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Internet Firm Attention and IPO Underpricing: Evidence from U.S. Major Exchanges

Understanding IPO Underpricing: An Empirical Analysis of Internet Firms, Investor Attention and Initial IPO Returns on NYSE and NASDAQ

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ABSTRACT

In this thesis, I study whether firm type, internet or non-internet firm, affects the relationship between retail investor attention and initial public offering (IPO) underpricing. A sample of 256 IPOs listed on the NYSE and NASDAQ from 2019 to 2021 was collected and analysed through regression analysis and interaction plots. My results reveal that, contrary to expectations, internet firms do not enhance the effect between abnormal Google Search Volume Index (ASVI) and first-day IPO return in comparison with non-internet firms. Although investor attention may have an impact, the findings suggest that the influence of retail investor attention on IPO underpricing remains consistent across firm types, thus alternative factors should be considered. This thesis contributes to a deeper understanding of IPO underpricing dynamics and underlines the importance of monitoring investor attention.

Keywords: IPO, Attention, Internet Search, Google, Retail Investor, Firm Type

JEL-codes: C20, D83, G12, G14, G24, G30, G41, and L86

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CHAPTER 1: Introduction

The valuation of Initial Public Offerings (IPOs) plays a crucial role in the financial world since it allows public capital market participants an opportunity to assess the value of a company's assets for the first time. The act of going public puts a company in the spotlight, which can have several implications for companies. A feature of the IPO market that has been highlighted by the media in recent years is the large underpricing (i.e., the difference between the initial offering price and the closing price on the first day) of internet companies. During the peak of the Internet stock bubble, in the year 2000, companies left approximately a total of $30 billion on the table at their IPOs (Ritter, 2014). This major overpricing goes against the assumption of traditional asset pricing models, which posits that information is immediately reflected in prices as soon as it becomes available. For this assumption to be valid, investors must pay sufficient attention to the asset.

However, in today's information age, where an overabundance of information is accessible, the attention of an investor has become a precious and limited resource that must be used efficiently to obtain the desired information (Falkinger 2008). Due to the constraints of limited attention, investors tend to concentrate more on processing market- and sector-wide information rather than firm-specific information (Peng & Xiong, 2006). Retail investors in particular, who make up an increasing share of the market, lack the time to absorb all the news about certain companies. When it comes to retail investors obtaining information, the media plays an important role. The article by Liu, Sherman, and Zhang (2007) shows that each additional instance of media coverage during the period when a company files for an IPO is associated with a higher level of underpricing.

Other research on this topic was done by Andrei and Hasler (2005), who found that investors' attention to news plays notably contributes to explaining the variation in stock returns. However, in many cases, this investor attention is something intangible that is difficult to observe directly. Da, Engelberg, and Gao (2011) change that with their research by using the Google Search Volume Index (SVI) as a direct measure to reflect this attention. Furthermore, they found that an increase in this index provides explanatory value for the large first-day returns of IPO stocks. This very same SVI is used in the study done by Ding and Hou (2015), in which they find that retail investor attention is responsible for an increase in the shareholder base and stock liquidity.

Nevertheless, it is feasible that not every industry receives equal investor attention, due to the different firm characteristics. This is confirmed in the recent research done by Que and Zhang (2021), in which they study the relationship between investor attention directed at specific industries and the valuations of firms within the venture capital market. The findings show that industries experiencing higher search volumes experience higher valuations. Over the past few years, one would probably point to the technology industry as the one that has received the most attention. Contrary to this notion, Beck's (2017) research found no evidence supporting the claim of higher levels of IPO

underpricing in the technology industry. However, the performances of the internet- and non-internet firms in the period following their IPO do show differences, according to Johnston and Madura (2002). Internet firms show significantly more favourable returns compared to non-internet firms. Given the nature of the internet industry, it is evident that there are substantial differences between these two categories of companies. These differences are reflected in the valuation of internet and non-internet firms at the IPO stage and their valuation at the close of their first trading day (Bartov, et al., 2002). They further state that investors' valuation of internet firms focuses more on positive cash flows, sales growth, and R&D rather than other factors that are more important for non-internet firms. This difference in the valuation of internet firms by investors may increase the original effect of investor attention on the level of IPO underpricing. This leads to the research question that will be central to this study:

"How does firm type, internet or non-internet firm, affect the relationship between investor attention and Initial Public Offering (IPO) underpricing?".

Cross-sectional regression analysis in combination with an interaction plot will be performed to capture the desired effect. This type of analysis is a technique to sort out the presence and magnitude of causal effects. The models are estimated using recent IPO data for the 2019-2021 period. The data gathered from Audit Analytics, CRSP, and Jay Ritter's website[1] contains all relevant information on U.S.-registered IPOs on the major exchanges. The studied outcome is IPO underpricing, expressed as the closing price in dollars at the end of the first trading day divided by the offering price in dollars minus one. The direct and unambiguous measure from the study of Da, Engelberg, and Gao (2011) will be used as a proxy of investor attention. The Google search frequency is likely to be representative of the internet search behaviour of the general population, as Google had a global search engine market share of about 92% in 2023[2]. The Search Volume Index (SVI) is made publicly available through Google Trends. Since there is no stock ticker available for the IPO, the SDC registered company name is used as the search term. Furthermore, including an interaction term in the model will measure the moderation effect of internet firms. This interaction term consists of the ASVI variable and a dummy variable that equals one if the firm can be classified as an internet firm and is zero otherwise. The distinction between internet and non-internet firms is made based on the internet variable used in the article by Loughran and Ritter (2004) and updated afterward. The model will also include several control variables such as investor sentiment, underwriter ranking, and total assets.

Finally, I expect to find that internet firms have an amplifying effect on the level of IPO underpricing in combination with retail investor attention, compared with companies in the sample

[1] Retrieved Apr. 2023 at: https://site.warrington.ufl.edu/ritter/ipo-data/
[2] Retrieved Apr. 2023 at: https://gs.statcounter.com/search-engine-market-share

that cannot be classified as internet firms. The results should indicate this by showing a significant effect on the interaction term and a clear difference in the slopes of the interaction plot. I expect this relationship to exist because we have seen in recent history that internet firms have been responsible for most of the underpricing. Additionally, I expect that the huge influence social media has on retail investors today will also contribute to the underpricing of an internet firm. However, internet firms are no longer something new in the IPO market, so it also seems plausible that the precise valuation of these types of companies has become increasingly efficient. In that case, the underpricing should be less pronounced using recent data. Nevertheless, I expect that there may be substantial differences within internet firms due to differences in business activities, which may leave variance unexplained.

The remainder of this paper is structured as follows. Chapter 2 presents a review of related literature. Chapter 3 describes the data sources, variable construction, and the process of assembling the sample. Chapter 4 outlines the methodology used in computational chapters. Chapter 5 studies how the moderation effect impacts the relationship between abnormal Google search volume and initial IPO returns. Finally, Chapter 6 provides a conclusion to the paper, wherein the key findings and implications of the study are summarized.

CHAPTER 2: Theoretical Framework

2.1 Investor Attention

In this study, it is crucial that we have a precise understanding of the meaning of attention because the definition we adopt will determine the approach we use to measure it. One usually uses the term attention to denote the act of listening to, watching, or thinking about something carefully (cf. The Oxford English Dictionary Online). A more scientific approach is discussed by psychologist William James, who says that attention is taking possession of the mind in a clear and vivid manner, with the presence of seemingly simultaneous options or trains of thought. Focus, concentration, and awareness are among its essences. Attention involves withdrawing from some things to engage more effectively with others (Wu & Wayne, 2011).

Selective attention is commonly understood as a reaction to limitations, in which all but the most important or relevant stimuli for a task are filtered out (Dayan, et al., 2000). In a contemporary era characterised by an overwhelming abundance of information, selecting the most relevant information at a given moment is pivotal to behaving adaptively in a complex world. According to Knudsen (2007), the mechanisms of attention are accountable for the specific selection of data that gains access to working memory. Due to the limited attention available, individuals tend to overlook relevant information signals and important aspects of the situation when making decisions (Hirshleifer, 2015). When people fail to pay sufficient attention to positive news, it can lead to positive abnormal returns. In the same way, negative abnormal returns are observed if bad news is neglected. When resources of investor attention are depleted, for instance, when there is great decision pressure or distracting news, individuals usually tend to use more intuitive thinking. This is supported by DellaVigna & Pollet (2009), who show that earnings announcements on Fridays are characterised by lower immediate response rates and higher delayed response rates. The underlying cause for this occurrence is that investors are distracted from work-related activities on Fridays.

Moreover, the focus of this research primarily lies on a specific group of individuals known as retail investors. This type of investor includes individuals who invest financial capital with the expectation of a future return or to gain a benefit. In this context, “attention” refers to the cognitive focus and awareness of financial assets, market information, and trading decisions of investors. A characteristic of retail investors that is often described in the literature is that these individuals are exposed to biases that alter their behaviour. According to Baker and Ricciardi (2014), most investors can be broadly categorised into two groups: overconfident and status quo. An overconfident investor might show excessive confidence in the accuracy of the information they possess and their competence to make effective decisions based on that information. On the other hand, the status quo bias refers to the tendency of investors to maintain their current investment positions and fail to update their beliefs or adjust their strategies, even when there may be potential gains to be realised by

doing so.

Hence, these biases illustrate that the information retail investors acquire and the information to which they give priority play an important role in the valuation of financial assets. In financial literature, the concept of investor attention is first described in the paper by Hong and Stein (1999), who introduced a framework to explain several market phenomena. They argue that attention allocation among investors is finite and can be influenced by various factors, such as news, events, or personal biases. The paper discusses overreaction and underreaction among retail investors and suggests that attention-based trading strategies can explain momentum effects, where investors allocate more attention to recent winners. If a particular group of traders initially underreacts to news in the short term, there will inevitably be an overreaction in the long term due to the nature of arbitrage strategies.

For most retail investors, thousands of options exist, making it impossible to assess the merits of each available common stock. Many investors tackle this challenge by considering buying stocks that have recently caught their attention (Barber & Odean, 2008). In the field of behavioural finance, Barber and Odean have been leaders since the publication of the article “All that Glitters: The Effect of Attention and News on the Buying Behavior of Individual and Institutional Investors”, which provided empirical evidence on the relationship between attention and investment decisions. The findings revealed that stocks attracting substantial attention experience heightened trading volumes and greater liquidity. However, despite the initial attention, these stocks tend to exhibit lower subsequent returns. These observations underscored the potential influence of attention on market efficiency and its role in the emergence of mispricing. On the other hand, professional investors, due to their expertise, resources, and dedicated time, are less likely to be influenced by attention-driven purchases. Unlike retail investors, professionals can actively monitor a larger number of stocks on an ongoing basis.

Furthermore, Li and Yu (2012) provide evidence that behavioural biases not only have an impact on individual stock prices but also on the overall aggregate market. Li and Yu show that being close to the 52-week high is a positive predictor of future returns, whereas being close to the historical high is a negative predictor of future market returns. This is further supported in the article by Andrei and Hasler (2015), who demonstrate in their model that both volatility and the risk premium increase with investors' attention and uncertainty. The model they developed shows that attention and uncertainty influence the dynamics of asset returns. Additionally, Kumar and Lee (2006) document that the behaviours exhibited by individual retail investors share a common trend or direction. Retail investors often follow a similar trend because their attention is often drawn to certain stocks or industries by the news, or in more recent times, by social media.

2.2 Initial Public Offering First-Day Return

In the first place, it should be noted that underpricing is usually viewed as the practice of listing an IPO at a price below its actual value in the stock market. This underpricing is typically temporary since investor demand will subsequently push the stock price closer to its true market value. Similarly, the academic definition given by Ljungqvist (2007) reads as follows: underpricing is estimated as the percentage difference between the price at which the IPO shares were sold to investors (the offer price) and the subsequent market price at which the shares are traded. When computing initial underpricing returns, most studies use the closing price on the first day of trading, since underpricing becomes apparent within a relatively short period. Considering prices observed later, such as at the end of the first week of trading, generally has minimal impact on the underpricing determination.

The topic of IPOs has interested financial economists for numerous decades, generating early research within the field, such as Logue (1973), who states in his study that underwriters potentially stand to lose a significant amount of monopoly profit when companies go public due to underpricing. Another early study on this topic is the article from Ibbotson (1975), which demonstrates that newly issued securities, particularly common stock, tend to exhibit positive abnormal returns in the early days of trading. This raises questions about the market efficiency of asset pricing in "hot issue" markets. This challenges the notion of the efficient market hypothesis, which assumes that prices reflect all available information, and therefore shows the existence of asymmetric information. The majority of studies in the field commonly attribute information asymmetry as one of the primary reasons for observing underpricing in IPOs.

A further instance of this is discussed in the article by Welch (1989), in which the author emphasises the role of information asymmetry between firm owners and investors. IPO underpricing can create a larger gap between the costs and benefits faced by low-quality firms when deciding whether to reveal their true quality. This gap incentivizes low-quality firms to go public and reveal themselves to investors. The article also proposes that imitation costs - the difficulty that investors face in distinguishing good and bad investment opportunities - can contribute to the persistence of IPO underpricing. When investors encounter higher imitation costs, they tend to rely more heavily on the pricing of previous IPOs as a benchmark for valuing new IPOs. If these previous IPOs have consistently been undervalued, it can lead to a continued trend of underpricing in seasoned offerings.

In addition, the seminal work done by Rock (1986) states that information asymmetry is also present among various classes of investors. Not all potential investors are willing to bear the expenses of obtaining information, and even if they do obtain the information, the presence of noise makes it challenging to derive any meaningful value from it. This asymmetry allows better-informed investors, primarily institutional investors, to avoid participating in overvalued IPOs. Consequently, uninformed investors, lacking the same level of information, face the "winner's curse" when participating in IPOs. The winner's curse is a typical application of Akerlof's (1970) lemons problem. In this case, the

uninformed investors pay a higher price than the real value of the security. Issuers aim to mitigate the winner's curse by intentionally underpricing the IPO and stimulating investor interest.

Alternatively, Baron and Holmström (1980); Baron (1982) hypothesise that underwriters possess superior information regarding market demand for the IPO compared to the issuing company. They leverage this informational advantage by intentionally setting the offer price below the expected market value, resulting in underpricing. This indicates that the involvement of underwriters in the IPO process significantly impacts pricing. Carter and Manaster (1990) found that IPOs by well-reputed underwriters are linked to reduced risk and tend to show lower degrees of underpricing. Therefore, when an offering is associated with well-respected underwriters, investors tend to have greater confidence in the investment. The fair pricing of an IPO influences the underwriter's market share; for that reason, well-reputed underwriters strive to accurately price the IPO, as it directly affects their success (Dunbar, 2000).

Interestingly, the average IPO leaves $9.1 million on the table in the 1990-1998 period, an amount often equivalent to several years' worth of operating income (Loughran & Ritter, 2002). However, most issuers do not seem to object to these large sums of money being missed out on by the company. Although it should be noted that this amount is a distorted picture since the median is only $2.3 million, this means that a minority of companies are responsible for most of the underpricing. The authors argue that issuers of IPOs do not perceive the opportunity cost associated with underpricing to be on par with direct costs. As a result, underwriters can secure higher overall compensation compared to a scenario where all costs borne by issuers are bundled as direct fees. Investors in IPO stocks are reaping the benefits of this by making abnormal returns on the first day or days.

Conversely, IPOs that initially experience high initial returns tend to exhibit subsequent negative abnormal returns in the long run, which implies a potential reversal effect (Ritter, 1991). A possible reason for this underperformance in the three years following the IPO is that numerous firms decide to go public when their industry-specific trends are nearing their peak, with substantial variation across industries. Ritter also notes in his study that issuers want to make use of "windows of opportunity", which implies successfully timing IPOs to lower their cost of capital, for example, by taking advantage of disparities in borrowing costs that periodically arise (Stulz, 1988).

More recent research on this topic was done by Li et al. (2019), who examined how trust affects the level of IPO underpricing. Interestingly, they found that firms that go public in high-trust regions experience lower first-day returns in comparison with IPOs in low-trust regions. Trust plays a role in motivating investors to participate in IPOs situated in regions with higher trust levels. Typically, issuing firms are required to provide underpricing to secure investor participation. However, trust lessens the burden on the issuing firms, resulting in less underpricing. Another recent development is the interest of investors in environmental, social, and governance (ESG) factors. Baker et al. (2021) posit a relationship between ESG government ratings and IPO underpricing. By

using a sample of 7446 IPOs, they show a negative effect of ESG ratings on IPO underpricing. This negative relationship exists because higher ESG ratings are associated with lower information asymmetry.

2.3 IPOs, underpricing, and the role of investor attention

Evidence for the existence of the relationship between retail investor attention and the initial IPO return is first provided by Da et al. (2011). In their seminal study, they pioneered the application of Google Trends as a tool for assessing investor interest. They found that search volume data can serve as a viable proxy variable for estimating various financial metrics such as excess returns, abnormal turnover, and news reports. This approach combines the utilisation of search volume data and information timing, allowing for the analysis of related yet subtly different characteristics. Based on a sample of 185 U.S. IPOs from January 2004 to December 2007, the study reveals that IPOs that receive notable investor attention experience high initial returns and are followed by long-term underperformance of the stock. This finding aligns with the research by Barber and Odean (2008), which demonstrates that individual investors tend to purchase "attention-grabbing" stocks, leading to temporary price pressure and resulting in inflated stock prices. In support of this, the results show a significant positive effect of the Abnormal Search Volume Index (ASVI) on the first-day IPO returns, at the five percent significance level. Even after controlling for multiple firm- and industry-specific variables, the relationship continues to be significant. In fact, a one-standard deviation increase in the ASVI variable results in a 3.18 percent increase in the initial first-day IPO return. Although an alternative, less reasonable explanation is given, namely, the possibility that the relationship works the other way around. Market participants' expectations regarding first-day IPO returns can influence their search behaviour, as they search a lot for a firm before the IPO if higher-expected first-day returns are present.

Furthermore, Vakrman, and Kristoufek, (2015) conducted the same kind of research; however, the context is slightly different. The database consists of 75 emerging-growth IPOs that went public between 2004 and 2010 in the U.S. The relationship is first studied on a basic level; firms in the sample are divided into three distinct groups based on their ASVI values before going public, namely high, medium, and low attention groups. The findings reveal clear differences between the high- and low-attention groups, with average first-day IPO returns of 22.85 percent and 12.23 percent, respectively. Subsequently, the regression analysis suggests that the effect of investor attention is highly significant and has a notable magnitude. A one-standard-deviation increase in ASVI leads to a 41.4 percent increase in the standard deviation of the first-day IPO return. However, according to the authors, this significant effect is only present for companies that go public during periods of positive market sentiment.

Another more recent study that examines the relationship between investor attention and initial IPO performance is done by Zhao, Xiong, & Shen (2018). As opposed to other papers that

study this relationship, the Baidu Index (the largest search engine in China) is utilised as a proxy for investor attention. The sample consists of the first 28 IPOs of China's Growth Enterprises Market, which has only been in existence since 2009. The results from the regression analysis show strong evidence of the existence of a relationship between abnormal investor attention and first-day IPO returns, on a one percent significance level. This is after controlling for the offering size of the IPO, which is also the sole control variable used in the model. The positive and significant results indicate that higher investor attention leads to greater initial IPO returns. Hence, I intent to examine whether this relationship remains valid in recent years, positing the following hypotheses:

H1: *There is a positive relationship between retail investor attention and IPO underpricing.*

2.4 The moderating role of firm type: Internet firms

Previous studies have shown that a minor group of IPOs are largely responsible for most of the money lost through underpricing, especially during the internet bubble period. This raises questions about the similarities between companies that leave such large sums on the table. Internet-based companies generate revenue through various sources, including online sales, financial transaction fees, paid advertising, cloud services, and a multitude of other business lines[3]. Likewise, Kauffman and Wang (2008) define internet firms as entities that primarily generate their revenues from the internet, with a cut-off point of 90 percent of the total revenues generated via the internet. The valuation of internet companies has posed significant challenges in the past and has thus become a highly debated topic among financial economists. Schwartz and Moon (2000) suggest that the valuation of an Internet stock can be considered reasonable if growth rates in revenues are substantial. Despite a real chance of potential bankruptcy, if the initial growth rates are sufficiently high and contain enough volatility over time, valuations can reach levels that might seem extraordinarily high compared to a "normal" company. From an intuitive perspective, one could posit that internet companies may have a relatively easier path to expanding into new markets due to the absence of physical resources. Nevertheless, Kotha, Rindova, and Rothaermel (2001) claim that internet firms are not that different from traditional firms by saying that internet firms rely as much on transferring competitive advantage from home markets to foreign markets.

The phenomenon of internet firms going public is not something new in the current economy; however, severe IPO underpricing remained present after the internet bubble busted due to the difficulty in valuation. Research has shown that there are noticeable differences in the valuations of internet and non-internet companies, particularly during the prospectus and final IPO stages (Bartov et al. 2002). In addition, there are substantial disparities between the valuations at the IPO stage and

[3] Retrieved at: https://www.investopedia.com/articles/personal-finance/030415/worlds-top-10-internet-companies.asp

their valuations as determined by the stock market at the conclusion of the first day of trading. For non-internet firms, this is mainly attributable to the relative size of their offerings. On the contrary, for internet firms, many other factors, such as positive cash flows, also play a major role in addition to the relative size of their offerings. Aggarwal et al. (2009) find that firms with more negative earnings show higher valuations compared to those with less negative earnings. According to the author, this suggests that negative earnings can serve as an indicator of growth opportunities for internet firms, and such growth prospects constitute a substantial component of the overall value of IPO firms. Possible explanations for these differences in valuation are given by DuCharme et al. (2001) who studied a sample of 342 internet IPOs. For instance, one of the explanations is that underpricing could potentially be a way of "sweetening the investors' taste" for future financing offers.

Moreover, in the article by DuCharme et al. (2001) evidence of a positive effect of media exposure seven days before the IPO date on underpricing among internet firms is provided. Hence, being an internet company would potentially enhance the relationship between investor attention and the underpricing of the company. Tsukioka et al. (2018) elaborate on this by suggesting that investors' excessive attention on internet stocks results in setting the offer price at the filing range's maximum point and increasing the initial trading price. However, it is observed that the trading price, pushed up by pre-IPO investor sentiment, eventually declines. During the internet bubble, retail investors demonstrated excessive bullishness toward the IPO market; however, non-retail investors did not show similar levels of overoptimistic behaviour during the same period (Chan 2014). Secondly, there is evidence indicating that investor demand plays a crucial role in driving the volatility of IPO returns on the first trading day during this period. In conclusion, I intend to test the following hypotheses in this paper:

H2: *Firm type will moderate the relationship between retail investor attention and IPO underpricing, such that this association will be stronger when the firm is internet-based and weaker when it is a non-internet firm.*

CHAPTER 3: Data

This paper focuses on 256 Initial Public Offerings of NYSE- and NASDAQ-listed companies between January 2019 and December 2021, obtained from the Audit Analytics IPO database. Of all these observations, 47 IPOs took place in 2019, 78 IPOs in 2020, and 131 IPOs in 2021. Only traditional IPOs are included in the sample, while spin-offs are excluded since the stock of the parent company is already publicly available for retail investors. The firms in the sample operate in a variety of sectors and are relatively large companies, with the average company having total assets of nearly $2 billion. The number of years the companies are officially operating up to the year of the IPO is very varied, ranging from one- to 170-year-old companies. After excluding all stocks with a final offering price below five dollars, the average offering price comes down to $20.79. The majority of the shares are listed on the NASDAQ, specifically 71 percent of the sample, compared to 29 percent listed on the NYSE. Public listings on over-the-counter (OTC) markets are not included.

The closing price on the day the corresponding IPO took place is obtained from CRSP, this is the price at which the last purchase of the stock took place before the market closes. Other price, accounting, and volume-related variables are obtained from Audit Analytics, CRSP, and SEC and are described in Table I. For instance, the IPO price represents the initial offering price at which public market participants can buy a share of the company for the first time. Linking the multiple databases is enabled by the variable ticker, which is a unique symbol that each security of a publicly traded company possesses. With these variables at our disposal, it is possible to calculate the underpricing of the IPO. It is also possible that overpricing may occur, which is why the more universal term first-day return was chosen. The first-day return variable is calculated as follows:

$$First - Day\ Return = \frac{Closing\ Price\ (\$)}{IPO\ Price\ (\$)} - 1 \quad (1)$$

Furthermore, the number of shares a private company initially offered during the IPO is stored in the IPO shares variable. This allows the offering size of the respective IPO to be determined in the following way:

$$Offering\ size = Log(IPO\ shares\ \times\ IPO\ price\ (\$)) \quad (2)$$

One of the variables of interest is the internet dummy variable taken from the IPO database of Jay R. Ritter's website[4]. This database stems from the article by Loughran and Ritter (2004). This variable takes the value one if a firm is “internet-based”, and zero otherwise. To identify IPOs that are related to the internet sector at the time of offering, Loughran and Ritter merge the internet classifications provided by Thomson Financial Securities Data, Dealogic, and IPOMonitor.com. By combining the information from these sources, they can accurately determine which IPOs are associated with the internet industry. It should be acknowledged that the classifications used to identify internet-related

[4] Retrieved Apr. 2023 at: https://site.warrington.ufl.edu/ritter/ipo-data/

IPOs may contain some arbitrariness leading to potential misclassification. Instances can arise where certain companies, such as Storage Area Network (SAN) companies and telecommunications companies, may be classified as internet stocks despite not fitting within the scope of this category. This highlights the subjective nature of classification and the possibility of overlap in identifying internet-related IPOs.

Another dummy variable obtained from this database is the VC variable, which takes a value of one if the firm is backed by venture capital prior to the IPO, in the samples does venture capital also include growth capital (which is a type of private equity investment). The variable dual is also a dummy variable with one for IPOs where different classes of shares are available at the offering. When a specific company can be considered a technology firm, which is based on the SIC code, a four-digit code that categorizes companies based on their main business activities, then the variable tech takes a value of one. The founding year of the company is also included in this database, this variable makes it possible to determine the age of the company by calculating the difference between the IPO date and the founding year.

Moreover, the Search Volume Index (SVI) is obtained from Google Trends to measure investor attention. Because there is no ticker of the security of the firm available prior to the IPO, and thus cannot be searched on Google, the SVI is taken from the SDC registered company name. The SVI represents a number that denotes the worldwide search interest relative to the utmost point displayed on the Google Trends chart. This chart consists of the 52 weeks preceding and the 52 weeks succeeding the week of the IPO of the firm. A magnitude of 100 signifies the peak of popularity, whereas a magnitude of 0 indicates an absence of data for the specified search term. For each company in the sample, there are 105 weekly SVI observations available. Using these indexes, it is possible to ascertain our variable of interest, namely the Abnormal Search Volume Index (ASVI) for each company. This is computed as the logarithm of SVI during week *t*, which corresponds to the week of the IPO, and subtracting the logarithm of the median SVI observed during the eight weeks preceding the IPO. The function for this calculation can be expressed as follows:

$$ASVI_t = \log(SVI_t) - \log\left[Median(SVI_{t-1}, \dots, SVI_{t-8})\right] \quad (3)$$

Lastly, the sentiment variable is obtained from Jeffrey Wurgler's investor sentiment database, available on his website. The monthly index of investor sentiment change is at one's disposal until June 2022 and is conducted according to the paper of Baker and Wurgler (2006). This index is based on the following five standardised sentiment proxies: value-weighted dividend premium, first-day IPO returns, IPO volume, closed-end fund discount, and equity share in new issues. In advance of determining the index, orthogonalization was first applied to each sentiment proxy in relation to a defined set of six macroeconomic indicators (industrial production index; nominal durables consumption; nominal nondurables consumption; nominal services consumption; NBER recession indicator; employment; Consumer Price Index). Table I provides a comprehensive enumeration of all relevant variables, accompanied by detailed definitions for each.

Table I Used Variables and Their Definition.

Variable	Definition
Variables obtained from Center for Research in Security Prices (CRSP)	
Closing Price	The closing price represents the last transaction price before the market closes for the day. In this study, the closing price reported by the Center for Research in Security Prices (CRSP) is the same date as the IPO date. N=256
Industry Return	Industry Return is the mean initial IPO return on the first trading day by industry. The industry is classified by the first two digits of the SIC code. The historic return is based on a sample consisting of 1862 US IPOs for 2000-2013. N=254
Variables obtained from Audit Analytics (WRDS)	
IPO date	The IPO date is the date on which the security becomes publicly purchasable for the first time.
IPO Shares	The quantity of shares initially issued during the IPO.
IPO Price	The initial price in dollars ($) at which a company's securities are offered to the public during an IPO, determining the valuation and starting point for secondary market trading.
Assets	The total asset size is the aggregate value in dollars ($) of all assets owned and controlled by the company. The value is determined near the IPO date.
IPO type	IPO type refers to the classification of an IPO based on the method of offering.
SIC Code	Standard Industrial Classification (SIC) are four-digit numerical codes that group companies into industry categories based on their business activities.
NYSE	NYSE is a dummy variable with 1 for firms traded on the New York Stock Exchange, 0 otherwise.
NASDAQ	NASDAQ is a dummy variable with 1 for firms traded on the NASDAQ, 0 otherwise.
Offering Size	Offering size is the quantity of IPO shares multiplied by the IPO prices in dollars ($).
First-day Return	First-Day Return is the initial IPO return on the first trading day, closing price divided by the IPO offering price, reduced by 1.
Variables obtained from U.S. Securities and Exchange Commission (SEC) EDGAR Database	
Lead Underwriter	The lead underwriter is the investment bank or other financial institution that is primarily responsible for organizing an IPO.

Variables obtained from Federal Reserve Economic data (FRED) database	
Interest	Contains the monthly U.S. interest rate percentage for every month in the sample. Defined as the 10-Year Treasury Constant Maturity minus the 2-Year Treasury Constant Maturity.
Variables obtained from Jay R. Ritter IPO database (https://site.warrington.ufl.edu/ritter/ipo-data/)	
VC	VC is a dummy variable with 1 for Venture Capital backed firms prior to the IPO (including growth capital), 0 otherwise
Internet	Internet is a dummy variable with 1 if is an internet-based company, 0 otherwise.
Dual Class	Dual Class is a dummy variable with 1 for firms which had multiple share class IPOs, 0 otherwise.
Tech	Tech is a dummy variable with 1 for companies which can be classified as technology stocks. Technology stocks are defined according to the following SIC codes described in the article by Loughran and Ritter (2004): 3571, 3572, 3575, 3577, 3578, 3661, 3663, 3669, 3671, 3672, 3674, 3675, 3677, 3678, 3679, 3812, 3823, 3825, 3826, 3827, 3829, 3841, 3845, 4812, 4813, 4899, 7371, 7372, 7373, 7374, 7375, 7378, 7379.
Founding Year	The founding year is the year the company is originally founded.
Age	The age of the company expressed in years calculated by the difference in the year the IPO took place and the Founding Year.
Underwriter	The Underwriter variable is a ranking on the scale 1-6, where 1 is the highest ranking possible. Jay Ritter's ranking is on the scale 0-9 (9 highest) and therefore have been adjusted. For these rankings, Jay Ritter starts with the Carter and Manaster (1990) and Carter et al. (1998) rankings and made several alterations. The remaining underwriter ranking was determined by Bruce Foerster of South Beach Capital. Last updated in 2022.
Variables obtained from Google Trends (https://trends.google.com/trends/)	
SVI	The Search Volume Index (SVI) is the weekly aggregate search frequency based on the name of the company, obtained from Google Trends. The number represents global search interest relative to the highest point on the chart, which consists of the 52 weeks prior- and the 52 weeks following the week of the IPO of the company. A value of 100 is the peak popularity and a value 0 refers to a lack of data for the search term.
ASVI	The Abnormal Search Volume Index (ASVI) is the logarithm of SVI week 0 (the week the IPO took place) reduced by the logarithm of the median SVI of the 8 weeks prior the IPO.

Variables obtained from Jeffrey Wurgler Investor sentiment data (https://pages.stern.nyu.edu/~jwurgler/)	
Sentiment	Sentiment is the monthly index of investor sentiment change from the article from Baker and Wurgler (2006). The sentiment index is based on five standardized sentiment proxies (value-weighted dividend premium, first-day IPO returns, IPO volume, Closed-end fund discount and equity share in new issues), where each of the proxies has first been orthogonalized with respect to a set of six macroeconomics indicators. The reported monthly change corresponds to the month the company went public.

Furthermore, in Table II, the descriptive statistics for the relevant variables are reported. The table indicates that the average first-day returns are positive, with a value of 0.237, thereby confirming the underpricing theory commonly associated with IPOs. The mean of the VC dummy reveals that a majority, specifically 59 percent, of the firms were backed by venture capital and/or growth capital prior to the IPO. Also, it is noteworthy that the sentiment variable, on average, exhibits a positive value. This suggests that, over the course of the observed period, retail investors generally maintained a positive attitude towards the market and were not hesitant to make investments. Moreover, there is a considerably large standard deviation and substantial variation between the minimum and maximum observations for the offering size. This indicates that IPOs occur at vastly different scales within the sample.

Besides, Table III in Appendix A presents the correlations among variables of interest and control variables. In general, the correlations between First-Day Return, ASVI, Internet, and the other mentioned variables are quite low. The table indicates for both ASVI and Internet a positive correlation between first-day return. The correlation between assets and offering, as well as the correlation between sentiment and interest are fairly high; however, their correlation with the variables of interest is low. The reason for these high correlations is that big enterprises, with high assets, issue more stocks and/or at a higher price. Secondly, generally speaking, investor sentiment is higher in periods of low interest rates. Finally, the correlation between tech and internet is remarkably low, which suggests that the firms classified as such have completely different lines of operation.

Table II Descriptive Statistics.

Comments: The table shows the descriptive statistics of all the variables of interest. The variables are defined in Table I. The sample period is from January 2019 to December 2021.

Variable	Mean	Std. Dev.	Min	Max
First-day Return	0.237	0.399	-1	2.011
ASVI	1.242	0.906	-0.357	4.143
Internet	0.129	0.336	0	1
VC	0.590	0.493	0	1
Dual	0.359	0.481	0	1
Tech	0.223	0.417	0	1
Sentiment	0.709	0.592	-0.107	2.083
Age (in years)	19.680	23.782	1	170
Offering (in million $)	504	1,040	6	11,900
Assets (in million $)	1,990	4,550	14.6	37,800
Interest Rate	0.822	0.548	0.05	1.47
Industry Return	0.218	0.046	0.075	0.251
Observations	256			

In addition, to further describe the data, some visual presentations are provided. To evaluate the actual increase in investor attention surrounding the IPO date, Figure I presents a time-series regression plot. In this plot, the mean, as well as the median, of the 256 IPOs in the sample are shown for each week, ranging from 8 weeks prior to 8 weeks following the IPO. For both metrics, a pronounced and strong increase is observed around the week of the IPO (week 0), with the median showing a slightly larger uptick. Furthermore, it is noteworthy that investor attention promptly reverts to the pre-IPO level after a few weeks. This verifies the statement of a significant jump in investor attention during the IPO week discussed in the study by Da et al. (2011).

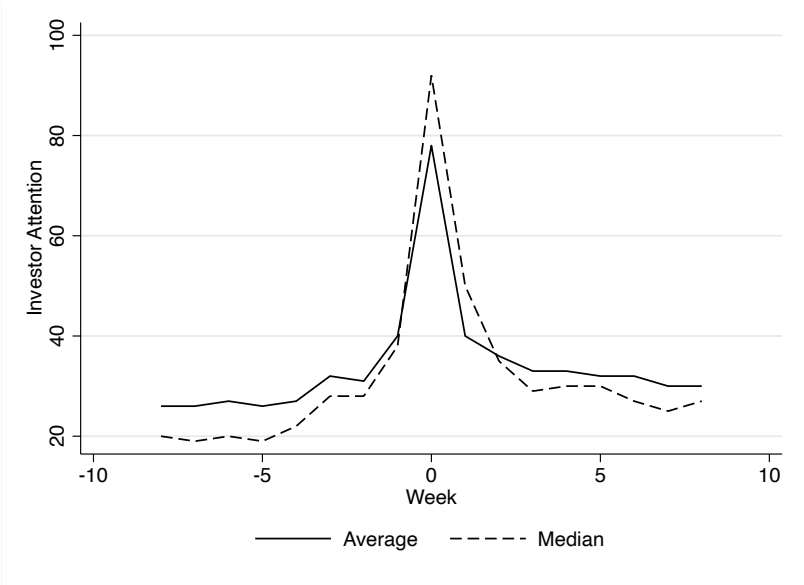

Figure I Mean and Median SVI around IPO for all firms.

Comments: The figure shows a time-series regression of the Google Search Volume Index (SVI) 8 weeks prior to the IPO and 8 weeks following the IPO. For each week, the mean and median SVI of all 256 firms in the sample are shown.

In Figures II and III, the same metrics are shown; however, the sample is divided into two subsamples. Namely, a subsample consisting of internet-based firms and non-internet-based firms. The figures illustrate the differences in the trajectory of the SVI during the weeks preceding and following the IPO for both groups and indicate negligible differences between the two subsamples for the mean as well as the median. It can be stated that both subsamples experience a similar increase around the IPO date.

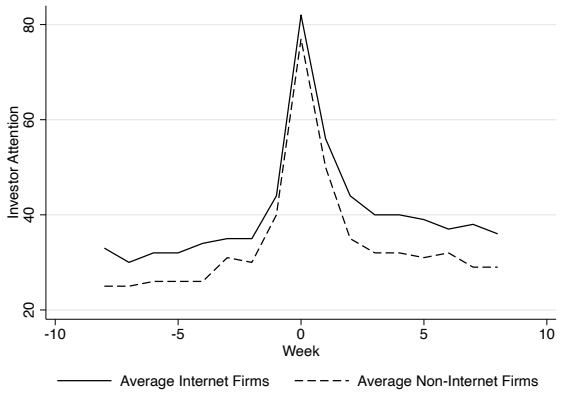

Figure II Mean SVI around IPO.

Comments: The figure shows a time-series regression of the Google Search Volume Index (SVI) 8 weeks prior to the IPO and 8 weeks following the IPO. The total sample is divided in two subsamples: Internet & Non-Internet Firms. The mean of both these subsamples is shown.

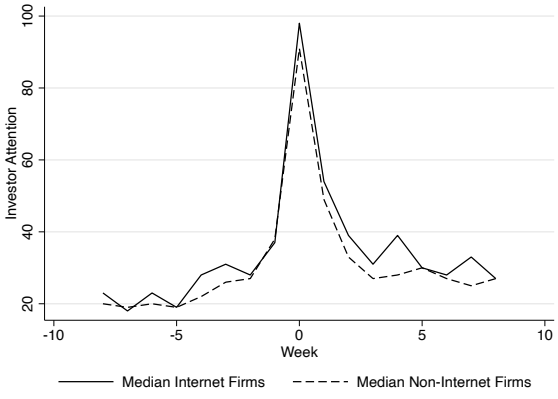

Figure III Median SVI around IPO.

Comments: The figure shows a time-series regression of the Google Search Volume Index (SVI) 8 weeks prior to the IPO and 8 weeks following the IPO. The total sample is divided in two subsamples: Internet & Non-Internet Firms. The Median of both these subsamples is shown.

Lastly, the mean IPO underpricing for internet and non-internet firms is displayed in Figure IV. It is evident that, on average, internet-based firms in the sample experience a higher level of underpricing, implying that these companies are leaving more money on the table.

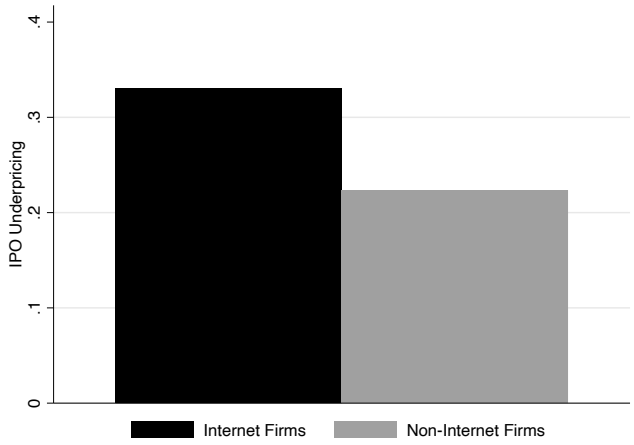

Figure IV Mean IPO Underpricing level.

Comments: The figure shows the mean IPO underpricing (First-Day Return, as described in Table 3.1) for 33 Internet-based firms in the sample in black. In grey, the mean of the 223 non-Internet-based firms is shown.

CHAPTER 4: Methodology

To analyse the collected data, I will use Ordinary Least Squares (OLS) regression analysis in combination with an interaction plot. OLS regression analysis is used to capture the effect of investor attention (independent variable) on IPO underpricing (dependent variable) within the same single period. Besides, this type of analysis is capable of modelling the moderation effect of internet firms on the relationship between investor attention and first-day return. The first step is to confirm the existence of the relationship between investor attention and IPO underpricing within our sample period (2019-2021). This will be accomplished through the following regression model:

$$(4) \qquad First - day\ Return_i = \beta_0 + \beta_1 ASVI_i + \sum_j \beta_j \boldsymbol{Control\ Variables_{j,i}} + \epsilon_i$$

After conducting the regression *(4)*, a subsequent regression will be performed to measure the effect of adding the moderator variable and assess whether it has an amplifying or attenuating effect. It is crucial to control for both firm/IPO-specific as well as market-specific factors. The firm/IPO-specific control variables to be included in the model are Age, Offering, Assets, VC, Dual, Underwriter, and Tech. The first three variables mentioned will be logarithmically transformed to reduce skewness due to their relatively large magnitudes. The market-specific variables to be added are Sentiment, Interest, and Industry Return. For a more comprehensive explanation of these variables, reference is made to Table I. Consequently, the final model can be expressed as follows:

$$(5) \qquad First - day\ Return_i = \beta_0 + \beta_1 ASVI_i + \beta_2 Internet_i + \beta_3 ASVI\#Internet_i + \sum_j \beta_j \boldsymbol{Control\ Variables_{j,i}} + \epsilon_i$$

Moreover, following the regression analysis, two different plots will be conducted to visualise the possible moderation (interaction) effect of being an internet firm. First, a fitted regression plot will be generated for the whole sample and for internet and non-internet firms separately. The magnitude of the effect of ASVI on first-day return should become evident in the subsamples. Subsequently, a margin plot is created, which allows for a graphical representation of how the slopes of for internet and non-internet are different from each other. This plot serves as a valuable complement to the findings obtained through the regression analysis. Conversely, it functions as a diagnostic tool. When the results do not align, it may signal a potential weakness in the regression analysis.

To check for the potential presence of heteroscedasticity in this model, a white test is conducted. However, the results of this test are highly insignificant, indicating the presence of equal variance, also known as homoscedasticity. Furthermore, a check for potential multicollinearity is performed using a variance inflation factor (VIF) test. The results of this test reveal no significant correlation between the independent and/or control variables in the model.

CHAPTER 5: Results

Ordinary Least Squares (OLS) regression analysis is used in the model to estimate the desired results. Due to the inclusion of various types of variables in the model, for instance, dummy and logarithmic variables, providing a clarification of the interpretation is necessary. Since most of the variables in the model are continuous variables, including the dependent variable First-Day IPO Returns, it will be discussed first. The coefficient (β) of continuous variables, can be interpreted as follows: when the independent variable increases by one, the dependent variable increases by the coefficient value of the corresponding variable, β. The interpretation of the dummy variables is comparable but slightly different. The coefficient of, for instance, Internet (β) represents the difference in the estimated First-Day IPO Returns between internet firms (Internet = 1) and non-internet Firms (Internet = 0), holding everything else constant. If the firm is Internet-based, then the dependent variable increases by β.

For the logarithmic transformed variables, the interpretation proceeds as follows: a one percent (%) change in the independent variable is associated with a change in the dependent variable of 0.01 times the coefficient (β). Lastly, the interaction effect of the continuous and the dummy variable can be interpreted in the following way: if the coefficient of the interaction term is positive it can be said that the effect of ASVI on First-Day Returns is stronger for firms that are internet-based. To further explain the interaction effect, the slopes of the dependent on the independent variables are shown with the moderator variable held constant at two values.

When not accounting for relevant control variables, the model yielded an R-squared of approximately 7.1%. This statistic can be considered 7.1% of the total variance of first-day return which is explained by the independent variables in the model. The R-squared of the total model, where First-Day Return is controlled for all firm-, IPO-, and macro-specific factors, yields an R-squared of about 15.8%. This implies that 15.8% of the variation in first-day return is explained by the explanatory variables. In total, this translates to an average R-squared of 9.79% across the model. The model argues that the vast majority of the variation in underpricing remains explained by factors other than the elements currently included.

In Table IV, the results of the model are shown. Firstly, column 1 in Table III shows that ASVI, on a stand-alone basis, can predict first-day return. A one-standard deviation increase in the ASVI of a firm on average leads to a 9.88% higher first-day return. This 9.88% increase is calculated by multiplying the coefficient of 0.109 with the standard deviation of ASVI, as stated in Table II. The corresponding p-value is beneath the 1% level of significance, expressing a significant effect. The presence of this effect shows that retail investor attention is a reliable predictor of IPO underpricing. Column 2 shows that the Internet dummy, in isolation, lacks predictive power, as the coefficient does not have a sufficient level of significance.

To capture the possible moderation effect, the interaction term is added in column 4; however, the coefficient is highly insignificant. This insignificance, in combination with the very

small magnitude, does not indicate the presence of an effect. For this reason, it cannot be stated that the coefficient is different from zero. Moreover, columns 5 through 10 in Table IV control for various characteristics. Hence, column 8 takes all firm-specific factors into account, column 9 all IPO-specific characteristics, and column 10 all market-wide factors. Overall, the predictive power of ASVI remains over all these regressions. The magnitude of the coefficient stays more or less the same and stays significant at the 1% level. Furthermore, it can be observed that the coefficients of the interaction term as well as the internet dummy remain insignificant. The coefficient of the interaction term demonstrates a remarkably low magnitude.

Finally, in column 14 all the relevant control variables affecting First-Day Return are included. It can be noticed that the coefficient of ASVI is still significant, with a corresponding p-value smaller than 5%. However, the magnitude of the coefficient has declined to 0.071, which indicates that a one-standard-deviation increase in ASVI leads on average to 6.43% (=0.071 × 0.906) higher First-Day Return. This 6.43% increase shows that retail investor attention indeed leads to a higher level of underpricing. Nevertheless, the p-value of the interaction term is way above 10%, indicating an insignificant effect, and therefore cannot be interpreted. In conclusion, I do not reject my Hypotheses 1 which claimed that there exists a positive relationship between investor attention and IPO underpricing. On the contrary, Hypotheses 2 which stated that firm type, internet-based or not, will moderate the relationship between retail investor attention and IPO Underpricing, is rejected based on these results.

Most of the control variables show the expected direction and magnitude, with the exception of sentiment. Sentiment has a negative sign, which contrasts with previous studies that usually report a positive effect on investor sentiment. Generally, IPO underpricing is more pronounced in periods of high investor sentiment. However, in this study, it is plausible that the inclusion of the ASVI variable, which shows a positive effect, may absorb a portion of the effect of sentiment. There exists a likelihood that there is a positive association between ASVI and sentiment. Particularly, to develop investor sentiment, it is necessary to first allocate one's attention to the stock, often achieved by looking up the stock.

Moreover, in order to further support the finding that internet firms do not have a moderating effect, visual presentations can be observed in Figures V and VI. In Figure V, the fitted values of the regression are plotted for the sample; additionally, two subsamples (internet and non-internet) are created and added to the plot. It can be observed that the slopes of the subsamples are almost identical, which indicates minimal differences between the subsamples. Furthermore, Figure VI shows an interaction/margins plot, which shows the predicted outcome. It is evident that both slopes are nearly identical. In the presence of a moderation effect, the solid line should show a considerably steeper slope, which is clearly not the case in Figure VI. These results provide additional confidence to reject Hypotheses 2.

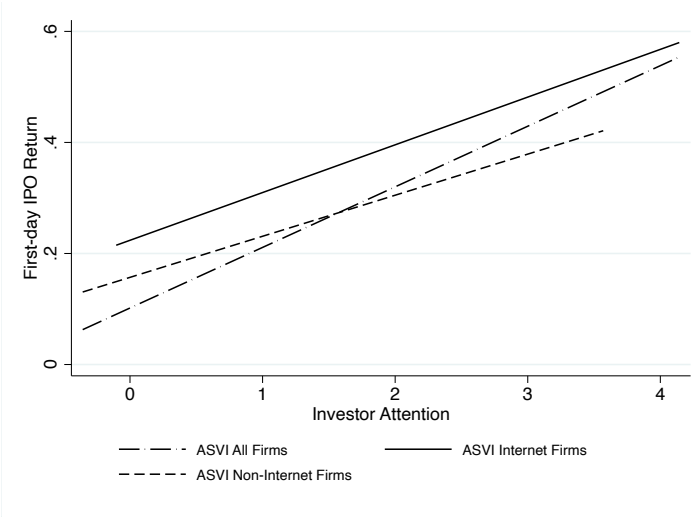

Figure V Fitted values subsamples.

Comments: The figure shows the fitted OLS values for the whole sample and two subsamples: Internet firms and non-Internet firms. The plotted lines illustrate the effect of ASVI on first-day return.

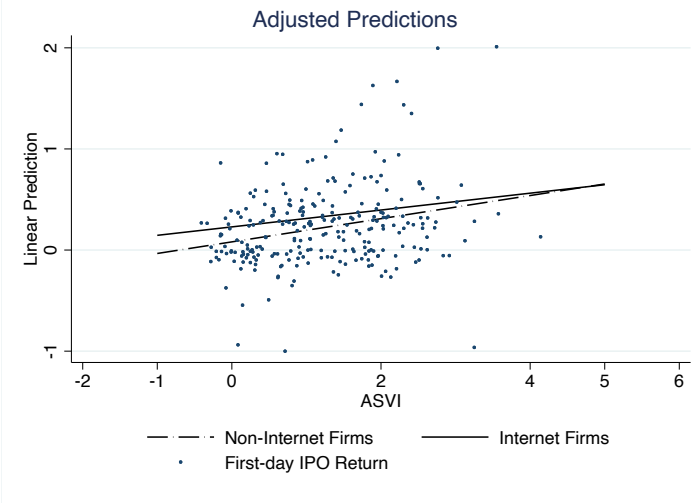

Figure VI Interaction plot.

Comments: The figure shows the interaction of ASVI and the Internet dummy in predicting the first-day return. The plotted lines illustrate the effect of ASVI on First-Day Return for the firms that are Internet-based (Internet =1) and for firms that are non-Internet-based (Internet = 0).

Finally, additional robustness checks are presented in Table V in Appendix A. The same total model was estimated using a different sample and using an alternative measure of the dependent variable. In column 1 is First-Day Return calculated in the following way: $\log\left(1 + \frac{\text{Closing Price}}{\text{IPO Price}}\right)$, instead of the calculation stated in Chapter 3. In Column 2, the sample is restricted exclusively to the year 2020. Furthermore, in column 3, the sample merely consist of firms who are venture capital backed. The reported results remained consistent and unaffected when tested under alternative specifications.

Table IV Abnormal Search Volume, Internet firms & First-Day IPO Return

*Comments: This table showcases the regression of First-Day Return on Abnormal Search Volume Index (ASVI), Internet, and IPO-, firm- and market characteristics. First-day return of the individual firm is the dependent variable. ASVI and Internet are the variables of interest together with the interaction term between those two, which measures the moderation effect. The other relevant controls are defined in Table I. The sample period ranges from 1 January 2019 until 31 December 2021. Only stocks with a minimum price exceeding 5 dollars that are traded on the NYSE and NASDAQ are included. Furthermore, only traditional IPOs and tickers with a valid SVI are included. Under the estimated coefficients, the standard errors are indicated by parentheses. *, **, *** represent significance at a 10%, 5%, and 1% level respectively.*

	Dependent variable: First-Day Return										
Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**
ASVI	0.109***		0.110***	0.115***	0.105***	0.097**	0.115***	0.093***	0.113***	0.104***	0.071**
	(0.027)		(0.027)	(0.029)	(0.029)	(0.030)	(0.029)	(0.031)	(0.029)	(0.029)	(0.031)
Internet		0.107	0.110	0.148	0.125	0.102	0.156	0.098	0.153	0.128	0.080
		(0.074)	(0.072)	(0.114)	(0.114)	(0.115)	(0.114)	(0.117)	(0.115)	(0.114)	(0.115)
ASVI#Internet				-0.031	-0.030	-0.009	-0.046	-0.004	-0.039	-0.032	0.008
				(0.073)	(0.072)	(0.073)	(0.073)	(0.074)	(0.073)	(0.072)	(0.074)
Sentiment					-0.093**					-0.160**	-0.165**
					(0.041)					(0.076)	(0.078)
VC						0.124**		0.136**			0.095
						(0.050)		(0.060)			(0.061)
Tech								0.093			0.086
								(0.062)			(0.061)
Underwriter							-0.057***		-0.054*		-0.053*
							(0.026)		(0.029)		(0.030)
Dual Class									-0.048		-0.044
									(0.054)		(0.054)
Interest										0.177	0.172
										(0.168)	(0.169)
Industry Return								-0.147			-0.697
								(0.595)			(0.614)
Log(Assets)								-0.005			-0.077**
								(0.019)			(0.036)
Log(Offering)									0.011		0.095**
									(0.025)		(0.045)
Log(Age)								0.009			0.015
								(0.038)			(0.037)
Constant	0.102**	0.223***	0.087**	0.081*	0.161***	0.032	0.159***	0.116	-0.034	0.110	0.006
	(0.041)	(0.027)	(0.042)	(0.045)	(0.057)	(0.048)	(0.057)	(0.400)	(0.499)	(0.075)	(0.524)
Observations	256	256	256	256	256	256	256	254	256	256	254
R^2	0.061	0.008	0.070	0.071	0.089	0.093	0.088	0.099	0.092	0.093	0.158

CHAPTER 6: Discussion

According to Da et al. (2011), the Google Search Volume Index plays an important role in explaining the large initial IPO return for a sample of IPO stocks. In this study, I test whether this relationship is strengthened across diverse types of firms, namely internet-based firms. My results showed that there is no amplifying effect of being an internet-based firm on the relationship between retail investor attention and initial IPO return over recent years (i.e., 2019-2021), due to the insignificant effect of the moderation term. Although no previous identical research is available on the same moderation effect, my findings differ from similar research in this area. For instance, Bartov et al. (2002) report that there are apparent variations in the valuations of internet and non-internet firms, particularly evident during the IPO stage. Big differences exist between the value determined at the IPO and the value of the stock as determined by the market. In my sample, there are no indications that these major differences exist between the two types of businesses. It is therefore feasible that the efficiency of valuing internet stocks, when compared to "normal" stocks, has improved for both underwriters and market participants over the period between this study and the studies discussed in Chapter 2.4. The retail investor may have become more aware of the true value associated with an internet stock. This is evident in the sample because the effect of ASVI on first-day return does not differ between the two types of firms. This suggests that there is little to no overreaction by retail investors to internet stocks anymore.

Furthermore, Schwartz and Moon (2000) mention that the high price paid for internet stocks can be considered rational, given that the future growth rates are sufficiently high. During the period of this study, internet stocks were relatively newcomers to the IPO market, and the potential of these stocks was substantial yet uncertain. However, in the sample period of my study, it is very likely that an increased level of expertise in valuing internet-based stocks was present, allowing future growth rates to be estimated more accurately. This is also the case in the more recent research of Tsukioka et al. (2018), who suggests that excessive investor attention on internet stocks results in underwriters setting the IPO price at the upper limit of the filing range, while at the same time, the price at the end of the first trading day also increases. My results show that excessive investor attention does indeed lead to higher first-day returns, however, this phenomenon applies not exclusively to internet IPOs, but to all IPOs included in the sample.

On the contrary, my results on the relationship between investor attention and IPO underpricing are in line with previous research. Besides, according to the results, it can be explained that retail investors are purchasers of "attention-grabbing" stocks, aligning with the findings of Barber and Odean (2008). In each regression within the model, the ASVI variable shows a statistically significant positive effect on initial IPO return. Given this finding, it can be said that the measurement discussed by Da et al. (2011) possesses predictive power in the contemporary context. Nonetheless,

the R^2 of 15.8% indicates that there exist additional factors that have a substantial influence on first-day IPO returns. For instance, it is plausible that information asymmetry has a significant influence on initial IPO returns. This information asymmetry results in retail investors lacking complete information about the firm going public on the market, thus causing a disparity between the IPO valuation and that of retail investors.

Undoubtedly, the possibility exists that internet-based firms may have had an amplifying effect in a "hot issue" market for internet IPOs, such as the dot-com bubble. However, it is reasonable that the hot issue market for internet stocks has been surpassed within my sample. This hot issue market may potentially exist in the current period for a different type of firm. For example, in the robustness checks in Table V the tech dummy shows a significant effect on First-Day returns in the year 2020. Despite the fact that this thesis suggests that the relationship is robust across different firm types, highlighting the importance of other factors such as investor sentiment, it encourages other researchers to explore alternative firm types that might influence IPO underpricing.

CHAPTER 7: Limitations

While this study provides valuable insights into the dynamics of first-day IPO returns in relation to retail investor attention and internet firms, it carries certain limitations that should be considered in future research. First, perhaps the generalizability of my findings can be constrained by the specific dataset used in this study, limited to only IPOs listed on the NYSE and NASDAQ from 2019 to 2021. Expanding the scope to include a broader range of exchanges and a longer timeframe could yield a more complete understanding of these relationships. Additionally, the classification of firms into internet and non-internet categories possibly overlooks the diversity within each of the two categories. Future research may benefit from applying more detailed classifications to better understand how different internet-based firms respond to investor attention. For instance, delving into industry-specific characteristics within internet firms could offer deeper insights.

Moreover, while the use of Google search data as a proxy for retail investor attention is an effective approach, it may have its limitations. In future research, there is an opportunity to improve the depth of the analysis by including various sources of data for investor attention. For example, it would be interesting to see whether investor sentiment on social media, as a proxy for investor attention, will yield comparable results as found in this study. Such an approach would likely provide other perspectives on how retail investors interact with and respond to IPOs. Finally, in this study, I have focused only on internet firms as a moderator factor; however, alternative moderating factors could also have a noticeable effect.

CHAPTER 8: Conclusion

In this thesis, I have looked at the influence of being an internet-based firm on the relationship between retail investor attention and IPO underpricing. Previous research has shown that Google search is a reliable predictor for initial IPO returns; nevertheless, it remains unclear whether this effect is different for certain types of firms. In particular, prior to this study, no research had been conducted regarding the moderation effect of internet firms. Although previous studies show that the valuation of internet stocks at the IPO stage often differs from the valuation of "normal" stocks, due to the fact that other factors, such as future cash flows, are more crucial. In the aftermath of the digital age, with the evolving dynamics of financial markets, investor attention in the IPO context has become increasingly important. As more internet and technology firms seek to go public, a better understanding of this relationship will address the gap in existing literature. For this reason, the central question examined in this dissertation was: *"How does firm type, internet or non-internet firm, affect the relationship between investor attention and initial public offering (IPO) underpricing?"*.

In order to provide an answer to this research question, the first-day IPO returns of 256 stocks listed on the NYSE and NASDAQ between 2019 and 2021 are studied. In addition to this, the Google Search Volume Index was obtained for each stock in the sample up to 8 weeks before the IPO. Moreover, the final model adds important IPO-, firm-, and market-specific characteristics as controls. Both the results of the OLS regression analysis and the interaction plot showed that there was no evidence of an enhancing effect of internet firms on the relationship between the abnormal SVI and first-day return.

Hence, this study concludes that even though the existing body of literature shows that differences exist between internet and non-internet firms at the IPO stage, internet firms do not have a higher chance of experiencing higher IPO underpricing compared to non-internet firms, which have similar levels of retail investor attention. The findings from this thesis, in combination with previous research, suggest that higher levels of investor attention are associated with larger IPO underpricing. However, since the hypothesis related to being an internet firm as a moderator was rejected, this effect is unlikely to be related to the firm type of the stock issued. Furthermore, the findings confirm the significance of investor sentiment on asset pricing, as acknowledged in prior research. In conclusion, this thesis advances our understanding of IPO underpricing, opening the door for further research into the changing dynamics of financial markets.

Finally, the findings of this thesis carry practical implications for some key groups, for instance, individual investors and financial professionals. For both novice and seasoned investors considering investments in IPO stocks, this study underlines the importance of monitoring market attention as well as sentiment. Paying attention to Google search trends when assessing investment opportunities appears to be useful. Higher ASVI values for a particular stock could potentially lead to greater demand for IPO shares, which boosts the first-day IPO return. However, it is crucial for retail

investors to understand that this relationship remains consistent for both internet and non-internet firms. Therefore, it is necessary for investors not to overreact to these types of stocks.

On the other hand, financial professionals, such as portfolio managers, underwriters, and investment analysts, can benefit from these findings by integrating a more nuanced understanding of IPO underpricing into their decision-making. The study has shown that the classification of internet firms is not one of the primary drivers of IPO underpricing. Consequently, financial professionals should consider focusing on other factors when estimating the potential performance of IPOs. Examples of other factors include underwriter ranking, investor sentiment, and firm size, which could lead to a more informed investment decision and/or strategy.

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APPENDIX A

Table III Correlations.

Comments: The table shows the correlations among First-Day Return, ASVI, Internet, and other control variables. All the variables mentioned in the table are defined in Table I. The sample period is from 1 January 2019 to 31 December 2021.

	First-Day Return	ASVI	Internet	Sentiment	VC	Interest	Tech	Underwriter	Dual Class	Log (Assets)	Log (Offering)	Log (Age)	Industry Return
First-Day Return	1.000												
ASVI	0.248	1.000											
Internet	0.090	-0.011	1.000										
Sentiment	-0.182	-0.153	-0.127	1.000									
VC	0.207	0.204	0.107	-0.092	1.000								
Interest	-0.114	-0.102	-0.105	0.842	-0.138	1.000							
Tech	0.099	0.078	-0.038	0.122	-0.050	0.125	1.000						
Underwriter	-0.142	-0.025	-0.062	-0.123	-0.160	-0.079	-0.118	1.000					
Dual Class	-0.017	-0.006	0.198	0.155	-0.037	0.113	0.088	-0.152	1.000				
Log (Assets)	-0.024	-0.042	0.260	0.090	-0.163	0.051	0.003	-0.367	0.224	1.000			
Log (Offering)	0.116	0.101	0.251	0.074	0.026	0.072	0.117	-0.466	0.316	0.836	1.000		
Log(age)	-0.116	-0.215	0.017	0.050	-0.518	0.054	0.075	-0.015	0.081	0.403	0.240	1.000	
Industry Return	0.045	0.061	-0.172	0.054	0.180	0.058	0.298	-0.143	-0.058	-0.259	-0.042	-0.050	1.000

Table V Robustness Checks.

Comments: This table showcases the regression of First-Day Return on Abnormal Search Volume Index (ASVI), Internet, and IPO-, firm- and market characteristics. First-day return of the individual firm is the dependent variable. ASVI and Internet are the variables of interest together with the interaction term between those two, which measures the moderation effect. The other relevant controls are defined in Table I. The sample period ranges from 1 January 2019 until 31 December 2021. Only stocks with a minimum price exceeding 5 dollars traded on the NYSE and NASDAQ are included. Furthermore, only traditional IPOs and tickers with a valid SVI are included. In column 1, the dependent variable First-Day Return is measured as follows: : $log\ (1 + \frac{Closing\ Price}{IPO\ Price})$*. In column 2, the sample consists of stocks that went public in the year 2020. In column 3, the sample consists of stocks that are Venture Capital backed before the IPO. Under the estimated coefficients, the standard errors are indicated by parentheses. *, **, *** represent significance at a 10%, 5%, and 1% level respectively.*

	Dependent variable: First-Day Return		
Model	**(1)**	**(2)**	**(3)**
ASVI	0.026*	0.039*	0.032*
	(0.014)	(0.022)	(0.019)
Internet	0.035	-0.003	0.047
	(0.051)	(0.094)	(0.069)
ASVI#Internet	0.001	-0.010	-0.009
	(0.033)	(0.051)	(0.044)
Sentiment	-0.073**	0.131	-0.117**
	(0.034)	(0.244)	(0.046)
VC	0.035	0.143**	
	(0.027)	(0.059)	
Tech	0.029	0.114**	0.072*
	(0.027)	(0.056)	(0.040)
Underwriter	-0.023*	-0.022	-0.049*
	(0.013)	(0.023)	(0.026)
Dual Class	-0.018	-0.025	0.009
	(0.024)	(0.051)	(0.037)
Interest	0.068	-0.022	0.108
	(0.075)	(0.216)	(0.100)
Industry Return	-0.190	-1.195**	0.142
	(0.272)	(0.494)	(0.484)
Log(Assets)	-0.036**	-0.047	-0.017
	(0.016)	(0.033)	(0.028)
Log(Offering)	0.049**	0.055	0.020
	(0.020)	(0.048)	(0.031)
Log(Age)	0.005	0.038	0.001
	(0.016)	(0.033)	(0.027)
Constant	0.602**	0.743	0.738**
	(0.232)	(0.573)	(0.369)
Observations	254	77	151
R^2	0.152	0.316	0.148