively. Lastly, a final change is made to the NBER business dating method: when the market returns either above 20% or below -20% returns in a specific month, the minimum phase length is ignored by both articles. This allows for bear markets such as the October 1987 crash and the February 2020 Covid crash to also be included in the definition. Both algorithms are used on S&P 500 data from 1985 until 2022.

By using the two methods for determining bear markets ex post, we identify 10 separate bear markets during the period from January 1985 until September 2022. In chronological order (shown by their peak-trough dates), these were:

1. August 1987 - November 1987
2. May 1990 - October 1990
3. January 1994 - July 1994
4. March 2000 - October 2002
5. February 2004 - August 2004
6. October 2007 - March 2009
7. April 2011 - October 2011
8. May 2015 - February 2016
9. February 2020 - March 2020
10. January 2022 - September 2022

The last bear market continues until the end of the period, and thus has not yet been finalized. The 20% rule is only applied twice in the period, first in 1987, and secondly in 2020, when the bear market lasted only 1 month. When constructing the bear market variable, we utilize the same method as Gonzalez et al. (2005), and define bear markets as beginning the month following the peak, and ending the month of the trough. Similarly, bull markets begin the month following a trough, and end the month of the peak. By that definition, there were 10 bear-, and 10 bull markets in the sample time period.

3.2. Descriptive Statistics

As in Lowry et al. (2010), we use the variability of IPO returns to evaluate initial returns to IPO investors in the most efficient way. Accordingly, since price stabilizing activities have an impact on the trading prices of the stock in the immediate days following the offering[6], we have decided to employ the one-month initial return (rather than first-day return) in all of our analyses since it increases the probability that our measure is a true reflection of market value.

[6] Ruud, Judith S. (1993) and Hanley, Kathleen Weiss, Kumar, A. Arun, and Seguin Paul J. (1993)

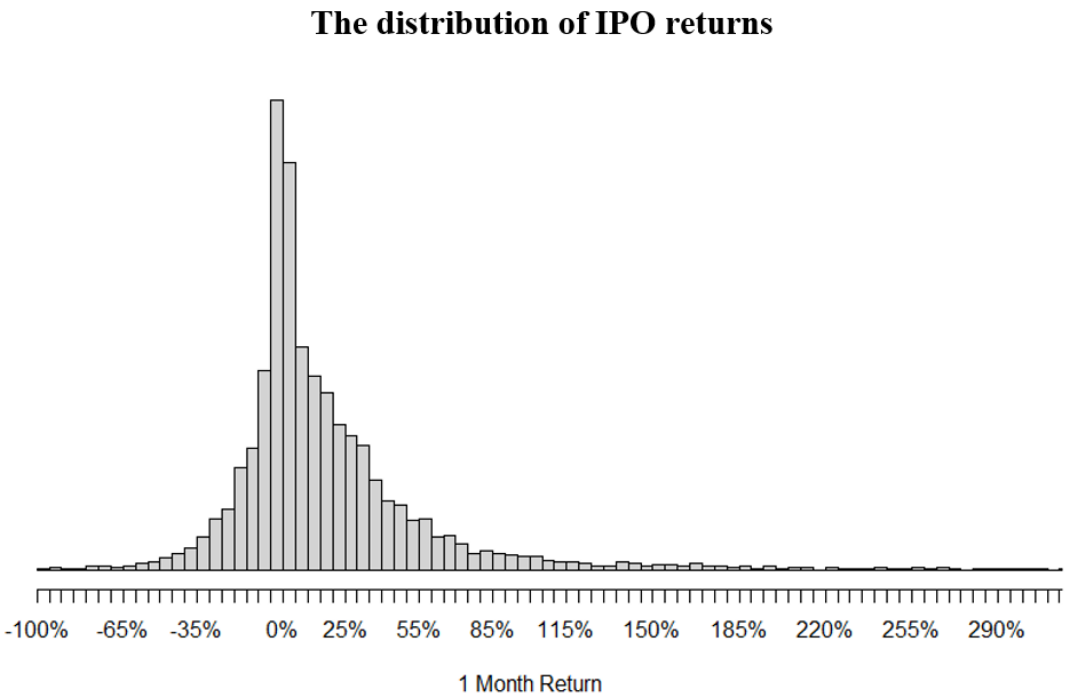

Figure 1. Frequency distribution of first-month IPO return between 1985-2022. The first-month return is defined as the percentage difference between the aftermarket price 1 month after the offer date and the offer price.

In Figure 1, the distribution of initial returns to IPOs over the sample period is shown. In the sample, the average initial return is 21% and the standard deviation is 57%, which is similar to the results of Lowry et al. (2010) at 22% and 55% respectively for the years 1965 to 2005. Additionally, 9% of the IPOs in our sample have a one-month initial return equal to 0% while the corresponding value in Lowry et al. (2010) is 4%. As seen in the figure, the initial return distribution is slightly positively skewed (5) and heavily tailed with kurtosis of 44.

Monthly initial IPO return, volatility, and number of IPOs

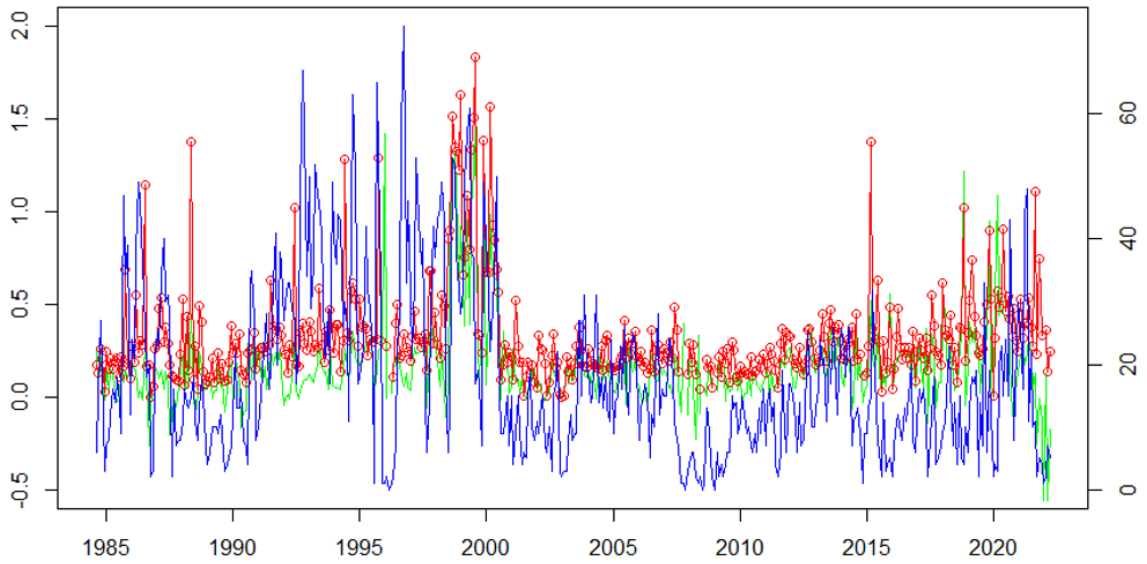

Figure 2. The blue line equals the monthly number of IPOs (right axis), the green line equals to the average monthly IPO return and the red line equals to the standard deviation of the monthly return (left axis). The average initial return is measured as the average of the percent difference between the aftermarket price one-month after the offering date and the offer price.

Figure 2 combines the monthly number of IPOs (blue), the average one-month initial return (green) and standard deviation of the one-month initial return (red) between 1985 and 2022. The figure shows similar data patterns as that of Lowry et al. (2010) when excluding single months with extreme return and high standard deviation. The figure displays a co-movement for the average return and the variability of average return that is mostly consistent over the period, with exception for around the year 1987 and 1992-1994. However, the IPO market seems to become less volatile after the IPO bubble around 2000. After the bubble, the co-movement of the average return and the variability of returns becomes greater and there are little to no spikes. The number of IPOs also become more cyclical suggesting that investors and founders might come to be more aware of the benefit of good timing as a consequence of the high returns during the bubble. Around 2015 however, the market started to become more volatile again and in 2022, the average return and the number of IPOs has declined to an all-time-low where IPOs on average are overpriced. Further, the monthly number of IPOs seems to follow cycles as argued by Pástor and Veronesi (2005), especially after the IPO bubble.

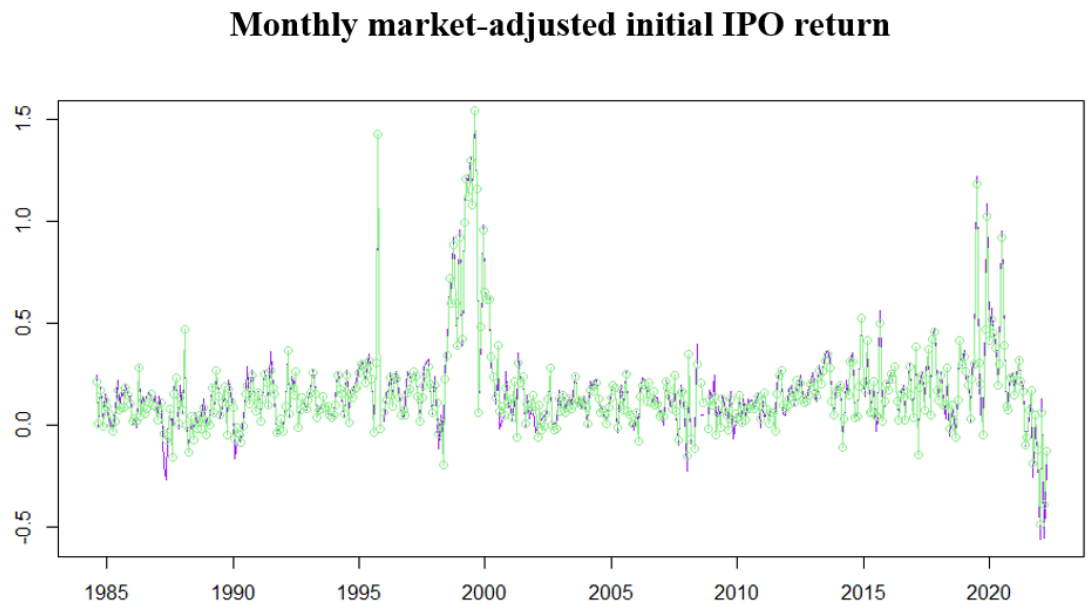

Figure 3. The purple line equals to the average monthly IPO return and the green line equals to the market-adjusted monthly initial IPO return.

In figure 3, both the IPO return (purple) and the market-adjusted IPO return (green) are displayed. As expected, the lines are almost identical besides some differences in the magnitude of the tops and bottoms which depends on the performance of the market in general. Generally, in bull markets the average returns are greater than the adjusted average returns, while the opposite is true in bear markets.

Table 2

Descriptive Statistics of Monthly Mean and Volatility of IPO Initial Returns

The average monthly return and variability of initial returns is measured across all firms that went public each month during 1985 – 2022. Initial returns are measured as the percent difference between the aftermarket price one-month after the offering date and the offer price. The statistics in this table reflect the monthly time series of these cross-sectional averages and standard deviations, σ. Corr represents the correlation between the averages and standard deviations over time. Months with only one IPO is included in the average return but not in the standard deviation. The periods in the specific bear-markets are shown in the table as the peak-trough dates but when calculated we have used the month after the when the peak occurred.

	N	Mean	Std. Dev.	Corr.	Adjusted-Mean
1985 – 2022	450	0.169	0.217	0.731	0.162
1985 - 2022 (omitting '98-'00)	426	0.139	0.151	0.501	0.132
1985 – 2022 (omitting bear markets)	362	0.197	0.219	0.791	0.184
1985 – 2022 (omitting bull markets)	91	0.090	0.216	0.674	0.109
Bear Markets					
Aug 1987 - Nov 1987	3	-0.173	0.082	-0.967	-0.057
May 1990 - Oct 1990	5	-0.064	0.095	0.782	-0.025
Jan 1994 - Jul 1994	5	0.055	0.102	0.451	0.062
Mar 2000 - Oct 2002	31	0.199	0.323	0.885	0.210
Feb 2004 - Aug 2004	6	0.102	0.036	0.155	0.099
Oct 2007 - Mar 2009	17	0.079	0.108	0.405	0.098
Apr 2011 - Oct 2011	6	0.056	0.070	-0.031	0.076
May 2015 - Feb 2016	9	0.185	0.189	0.805	0.192
Feb 2020 - Mar 2020	1	-0.001	0.000	n.m.	-0.049
Jan 2022 – Sep 2022	8	-0.180	0.337	0.778	-0.128

Table 2 shows the descriptive statistics of Figure 2 and 3, and for the individual bear markets. For each month, we calculate the number of IPOs, the average IPO return, the standard deviation of the average return, and the average IPO return adjusted for the market effect for all IPOs during that month. Column 2 and 3 shows the time-series mean and standard deviation while column 4 shows the correlation between the monthly standard deviation and mean and column 5 shows the market-adjusted mean return. The result for the sample period is comparable to the findings of Lowry et al. (2010) where the average initial return was 16.6% (16.9%) and the standard deviation was 25.6% (21.7%) for the period 1965-2005

(1985-2022). As expected, the average return and variability of average return are lower when looking at the monthly data compared to the cross-sectional data since months during hot markets when the number of IPOs are higher than usual, are weighted equally as months with far fewer IPOs. As the IPO return tends to be higher during months with more listings, the equal-weighting of months causes the average return to decrease.

The adjusted mean is higher in bear markets and lower in bull markets, compared to their unadjusted counterparts. However, our data suggest that the market impact is greater for bear markets (-1.9%) than for bull markets (+1.3%), implying that the market declines 46% more in bear markets than it increases in bull markets. When comparing the sample period with and without the IPO bubble period (September 1998 to August 2000) it is clear that the IPO bubble period during 1998-2000 greatly impacts the sample initial return, as shown by the large decrease in mean of the monthly average one-month IPO returns from 16.9% to 13.9% when omitting that period.

Despite the fact that we have equal amounts of bear-, and bull markets, bear markets constitute 20% of the sample while the periods defined as bull markets represent 80%. This can be explained by bear markets being shorter than bull markets in general and that bull markets are the “normal state” in the market.

Further, the initial return is 46% lower and the standard deviation is 56% lower in bear markets compared to bull markets. The bear market in 2000-2002 had much higher initial returns compared to the other bear markets due to the fact that the beginning of the period overlaps with the IPO bubble that ended in August 2000. That bear market has the greatest number of months as well. Therefore, excluding the part of the bear market period 2000-2002 that overlaps with the IPO market would significantly lower both the initial return and standard deviation of all bear markets as a group. Moreover, there is no clear pattern regarding the return, standard deviation or correlation of the different bear markets besides that the significantly longer bear markets have higher average initial return while the shorter periods have returns closer to zero or strongly negative returns.

In general, the return tends to increase when it is adjusted for the market return in bear markets. More precisely, the return becomes less negative for negative returns and more positive for positive returns in bear markets. For the bear markets in 2020 and 2004 however, the effect is in the opposite direction and the returns decrease. The effect in 2004 is almost insignificant (-0.003). The largest effect was in 1987 (+0.116) and 2022 (+0.052).

4. Hypothesis test

Table 3

Variable Definitions

Variable	Definition
Average IPO Initial Return	Average Percentage difference between the prices one month after IPO and the offer prices during a specific month
Standard Deviation of IPO Initial Return	The standard deviation of all initial IPO returns during a specific month
Number of listed firms	The number of IPOs during a specific month
Average Adjusted Initial Return	Average percentage difference between the IPO Initial Return and the S&P 500 return during a specific month
Adjusted Standard Deviation of IPO Initial Return	The standard deviation of all S&P 500 adjusted initial IPO returns during a specific month
Bear market, dummy	Equals one if the IPO month is characterized as a bear market, zero otherwise
2M before Bear market (BM), dummy	Equals one in the month before and two months before the start of a bear market
Percentage NYSE	Percentage of all listings that occur on the NYSE during a given month
Percentage Nasdaq	Percentage of all listings that occur on Nasdaq during a given month
Bear market [Number], dummy	Equals one in each respective bear market in chronological order
Bubble Period	Equals one in the months between September 1998 up until August 2000, zero otherwise

Table 4

Linear regression on average, standard deviation, number of listed firms, market adjusted average and market adjusted standard deviation on bear markets

This table shows the linear regression of various dependent variables against the bear market dummy as well as the 2M before bear market dummy. Average IPO return is calculated as the average one-month return of the companies listed in each specific month. Similarly, standard deviation of IPO initial returns describes the standard deviation of the one-month returns of all companies listed in a specific month. Number of listed firms counts the number of firms listed during a specific month. The average adjusted IPO initial return is calculated as the average of the initial returns minus the market return during the same period of all companies listed in a specific month. The standard deviation of adjusted IPO initial returns calculates the standard deviation of the market-adjusted returns. The bear market dummy equals one in months when the market is defined as a bear market. The 2M before BM dummy equals one two months preceding a bear market. P-values are given in parentheses.

$$IR_i = \beta_0 + \beta_1 Bear\ market_i$$

$$Stdev_i = \beta_0 + \beta_1 Bear\ market_i$$

$$Number_i = \beta_0 + \beta_1 Bear\ market_i,$$

$$Adjusted\ IR_i = \beta_0 + \beta_1 Bear\ market_i$$

$$Adjusted\ Stdev_i = \beta_0 + \beta_1 Bear\ market_i$$

	Average IPO Initial Return	Std. Dev. of IPO Initial Return	Number of IPOs	Average Adj. IPO Initial Return	Std. Dev. of Adj. IPO Initial Return
1985 - 2022 (IPO Bubble included)					
Intercept	18.882 (<.001)	33.400 (<.001)	19.472 (<.001)	17.519 (<.001)	33.350 (<.001)
Bear market dummy	-9.921 (<.001)	-6.064 (.067)	-7.000 (<.001)	-6.603 (.014)	-6.019 (.069)
R^2	0.029	0.008	0.041	0.014	0.008
1985 - 2022 (IPO Bubble omitted)					
Intercept	15.897 (<.001)	29.264 (<.001)	18.494 (<.001)	14.578 (<.001)	29.217 (<.001)
Bear market dummy	-10.434 (<.001)	-6.258 (.009)	-6.832 (<.001)	-7.007 (<.001)	-6.206 (.009)
R^2	0.060	0.016	0.042	0.030	0.016
1985 - 2022 (IPO Bubble included, but overlap with bear market excluded)					
Intercept	19.540 (<.001)	34.237 (<.001)	19.503 (<.001)	18.188 (<.001)	34.186 (<.001)
Bear market dummy	-14.077 (<.001)	-11.231 (<.001)	-7.840 (<.001)	-10.617 (<.001)	-11.174 (<.001)
R^2	0.056	0.025	0.048	0.034	0.025

$$IR_i = \beta_0 + \beta_1 Bear\ market_i + \beta_2 2M\ before\ BM_i$$

$$Stdev_i = \beta_0 + \beta_1 Bear\ market_i + \beta_2 2M\ before\ BM_i$$

$$Number_i = \beta_0 + \beta_1 Bear\ market_i + \beta_2 2M\ before\ BM_i$$

$$Adjusted\ IR_i = \beta_0 + \beta_1 Bear\ market_i + \beta_2 2M\ before\ BM_i$$

$$Adjusted\ Stdev_i = \beta_0 + \beta_1 Bear\ market_i + \beta_2 2M\ before\ BM_i$$

Regression with bear market dummy and 2-months before bear market dummy

	Average IPO Initial Return	Std. Dev. of IPO Initial Return	Number of IPOs	Average Adj. IPO Initial Return	Std. Dev. of Adj. IPO Initial Return
1985 - 2022 (IPO Bubble included)					
Intercept	18.826 (<.001)	32.929 (<.001)	19.427 (<.001)	17.352 (<.001)	32.882 (<.001)
Bear market dummy	-9.865 (<.001)	-5.593 (.093)	-6.954 (<.001)	-6.436 (.016)	-5.551 (.095)
2M before BM dummy	1.010 (.847)	8.414 (.176)	.823 (.792)	3.028 (.554)	8.351 (.179)
R^2	0.029	0.012	0.042	0.015	0.012
1985 - 2022 (IPO Bubble omitted)					
Intercept	15.936 (<.001)	28.969 (<.001)	18.546 (<.001)	14.507 (<.001)	28.922 (<.001)
Bear market dummy	-10.472 (<.001)	-5.963 (.013)	-6.883 (<.001)	-6.936 (<.001)	-5.910 (.014)
2M before BM dummy	-.731 (.855)	5.547 (.226)	-.990 (.751)	1.350 (.723)	5.550 (.224)
R^2	0.060	0.020	0.042	0.031	0.020
1985 - 2022 (IPO Bubble included, but overlap with bear market excluded)					
Intercept	19.523 (<.001)	33.822 (<.001)	19.460 (<.001)	18.061 (<.001)	33.774 (<.001)
Bear market dummy	-14.060 (<.001)	-10.816 (.001)	-7.797 (<.001)	-10.490 (<.001)	-10.762 (.002)
2M before BM dummy	.314 (.952)	7.521 (.223)	.790 (.799)	2.318 (.647)	7.460 (.225)
R^2	0.056	0.028	0.049	0.034	0.028

Table 4 shows the primary regression results. Within the marked areas, each column displays a regression of the respective variables: average IPO return, standard deviation of the IPO return, the number of firms listed during the month, the average market-adjusted IPO return and the standard deviation of the average market-adjusted IPO return. Aforementioned variables were plotted against whether or not a bear market occurred during a specific month.

As shown in Table 4, all intercepts (representing bull markets) have p-values lower than 0.001 and are thus significant on a 0.1% level. In all regressions, bear markets have a substantial significant negative effect on the average IPO return and number of IPOs. One can also observe that all R-squares in our regressions are very small which is unsurprising since R-square represents the variability around the fitted line in the regression, and as described in previous parts, IPOs are known to vary substantially in terms of monthly return and the number of IPOs. As a result, the data has no clear trend, which is a major reason for why IPO underpricing is not yet fully understood. The significant coefficient however still impacts the dependent variables as reported in our tables.

In the first regression when the IPO bubble period is included, all bear market coefficients are significant at a 10% level and when excluding the bubble period, the coefficients are significant at a 1% level. The bear market in 2000 to 2002 overlaps with the IPO bubble during the period March 2002 to August 2002. Including the IPO bubble but adjusting for these months and removing them from the bear market increases the significance to a 0.1% level. In column 4 and 5, we adjust the IPO return for the market effect, and when removing the market effect of a bear market, IPO underpricing decreases with 10.6% and IPO variability decreases with 11.2% during a bear market. This is in contrast to the 14.1% and 11.2% without the market adjustment respectively.

Unsurprisingly, the bear market effect on the average initial return decreases when adjusting for the market effect. This is because stock prices generally increase in bull markets and decrease in bear markets. Hence, any negative effect bear markets would have on the initial return is removed, similar to any positive effect bull markets may provide. Interestingly, we see a decrease in the intercept of roughly 1.4% across the different datasets, implying that stocks are on average less underpriced than previous studies have found. Additionally, although we see a negative effect overall on the intercept of the initial return, the same is not true for the standard deviation. Despite the adjustment, the intercept for the standard deviation is only slightly lower for the adjusted values. Moreover, the bear market effect is not significantly different between the unadjusted and adjusted values. Therefore, one can conclude that bear markets seem to have significantly lower standard deviation compared to other months, along with lower returns as well.

Continuing with the analysis, the effect of the overlap can clearly be seen in the results. When removing the overlap between the IPO bubble and the fourth bear market in the sample, the intercept increases while the bear market effect becomes more negative. This is true for all tested variables. With the bubble omitted from the sample completely, we also see some interesting results. The effect that the bear market has on the sample is far lower than with the overlap removed, driven by a decrease in the intercepts of around 3.5 (pp).

Since we define the start of the bear markets as the beginning of the month after the peak has occurred, we include a dummy for two months before the start of our defined peak, since these months have a bull-market during the whole period, enabling us to compare bear markets with its respective peak month. However, since the period samples for these months are small, the effect of the 2-month dummy is not significant, although we find the results

interesting. Our results suggest that the effect of the months leading up to a bear market is greatest for the standard deviation of the average IPO returns, both for the adjusted return and the unadjusted return (when doing the regression on a 3-month dummy instead, the results become more significant for all regressions). The difference in variability of the market-adjusted IPO return in the two months before the beginning of the bear market (+7.5%) compared with the bear market (-10.8%) is greater than 18%.

Table 5

Correlation on share of IPOs listed on Nasdaq and NYSE

This table shows the correlations between the bear market dummy and the monthly percentage of companies listed on the NYSE and Nasdaq respectively.

	1985-2022 Bear markets Including the IPO bubble	1985-2022 Bear markets Omitting the IPO bubble	1985-2022 Bear markets Including the IPO bubble but removing the overlap
Percentage NYSE	0.040 (.401)	0.053 (.274)	0.077 (.102)
Percentage Nasdaq	-0.054 (.256)	-0.068 (.161)	-0.082 (.084)

The results in Table 5 show that during bear markets, the share of firms that list on Nasdaq decreases between 5 and 8 %. However, only the results for when including the IPO bubble but removing the overlapping months are significant, and on a 10% level. We chose to do the correlation on the bear markets when excluding the overlap with the IPO bubble as that period can be seen as an exception where the number of technological firms (representing Nasdaq) was significantly higher than normal. The results somewhat confirm our theory of selection bias regarding firms in bear markets. However, the effect is smaller and less significant than expected.

Table 6

Linear regression on average, standard deviation, number of listed firms, market adjusted average and market adjusted standard deviation on individual bear-markets

This table shows the linear regression of various dependent variables against the ten bear markets identified in the sample. Average IPO return is calculated as the average one-month return of the companies listed in each specific month. Similarly, standard deviation of IPO initial returns describes the standard deviation of the one-month returns of all companies listed in a specific month. Number of listed firms counts the number of firms listed during a specific month. The average adjusted IPO initial return is calculated as the average of the initial returns minus the market return during the same period of all companies listed in a specific month. The standard deviation of adjusted IPO initial returns calculates the standard deviation of the market-adjusted returns. The bear market dummies equals one in the months where the market is defined as being the respective bear market. The 2M before bear market dummy equals one in the two months preceding a bear market. P-values are given in parentheses.

$$IR_i = \beta_0 + \beta_1 Bear\ market\ 1_i + \beta_2 Bear\ market\ 2_i + \beta_3 Bear\ market\ 3_i + \beta_4 Bear\ market\ 4_i + \beta_5 Bear\ market\ 5_i + \beta_6 Bear\ market\ 6_i + \beta_7 Bear\ market\ 7_i + \beta_8 Bear\ market\ 8_i + \beta_9 Bear\ market\ 9_i + \beta_{10} Bear\ market\ 10_i$$

$$Stdev_i = \beta_0 + \beta_1 Bear\ market\ 1_i + \beta_2 Bear\ market\ 2_i + \beta_3 Bear\ market\ 3_i + \beta_4 Bear\ market\ 4_i + \beta_5 Bear\ market\ 5_i + \beta_6 Bear\ market\ 6_i + \beta_7 Bear\ market\ 7_i + \beta_8 Bear\ market\ 8_i + \beta_9 Bear\ market\ 9_i + \beta_{10} Bear\ market\ 10_i$$

$$Number_i = \beta_0 + \beta_1 Bear\ market\ 1_i + \beta_2 Bear\ market\ 2_i + \beta_3 Bear\ market\ 3_i + \beta_4 Bear\ market\ 4_i + \beta_5 Bear\ market\ 5_i + \beta_6 Bear\ market\ 6_i + \beta_7 Bear\ market\ 7_i + \beta_8 Bear\ market\ 8_i + \beta_9 Bear\ market\ 9_i + \beta_{10} Bear\ market\ 10_i$$

$$Adjusted\ IR_i = \beta_0 + \beta_1 Bear\ market\ 1_i + \beta_2 Bear\ market\ 2_i + \beta_3 Bear\ market\ 3_i + \beta_4 Bear\ market\ 4_i + \beta_5 Bear\ market\ 5_i + \beta_6 Bear\ market\ 6_i + \beta_7 Bear\ market\ 7_i + \beta_8 Bear\ market\ 8_i + \beta_9 Bear\ market\ 9_i + \beta_{10} Bear\ market\ 10_i$$

$$Adjusted\ Stdev_i = \beta_0 + \beta_1 Bear\ market\ 1_i + \beta_2 Bear\ market\ 2_i + \beta_3 Bear\ market\ 3_i + \beta_4 Bear\ market\ 4_i + \beta_5 Bear\ market\ 5_i + \beta_6 Bear\ market\ 6_i + \beta_7 Bear\ market\ 7_i + \beta_8 Bear\ market\ 8_i + \beta_9 Bear\ market\ 9_i + \beta_{10} Bear\ market\ 10_i$$

	1985-2022 (Including the IPO bubble between Sep 1998 – Aug 2000)					1985-2022 (Omitting the IPO bubble between Sep 1998 – Aug 2000)				
	Average IPO Initial Return	Std. Dev. of IPO Initial Return	Number of IPOs	Average Adj. IPO Initial Return	Std. Dev. of Adj. IPO Initial Return	Average IPO Initial Return	Std. Dev. of IPO Initial Return	Number of IPOs	Average Adj. IPO Initial Return	Std. Dev. of Adj. IPO Initial Return
Intercept	18.882 (<.001)	33.400 (<.001)	19.472 (<.001)	17.519 (<.001)	33.350 (<.001)	15.897 (<.001)	29.264 (<.001)	18.656 (<.001)	14.578 (<.001)	29.217 (<.001)
Bear market 1 Aug '87- Nov '87	-36.185 (.005)	-21.764 (.165)	-2.806 (.712)	-23.212 (.068)	-22.140 (.157)	-33.200 (<.001)	-17.628 (.105)	-1.989 (.781)	-20.271 (.024)	-18.007 (.097)
Bear market 2 May '90 - Oct '90	-25.282 (.012)	-18.014 (.139)	-10.072 (.088)	-20.068 (.043)	-18.821 (.121)	-22.298 (.002)	-13.878 (.100)	-9.256 (.096)	-17.127 (.014)	-14.688 (.081)
Bear market 3 Jan '94 - Jul '94	-13.404 (.183)	-2.657 (.827)	22.928 (<.001)	-11.368 (.250)	-2.591 (.831)	-10.419 (.147)	1.479 (.861)	23.744 (<.001)	-8.426 (.225)	1.542 (.854)
Bear market 4 Mar '00 - Oct '02	1.007 (.810)	-.595 (.906)	-5.085 (.038)	3.520 (.391)	-.582 (.908)	-5.074 (.118)	-8.229 (.031)	-7.925 (.002)	-2.271 (.468)	-8.196 (.031)
Bear market 5 Feb '04 - Aug '04	-8.640 (.348)	-14.761 (.184)	.194 (.971)	-7.574 (.402)	-14.678 (.186)	-5.655 (.389)	-10.624 (.169)	1.011 (.842)	-4.633 (.465)	-10.545 (.171)
Bear market 6 Oct '07 - Mar '09	-10.945 (.073)	-16.112 (.063)	-15.002 (<.001)	-7.761 (.194)	-14.553 (.093)	-7.960 (.068)	-11.976 (.047)	-14.185 (<.001)	-4.820 (.251)	-10.421 (.082)
Bear market 7 Apr '11 - Oct '11	-13.320 (.148)	-16.400 (.140)	-10.639 (.049)	-9.894 (.273)	-17.004 (.126)	-10.335 (.116)	-12.264 (.112)	-9.823 (.054)	-6.952 (.273)	-12.871 (.095)
Bear market 8 May '15 - Feb '16	-.369 (.961)	-1.494 (.877)	-9.028 (.042)	1.713 (.817)	-1.004 (.917)	2.616 (.627)	2.642 (.693)	-8.212 (.049)	4.654 (.371)	3.129 (.639)
Bear market 9 Feb '20 - Mar '20	-18.945 (.397)	-32.838 (.225)	-17.472 (.183)	-22.394 (.308)	-30.867 (.253)	-15.960 (.318)	-28.701 (.126)	-16.656 (.178)	-19.453 (.207)	-26.734 (.153)
Bear market 10 Jan '22 - Sep '22	-36.873 (<.001)	11.810 (.252)	-14.847 (.002)	-30.369 (<.001)	10.354 (.314)	-33.888 (<.001)	15.946 (.026)	-14.031 (.002)	-27.428 (<.001)	14.487 (.043)
R^2	0.087	0.031	0.121	0.061	0.030	0.135	0.058	0.141	0.090	0.056

1985-2022 (Including the IPO bubble, but removing the overlap)

	Average IPO Initial Return	Std. Dev. of IPO Initial Return	Number of IPOs	Average Adj. IPO Initial Return	Std. Dev. of Adj. IPO Initial Return
Intercept	19.540 (<.001)	34.237 (<.001)	19.662 (<.001)	18.188 (<.001)	34.186 (<.001)
Bear market 1 Aug '87- Nov '87	-36.842 (.004)	-22.601 (.146)	-2.995 (.691)	-23.881 (.061)	-22.975 (.139)
Bear market 2 May '90 - Oct '90	-25.940 (.010)	-18.851 (.119)	-10.262 (.080)	-20.736 (.036)	-19.657 (.103)
Bear market 3 Jan '94 - Jul '94	-14.062 (.161)	-3.494 (.772)	22.738 (<.001)	-12.036 (.223)	-3.426 (.776)
Bear market 4 Mar '00 - Oct '02	-8.717 (.054)	-13.203 (.016)	-8.931 (<.001)	-5.881 (.186)	-13.164 (.016)
Bear market 5 Feb '04 - Aug '04	-9.298 (.310)	-15.598 (.158)	.005 (.999)	-8.243 (.361)	-15.514 (.159)
Bear market 6 Oct '07 - Mar '09	-11.602 (.056)	-16.949 (.049)	-15.192 (<.001)	-8.429 (.158)	-15.389 (.073)
Bear market 7 Apr '11 - Oct '11	-13.978 (.127)	-17.237 (.119)	-10.829 (.043)	-10.562 (.242)	-17.839 (.106)
Bear market 8 May '15 - Feb '16	-1.027 (.891)	-2.331 (.808)	-9.218 (.036)	1.045 (.888)	-1.839 (.848)
Bear market 9 Feb '20 - Mar '20	-19.603 (.379)	-33.675 (.210)	-17.662 (.175)	-23.063 (.293)	-31.703 (.237)
Bear market 10 Jan '22 - Sep '22	-37.531 (<.001)	10.973 (.284)	-15.037 (.001)	-31.037 (<.001)	9.518 (.352)
R^2	0.095	0.045	0.134	0.063	0.043

In Table 6, we have done regressions with a dummy variable for each individual bear market in order to evaluate the robustness of our results in Table 4. Firstly, the significance levels are at 0.1% level for all intercepts, however, vary a lot for the individual bear markets dummies. In the regressions including the IPO bubble and excluding the overlapping months in 2002, all bear markets have a negative effect on the IPO return and 50% of them are significant, at a 10% level. The same applies for the market-adjusted returns (30% are significant at a 10% level.), besides for the market in 2015 to 2016 (BM 8) which has a positive effect. The bear market in 2015 to 2016 differs slightly from the others since it does not experience any drastic decline but rather stagnates and depreciates slowly over the period. Thus, the small positive insignificant effect for the period is not surprising.

Regarding the standard deviation and the number of IPOs, 20% of the bear markets are significant at a 10% level for the variability of average return and 70% for the number of IPOs. In the regression which excludes the IPO bubble, 60% of the bear markets are significant at a 10% level for the variability of return, 30% for the return, and 70% for the number of IPOs.

The robustness is the highest for the number of IPOs while the variability of the average return is slightly less so and the average return is the least robust. However, when looking at the cross-sectional data, most of the variables are significant 5% and the coefficients have an even greater effect.

5. Conclusion

The results in our regressions confirm our hypothesis that during bear markets, IPOs are priced closer to their market value and the variability of returns are lower compared to bull markets. Consequently, the number of IPOs decreases, since founders or "inventors" wish to obtain as high valuation as possible for their business; a finding that is consistent with previous literature (Pástor and Veronesi, 2005).

Furthermore, the average return and the variability of the average return becomes more stable with fewer spikes in the period following the IPO bubble. However in 2015, the IPO market started to become more volatile again and in 2022, the average return and the number of IPOs reached an all-time-low with on average overpriced IPOs. The current abnormal IPO market characterized by substantial overpricing creates uncertainty regarding the future of the IPO market. The previous abnormal IPO market, the late 1990's IPO bubble, seemed to have changed the behavior of the market up until now. Although it seems unlikely that the current trend of overpricing would last given the market structure (investors will not subscribe to new issues if they are consistently overpriced), it does pose interesting questions regarding the future of the listing process. Now that more and more individual retail investors are gaining access to the market, alternate routes for listing could emerge to challenge the traditional underwriting method.

In general, the negative effect of bear markets seems to be the strongest for the average IPO return, second for the number of IPOs and third for the variability of returns (even if the effect is strong overall). The order holds true when adjusting for the market return as well. When comparing bear markets with the closest previous month that have a consistent bull market, the negative effect of bear markets seems to be strongest for the variability of returns. However, since all regressions with the 2-month dummy are insignificant, no correlation can be assumed. However, the results suggest that the peak months experience significantly higher variability of returns, which could be expanded further in future research. Another interesting finding is that in general, the negative effect of bear markets on the initial returns is larger than the positive effect of bull markets.

Our hypothesis regarding a selection bias among the firms listing in bear markets holds true when including the IPO bubble and excluding overlapping months, due to the fact that the amount of firms listing on Nasdaq decreases during bear markets at a significant level. Also, the share of firms listing on the NYSE does increase by around 7.2% during bear markets. This effect is almost significant at a 10% level. However, the effects are smaller and less significant than expected. Thus, when using exchange as a proxy, selection bias has a small explanatory value for the decrease in underpricing during bear markets.

One of the possible extensions of our paper is further investigation on cross-sectional differences, for example if the firm is VC-backed, the firm age and the industry, which could act as more effective proxies for difficult-to-value firms. We believe that doing the regressions with more cross-sectional variables, and also within specific industries or other firm characteristics, will increase the R-squares since the cross-sectional variables can help explain the variability in the data. Moreover, since our findings suggest that IPOs in bear markets are priced closer to their respective market prices, it would be interesting to analyze the degree of price discovery for IPOs in bear-, and bull markets respectively. Put in the context of Edelen and Kadlec's (2005) findings, it could provide added insights into the pricing process during different market states.

Another possible extension would be to examine how underwriter rank, i.e. how competent, prestigious and reputable the investment bank underwriting the IPO is, varies between different IPO markets. As the IPO market contracts, there are fewer IPOs for investment banks to compete on. There is a possibility that more reputable underwriters would fare better in these conditions, thus contributing to more accurate pricing. Furthermore, as underwriters compete for fewer IPOs, IPO underpricing might decrease as a way of attracting more mandates. By studying how the average underwriter rank compares between the market periods, one could examine how large of a contributing factor it is in the lower underpricing during bear markets.

Lastly, re-doing the study in the future to examine if the average initial IPO returns will be underpriced to the same extent as before (~20%), with regards to the recent overpricing in the market, would also, indeed, be interesting

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