MASTER THESIS BA

IPO UNDERPRICING: THE ROLE OF MEDIA COVERAGE DURING THE COVID-19 ERA

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Abstract

The short-term IPO underpricing anomaly has been under investigation for many decades. Research on the short-term IPO underpricing anomaly has led to the identification of a multitude of explanations for the existence of the IPO underpricing anomaly. These explanations are typically found at the firm level. Antecedents outside of the firm, like media coverage, have gained less scholarly attention. The COVID-19 pandemic has influenced news reporting and IPO underpricing during the period. This study delves into the effect of ex-ante media coverage on IPO underpricing during the COVID-19 period which has as of yet received, to the authors best knowledge, no previous academic attention. The study employs textual analysis in the form of a bag of words approach to determine the sentiment of media articles one week prior to the IPO. Based on a sample of 155 IPOs from 2019 and 2020 on the American market and over 1,800 news articles, I show that (a) positive sentiment displayed in media coverage is positively associated with first-day IPO underpricing; (b) this effect is more pronounced during the COVID-19 period; (c) this effect is stronger when the media coverage is close to the IPO date; (d) the number of news articles and negative sentiment have no association with first-day IPO underpricing. The findings emphasize the influence ex-ante media can exert on short-term IPO underpricing during a global crisis like the COVID-19 pandemic.

Keywords: Initial public offering, underpricing, media coverage, textual analysis, COVID-19.

Table of contents

1. Introduction 1

1.1 Background of IPO underpricing 1

1.2 Contributions and research question 3

1.3 Outline 4

2. Literature review 5

2.1 The IPO underpricing anomaly 5

2.2 Information asymmetry 7

2.2.1 Baron's model of the incentive problem 7

2.2.2 Winners curse theory 8

2.2.3 Signalling theory 10

2.3 Marketing considerations 11

2.3.1 Information cascade effect 11

2.3.2 Promotional trade-off 12

2.3.3 Product marketing 13

2.3.4 After-market trading and flipping 13

2.4 Investor sentiment 14

2.4.1 Exuberant investors 14

2.4.2 Sentiment and regulations 15

2.5 Other theories influencing IPO underpricing 16

2.5.1 Differences across countries 16

2.5.2 Broad ownership purposes 16

2.5.3 Protection against litigation 17

2.5.4 Prospect theory 17

2.6 The COVID-19 impact 18

2.6.1 Impact on the American market 18

2.6.2 Impact on IPOs 18

2.6.3 Impact on media coverage 19

2.7 Hypothesis development 20

2.7.1 Media coverage volume 20

2.7.2 Media coverage sentiment 24

3. Methodology 28
3.1 Variables and measurement 28
3.1.1 Dependent variable 28
3.1.2 Independent variables 28
3.1.3 Control variables 30
3.2 Sample and data 32
3.2.1 Sample 32
3.2.2 Data 33
3.3 Research method 34
3.4 Empirical models & robustness 35
3.4.1 Empirical models 35
3.4.2 Robustness 36
4. Results 37
4.1 Descriptive statistics 37
4.2 Assumptions 44
4.3 Multivariate results 46
4.4 Robustness checks 53
5. Discussion 57
5.1 Media coverage and IPO underpricing 57
5.2 Media coverage and IPO underpricing during the COVID-19 period 60
5.3 Investor attention, timing of media coverage, and overall sentiment 61
5.4 Implications 62
5.5 Limitations 63
5.6 Future research 64
6. Conclusion 65
Appendix A - Examples of sentiment analyses 66
Appendix B - IPO firms sample 68
Appendix C - Assumption testing 70
Appendix D - Additional robustness tests 73
References 75

1. Introduction

1.1 Background of IPO underpricing

Initial Public Offering (IPO) pricing has been a phenomenon under investigation since Ibbotson (1975) (Bajo & Raimondo, 2017). Research into IPO shares pricing has led to the identification of three distinct anomalies: IPO short-term underpricing by Ibbotson (1975), hot issue periods by Ritter (1984) and long-term underperformance by Ritter (1991) (Leleux & Muzyka, 1997). These three anomalies have been subject to much academic debate and no one theory exists to fully explain these anomalies. Since the 2000s, due to the internet bubble and the dramatic fall of IPO prices afterwards, there has been a renewed interest of scholars in the process and performance of IPOs (Lowry et al., 2017; Ritter, 2003). This interest is likely further fuelled by the massive IPOs since the start of the 2010s of mainly already well-established tech companies such as Facebook (Meta), Alibaba, Spotify, Uber Technologies, and AT&T.

Firms require capital to make investments to further grow the company which is generally regarded as the primary reason for going public. Apart from obtaining capital, other reasons to make the transition from a private to public company are widespread, and some of these reasons were identified by Brau & Fawcett (2006). The most important motivation for going public is to have public shares available for the future acquisition of the company and to establish a market value and reputation for the company (Brau & Fawcett, 2006). Other reasons relate to capital structure concerns in the form of debt becoming too expensive, allowing insiders to cash out, and minimize the cost of capital (Brau & Fawcett, 2006). During, and primarily after the IPO, the company has to give up a lot of its previously private information in the form of legally required financial documentation (Brau & Fawcett, 2006). An important first step in the IPO process is choosing an investment bank to fulfil the role of underwriter. The issuer, by paying a fee to the underwriter, will transfer the financial risk to the underwriter. The underwriter plays a pivotal role in the pricing of the shares offered (Lowry & Schwert, 2004). The role of the underwriter features prominently in theories attempting to explain IPO underpricing.

This paper will focus on the IPO short-term underpricing anomaly, which has been under investigation since the publication of Ibbotson's paper in 1975. Many theories have emerged over the years since the paper of Ibbotson (1975) was published, in an attempt to explain this anomaly. From the onset, scholars identified information asymmetry between several involved parties of the IPO as the primary reason for the existence of the IPO underpricing anomaly (Brau & Fawcett, 2006). In short, these theories all suggest, that certain parties hold superior information over other involved parties which influences the pricing of the IPO (Brau & Fawcett, 2006). Other researchers attempted to explain the IPO underpricing anomaly by looking at marketing factors and behavioural theories, such as the prospect theory (Brau & Fawcett, 2006). These theories state that deliberate, or willingness, to underprice for marketing benefits or perceived value, serves as an explanation for the IPO underpricing anomaly

(Loughran & Ritter, 2002). More recently, the sentiment[1] of investors is perceived as the dominant explanation for short-term IPO underpricing (Baker & Wurgler, 2007). The sentiment that an investor holds towards a certain firm or industry, e.g., positive or negative, influences the pricing of the IPO (Baker & Wurgler, 2007). Investor sentiment theories are in contradiction to the belief of the existence of rational investors. These investors are driven by sentiment rather than known facts about the company and might even disregard facts in favour of feelings toward a company (Baker & Wurgler, 2007). Empirical results both support and oppose the theories that have evolved over the years causing increasing academic debate about the reliability and validity of many of these theories.

Many studies regarding stock performance and IPO underpricing typically investigate antecedents that are at the firm level, with few studies investigating antecedents outside of the firm (Guldiken et al., 2017). Surprisingly, in spite of the development of theories in the realm of information asymmetry, marketing considerations and investor sentiment, an antecedent like media coverage, closely linked to information asymmetry, marketing considerations and investor sentiment, has received little attention in past research (Bajo & Raimondo, 2017). The media does not only serve to bridge the gap of information between parties but can also draw the attention of investors, regardless of the information displayed (Liu et al., 2014a). The sentiment of this media coverage is especially important. Whether the article displays a positive or negative story about the company and its upcoming IPO can greatly influence the interest of investors in the company and the subsequent IPO (Liu et al., 2014a).

Research into the effects of ex-ante media coverage on IPO underpricing have yielded contradicting empirical results. Pollock & Rindova (2003); Fang & Peress (2009); Zou et al. (2020) found negative relationships between the volume of media coverage and IPO underpricing. Zou et al. (2020) specifically indicates that the sentiment of the media plays no role, arguing that no matter what sentiment is displayed, it always lowers the information asymmetry that exists between investors and the IPO firm, subsequently lowering the amount of underpricing. Other empirical studies found positive relationships between media coverage volume and IPO underpricing (DuCharme et al., 2001; Liu et al., 2007; Liu et al., 2008; Liu et al., 2014b; Guldiken et al., 2017; Bajo & Raimondo, 2017). Support was also found for the role of sentiment displayed in media coverage. Bajo & Raimondo (2017) found that positive sentiment displayed in media coverage, positively affects first-day IPO underpricing, while in the same year, Guldiken et al. (2017) found that uncertain tones in the media show a negative relationship with the short-term share prices of IPOs.

Not only has the effect of media coverage on IPO underpricing received little attention in prior academic research, but the effect is still largely unexplored during extraordinary periods. Loughran & Ritter (2004) found several extraordinary periods in which IPO underpricing behaved differently, namely: the dotcom bubble of 1999-2000 and the financial crisis of 2008. The recent COVID-19 pandemic is another potential extraordinary period in which IPO underpricing behaves differently from

[1] Sentiment and tone are used interchangeably throughout the paper.

most other time periods. To the best of the author' knowledge, the effect of media coverage on IPO underpricing during the COVID-19 crisis has as of yet received little to no academic attention. This paper aims to bridge this gap.

1.2 Contributions and research question

This research aims to make further contributions to the body of short-term IPO performance literature. Studies on media coverage and IPO underpricing have as of yet paid little to no attention to the worldwide disruptive event of COVID-19. Mazumder & Saha (2021) discovered the existence of a distinct fear factor during the pandemic, which had a negative effect on IPO underpricing and notes that media coverage during this period was exceptional due to the almost daily count of COVID-19 victims in mainstream media channels, fuelling fear and altering sentiment among investors. Da et al. (2015) found that fear is negatively associated with stock returns and Salisu & Akanni (2020) constructed a COVID-19 fear factor and state that it is associated with stock declines. Similarly, Haroon & Rizvi (2020) found that uncertainty derived from media coverage about COVID-19, is associated with more volatility on financial markets. The effect of media coverage on short-term IPO underpricing during the COVID-19 period, could display a differing effect from other periods. This could be another interesting period for IPO underpricing in which the anomaly displays wildly differing results, similar to the periods found by Loughran & Ritter (2004). Especially the positive and negative media sentiments, while covered by Bajo & Raimondo (2017), is interesting to touch upon again in a period of much uncertainty and fear among investors fuelled by media coverage, in which negative coverage about the IPO firm could exacerbate this fear and uncertainty, while positive coverage about the IPO firm could possibly alleviate some of the fear among investors during this period.

This study contributes in the following way. First the study contributes to the body of literature on IPO underpricing and media coverage by considering both the volume and the tone of media coverage which has as of yet generated conflicting empirical results and can offer support for the role of media as an information provider or as an attractor of attention for investors. Second the study considers both the negative and positive sentiment of media coverage with the former receiving little attention in the IPO underpricing literature which could shed further light on the role of media in regard to IPO underpricing. Third the research considers the effect of media coverage volume and sentiment on IPO underpricing during the COVID-19 pandemic which has as of yet, to the best of the author' knowledge, received little to no previous academic attention and could offer new insights in the role of media during inherently uncertain times and its effect on IPO underpricing.

In terms of practical contributions the research could shed light on whether private firms that plan on going public, should invest resources into an attempt to manage their media coverage shortly before the planned IPO to adequately adjust the demand for the shares. Not only the amount of media coverage but also the sentiment of it could be indicators of investors' interest in the shares. Furthermore, the

research could indicate the importance for companies of setting up a department that manages public relations. Lastly, it could help companies to decide on their media presence during a period of uncertainty and fear among investors and whether this can be alleviated through the management of media coverage shortly before the planned IPO.

The objective of this research is to bridge the gap in existing literature by studying how the independent variables of media coverage volume, and sentiment of this coverage, affect the dependent variable of IPO underpricing during a worldwide disruptive event: COVID-19. To this purpose the following research question has been formulated:

"What is the effect of ex-ante media coverage on short-term underpricing when a company issues an IPO during the COVID-19 pandemic?"

1.3 Outline

The remainder of this paper is structured as followed. In chapter 2, relevant literature and theories regarding media coverage and IPO underpricing are discussed. At the end of this review, remaining theories that have no direct relevance to the effect of media coverage on IPO underpricing are briefly touched upon. At the end of the chapter, hypotheses are developed based on the literature review and empirical evidence. Chapter 3 delves into the methodology of the research. Methods of previous research are examined, and an appropriate research design is chosen for the purposes of this research. This is followed by an operationalization of the variables and a discussion of the data used for the construction of these variables. Finally, the empirical models are presented. In chapter 4 the results of the research are given. Starting with the descriptive statistics of the sample followed by regression tests and robustness checks in which the results are compared to previous studies and briefly explained. In chapter 5 follows a discussion of the results in which the results are explained in more detail. The chapter also discusses the implications of the results, the limitations of the research and avenues for future research. Finally, chapter 6 will follow up with a brief summary in the form of a conclusion. Additional materials that can aid in getting a better understanding of the methods used and interpretation of the results are presented in the appendices. All source material used throughout the research is referenced at the end of the paper, in alphabetic order.

2. Literature review

This chapter will enquire into relevant literature about IPO underpricing and media coverage. It will start with a discussion of the IPO underpricing anomaly in section 2.1 and will subsequently delve into theories that attempt to explain the IPO underpricing anomaly. In section 2.2 the theories within the sphere of information asymmetry are discussed. Section 2.3 considers and discusses the theories related to the marketing considerations of IPO underpricing. Section 2.4 discusses the relevant literature on investor sentiment and IPO underpricing. In section 2.5 brief attention is given to other theories that have contributed to the explanation of the IPO underpricing anomaly. Section 2.6 analyses the effect of the COVID-19 pandemic on the financial markets, IPO underpricing and media coverage. Finally, section 2.7 displays the development of the hypotheses based on the discussed theories and additional (recent) empirical evidence.

2.1 The IPO underpricing anomaly

The initial public offering (IPO) is the event of a private company going public, in which the private company offers its shares to the public. When a company prospers and is in need of more equity capital it might find it desirable to offer shares to the public (Ibbotson & Ritter, 1995). Going public is an event that is likely to happen only once in the history of the company[2]. While further offerings of shares to the public are likely to happen[3], the initial public offering of a company is unique due to the first-time information transference to the public and public valuation of the company (Ibbotson & Ritter, 1995).

The IPO topic has received a lot of academic attention. In particular, the best-known anomaly when it comes to the pricing of IPOs is the short-term underpricing anomaly (Ibbotson & Ritter, 1995). Ibbotson (1975) argued that the discrepancy between the initial offer price of the IPO and the first-day closing price represents underpricing. Ibbotson (1975) researched the underpricing anomaly with a sample of IPOs from the US market between 1960 and 1969 and found empirical evidence that there is a significant discrepancy between the initial offer price of the IPO and the first-day closing price.

While some research on IPO pricing and – underpricing existed shortly prior to Ibbotson (1975), it was this paper that began the widespread theorizing about the IPO underpricing anomaly. Ibbotson (1975) did not provide implicit explanations for the existence of this discrepancy but did give some clues as to why this discrepancy exists. Many theories have emerged and evolved over the years that contribute to the explanation of the IPO underpricing anomaly. The existence of the IPO underpricing anomaly is by now well-established, but the influencing factors remain hotly debated (Guldiken et al., 2017).

[2] Some companies went public, but were taken private again, to subsequently offer their shares to the public again at a later date (e.g., Levi & Strauss). This is quite extraordinary.
[3] E.g., secondary offerings.

On average IPOs on the US market are underpriced but the amount of IPO underpricing fluctuates heavily over time and due to big (worldwide) events, for instance the dotcom bubble and the crash thereafter (Loughran & Ritter, 2004). Loughran & Ritter (2004) observed average underpricing of 7% and 15% in the 1980's and 1990's respectively, to as high as 65% during the dotcom bubble of 1999-2000 and afterwards reverting back to 12% during the years 2001-2003. Loughran & Ritter (2004) argued that these deviations are due to the changing risk composition of firms, with for example the firms of the bubble period displaying higher risk than the firms of the 1980s and 1990s. In more recent years Ritter (2023) again observed high amounts of underpricing, while it stabilized after the dotcom bubble to around 12-13% it dropped again during the financial crisis of 2007-2008 after which it stabilized again to around 17% during 2011-2019[4]. Years in which the COVID-19 pandemic was prevalent, 2020, 2021 and 2022, underpricing again increased dramatically to 42% in 2020, 31% in 2021 and 49% in 2022. This is another indicator for the relevance of the COVID-19 period for IPO underpricing. On top of this, Loughran & Ritter (2004) found that managerial incentives of the issuers to decrease underpricing deteriorated over time. Loughran & Ritter (2004) additionally found that since the dotcom bubble the proportion of companies going public shifted increasingly towards young technology companies that often had a record of negative revenues which is in line with the changing risk composition.

Loughran & Ritter (2004) introduced the idea that theories can provide explanations for IPO underpricing during certain time periods, while during other time periods certain theories are insufficient for the explanation of the underpricing anomaly when too little variance is explained. Figure 1 displays the amount of money left on the table (red left-axis) and the percentage of underpricing (yellow right-axis) on the first trading day.

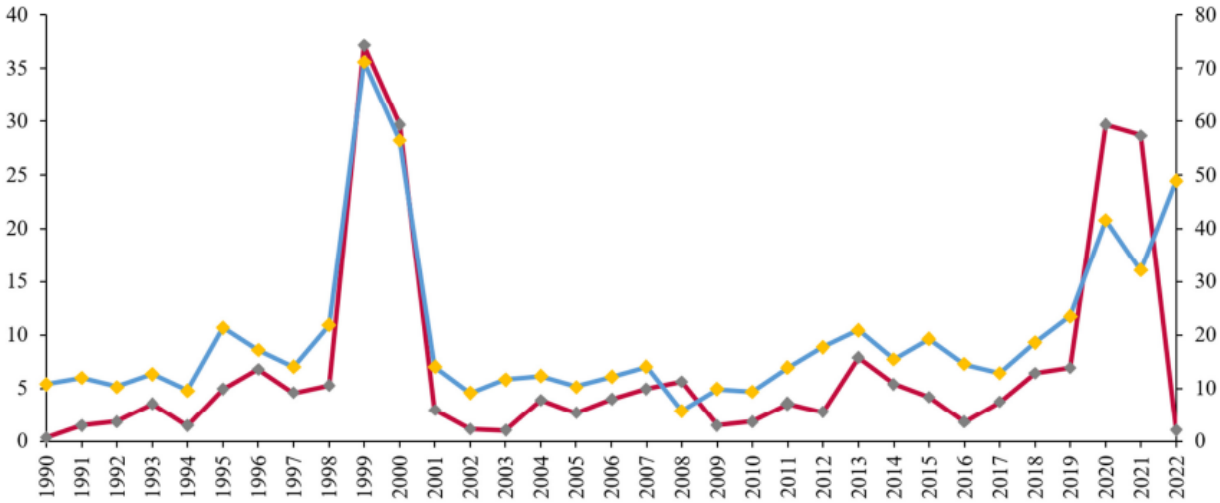


Figure 1 *IPO underpricing over the years*[3]

[4] Ritter J.R. (2023). Initial Public Offerings: Underpricing. Retrieved on 21 March, 2023 from https://site.warrington.ufl.edu/ritter/files/IPOs-Underpricing.pdf

2.2 Information asymmetry

Information asymmetry occurs when the amount of information is not equally distributed among involved parties (e.g., investors and issuers) (Myers & Majluf, 1984). These involved parties, when entering a financial transaction, have different levels of information and avenues to obtain this information (Myers & Majluf, 1984). The first body of literature that attempted to explain IPO underpricing revolved around this idea of the existence of information asymmetry between several involved parties of the IPO. This has produced a number of theories that contributed to the explanation of the IPO underpricing anomaly. It is assumed that the media contains information that can lower the existent gap of information between the involved parties in the IPO. Much of this information is publicly accessible to all interested parties. The theories on information asymmetry and IPO underpricing could thus serve as an explanation for the effect of media coverage on IPO underpricing.

2.2.1 Baron's model of the incentive problem

The first theory on information asymmetry and IPO underpricing relies on the existence of an information asymmetry between the issuing firm and the underwriter, in which the underwriter holds superior information over the issuing firm. Baron & Holstrom (1980) argued that an investment bank[5], by performing the role of an underwriter for the issuing of an IPO, can obtain private information from the company. It is assumed that the underwriter possesses superior information of the capital market as opposed to the issuing firm (Baron & Holstrom, 1980). Underwriters possess this superior information due to having more insights in stock demand through preselling activities and through previous underwriting activities on the capital market[6] (Baron & Holstrom, 1980). This superior information of the capital market, now coupled with the obtained private information by the underwriter, ensures that the underwriter is generally better informed than the issuing firm (Baron & Holstrom, 1980). Baron & Holstrom (1980) argued that this is how Information asymmetry between the underwriter and issuing firm arises. Issuers often realise that the underwriter possesses superior information and will delegate the pricing of the IPO to the underwriting party[7] (Baron & Holstrom, 1980). The underwriter, however, generally benefits from underpricing the IPO and is inclined to do so whenever feasible (Baron & Holstrom, 1980). To minimize marketing efforts and to ensure that demand meets supply, an underwriter is prone to underprice the IPO if issuers do not contractually protect themselves against this[8] (Baron & Holstrom, 1980). In this theory it is the underwriter that holds almost all the cards and will seek to maximally benefit from the IPO, possibly at the cost of the issuing firm. This theory of Baron & Holstrom (1980) was reinforced by Baron (1982). The model of Baron (1982) again proposes that the

[5] Investment banks are the most common underwriters for an IPO.
[6] Simply put, experience due to offering previous IPOs
[7] Issuing firms trust underwriters to come up with a more suitable price than themselves (Baron & Holstrom, 1980).
[8] E.g., a minimum offer price or total proceedings can be contractually established.

underwriter is better informed about the capital market than the issuing firm. Baron (1982) further describes what is now called the 'incentive problem' in relation to IPO underpricing. Issuers are unable to fully observe the distribution effort of the underwriter (e.g., marketing of the IPO) and are unable to observe whether underwriters use underpricing as a quick method to dispose of the shares, or a necessity that can also benefit the firm (Baron, 1982). This increases the chance of an issuer approving of the underpricing of the IPO by the underwriter(s) (Baron, 1982). Not only are underwriters prone to underprice the IPO to limit marketing expenses and lessen risk, but the underwriters also want to attract initial investors that purchase shares directly from the underwriters (Baron & Holstrom, 1980; Baron, 1982). The findings of Loughran & Ritter (2002) offer some support for the arguments made in the papers by Baron & Holstrom (1980) and Baron (1982). Loughran & Ritter (2002) found that underpricing serves as an indirect compensation from the firm to the underwriters. By allowing the underwriters to lower the price, it will accommodate the risk averse nature of underwriters and in addition allow underwriters to find buyers more easily without requiring excessive, expensive, marketing efforts (Loughran & Ritter, 2002).

Empirical findings however do not support that the information asymmetry between underwriters and the issuing firm is the sole reason for IPO underpricing to exist. Muscaralla & Vetsuypens (1989) found that self-marketed IPOs, those firms that issue the IPO without the aid of an underwriter, are also characterized by significant underpricing on the first trading day and found no significant difference between self-marketed IPOs and IPOs that are undertaken with the aid of a third-party underwriter. This does not invalidate the models of Baron & Holstrom (1980) and Baron (1982) but does clearly indicate that there are other reasons for the existence of IPO underpricing beyond the information asymmetry between underwriters and issuing firms. It should also be taken into account that the sample of Muscaralla & Vetsuypens (1989) was made up solely out of investment banks[9] that also perform the underwriter role for other firms planning to execute an IPO.

2.2.2 Winners curse theory

The most renowned model on information asymmetry and IPO underpricing revolves around the winners curse theory. The focus of this theory is on the information asymmetry that exists between different groups of investors (Rock, 1986). Rock (1986) argued that there are two distinct groups of investors: the small group of informed investors, and the large group of uninformed investors[10] (Rock, 1986). Information asymmetry arises due to the skewed division in information, with the informed investors possessing the lion share of the information on the capital market and the uninformed investors

[9] Generally, companies operating in other industries do not market their own IPO for a multitude of reasons: e.g., risk, lacking the expertise to do so and lacking the required networks. It would thus be very difficult to obtain a sample consisting of more diverse industries.

[10] Informed investors are those investors that have adequate networks and financial expertise while uninformed investors lack these networks and the financial expertise (Rock, 1986).

often possessing close to no information about the capital market (Rock, 1986). While an informed investor, due to the superior information held, will have far higher chance of recognizing a favourable or unfavourable price for a share, the uninformed investor is far more unlikely to (Rock, 1986). The winners curse can lead uninformed investors to overpay for shares in bids, which leads to underpricing when the price is not revised by the issuer and underwriters (Rock, 1986). The uninformed investors will "win" these bids the majority of the time, but they paid a hefty sum for the shares (Rock, 1986). Informed investors know this not a good price based on the superior information held by these informed investors (Rock, 1986). This is the first part of the model that shows how underpricing of shares can occur. Another part of the model involves attracting uninformed investors to shares of the IPO. Informed investors will invest in shares with an expected price deemed favourable by the informed, but many uninformed investors will not recognize a favourable price and either will not bid for the shares or bid too low to have a chance of obtaining these shares due to lacking the required information to make a sound decision (Rock, 1986). Uninformed investors will mostly end up winning bids for unfavourable shares and win few bids for favourable shares. The demand of informed investors is often too small to meet the supply of the issuing firm and uninformed investors will have to be attracted (Rock, 1986). The market cannot function without this large group of uninformed investors. These uninformed investors are difficult to inform due to often not possessing avenues information sources on the capital market (Rock, 1986). Since informing these investors is difficult, issuers, and by extension underwriters, require a different way to attract these investors to the shares of the IPO. The offer price of the shares will deliberately be priced lower to attract the uninformed investors (Rock, 1986). This leads to underpricing, and the expectation is that this underpricing will attract sufficient attention from uninformed investors to let supply meet demand (Rock, 1986). In some cases it is also possible that informed investors need to be attracted[11] in addition to uninformed investors when the price is deemed unfavourable by the informed as well (Rock, 1986). In the model of Rock (1986) firms are reluctant to lower the offer price but underwriters often advise the issuers to do so and issuing firms will diverge to this advice which was also noted on by Baron & Holstrom (1980) and Baron (1982).

The model of Rock (1986) finds support in the empirical findings of Beatty & Ritter (1986) who found that underpricing increases when there is little information available for investors and when issuing firms voluntarily disclose information, underpricing decreases. The findings of Beatty & Ritter (1986) also offer support for underwriters wanting to lower the price, when in their perception, demand will not exceed or meet supply at the current price level. Further empirical support for the model of Rock (1986) was found by Yu & Tse (2006). Yu & Tse (2006) found that the winners curse hypothesis shows a significant relationship with IPO underpricing and serves as the main reason for high underpricing of IPOs on the Chinese market.

[11] In practise this is quite unlikely since underwriters perform extensive due diligence before pricing the IPO.

2.2.3 Signalling theory

Apart from the existence of information asymmetry between issuers and underwriters and between groups of investors, another information asymmetry between involved parties in the IPO was found. This is the information asymmetry between issuers and investors. Beatty & Ritter (1986) argue that uncertainty among investors about the firm due to a lack of information about the private firm is a cause for underpricing. Investors are well aware that the issuing firms holds superior information about the company and will seek out signals or information about the company in an attempt to bridge this gap and get a better understanding about the performance and value of the company (Beatty & Ritter, 1986). Companies lower the offer price to not only appeal to investors, but also show to investors that they are willing to lower the price in the interest of the investor[12], despite the existent information asymmetry (Beatty & Ritter, 1986). Another choice for issuers is to voluntarily disclose information useful to investors to supply investors with information about the firm, which can possibly decrease the amount of underpricing due to investors obtaining a stronger notion about the value of a share and the overall value of the company (Beatty & Ritter, 1986). Underwriters however remain keen on maintaining underpricing to some degree for reasons previously mentioned despite the issuing firm disclosing information (Beatty & Ritter, 1986).

Contrary to the model of Rock (1986) in which firms reluctantly underprice their IPO, Allen & Faulhaber (1989) report that firms deliberately underprice the IPO to signal to potential investors that they can bear the costs of underpricing to lessen the effect of information asymmetry that exists between the issuing firm and investors. In this way an issuing firm does not have to give up any, perhaps, valuable information that the company would rather keep from the public at this time. This will garner the interest of investors in this IPO as the investors now believe that the issuing firm is strong and healthy as the company clearly signals that they can bear these costs and can recoup from the losses at a later stage (Allen & Faulhaber, 1989). The company is viewed as a favourable company to invest in by investors. Welch (1989) additionally reports that high-quality firms are willing to deliberately underprice their shares and can afford to do so, while low-quality firms, that cannot afford to do so, are forced to invest in other means[13] to signal favourably to investors and gain their attention that can paradoxically, end up being more expensive.

Some empirical support for deliberate underpricing was found by McCool et al. (1996) that report by using a Stochastic Frontier Approach, that IPOs deliberately underprice the IPO by on average 8 to 8,9%[14]. Further empirical evidence on deliberate underpricing and the motive(s) for deliberate underpricing is scarce.

[12] A signal.
[13] E.g., expensive, and exuberant marketing campaigns.
[14] This does not imply that it is necessarily done to provide signals to investors.

2.3 Marketing considerations

The second body of literature on IPO underpricing focuses on the underpricing of the IPO for marketing purposes. In this body of literature scholars attempt to explain the IPO underpricing anomaly by viewing it as a marketing tool. Issuing firms can deliberately underprice the shares to attract attention of investors or use it as a substitute for promotional activities. It is assumed that the media can be used to engage with investors and market the IPO and serve as a source for promotional activities of a company. Even if this source does not contain new information to bridge the information gap between different parties involved in the IPO, the media can still serve promotional activities (Liu et al., 2014a).

2.3.1 Information cascade effect

The first theory within this body of literature relies on the presence of information cascade effects on markets. An information cascade effect on the market occurs when investors make decisions based on the decisions of other investors (Bikhchandani et al., 1992). These information cascades do not only influence a decision of an investor but can also affect the sentiment of an investor towards a company or industry and thus further influence consumer – and investor behaviour (Bikhchandani et al., 1992). The underpricing of the IPO can cause a cascade effect on the market. Welch (1992) modelled that underpricing the IPO can be undertaken to cause a cascade effect on the primary market which attracts investors' demand. The information asymmetry between groups of investors, uninformed and informed, as found by Rock (1986), does not determine whether an investor will buy shares based on the information cascade[15] (Welch, 1992). It is assumed that all investors can obtain information about the demand for the shares which is the driving force behind the cascade effect (Welch, 1992). Investors will ignore or supress their own knowledge and feelings towards a company and make a decision based on the sentiments and decisions from other investors (Welch, 1992). An important part of the model is that a failure of the IPO is a loss for the issuer, since the issuer now likely needs to prepare a new offering, which incurs further costs, or arrange for private borrowing (Welch, 1992). The early investors are often informed investors, but as noted on early, the demand from this group alone is often not large enough to fulfil demand (Welch, 1992). The issuers difficulty is, to find an offer price which caters to early investors to create a cascade effect which will trigger the interest of later investors (Welch, 1992). The ideal offer price is almost impossible to find for an issuer (Welch, 1992). In fear of pricing the IPO at too high a level and the subsequent consequences of this[16], shares are often issued against a lower offer price than necessary, to attract the early investors[17] (Welch, 1992).

[15] Investors decide based on the decision made by other investors not necessarily based on information.
[16] Possible failure of the IPO, reputation damage et cetera.
[17] The IPO firm does not want to attract a few investors, but a lot of them to create the cascade effect (Welch, 1992).

2.3.2 Promotional trade-off

Apart from the intention of issuers to create a cascade effect to attract investors to the IPO, underpricing can serve as a marketing tool which allows for marketing cost savings. Habib & Ljungqvist (2001) view activities of promoting the IPO and underpricing the IPO as substitutes. Issuers are faced with many choices when it comes to promoting the IPO (Habib & Ljungqvist, 2001). Habib & Ljungqvist (2001) formalized and found empirical evidence for two ideas. Issuers that have more reason to care about underpricing (larger issues) spend more on promoting the IPO instead of underpricing the IPO as a promotional activity (Habib & Ljungqvist, 2001). Smaller issues, that stand to lose less from underpricing, can make a trade-off, and use underpricing as a marketing tool instead of pursuing costly promotional activities (Habib & Ljungqvist, 2001). Issuers making use of promotional activities have thus less need to deliberately underprice the IPO as a marketing gimmick (Habib & Ljungqvist, 2001). This also suggests that the indirect costs incurred from underpricing are at least partially recuperated by not incurring less costs from promotional activities.

Habib & Ljungqvist (2001) found that larger IPO issues, hiring an experienced, reputable, underwriter will decrease the underpricing of the IPO and regards it as form of promotion from the issuer of the IPO to potential investors. This form of promotion shows to investors that the issue is not overpriced (Habib & Ljungqvist, 2001). Issuers optimize at the margin; marginal costs have to equal marginal benefits and issuers that stand to benefit little from conventional promotional activities, are more inclined to accept underpricing as a promotional activity (Habib & Ljungqvist, 2001). These findings by Habib & Ljungqvist (2001) have further implications as it offers some empirical evidence that exclusively comparing the amount of underpricing is not sufficient[18]. For example the earlier mentioned findings of Muscaralla & Vetsuypens (1989) that disputed the model of Baron (1982) is based only on a comparison of the amount of underpricing alone and disregards factors like underwriter reputation. Stoughton et al. (2001) also offers support for the idea of deliberate underpricing as a marketing tool. To gain market share, companies are willing to incur the indirect costs of IPO underpricing in an attempt to gain a competitive advantage (Stoughton et al., 2001). Ljungqvist & Wilhelm (2003) also argued that underpricing the IPO indeed may serve a marketing purpose.

Bajo et al. (2016) analysed the role of underwriter reputation in relation to gaining the attention of investors. More reputable underwriters possess more information and a larger network than less reputable underwriters which puts them in a better position to spread information about the IPO (Bajo et al., 2016). This causes investors to have more attention for the IPO (Bajo et al., 2016). However, Bajo et al. (2016) did not find a significant relationship between the increased investor attention due to the reputation of underwriters and IPO underpricing but does find that issuing firms represented by reputable underwriters are associated with larger offer price revisions and greater IPO initial returns.

[18] This offers an important insight in the necessity of adequate firm and IPO control variables when conducting IPO underpricing research

2.3.3 Product marketing

Ideas on using underpricing as a marketing tool developed further. Demers & Lewellen (2003) argued not for the deliberate marketing role of underpricing to garner interest in the shares offered in the IPO, but for the products or services of the issuing firm. When using underpricing as a marketing tool, it is not only useful for completing the IPO and ensuring enough investors are attracted to the shares of the issuing firm, but also for the post-IPO performance of the issuing firm (Demers & Lewellen, 2003). Demers & Lewellen (2003) viewed marketing the entire company as one of the purposes of an IPO, with underpricing attracting additional attention to the company and its products or services. Underpricing might be less costly to a firm than first believed due to the gained benefits in the post-IPO phase of the firm (Demers & Lewellen, 2003). Demers & Lewellen (2003) analysed the website traffic of internet companies which they used as a direct measure of product market performance of these firms. Underpricing of the IPO increases the website traffic of internet companies shortly after the IPO (Demers & Lewellen, 2003). An economic quantification of the costs of underpricing and gains from increased website traffic showed that IPO firms can benefit significantly in the post-IPO period from underpricing the IPO (Demers & Lewellen, 2003). Demers & Lewellen (2003) extended these findings by analysing whether media exposure of IPO firms increases based on the amount of underpricing and found that media mentions in the month of the IPO were positively associated with the amount of underpricing[19].

2.3.4 After-market trading and flipping

Another marketing tool of underpricing the shares of the IPO relates to the trading volume of the stock of the issuing firm in the post-IPO phase (an active after-market). Underwriters have an interest in a higher after-market trading volume (Boehmer & Fishe, 2001). Underwriters place a portion of the shares with low-value investors (called flippers) who will sell the shares for a higher price in the aftermarket to higher valued investors (Boehmer & Fishe, 2001). This causes an increase in after-market trading (Boehmer & Fishe, 2001). These investors pay commissions and create trading profits for the underwriters (Boehmer & Fishe, 2001). Since these investors are often low-value investors and need to be compensated for the risk[20] incurred by taking on the shares at an early stage, the shares are underpriced to compensate these investors (Boehmer & Fishe, 2001). These investors trading the shares will create a higher after-market trading volume (Boehmer & Fishe, 2001). For the issuer there is a trade-off to be made. Less underpricing is expected to happen when there are no flipping activities, but the issuer suffers higher underwriting fees to compensate the underwriter for missing out on commissions and trading profits (Boehmer & Fishe, 2001). Higher underpricing is expected to happen

[19] Additional evidence that there is more attention for the firm after the IPO when underpricing has occurred.
[20] Since the shares have no established value yet, it is rather risky.

when there are flipping activities, but the issuer is compensated by lower underwriting fees (Boehmer & Fishe, 2001). By allowing the underwriters to buy shares at a discount and allocate these to investors that will trade them on the after-market, underwriters face less risk and obtain more avenues of obtaining profits and thus require lower compensation (Boehmer & Fishe, 2001). Boehmer & Fishe (2001) indeed found that underwriting fees are negatively related to flipping ratios and that underpricing, and after-market trading revenues of underwriters are positively related to the flipping ratios.

2.4 Investor sentiment

Investor sentiment can be described as beliefs about the company (e.g., financial, or strategic) that are not necessarily justified by the facts at hand but come from an irrational belief of the investor or a group of investors (Baker & Wurgler, 2007). Apart from the media containing information and attracting attention it can also contain sentiment. Investors acting on sentiment rather than rationality is an important part of the models of noise trading of e.g., DeLong et al. (1990) in which sentimental investors act contrary to rational investor models. The sentiment of media coverage can have an effect on the sentiment of investors. Investor sentiment has been recognized as an influencing factor on IPO underpricing with Baker & Wurgler (2007) stating that it is not a question whether investor sentiment affects stock prices, but only how to adequately measure this effect.

2.4.1 Exuberant investors

The first theory on investor sentiment and IPO underpricing revolves around the presence of non-rationality investors, or irrational investors, on the market. Ljungqvist et al. (2006) argued that there are investors on the market that hold irrational beliefs about a company. This is contrary to the belief of efficient markets in which investors are expected to act rationally. The model of Ljungqvist et al. (2006) focuses on the ‘exuberant’, or overly positive investors, that display a positive sentiment towards the company that goes beyond the expected positive sentiment based on the existing facts about the issuing firm that the investor might possess. The model suggests that by engaging in staggered shares, the offer price of the IPO is optimized (Ljungqvist et al., 2006). Similar to the cascade effect of Welch (1992) a portion of the shares are allocated by underwriters, first to regular investors who in turn sell these shares to the exuberant investors that hopefully arrive on the market later (Ljungqvist et al., 2006). The rest of the shares that were not allocated to the first regular investors can then additionally be offered by the issuing firm to exuberant investors resulting in higher offer prices (Ljungqvist et al., 2006). This high sentiment from exuberant investors could cease earlier than expected and thus the regular investors take a risk by taking on the shares early (Ljungqvist et al., 2006). To compensate the initial investors for taking the risk of taking on the shares early, the shares are underpriced which results in first-day underpricing (Ljungqvist et al., 2006). For this to work, there must be a dominant investor or a small

group of dominant investors, willing to take the shares on early and hold onto the shares for a certain period (Ljungqvist et al., 2006).

A different approach related to sentimental investors is taken by Dorn (2009). In this approach the issuing firm does not deliberately underprice the shares for some additional value, but is unable, or unwilling to correct the officer price (Dorn, 2009). Using a sample of IPOs from the retail sector, Dorn (2009) found that there is a willingness of some investors to overpay for the shares of the IPO driven by sentiment for the company that is not explained by the expected value of the shares based on existing facts. Dorn (2009) used the premium paid to obtain shares, relative to the share prices in the immediate aftermarket as a proxy of investor sentiment. Dorn (2009) argued that the willingness to overpay for the shares must indicate that at least some investors were driven by sentiment. The willingness to pay this premium and issuers unable to adjust this willingness in the offer price serves as an explanation for short-term IPO underpricing (Dorn, 2009). This inability to adjust the offer price could have to do with the underwriters being keen on maintaining the price as mentioned previously or an issuing firm simply being unaware of the degree of sentiment displayed towards the company. Support for this comes from Liu et al. (2008) who found that underwriters adjust the price based on media attention and fully adjust downwards, when there is little media attention, but only partially upwards, when there is a lot of media attention in accordance with their risk appetite.

Campbell et al. (2008) found that the effect of investor sentiment on IPO underpricing differs based on the valuation of the IPO. Issuing firms that enjoy high investor sentiment suffer from underpricing, but the underpricing is significantly higher for firms that are overvalued as opposed to firms that are undervalued (Campbell et al., 2008). Other proxies for investor sentiment such as trust produce similar results. Li et al. (2019) analysed the emerging market of China and used social trust measures to measure the trust that investors have in an IPO. Li et al. (2019) found that the amount of trust of investors impacts first-day underpricing of IPOs. IPO firms located in higher trust provinces suffer significantly less underpricing than IPO firms that are located in lower trust provinces (Li et al., 2019).

2.4.2 Sentiment and regulations

Similar results were found in emerging markets. Dong & Huang (2022) analysed the emergent market of China that implemented price limits to ease market volatility. Dong & Huang (2022) used the oversubscription rate of new shares, the turnover rate, and the investor sentiment index of Baker & Wurgler (2007) as proxies to measure investor sentiment. The findings of Dong & Huang (2022) indicate that implementing first-day price limits increases IPO underpricing on the first trading day. By limiting the first-day price by regulations, investor sentiment and market encouragement is intensified which leads to significantly higher underpricing (Dong & Huang, 2022). These results show an interaction between financial regulation and investor sentiment (Dong & Huang, 2022). This indicates that the act

of governmental institutions regulating shares, is viewed as a favourable signal by investors. If governmental institutions were not regulating these shares, then the share prices might have been higher.

2.5 Other theories influencing IPO underpricing

Apart from the theories mentioned above that hold a relationship with media coverage, there have originated other theories over the years that attempted to explain the IPO underpricing anomaly. These theories do not necessarily have a direct function for the explanation of the effect of media coverage on IPO underpricing but can serve as auxiliary explanations throughout the paper.

2.5.1 Differences across countries

Research into IPO underpricing shows that there are differences between countries in terms of IPO underpricing. Ritter (2003) analysed the differences between the European – and American markets and in this short survey found many differences between the European – and American markets that could influence IPO underpricing, such as market regulations and differences in analysts coverage shortly prior to the IPO. Banerjee et al. (2011) finds rather large differences in underpricing across countries. While for example Italy and Norway only show an average underpricing of respectively 8% and 4%, Germany shows average underpricing of over 40% (Banerjee et al., 2011). Banerjee et al. (2011) analysed these differences and found that certain country-level characteristics significantly influence IPO short-term underpricing. These country-level characteristics include degree of information asymmetry, the effectiveness of contract enforcement, and accessibility of legal recourse (Banerjee et al., 2011). This makes it difficult to compare underpricing across countries (Banerjee et al., 2011).

2.5.2 Broad ownership purposes

A rationale of IPO underpricing can be found in the desire of the public company for a broad ownership of the offered shares. Instead of the large majority of the shares falling in the hands of a few individuals, firms would rather have a broad ownership for liquidity reasons on the secondary market (Booth & Chua, 1996). Similar to the winners curse theory of Rock (1986) but for a different purpose, underpricing occurs due to firm wanting to attract many investors (Booth & Chua, 1996). Many of these investors are uninformed and if these investors wish to inform themselves about the company, they will incur investigation costs[21] (Booth & Chua, 1996). To compensate the investors for the incurred investigation costs, the shares are underpriced (Booth & Chua, 1996). Brennan & Franks (1997) argued that underpricing can help insiders retain control of the company. Underpricing will cause

[21] Costs in the form of simply time spent to investigate or purchasing subscriptions of news outlets or articles that cover the company and its IPO.

oversubscription of the shares which helps to broaden out the number of investors (Brennan & Franks, 1997). This permits the issuing firm to 'discriminate' against large applications and prevent a small group of investors obtaining the (large) majority of the shares during the IPO (Brennan & Franks, 1997). This discrimination of investors is not allowed on all markets but can serve as an additional reason for IPO underpricing on markets where it is permitted (Brennan & Franks, 1997).

2.5.3 Protection against litigation

Wariness of possible litigations that issuers and underwriters might face from investors is another possible reason for underpricing. Tinic (1988) argued that underpricing serves as insurance against potential legal liabilities due to the enactment of the Securities Act. IPOs issued before the enactment of the Securities Act showed significantly higher underpricing than IPOs prior to the enactment of the securities Act (Tinic, 1988). Underpricing can protect the underwriter from reputational damage and the issuer from potential legal actions (Tinic, 1988). The Securities Act is an act in the US that entails the full and fair disclosure of the character of the securities (Tinic, 1988). Hughes & Takor (1992) showed that the main risk of litigation is for the underwriter which causes the underwriter to discount the IPO shares. The amount of discounting depends on the reputation of the underwriter (Hughes & Takor, 1992). While underpricing of IPO shares is also prevalent in countries in which firms do not face this litigation risk, this analysis offers further support for the prevalent role that the reputation of the underwriter plays in understanding the IPO underpricing phenomenon (Hughes & Takor, 1992).

2.5.4 Prospect theory

The prospect theory has been used to explain the anomaly of IPO underpricing. In this context, the issuers focus on the change in wealth instead of the absolute gains (Loughran & Ritter, 2002). The reference point is the wealth possessed prior to the IPO and the evaluation and focus of the issuers is how this wealth changes by the IPO, in reference to the current wealth instead of the absolute wealth the IPO brings in (Loughran & Ritter, 2002). Key insiders of the issuing firm often possess shares that are retained post-IPO. Loughran & Ritter (2002) stated that the prospect theory predicts that issuers will sum the wealth loss from underpricing of the IPO with the wealth gain from the retained shares which often produces a net increase in wealth for pre-issue shareholders. According to Loughran & Ritter (2002) this is the reason why issuers do not mind leaving money on the table and thus do not mind the underpricing of the IPO and do not adequately revise the offer price, even when the issuing firm is able to do so. The focus of the issuers is on the change in wealth from the IPO compared to pre-IPO and not the absolute gain from it (Loughran & Ritter, 2002).

Ljungqvist & William (2005) using the behavioural perspective of Loughran & Ritter (2002) measured whether CEOs of IPO firms, who owned pre-issue stocks, make subsequent decisions

consistent with the behavioural measure of Loughran & Ritter (2002). Specifically, Ljungqvist & William (2005) test whether CEOs of IPO firms are satisfied with the underwriters performance, despite the wealth loss of underpricing. Ljungqvist & William (2005) found that CEOs that switch underwriter for the secondary offering suffer significantly less underpricing as opposed to non-switchers and switchers have a lower perceived wealth gain from the revaluation from pre-issue owned stocks as opposed to non-switchers. This indicates that it is not the degree of underpricing that makes CEOs switch underwriter for the secondary offering, but the lower-than-expected perceived wealth increase on retained shares (Ljungqvist & William, 2005).

2.6 The COVID-19 impact

2.6.1 Impact on the American market

The impact of the COVID-19 pandemic on the American market was both forceful and unprecedented, with previous pandemics only leaving mild traces on the American market (Baker et al., 2020). On the American market, volatility levels rivalled or even surpassed those of October 1987 and December 2008 (Baker et al., 2020). While volatility dropped later in March and the start of April, the volatility levels were still far above those of pre-pandemic levels (Baker et al., 2020). Baker et al. (2020) state that this volatility cannot possibly be explained by the lethality of the virus, since the mortality rate of the COVID-19 pandemic was only $1/25^{th}$ of that of e.g., the Spanish flu, yet the financial market reacted far more sharply. The main reasons, for this unprecedented volatility are the governmental restrictions that restricted the movement of individuals and commercial activity (Baker et al., 2020). While the first reactions to the COVID-19 pandemic were likely due to the initial fear of the pandemic, the later reactions were due to media outlets reporting on new (possible) restrictions due to the pandemic (Baker et al., 2020). The severity of the impact on a financial market coincides with the intensity of the pandemic in a specific country (Zhang et al., 2020). In a more recent study of Szczygielski et al. (2023) similar results were found to the study of Baker et al. (2020). The stock market responded to 1) a general state of uncertainty; 2) governmental policies, especially lockdown-style policies; 3) combined attention and bouts of panic from the pandemic evolution (Szczygielski et al., 2023).

2.6.2 Impact on IPOs

Initial evidence suggests that the IPO market performed extraordinarily well during the COVID-19 pandemic and was dubbed as the so-called: “IPO frenzy” (Baig & Chen, 2022). However, further investigation of the performance of IPOs showed that, while initially, IPOs were on average more underpriced than in previous periods and on average had higher proceeds, the post-performance of IPOs during this period was adversely affected, signified by more post-IPO return volatility due to information

uncertainty (Baig & Chen, 2022). While this information uncertainty positively impacts underpricing it also shows strong association with post-IPO volatility (Baig & Chen, 2022). Baig & Chen (2022) did not extend the research to the long-term performance of IPOs, but it is expected that the IPOs from this "IPO frenzy" period will perform poorly in the long run. Mazumder & Saha (2021) found that while IPO first-day underpricing was higher during the pandemic, as fear for the pandemic increased, first-day underpricing was negatively affected. IPO performance in the long run is also negatively affected by the fear for the pandemic (Mazumder & Saha, 2021). The performance of IPO firms is more sensitive to the fear of the pandemic when compared to other firms (Mazumder & Saha, 2021).

2.6.3 Impact on media coverage

The COVID-19 pandemic altered media coverage and its impact. Previous research already showed that news coverage from mainstream news outlets and social media can significantly impact the decision-making of stock market investors (Lee, 2020). In times of a market crisis, like the COVID-19 pandemic, positive and negative sentiments displayed in news coverage can have a ripple effect on the decision-making of stock market investors (Lee, 2020).

Haroon & Rizvi (2020) speak of an onslaught of news coverage due to the COVID-19 pandemic, with daily updates on all facets of the pandemic. This media coverage played a prominent role in generating uncertainty and volatility on the financial market (Haroon & Rizvi, 2020). This onslaught made it difficult for investors to assess news on the financial market(s) (Haroon & Rizvi, 2020). Due to the large quantities of news, and higher accessibility to news than ever before, investors appear to have had trouble judging the value of certain news items (Haroon & Rizvi, 2020). COVID-19 pandemic reporting led to a consistent pattern of news which investors overreacted to (Haroon & Rizvi, 2020).

Smales (2020) found that attention for the COVID-19 pandemic, in the form of online searches for news coverage on the pandemic (investor attention for the pandemic), negatively affected stock returns on the American market. Interestingly however, some sectors appear to have gained from the increased attention of the COVID-19 pandemic (Smales, 2020). Sectors, deemed by investors to gain or lose the least from the COVID-19 pandemic, like the healthcare and technology sectors, appear to have not been negatively affected, and possibly even gained from pandemic attention from investors. In the context of this study, this is an interesting finding since the current IPO market, and by extension this sample, is dominated by issuing firms from these two sectors[22] This would suggest that investors, rationally, sought out information on the impact of the COVID-19 pandemic on investments (Smales, 2020).

[22] Evident from the file of Ritter J.R. (2023). Initial Public Offerings: Updated Statistics. Retrieved on 27 June, 2023 from https://site.warrington.ufl.edu/ritter/files/IPO-Statistics.pdf

2.7 Hypothesis development

Media coverage proxies can take the form of sheer volume of media articles or tones (sentiment) contained in these articles (Bajo & Raimondo, 2017). The media can contain information or attract the attention of investors and alter the perception of the investors towards a company based on the tones contained in the coverage (Bajo & Raimondo, 2017). In this section the hypotheses regarding the effect of media coverage volume and sentiment of the coverage on IPO underpricing are developed based on the theories and (recent) empirical evidence.

2.7.1 Media coverage volume

The media can provide investors with both information and attract the attention of investors for the shares offered by the company (Liu et al., 2008; Liu et al., 2014b). The theories on IPO underpricing provide contrasting ideas about the relationship between media coverage and IPO underpricing. The first facet of media coverage, the sheer volume, following the literature of asymmetric information, is expected to lower the amount of information asymmetry that exists between several involved parties in an IPO due to the publicly accessible information the media coverage can contain. The media can contain information about the capital market that lowers the information asymmetry between the issuing firm and underwriters. This media coverage can facilitate more independency of the issuing firm from the underwriter. This can alleviate the incentive problem in which the underwriters are prone to underprice the IPO, and issuers due to their dependency on the underwriters superior knowledge, to accept this. From this a negative relationship between media coverage volume and short-term IPO underpricing as per Baron & Holstrom (1980); Baron (1982); Muscaralla & Vetsuypens, (1989), is expected. The increased accessibility of information about an IPO firm, facilitated by the media, can lower the existent information asymmetry between the groups of informed – and uninformed investors which can alleviate the effect of the winners curse, requiring less underpricing from the issuing firm to attract uninformed investors. A negative relationship between media coverage volume and short-term IPO-underpricing is expected (Rock, 1986; Beatty & Ritter, 1986; Yu & Tse, 2006). The information asymmetry between issuers and investors can also be partially alleviated by media coverage, offering accessible information to all investors about the IPO firm. Issuers could stand to do with less underpricing from signalling to investors (Allen & Faulhaber, 1989; Welch, 1989) or alleviate the uncertainty that exists among investors regarding the IPO (Beatty & Ritter, 1986) resulting in a negative relationship between media coverage volume and short-term IPO underpricing (McCool et al., 1996).

In more recent years questions arose whether the media contains genuine or novel information about the company that can affect the existing information asymmetry between the involved parties of the IPO. Tetlock (2011) for example found that investors overreact to stale news[23] which suggests that media

[23] Information that has already been available for some time, either republished or slightly rewritten.

coverage volume plays a role despite it not containing any new information. Liu et al. (2014b) found that media coverage is associated with different dimensions of IPOs. This includes dimensions in which information asymmetry does not seem to play a role as per the information asymmetry literature (Liu et al., 2014b). Due to doubts about the explanation power of information asymmetry theories, other theories to explain the relationship between media coverage and IPO underpricing have become increasingly popular in more recent years.

The marketing-centric literature offers different insights in the IPO underpricing anomaly and is often in contrast to the information asymmetry literature. Obtaining the investors' attention and demand for the IPO is the focal point of these theories instead of informing involved parties in the IPO to affect the information asymmetry gap. The media can grab the attention of investors for the IPO through the content it produces (Liu et al., 2014a; Liu et al., 2014b). The media can facilitate the cascade effects found by Bikhchandani et al. (1992) and Welch (1992). In this literature the IPO firm deliberately discounts the offer price to obtain the approval of early investors and create a cascade effect to attract later investors to the IPO. The degree of underpricing could attract further media attention strengthening this cascade effect. But underwriters adjust the offer price based on media attention and fully adjust downwards, when there is little media attention, but only partially upwards, when there is high media attention (Liu et al., 2008). This would predict a positive relationship between media coverage volume and short-term IPO underpricing[24]. From the trade-off promotional perspective of Habib & Ljungqvist (2001) increased media attention can serve as a promotional activity that lessens the need of issuers to underprice the IPO to attract attention. The media attention now substitutes underpricing as the promotional activity. This would predict a negative relationship between media coverage volume and short-term IPO underpricing. In addition, the theory of product marketing of Demers & Lewellen (2002) follows the same predicted relationship. More media attention for the company predicts less incentive to underprice the IPO shares for marketing purposes post-IPO. This would also predict a negative relationship between media coverage volume and short-term IPO underpricing. The theory of Boehmer & Fishe (2001) relies on the underwriters desire to flip the shares via early investors to induce an active after-market to gain potential trading profits and commissions. Increased media attention for the IPO could increase after-market trading which will require less compensation from the underwriter to the early investors in the form of underpricing[25]. This would predict a negative relationship between media coverage volume and short-term IPO underpricing. It would be short-sighted not to mention that for these relationships, based on the theories of Habib & Ljungqvist (2001); Demers & Lewellen (2002);

[24] This because the offer price only gets partially adjusted upwards which allows for more underpricing. If underwriters fully adjusted the offer price, media coverage would likely not have an effect (Liu et al., 2008). Underwriters are still rather risk-averse and are thus unlikely to fully adjust upwards because of media attention (Liu et al. 2008).

[25] The increased media attention has the potential to lower the risk of early investors as more attention to the stock is likely to increase the demand for it, thus requiring less underpricing as compensation for the risk taken by early investors.

Boehmer & Fishe (2001) to hold, it is assumed that the issuing firm and underwriter adjust the offer price based on the increased media attention. However as mentioned before Liu et al. (2008) found that there follows only a partial adjustment when there is a lot of media attention. This predicted negative relationship based on these three theories might not hold in practise.

The theories on the effect of media coverage on short-term IPO underpricing are mostly in favour of a negative relationship between media coverage volume and IPO underpricing. There is empirical support for the relationship between media coverage volume and IPO underpricing, but the direction of this relationship is disputed. Pollock & Rindova (2003) found that the volume of media coverage showed a negative relationship with IPO underpricing and Fang & Peress (2009) found that companies with no media coverage have higher stock returns as opposed to companies that do receive coverage in the media. Additionally, Zou et al. (2020) argues that no matter whether a media source is positive or negative, it decreases the amount of information asymmetry between involved parties of the IPO and found that media coverage decreases the amount of underpricing. Chen et al. (2020) similarly found a negative relationship between media coverage volume and IPO underpricing.

While support was found for the negative relationship between media coverage and short-term IPO underpricing in line with the information asymmetry – and marketing-centric literature, other empirical studies find a positive relationship between the volume of media coverage and IPO underpricing (DuCharme et al., 2001; Liu et al., 2007; Liu et al., 2008; Liu et al., 2014b; Guldiken et al., 2017; Bajo & Raimondo, 2017). It should additionally be noted that Guldiken et al. (2017) only found a positive relationship between the presence of credible (Dow Jones) media coverage and IPO underpricing and found no relationship when accounting for all media coverage and that Bajo & Raimondo (2017) only found a positive relationship at the 10% level when testing for media coverage volume on the day of the IPO itself. Guldiken et al. (2017) only considered underpricing a week after the IPO and did not test for first-day underpricing. Obtaining the investors' attention and demand for the stock was clearly observed during the internet bubble which led to an enormous amount of underpricing as stated before (Loughran & Ritter, 2004; Loughran & Ritter, 2002). These contrasting results might be the effect of different time periods and country differences (Loughran & Ritter, 2004; Banerjee et al., 2011). Attention spans of investors also do not last forever. Bajo & Raimondo (2017) found that attention spans do not last longer than one week and already become significantly weaker after three days and thus mostly affect short-term performance of IPOs. Based on the literature and mixed empirical results two hypotheses have been included, for the relationship between media coverage volume and IPO underpricing:

Hypothesis 1a: Media coverage volume in the week prior to the IPO completion has a positive effect on IPO underpricing during the first trading day.

Hypothesis 1b: Media coverage volume in the week prior to the IPO completion has a negative effect on IPO underpricing during the first trading day.

The COVID-19 period was an exceptional period for both media coverage and the financial market. Financial markets were severely impacted, including the IPO market of America. The impact on the American market was more forceful when compared to the impact of previous pandemics (Baker et al., 2020). IPO underpricing was observed to be higher during this period (Baig & Chen, 2022). The media played a pivotal role in this. Haroon & Rizvi's (2020) findings indicate that investors had a harder time evaluating media coverage on a firm due to the large amount of coverage produced by the COVID-19 pandemic. The results of Smales (2020) hint at investors actively seeking out news coverage on potential investments to gain an understanding of the impact of the pandemic on certain (planned) investments. The media coverage played an integral part in causing fear among investors by reporting daily COVID-19 cases and death tolls (Mazumder & Saha, 2021). Additionally, media coverage of this period fuelled uncertainty among investors with daily reports about new (possible) governmental measures to combat the pandemic (Baker et al., 2020; Szczygielski et al., 2023). Due to the inherently more uncertain and fear generating nature of the COVID-19 period and the role that media coverage played in this, as well as investors actively seeking out the impact COVID-19 had on possible investments via the media, while having a harder time to evaluate it; it is expected that the effect of media coverage on first-day IPO underpricing was not the same in this period as the pre-COVID-19 period.

Bali et al. (2017) found that higher uncertainty leads to lower stock returns while lower uncertainty leads to higher stock returns[26]. Salisu & Akanni (2020) showed that fear during the COVID-19 period led to a decline in stock prices. Mazumder & Saha (2021) specifically found that fear negatively affected first-day IPO underpricing due to increased uncertainty faced by investors during the COVID-19 period. These empirical results suggest that media coverage, which channelled uncertainty and fear due to the COVID-19 pandemic, had a more pronounced, negative effect on first-day IPO underpricing. While the findings of Bonsall et al. (2020) indicate that media coverage can serve as an alleviator of uncertainty in the context of financial markets by being more informative about a firm. This suggests that an increase in media coverage volume during the COVID-19 pandemic had a more pronounced positive impact on first-day IPO underpricing[27]. Smales (2020) also found that some sectors[28], like healthcare and technology sectors, that stood to lose the least, or even gained from the COVID-19 pandemic, were not negatively affected in terms of stock prices, unlike other sectors, and possibly even gained from the increased attention of investors. This would suggest a more pronounced positive effect since the great majority of the IPO firms operated within these two sectors, and an increase in media coverage volume could have led to more investor attention for these firms. On the contrary, Haroon & Rizvi's (2020) findings, suggesting that investors had a harder time to evaluate media coverage due to the COVID-19

[26] This could affect the first-day closing price of IPO shares, bringing the price closer to the original offer price
[27] The COVID-19 period is inherently uncertain, media coverage can possibly aid in alleviating some of this uncertainty, allowing for a more pronounced effect during a period of great uncertainty as opposed to a period of 'normal' uncertainty.
[28] See footnote 21.

pandemic, indicates a less pronounced effect of media coverage during the COVID-19 period. Investors reacted more slowly to news and disregarded more news than in prior periods (Haroon & Rizvi's, 2020).

These results suggest that the effect of media coverage volume on first-day IPO underpricing could have had a more, or less pronounced effect. On the one hand, the uncertainty and fear that the media channelled, could have increased, as the volume of media increased, which indicates a more pronounced effect on first-day IPO underpricing during the COVID-19 period. This also appeared as investors had the chance to use the increased media coverage to gain a better understanding of the impact of COVID-19 on possible investments or when media coverage served as a possible alleviator of uncertainty. On the other hand, investors appeared to have had a harder time evaluating media coverage during the COVID-19 period in which a higher volume of media coverage may only have made this more difficult. This indicates a less pronounced effect of media coverage volume on first-day IPO underpricing during the COVID-19 period. Thus the following is hypothesised for the effect of media coverage volume one week prior to the IPO on first-day IPO underpricing for the COVID-19 period:

Hypothesis 2: During the COVID-19 period, the impact of media coverage volume in the week prior to the IPO completion is more (less) pronounced on IPO underpricing during the first trading day.

2.7.2 Media coverage sentiment

Apart from sheer volume, the sentiments displayed in the media sources can also have an effect on short-term IPO underpricing and are a part of media coverage (Bajo & Raimondo, 2017). Sentiment in media coverage can drive investor behaviour (Bajo & Raimondo, 2017). The information asymmetry literature predicts that no matter what the media coverage contains, it lowers the information asymmetry gap which results in lower underpricing while the marketing-centric literature would predict either positive or negative relationships. These two bodies of literature mainly focus on the existence of media coverage and not its content. The literature on investor sentiment can further aid in predicting a relationship between the sentiment of a media source and short-term IPO underpricing. The first theory in this body of literature is of Ljungqvist et al. (2006), in which a group of investors invest in IPO shares based on sentiment rather than facts at hand and are willing to overpay. External positive or negative sentiment can affect the behaviour of exuberant investors with positive media articles further fuelling the exuberant behaviour of these investors and negative media sentiment perhaps halting the exuberant behaviour of these investors. However, as previously mentioned, these exuberant investors appear to arrive on the market at a later stage while the issuing firm allocates the shares, at a discount, to regular investors (Ljungqvist et al., 2006). This offers insufficient explanation for first-day underpricing (Ljungqvist et al., 2006). But as follows from the model of Ljungqvist et al. (2006), exuberant investors are unable to buy shares on the first day due to many regular investors not selling until an adequate price is met, which is often not on the first day (Ljungqvist et al., 2006). But if there are enough exuberant

investors, that could be attracted by sentiments in the media, the issuing firm does not gain from allocating shares at a discount to regular investors[29] (Ljungqvist et al., 2006). The exuberant investors are thus unhindered in buying the shares and can respond to sentiments purveyed by the media[30]. This predicts a positive relationship between positive media sentiment and IPO underpricing. As for negative sentiment, it is expected that this will halt the exuberance of the investors, likely lowering the first-day closing price and thus result in a negative relationship with IPO underpricing[31]. Dorn (2009) offers an additional explanation for short-term underpricing in the form of an inability to revise the offer price based on the willingness of investors to overpay. Sentiment can drive the investors to overpaying for shares (Dorn, 2009). Based on this, positive sentiment displayed in media coverage can further drive the willingness of investors to overpay for IPO shares and in the case of negative sentiments, it can halt this willingness. This predicts a positive relationship between positive media sentiment and IPO underpricing and a negative relationship between negative media sentiment and IPO underpricing. The offer price according to this theory will be unchanged while the first-day closing price is altered[32].

Empirical evidence for tones, or sentiment in media coverage and its relationship with IPO underpricing are divided. Guldiken et al. (2017) found that uncertain media a week prior to the IPO hurts the stock price a week after the IPO, arguing that investors despise uncertainty more than negativity. Zou et al. (2020) analysing a sample from the Chinese market, found that both positive and negative sentiment in media coverage negatively affect first-day underpricing, arguing that both sentiments appear to lower the information asymmetry gap between several parties involved in the IPO. Pollock & Rindova (2003) used the Janis Fader coefficient of imbalance and found that while low amounts of positive media sentiment have little effect, once it reaches a critical point, positive media sentiment is positively associated with IPO underpricing. Bajo & Raimondo (2017) decided on a different approach, calculating the number of positive words relative to the total number of words and report that positive sentiment has a positive effect on first-day IPO underpricing while no relationship was found for negative sentiment. Gupta et al. (2022) analysing a sample from the Indian market, found that positive sentiment appears to play a significant role in first-day IPO underpricing, while negative sentiment appears insignificant similar to the results of Bajo & Raimondo (2017). Chahine et al. (2020) found that through the hiring of investor relation consultants more positive news coverage is created prior to the IPO leading to higher short-term underpricing.

The literature and prior empirical results point to a positive relationship between positive sentiment contained in media coverage and first-day IPO underpricing. As for the relationship between negative

[29] With the presence of many exuberant investors, issuing firms do not have to worry about demand issues.
[30] While this lowers the underpricing to some degree, since the offer price will be unaltered, the first-day closing price can be heavily impacted by exuberant investors, increasing underpricing.
[31] It could also be argued that the company now feels the need to allocate shares at a discount to regular investors again. However, it is expected that the halt of exuberant investors has a stronger effect on IPO underpricing than a slightly lower offer price (Ljungqvist et al., 2006).
[32] Since according to this theory, there is an inability to revise the offer price.

sentiment contained in media coverage and first-day IPO underpricing, the literature points to a negative relationship while the empirical results are more mixed pointing to a negative relationship and no existing relationship. The following is hypothesized:

Hypothesis 3: The positivity of the tone of media coverage in the week prior to the IPO completion has a positive effect on IPO underpricing during the first trading day.

Hypothesis 4: The negativity of the tone of media coverage in the week prior to the IPO completion has a negative effect on IPO underpricing during the first trading day.

Similar to the effect of media coverage volume, it is expected that the effects of sentiment displayed in media coverage on first-day IPO underpricing during the COVID-19 period differ from the pre-COVID-19 period. While literature and empirical results on the effect of media sentiment, or sentiment in general, on stock price movements, during the COVID-19 pandemic are scarce, an effort is made to formulate hypotheses based on the available literature.

Cevik et al. (2022) found that investor sentiment during the COVID-19 period impacted stock prices. While a positive investor sentiment impacted stock prices positively during the COVID-19 period, negative investor sentiment negatively affected stock prices (Cevik et al., 2022). However, while the results of this study by Cevik et al. (2022) indicate that sentiment plays a role in stock price movements, the study does not analyse whether the effect of differs when compared to other periods. Results in a recent study by Bai et al. (2023) indicate that positive sentiment displayed in media during the COVID-19 period had an alleviating effect on stock prices, while negative sentiment had an amplifying effect on stock prices. The COVID-19 pandemic and the intensification of it had an adverse effect on the financial markets across the world, leading to plummeting stock prices (Bai et al., 2023). Positive sentiment however, alleviated this adverse effect, while negative sentiment exacerbated it, especially in moments when the effects of the pandemic intensified (Bai et al., 2023). This can be interpreted as positive – and negative sentiment displayed in the media, additionally alleviating, or exacerbating the adverse effects of the COVID-19 pandemic on top of the previously discussed effect of moving sentimental investors[33]. This hints at a more pronounced positive relationship between positive media sentiment and IPO underpricing and a more pronounced negative relationship between negative media sentiment and IPO underpricing during the COVID-19 period. As investors sought out information in the media on the impact of COVID-19 on possible investments as per Smales (2020), it follows that companies that lost little, or gained from the COVID-19 pandemic, received (more) positive sentiment while companies that were negatively affected received (more) negative sentiment. The positive and

[33] It is expected that during the COVID-19 period the effect will be more pronounced increasing or decreasing the first-day closing price of the IPO stock, contributing to more or less underpricing.

negative sentiment in this media coverage could have further affected the investors seeking COVID-19 impact information on investments, with positive sentiment reassuring these investors and negative sentiment further unnerving investors. It follows that IPO firms that received positive sentiment during this period due to a limited effect or positive effect from the COVID-19 pandemic garnered increased interest from investors which drove up the first-day closing price while the opposite was true for IPOs that received a lot of negative sentiment due to being negatively affected by the COVID-19 pandemic as per Bai et al. (2023). It is assumed that the IPOs that received increased positive sentiment due to COVID-19 pandemic only having a limited or even positive effect on the IPO firm, were looked even more favourably upon during the COVID-19 period, since there were only a limited number of investments available that were not severely negatively impacted by the COVID-19 pandemic (Smales, 2020). Positive sentiment connected to the impact of COVID-19 became a driving factor, leading to a more pronounced effect of positive sentiment in media coverage during the COVID-19 period. On the contrary, negative sentiment connected to the COVID-19 pandemic due to the IPO being severely negatively affected by the COVID-19 pandemic, were possibly even more actively avoided by investors during this period inducing a more pronounced effect. This predicts a more pronounced positive relationship between positive media sentiment and IPO underpricing and a more pronounced negative relationship between negative media sentiment and IPO underpricing during the COVID-19 period.

The results suggest that sentiment contained in media coverage could have had a more pronounced effect during the COVID-19 period. While positive sentiment alleviated the COVID-19 pandemic and reassured investors of a relatively safe investment during the COVID-19 period, negative sentiment exacerbated the effect and unnerved investors. The following hypotheses are formulated:

Hypothesis 5: During the COVID-19 period, the impact of the positivity of the tone of media coverage in the week prior to the IPO completion is more pronounced on IPO underpricing during the first trading day.

Hypothesis 6: During the COVID-19 period, the impact of the negativity of the tone of media coverage in the week prior to the IPO completion is more pronounced on IPO underpricing during the first trading day.

Table 1
This table displays the predicted relationships between the media coverage variables and first-day IPO underpricing.

Variable	Hypothesized	Information asymmetry	Marketing considerations	Investor sentiment	Empirical findings
MedVol	+/-	-	+/-		+/-
MedPos	+	-	+/-	+	+
MedNeg	-	-	+/-	-	-

3. Methodology

This chapter delves into the methodology of the research. In section 3.1 the variables for the research and the measurement of these variables are described, in the order of dependent, independent and control variables. This is concluded with a table of all the variables and the measurements and sources of these. In section 3.2 the sample and data sources for the variables are discussed. In section 3.3 research methods that have been used to tackle similar research questions are explored followed by the selection of the most appropriate method for this research. Finally, in section 3.4 the empirical models are developed and elaborated on.

3.1 Variables and measurement

3.1.1 Dependent variable

This study regards one dependent variable: IPO underpricing on the first trading day. In the IPO literature, underpricing is calculated as the percentage change of the closing price on the first-day and the initial – or offer price set by the issuing firm (DuCharme et al., 2001; Pollock & Rindova, 2003; Bajo & Raimondo, 2017; Zou et al., 2020; Mazumder & Saha, 2021). In the literature IPO underpricing is sometimes interchangeably referred to as initial returns but follows the exact same measurement as that of IPO underpricing (Bajo & Raimondo, 2017; Mazumder & Saha, 2021)[34]. Following the literature the dependent variable of first-day IPO underpricing is the percentage change between the offer price and the closing price on the first day. No other measurements of IPO underpricing are known to the author of this paper and are thus not accounted for. Table 2 presents the measurement for IPO underpricing.

3.1.2 Independent variables

Three independent variables are considered for this study to measure the effect of media coverage on IPO underpricing. The first variable is the sheer newspaper volume of media coverage one week prior to the IPO. The measurement of this, is simply the total count of media articles from news outlets mentioning the IPO firm one week prior to the IPO as also done by Pollock & Rindova (2003); Liu et al. (2007); Guldiken et al. (2017); Bajo & Raimondo (2017). Other measurements such as total word count might be used for robustness' sake (Bajo & Raimondo, 2017). In this, the article need not necessarily mention the upcoming IPO of the firm but only mention the IPO firm. Since the IPO of the

[34] These authors also use these terms interchangeably throughout their respective papers.

firm is highly newsworthy, it is however likely that the great majority of the articles will mention the IPO in the week prior.

The other two independent variables relate to the content of the articles: specifically, sentiment displayed in the news article either positive and/or negative. In comparable research, different methods to capture the sentiment of a news article have been used. Pollock & Rindova (2003) used the Janis-Fader coefficient of imbalance to measure the sentiment of media coverage. In this, the total 'tenor' of a certain IPO firm is calculated by relating the number of positive and negative articles to the total number of articles (Pollock & Rindova, 2003). To determine the sentiment of a single article, key words related to positivity and negativity are used (Pollock & Rindova, 2003). Dichotomizing this as positive or negative based on the highest number of keywords relating to a sentiment disregards the possibility of an article containing multiple sentiments as suggested by (Lamertz & Baum, 1998). To counter this, Pollock & Rindova (2003) looked at each paragraph separately and dichotomized the article as positive or negative based on the number of positive and negative paragraphs.

Bajo & Raimondo (2017) chose the textual analysis approach of Loughran & McDonald (2011) to measure the media coverage sentiment of an IPO firm. This method prescribes searching inside the news article for words that are likely associated with a certain sentiment, in this case positivity or negativity (Bajo & Raimondo, 2017). As opposed to dichotomizing the article as positive or negative, this method employs a 'bag of words' approach in which the frequency of these positive or negative words relative to the total wordcount of the article are considered (Loughran & McDonald, 2011). The positive or negative tone for a company is then computed by averaging the detected tones in the articles regarding this company. Guldiken et al. (2017) used the same approach for calculating uncertain sentiment. This method further counters the problem of dichotomizing an article and possibly disregarding other displayed sentiments in the news article as proposed by (Lamertz & Baum, 1998).

For this research the choice falls on the method of Loughran & McDonald (2011) to attempt to fully capture the positive and negative sentiment of each individual article. Table 2 presents the specific measurements for these three media coverage independent variables. Articles are retrieved one week prior to the IPO completion date. Appendix A shows examples of how news articles were analysed.

Pollock & Rindova (2003) does not indicate what specific keywords were used for the identification of the positive sentiment. Loughran & McDonald (2011) developed a list of words specifically suitable when the article is written in a financial context, for a wide variety of sentiments including positive and negative sentiments which were also used by Guldiken et al. (2017) and Bajo & Raimondo (2017). To ensure that the composition of the positive and negative words are beyond the researchers control, to limit bias in this regard, the word lists for positive and negative sentiment of Loughran & McDonald (2011) are used. These two word lists consist of over 300 positive – and 2300 negative words[35].

[35] Due to the length of these word lists these are not included in this paper. They can be found here: Loughran & McDonald (2022). Master Dictionary w/ Sentiment Word Lists. Retrieved on 11 January, 2023 from https://sraf.nd.edu/loughranmcdonald-master-dictionary/

3.1.3 Control variables

To rule out alternative explanations for the effect of media coverage on IPO underpricing, several alternative explanations are controlled for. The offer price and – size have served as explanations in the past, for IPO underpricing. Offer size was controlled for by Guldiken et al. (2017) as it may be assumed that the absolute value of the offer size (size of the IPO) can have additional effects on the amount of underpricing. Similar to the offer size the absolute value of the offer price can also have an effect on IPO underpricing. The choice of offer price contains signals for investors. Similar to signalling by underpricing as described by Allen & Faulhaber (1989), the choice of offer price can also signal to investors in what state the company is in[36]. Next up, Firm age, controlled for by Bajo & Raimondo (2017) and Guldiken et al. (2017), since the expectation is that older firms will outperform younger firms due to having a track-record (Ritter, 1998), measured as the years between founding – and IPO date[37]. The size of the firm can have a similar effect to that of age. When a firm is larger it is likely to attract more attention which can affect the results between media coverage and IPO underpricing. Firm size is measured in the total number of employees in the year of the IPO as also done by Guldiken et al. (2017). Additionally, since the timing of the media coverage plays a role in IPO underpricing (Bajo & Raimondo, 2017) the duration in days between announcement of the IPO and IPO listing is also included as a control variable which was also found to be influencing IPO underpricing by Johan (2010). Lastly, several dummy variables are included to the model that have in the past shown to have an effect on IPO underpricing. A dummy variable is included for the stock exchange, NYSE or NASDAQ which was identified by Loughran (1993) to play a role in IPO underpricing and used by Guldiken et al. (2017). A dummy variable for whether a firm was VC-backed or not is also included. Firms that are VC-backed are generally regarded to be of higher quality, by investors and being VC-backed thus sends a signal to investors. Additionally the venture capitalists can also influence the IPO process (Lee & Wahal, 2004). VC-backing was also controlled for by Bajo & Raimondo (2017) and Guldiken et al. (2017). Lastly, dummy variables for industry, based on SIC-codes, and the year are included as also done by Bajo & Raimondo (2017) and Guldiken et al. (2017). Guldiken et al. (2017) also controlled for board characteristics since these characteristics are used by investors as signals to value the IPO firm. Availability of this data is a problem however, so these are not included. The same goes for the lockup control variable of Bajo & Raimondo (2017) which was used to determine the effect of the presence of a lockup period. To avoid extreme values from influencing the results, several of the non-dummy variables are converted to the natural logarithm. Total proceedings are not included in the model due to the high correlation with both offer price and – size Table 2 presents the specific measurements for these control independent variables. All currency values are measured in the currency of the market, the: USD.

[36] A high offer price could signal that the main priority of the IPO firm is to cash out. A lower offer price could signal that the IPO firm can afford to leave money on the table (Allen & Faulhaber, 1989).
[37] The IPO date and IPO completion date are used interchangeably, the day the shares start trading.

Table 2
Variables and measurements. This table displays the variables used in the regression models and the measurements of these variables including sources for the measurements and data.

	Measurement	Source	Data source
Dependent variable			
First-day underpricing	$\frac{\text{Price}_{\text{Closing}} - \text{Price}_{\text{Offer}}}{\text{Price}_{\text{Offer}}} * 100$	E.g., Bajo & Raimondo (2017)	Zephyr
Independent variables			
Media coverage volume	Natural logarithm of the count of media articles mentioning the IPO firm one week prior to the IPO date.	Pollock & Rindova, (2003)	LexisNexis
Media coverage positive	$\sum_{i=1}^{n} \frac{Positive\ \%\ i}{\sum News\ articles}$ $Positive\ \%\ i = \frac{Positive\ wordcount}{Total\ wordcount}$	E.g., Bajo & Raimondo (2017)	LexisNexis/ LIWC
Media coverage negative	$\sum_{i=1}^{n} \frac{Negative\ \%\ i}{\sum News\ articles}$ $Negative\ \%\ i = \frac{Positive\ wordcount}{Total\ wordcount}$	E.g., Bajo & Raimondo (2017)	LexisNexis/ LIWC
Control variables			
Offer price	Natural logarithm of the offer price	(Guldiken et al., 2017)	Zephyr
Offer size	Natural logarithm of the total number of shares offered	(Guldiken et al., 2017)	Zephyr
Firm age	Natural logarithm of (year of date IPO listing – year of date founding of the firm)	E.g., Guldiken et al. (2017)	Ritter file
Firm size	Natural logarithm of the number of employees in the year of the IPO	Guldiken et al., 2017)	ORBIS
Duration	Natural logarithm of the difference in days between the announcement date of the IPO and the IPO listing date	Johan (2010)	Zephyr
Stock exchange dummy	Dummy variable for stock exchange	E.g., Loughran (1993)	Zephyr
VC-backed dummy	Dummy variable for VC-backing	(Bajo & Raimondo, 2017)	Ritter file
Industry dummy	Dummy variable for SIC-codes	(Guldiken et al., 2017)	ORBIS
Year/COVID dummy	Dummy variable for the year/COVID period	E.g., Bajo & Raimondo (2017)	Zephyr

3.2 Sample and data

3.2.1 Sample

To capture the effect of COVID-19 on media coverage and IPO underpricing, two samples are collected. The first sample period is chosen to capture the effect of the COVID-19 pandemic. The sample consists of IPOs on the US stock markets between the declaration of COVID-19 as a public health emergency in the US on January 31 2020 to December 31 2020 in accordance with other literature on IPO underpricing and the effect of COVID-19 (e.g., Baig & Chen, 2022). This sampling period captures the effect of the COVID-19 pandemic on the US market. The second sample comprises of IPOs in the pre-COVID-19 period from January 1 2019 to December 31 2019. This second sample captures the 'ordinary' IPOs on the US market during a period in which there was no great uncertainty caused by a global event. This paper exclusively considers IPOs that have confirmation of completion and thus does not include rumoured IPOs, withdrawn IPOs or failed IPOs as per Bajo & Raimondo (2017). Consistent with previous literature on IPO underpricing, this paper additionally excludes IPOs with an offer price below 5 USD, IPO firms that operate in the financial sector (SIC codes 6000-6999), spin-offs, and right issues as per e.g., Bajo & Raimondo (2017); Guldiken et al. (2017); Mazumder & Saha (2021).

The initial sample consisted of 416 completed IPOs during the period of 1 January to 31 December 2019 and 31 January to 31 December 2020. After removing IPOs from the financial sector (SIC-codes 6000-6999), 211 IPOs remained. This sample included spin-offs, right issues, and IPOs with an offer price below 5 USD. After excluding the spin-off and right issues IPOs, and the IPOs with an offer price below 5 USD, 199 IPOs remained. IPO firms with incomplete data were removed from the sample which narrowed the sample down to 164 IPOs. Lastly some IPO firms received no media coverage in the week prior to the IPO and were excluded from the sample, resulting in a sample of 158 IPOs. Three extreme outliers that were caused by data errors were removed from the sample, two from the COVID period and one from the pre-COVID period. The final sample comprises of 155 IPOs on the US market of which 69 IPOs were completed during the pre-COVID period and 86 IPOs during the COVID period. The 155 IPOs produced a total of 1818 news articles one week prior to the IPO.

A side note on the COVID sample of 86 IPOs is, that it could be argued that the COVID pandemic did not impact the American market until the mid of March 2020. The possible impact of this on the results is quite limited since only 6 IPOs were completed before March 2020 in the COVID period with the majority of these being completed near the end of February. Impact of the COVID pandemic was already noticeable near the end of February with the stock markets being plunged in COVID fears and several indexes posting their sharpest falls since 2008 (Zhang et al., 2020; BBC, 2020; Tappe, 2020). Appendix B shows the companies included in the sample.

3.2.2 Data

The first two data sources are the ORBIS M&A and Zephyr databases. These databases contain specialized data on M&As and IPOs and provide a wide range of data on these topics covering many years and countries. The Zephyr database (a subsidiary of ORBIS) provides the primary data on the IPOs. The Zephyr database provided the following data for this research: the company name and unique ISIN – and BVID numbers, IPO date, stock exchange and country, offer price, offer size, IPO listing/completion date, IPO announcement date, and closing price of the stock on the first trading day. The data that Zephyr provides is reviewed constantly and is based on articles written by distinguished news outlets, data given by companies themselves and data published by stock exchanges. ORBIS is primarily used as an additional source for missing values in the Zephyr database. These missing values occur likely due to the plans of ORBIS to replace Zephyr with a new database in the ORBIS domain which results in some data not being updated in Zephyr. The unique ISIN number, associated with the IPO of the firm and BVID number, will be used to avoid possible mismatches between companies with similar names or mismatches due to further public offerings of the firm. ORBIS additionally provides data for the size of the IPO firms in the form of number of employees in the year of the IPO and the SIC-codes of the IPO firms.

The last two control variables: VC-backing and firm age[38] are obtained from the comprehensive data files of Professor Ritter[39] which were also used by Bajo & Raimondo (2017) and Guldiken et al. (2017). Professor Ritter personally updates these files which also provides other data on IPOs which is generally difficult to obtain, or only accessible from very costly databases. These date files, unfortunately, did not receive timely updates for underwriter reputation, which is the reason why this was not controlled for in the tests later.

The fourth data source is the LexisNexis (Nexis Uni) database that will be used to obtain the news articles of the IPO firms one week prior to the IPO, to determine the media coverage and allow for a sentiment analyzation using textual analysis[40]. This covers the three independent variables. The Linguistic Inquiry and Word Count (LIWC) program is used for the textual analysis. By compiling a unique dictionary consisting of the words from the word lists of Loughran & McDonald (2011), each article is analysed. LIWC then provides the total word count of the article and the number of positive and negative words used in that article relative to the total word count. Only the body text of an article is analysed since the other parts of the article usually contain a lot of 'clutter'[41] words that could inflate

[38] While ORBIS does provide data on firm age, this is based on incorporation date and not the founding date which can vary widely.
[39] Data files can be found here: Ritter (2023) IPO Data. Retrieved on 2 April, 2023 from https://site.warrington.ufl.edu/ritter/ipo-data/
[40] The search for the articles allowed for common variations and abbreviations e.g. Group, Inc, Corp. The articles were searched on name of the IPO firm in the period one week before the IPO date. Later, using Excel formulas these were divided in three separate periods for the robustness test later on.
[41] Words that are not content-related but either related to Nexus Uni or the specific news outlet/author.

the total word count and misrepresent the sentiment displayed in the article[42]. Since some articles retrieved from LexisNexis contained hyperlinks[43], in the form of references, these were manually removed from the body text to prevent total wordcount inflation and its effect on the relative sentiment of an article. Furthermore, while LexisNexis generally has adequate built in filters for news coverage, occasionally items that did not resemble news coverage, showed up in the list. These were then removed.

3.3 Research method

The research will follow a quantitative approach utilizing a multivariate method in accordance with previous studies. The method that is widely used in the media coverage and IPO underpricing literature is the ordinary least squares (OLS) method. The OLS method was used by e.g., Pollock & Rindova (2003); Bajo & Raimondo (2017); Guldiken et al. (2017); Zou et al. (2020) to analyse the relationship between media coverage and IPO underpricing. The objective of all multivariate regression is to predict the outcome of the dependent variable based on a known value of the independent variables. The objective of the OLS method specifically is to find the least or minimum amount of the sum of squares due to error, also called residuals (Hair et al., 2010). OLS requires a metric dependent variable and -independent variables, but categorical variables can be included in the form of dummy variables (Hair et al., 2010). Since the method is fairly simple to conduct and the outcomes are also easy to understand, the method is quite popular (Hair et al., 2010).

Drawbacks of the OLS method are that to obtain reliable results, quite a few assumptions need to be fulfilled. An adequate sample size is required of at least 10 times the number of variables in the regression model, but most researchers suggest a stricter number of 15 times the number of variables (Hair et al., 2010). Apart from that, outliers or influential observations that deviate largely from the average have to be dealt with (Hair et al., 2010). These can be fulfilled by obtaining a large enough sample and removing or altering the influential observations from the dataset (Hair et al., 2010). A third assumption is, that there should be some form of linearity between the independent – and dependent variables (Hair et al., 2010). Furthermore, to receive unbiased results, there ought to be an equal variance between all observations (homoscedasticity) and there should not be perfect multicollinearity (correlation between independent variables) to influence the effect on the dependent variable (Hair et al., 2010). While some correlation between the independent variables is expected, this should be at a minimum. A difficult assumption to check is the independence of the error terms, which is often not statistically verified but verified by theoretical reasoning. Finally, to avoid endogeneity issues, the error

[42] This was done in the following way: since every article has the same layout, I flagged in LIWC to only consider the words between the words ‘body’ and ‘end of document’. This perfectly captures the body text.
[43] Hyperlinks can contain a very high wordcount and these were generally present in the articles of higher quality news outlets (e.g., The Washington Post, Financial Times et cetera.)

term should not be correlated with the independent variables the and the error terms should be normally distributed (Hair et al., 2010).

In line with previous studies, this research will make use of the OLS regression method to analyse the relationship between media coverage and IPO underpricing prior and during the COVID-19 period. The assumptions will be verified prior to analysing the data in the form of statistical test, graphs, and personal interpretation of these.

3.4 Empirical models & robustness

3.4.1 Empirical models

As mentioned in section 3.3 a multivariate analysis will be conducted using the ordinary least squares regression to test the relationship between media coverage and first-day IPO underpricing. The data on the IPO firms is cross-sectional. The empirical models are similar to previous studies examining the effect of media coverage on IPO underpricing (e.g., Bajo & Raimondo, 2017; Pollock & Rindova, 2003; Zou et al., 2020). The examination of the relationship utilizes the following empirical model to test the effect of media coverage proxies on IPO underpricing, specifically it pertains to testing hypotheses 1, 3 and 4:

$$(I)\ Underpricing_{i,t} = \alpha + \beta 1 MedVol_{i,t} + \beta 2 MedPos_{i,t} + \beta 3 MedNeg_{i,t} + \beta 4 OfferPrice_{i,t} + \beta 5 OfferSize_{i,t} + \beta 6 FirmAge_{i,t} + \beta 7 FirmSize_{i,t} + \beta 8 Duration_{i,t} + \beta 9 StockEx_{i,t} + \beta 10 Vc_{i,t} + \beta 11 Industry_{i,t} + \beta 12 Year_{i,} + \varepsilon_{i,t}$$

Where: $_i$ denotes an individual firm, $_t$ denotes the time in years, α the constant and ε the error term. Underpricing is the first-day percentage difference between the offer price and the closing price listed on the American market; MedVol is the total count of media articles mentioning the IPO firm one week prior to the IPO; MedPos is the average positive wordcount of the media articles compared to the total wordcount mentioning the IPO firm one week prior to the IPO; MedNeg is the average negative wordcount of the media articles compared to the total wordcount mentioning the IPO firm one week prior to the IPO; Offer price is the price for which a share is offered to the market by the issuing firm; Offer size is the number of shares offered to the public by the issuing firm; Firm age is the age of the IPO firm from the year of data founding of the firm and the year of data listing of the IPO; Firm size is the total number of employees of an IPO firm in the year of the IPO; duration is the number of days between the announcement and listing of the IPO on the market; StockEx is a dummy variable for the stock exchange on which the firm listed its IPO, either the NASDAQ or the NYSE; VC is a dummy variable for whether an IPO firm was VC-backed or not at the time of the IPO; Industry is a set of dummy variables for the SIC-codes that the IPO firms belong to; Year is a dummy variable for the year

in which the IPO firm completed its IPO. Finally, ε denotes the error term. Relationships are only deemed significant when the respective P-values are below 0.1, although stronger support is obtained when P-values are below 0.05 or 0.01.

The second empirical model is used to test the hypotheses 2, 5 and 6. It adds three interaction variables between the year, now called COVID, variable and the media coverage variables:

$$(II)\ Underpricing_{i,t} = \alpha + \beta 1 MedVol_{i,t} + \beta 2 MedVol_{i,t} * COVID + \beta 3 MedPos_{i,t} + \beta 4 MedPos_{i,t} * COVID + \beta 5 MedNeg_{i,t} + \beta 6 MedNeg_{i,t} * COVID + \beta 7 OfferPrice_{i,t} + \beta 8 OfferSize_{i,t} + \beta 9 FirmAge_{i,t} + \beta 10 FirmSize_{i,t} + \beta 11 Duration_{i,t} + \beta 12 StockEx_{i,t} + \beta 13 Vc_{i,t} + \beta 14 Industry_{i,t} + \beta 15 COVID + \varepsilon_{i,t}$$

3.4.2 Robustness

Additional robustness tests are conducted to determine whether the results hold under different conditions. The first concern is that media coverage volume can be measured in different ways. Media coverage volume is additionally measured in total number of words as opposed to exclusively in number of articles as per Bajo & Raimondo (2017) and for a third measurement, the duplicate articles are also included based on Tetlock (2011). The second concern is possible endogeneity between media coverage and IPO underpricing on the trading day itself. It is possible that during the first trading day it becomes clear that the IPO will be underpriced since the offer price and current trading price are known. This could lead to media coverage based on this observed underpricing on this day (Bajo & Raimondo, 2017). To alleviate this second concern, an additional test is run which restricts the media coverage sample to new articles before the IPO date[44]. A third concern is the timing of the media coverage. To this end another test is run in which the sample is divided in time-periods of received media coverage, as was also done by Bajo & Raimondo (2017). This can show the diminishing effect of media coverage volume and sentiments contained within, on IPO underpricing, as the media coverage moves further away from the IPO date as per the investor attention hypothesis that will be elaborated on later (Bajo & Raimondo, 2017). Another robustness is test is conducted using the Janis Fader coefficient of imbalance also used by Pollock & Rindova (2003) to measure the sentiment, or tenor, a firm received based on the number of positive and negative articles. This measure relates positive, and negative sentiment instead of measuring these independently. Another robustness test is conducted in which the continuous variables are winsorized to account for possible spurious outliers influencing the results. A final concern is that some IPOs were not completed after the mid of March 2020 and possibly being unaffected by the COVID-19 pandemic. An additional robustness test, excluding the IPOs prior to the Mid of March, for the interaction effect between COVID-19 and the media coverage variables is conducted.

[44] It thus excludes all media coverage on the IPO date itself.

4. Results

This chapter presents the results of the paper. Section 4.1 displays a multitude of descriptive statistics and a discussion of these based on prior studies. This section is concluded with a Pearson's Correlation matrix to display the individual correlations between the variables. Section 4.2 discusses the assumptions of OLS and to what degree the empirical models meet the assumptions and the consequences of this. Section 4.3 delves into the multivariate regression results of both empirical models in which the results are briefly discussed as a prelude for the discussion in chapter 5. Finally section 4.4 presents a couple of robustness tests for as far as these were not accounted for in the results section.

4.1 Descriptive statistics

Table 3
This table reports the descriptive statistics for the 155 IPOs that went public on the US market between 1 January 2019 to 31 December 2019 and 31 January 2020 to 31 December 2020. Panel A reports the IPO - and firm characteristics. Underpricing is the difference between the first day closing price and the offer price divided by the offer price. Offer price is the price the IPO offered its shares for to the public. Offer size is the number of shares offered to the public by the IPO firm. Firm age is measured in years from the founding date to the IPO date. Firm size is the number of employees in the year of the IPO. The duration in days is the total duration of the IPO from announcement date to completion date. The stock exchange dummy assumes a value of 1 if the IPO was listed on the NYSE and a value of 0 if the IPO was listed on the NASDAQ. The VC-backing dummy assumes a value of 1 if the company was backed by venture capital prior to the IPO or 0 if not backed by venture capital. Media volume is the total number of news articles written about the company a week prior to the IPO, number of words is the total number of words about the IPO in the news articles a week prior to the IPO, positive and negative sentiments are the averages of the positive and negative tones across the news articles a week prior to the IPO.

Variable	*Obs*	*Mean*	*Median*	*St. Dev.*	*Min*	*Max*
Panel A: IPO and firm characteristics						
Underpricing	155	0.38	0.29	0.49	-0.84	2.01
Offer price	155	19.90	17.00	13.59	5	120
Offer size (in thousands shares)	155	18,218	10,350	35,165	575	380,880
Firm age in years	155	16.41	9.54	24.67	1.73	179
Firm size	155	3,373	143	24,297	3	300,000
Duration in days	155	45.44	27.00	52.15	0	344
Stock exchange dummy	155	0.19	0	0.4	0	1
VC-backed dummy	155	0.77	1	0.42	0	1
Panel B: Media coverage characteristics						
Media volume	155	11.74	8	17.03	2	155
Number of words	155	4,026	1,847	8,803	381	78,267
Positive sentiment (%)	155	0.41	0.36	0.28	0	1.54
Negative sentiment (%)	155	0.36	0.29	0.30	0	1.81

Panel A of table 3 displays the descriptive statistics of the total sample at the IPO - and firm level for dependent and control variables. The underpricing is the percentage difference between first-day closing price and the offer price set by the IPO firm. The IPO firms displayed an average (median) underpricing of 38% (29%) with an average (median) offer price of 19.90 USD (17.00) and on average an IPO offered slightly above 18.2 million shares (10.3 million median) to the public. Not reported in the table[45], but the average firm collected nearly 426 million USD in proceedings from the IPO. The age of the firm was almost 16.5 years before commencing the IPO (9.5 years median). On average the IPO firm had a size of 3,373 employees (143 median) in the year of the IPO and about 77% of the IPOs were backed by venture capital. The duration of the IPO was on average roughly 45 days (27 days median) from announcement to completion. Only 19% of the firms went public on the NYSE while 81% went public on the NASDAQ stock exchange.

Panel B of table 3 displays the descriptive statistics of the independent variables of media coverage received by the IPOs a week prior to the IPO and results obtained from the textual analysis of the articles in the form of total word count, positive word count, and negative word count. On average an IPO firm received almost 12 news articles (8 median) in the week prior to the IPO which amounted to an average of 4,026 words (1,847 median). On average an IPO received 0.41% (0.36% median) positive sentiment across all the news articles covering the IPO firm a week prior to the IPO and 0.36% negative sentiment (0.29% median).

This sample displays different characteristics when compared to prior studies. Bajo & Raimondo (2017) display an average underpricing of 27% for IPOs between January 1995 and December 2013 compared to the 38% underpricing of this sample. A more recent sample from Baker et al. (2021) finds 17.31% average underpricing in the period 2008 to 2018. Mazumder and Saha (2021) found 13.8% average underpricing in 2019 and 27.3% in the first half of 2020. IPOs in the sample of Bajo & Raimondo (2017) appear a lot smaller with average proceedings of 102 million USD compared to the average proceedings of almost 426 million USD in this sample. The average IPO appears to have become larger. Mazumder and Saha (2021) find average proceedings similar to Bajo & Raimondo (2017) in 2019 and 2020 of around 158 million USD. IPOs in this sample also have a higher VC-backing frequency when compared to the Bajo & Raimondo (2017) and Mazumder and Saha (2021) studies, 77% versus 48% and 47% respectively, while the average age of the IPO firm is almost identical. In terms of media coverage the volume does not differ a lot, but this sample received more positive tones as opposed to the Bajo & Raimondo (2017) sample, 0.41% versus 0.28% while the received negative sentiment is slightly lower in this sample 0.36% versus 0.41%. The sample of Guldiken et al. (2017) reports similar numbers for average media coverage per IPO firm for a sample of IPOs from 2006 but the firms in this sample are a lot younger with an average of just 7.4 years compared to the average age

[45] Not reported because it is not used in the empirical models. This due to the high multicollinearity that exists between proceedings and IPO offer price – and size since IPO proceedings is made up out of the product of these two variables.

of this sample of 16.4 years. Similarly, the firms in the sample of Mazumder and Saha (2021) displayed an average age of only about 5.4 years. The sample of Guldiken et al. (2017) is dominated by IPOs going public on the NYSE as opposed to this sample of IPOs that predominantly completed the IPO on the NASDAQ. An older sample of Pollock & Rindova (2003) of IPOs completed in 1992 finds average underpricing of just 11.68% and an average of about 2 news articles about the IPO. Overall this sample displays mostly different characteristics as opposed to the samples of previous studies which should be taken into account when interpreting the results.

Table 4
Distribution of the sample of IPOs across industries based on the first digit SIC-code as per Guldiken et al. (2017) and the corresponding first-day underpricing and media volume means and medians. Underpricing (UndFD) is the first day closing price and the offer price divided by the offer price and media volume (MedVol) is the total count of media articles one week prior to the IPO.

Industry by first digit SIC-code (major division)	*Freq.*	*Mean UndFD*	*Median UndFD*	*Mean MedVol*	*Median MedVol*
Agriculture, forestry, fishing (0100-0999)	1	4.17%	4.17%	7	7
Mining (1000-1499)	1	-5.71%	-5.71%	7	7
Manufacturing (2000-3999)	35	43.46%	31.82%	9.91	7
Transportation & Public utilities (4000-4999)	1	9.95%	9.95%	7	7
Wholesale trade (5000-5199)	1	65.71%	65.71%	7	7
Retail trade (5200-5999)	8	36.5%	34.83%	10.88	9
Services (7000-8999)	108	36.87%	28.32%	12.56	8
Total	155	37.87%	28.63%	11.74	8

Table 4 displays the distribution of the IPO firms across industries with the average amount of underpricing and media coverage per industry. The IPOs represent a total of 7 industries but are quite concentrated, with the large majority of the IPOs operating within the services, manufacturing industries and retail trade industries. In terms of underpricing, the wholesale trade suffered the highest underpricing but is represented by just one IPO followed by the manufacturing industry which is represented by 35 IPOs. The retail and services industry experienced similar underpricing. Media volume seems to be well distributed with the services industry on average receiving the most media coverage followed by the retail and manufacturing industries. The medians of media volume are also very similar. This also means that the sample is not completely representative of all IPOs on the American market, since two industries dominate the sample. However, when compared to all IPOs on the American market available in the Zephyr database, the distribution of industries is not very surprising. Around 73.5% of all 17,998 IPOs[46]

[46] The total IPOs amount to 24,685, 17,998 is excluding the financial firms (SIC 6000-6999) in accordance with the sample used in this paper. Further exclusions are not accounted for, so the % might differ slightly.

are from the services and manufacturing industries. It is important to keep in mind that some industries are underrepresented in this sample, but these are generally underrepresented in the IPO market. The remaining 26.5% are divided over 8 industries. For example, only 0.57% of all 17,998 IPO firms were operating in the Agriculture, forestry, fishing industry.

Panel A of table 5 shows the differences between the pre-COVID-19 - and COVID-19 periods for the IPO – and firm characteristics. Two tests for each variable are included. Since the variables do not always display equal variance across the two periods, violating the homogeneity assumption, the Welch t-test was conducted instead of a regular two samples t-test. For some variables the normality assumption was violated for one of, or both groups as well so in addition a non-parametric test: the Mann-Whitney U test was conducted for all variables. For all variables the shapes of both periods are rather similar and is thus interpreted as a test for the difference in medians. The amount of underpricing shows a significant result for both tests leading to a rejection of the null-hypothesis that underpricing is the same in the pre-COVID-19 period as in the COVID-19 period at the 1% level. IPOs completed during the COVID-19 period experienced significantly more underpricing than IPOs that were completed during the pre-COVID-19 period. There is also support for a difference in the offer price and – size with both being higher in the COVID-19 period. It seems that during the COVID-19 period, IPO firms were more confident and established higher offer prices than in the pre-COVID-19 period and at the same time offered more shares to the public. This means that IPOs during the COVID-19 period were on average larger since both the offer price and offer size are larger. The age of the firms, size measured in number of employees, and the degree of VC-backing do not significantly differ over the two periods. The IPO firms across the two periods thus mostly show similar firm characteristics. The duration of IPOs, the time between announcement date and completion date, seems to be longer in the pre-COVID-19 period showing significance at the 5% level for the t-test and significance at the 1% level for the Mann-Whitney U test. During the pre-COVID-19 period IPOs were either announced sooner or took longer to complete. There appears to be no difference in the decision for stock exchange listing, with the NASDAQ being the preferred stock exchange in both the pre-COVID-19 – and COVID-19 periods. For the t-tests the natural logarithm is taken of the offer price, offer size, firm age, firm size, and duration to limit the influence of extreme values.

In panel B of table 5 the differences across the two periods of the independent variables of media coverage are shown. There seems to be no difference between the two periods in terms of number of news articles, with both the means and medians showing almost no difference across the two periods which also holds for the total number of words. IPO firms appear to have received a similar amount of news coverage in both periods. The positive sentiment displayed appears to be the same across the two periods. This is surprising since it is reasonable to expect that IPOs in the pre-COVID-19 period would

have received more positive sentiment than during the COVID-19 period[47]. The negative sentiment however shows a significant difference at the 1% level for the t-test and for the Mann-Whitney U test. IPO firms in the pre-COVID-19 period received significantly more negative sentiment as opposed to the IPO firms in the COVID-19 period. This is even more surprising since the COVID-19 pandemic had severe economic consequences and generally had a negative effect on the performance of businesses all across the world (Donthu & Gustafsson, 2020). It is then logical to assume that firms that complete their IPO during the COVID-19 period received more negative tones as opposed to the firms that completed their IPOs in the pre-COVID-19 period. This is not the case for this sample. Figure 2 depicts the patterns in underpricing for the two periods per quartile.

Table 5
Descriptive statistics of the variables of the sample split into the pre-COVID-19 period and COVID-19 period. The definitions are the same as presented in table 3. Panel A displays the IPO - and firm characteristics and panel B the media coverage characteristics. Columns 1-3 present descriptive statistics for the pre-COVID-19 period and columns 4-6 for the COVID-19 period. The last two columns, 7 and 8, present t-tests and Mann-Whitney U tests of differences, between the two periods for IPO – and firm characteristics and media coverage characteristics.

Variable	Pre-COVID-19 (2019)			COVID-19 (2020)			Test of differences	
	Mean	*Median*	*St. Dev.*	*Mean*	*Median*	*St. Dev.*	*Welch t-test*	*Mann-Whitney U test*
Panel A: IPO and firm characteristics	(1)	(2)	(3)	(4)	(5)	(6)	(4-1)	(5-2)
Underpricing	0.24	0.2	0.36	0.49	0.34	0.55	0.25***	0.14***
Offer price	17.99	16	9.16	21.43	19	16.19	3.44*	3***
Offer size (in thousands)	20,944	7,891	50,217	16,030	11,270	14,564	-4,914	3,379**
Firm age in years	16.56	10.34	25.66	16.29	8.97	24	-0.27	-1.37
Firm size	1,896	171	4,793	4,559	121	32,373	2,663	-50
Duration in days	49.51	28	54.51	42.17	23	50.26	-7.34**	-5***
Stock exchange dummy	0.23	0	0.425	0.16	0	0.371	0.07	0
VC-backed dummy	0.77	1	0.425	0.77	1	0.425	0	0
Panel B: media coverage characteristics								
Media volume	11.81	7	15.23	11.79	8	18.43	-0.02	-1
Number of words	4,332	1,848	8,700	3,779	1,843	8,928	-553	-5
Positive sentiment (%)	0.45	0.42	0.32	0.39	0.32	0.25	-0.06	-0.1
Negative sentiment (%)	0.44	0.31	0.35	0.30	0.27	0.24	-0.14***	-0.04***

*** Denotes significance at the 1% level.
** Denotes significance at the 5% level.
* Denotes significance at the 10% level.

[47] Since the COVID period was inherently an uncertain in which less positiveness and more negativity is expected.

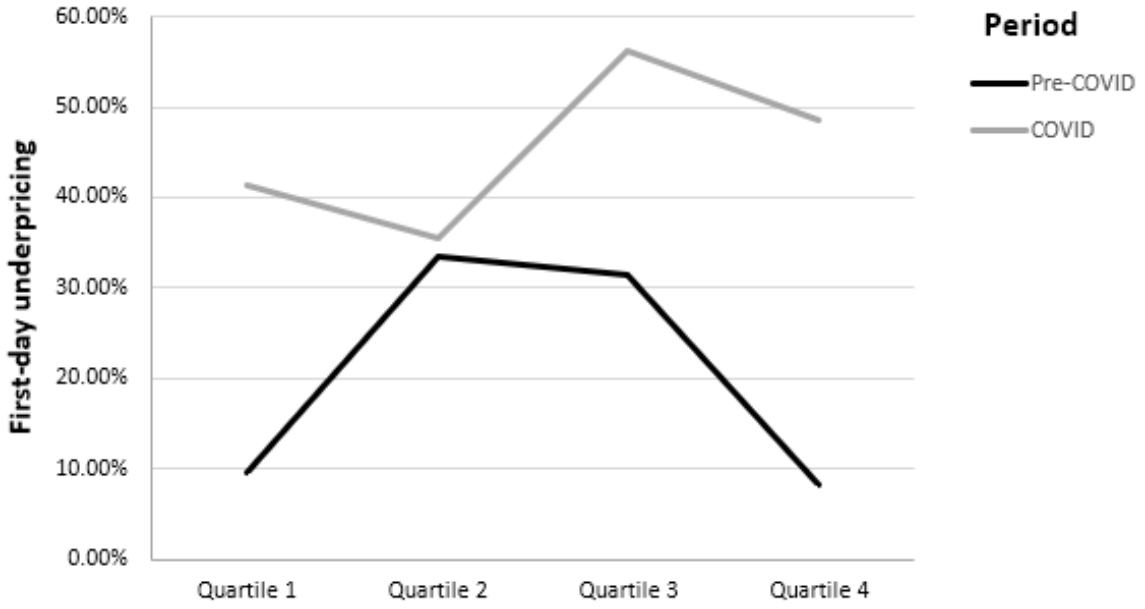


Figure 2 *Difference in underpricing between the pre-COVID-19 and COVID-19 periods per quartile*

To check the robustness of the difference in underpricing between the two periods, Table 6 displays the amount of money left on the table across the two periods. In the pre-COVID-19 period the IPOs left 7.35 billion USD on the table, averaging 106.5 million USD per IPO. In the COVID-19 period IPOs left almost 22 billion USD on the table averaging about 255 million USD per IPO. This is similar to the reports of Ritter (2023) that reported average money left on the table of 6.93 billion USD for 2019 and 29.66 billion USD for 2020. Prior studies generally do not report the money left on the table statistic and leave out variables necessary to calculate this for the respective samples, so further comparison is an arduous task. The tests display significant results at the 5% level for the t-test and 1% level for the Mann-Whitney U test providing additional support for the difference in underpricing between the two periods. Figure 3 visualizes the money left on the table. During COVID-19 period, more IPO firms left amounts above the 100 million the table as opposed to the pre-COVID-19 period, and fewer left smaller amounts on the table.

Table 6
Descriptive statistics for the amount of money left on the table by IPOs. Money left on the table is the difference between the total proceedings (offer price*number of shares offered) and the first day closing price*the number of shares offered. Columns 1-3 present descriptive statistics for the pre-COVID period and columns 4-6 for the COVID period. The last two columns, 7 and 8, presents t-tests and Mann-Whitney U tests.

Variable	Pre-COVID period (2019)			COVID period (2020)			Test of differences	
	Mean	*Median*	*St. Dev.*	*Mean*	*Median*	*St. Dev.*	*Welch t-test*	*Mann-Whitney U test*
	(1)	(2)	(3)	(4)	(5)	(6)	(4-1)	(5-2)
Money left on the table (USD million)	106.5	28.18	300.5	255	91.82	651.4	148.5**	63.64***

*** Denotes significance at the 1% level.
** Denotes significance at the 5% level.
* Denotes significance at the 10% level.

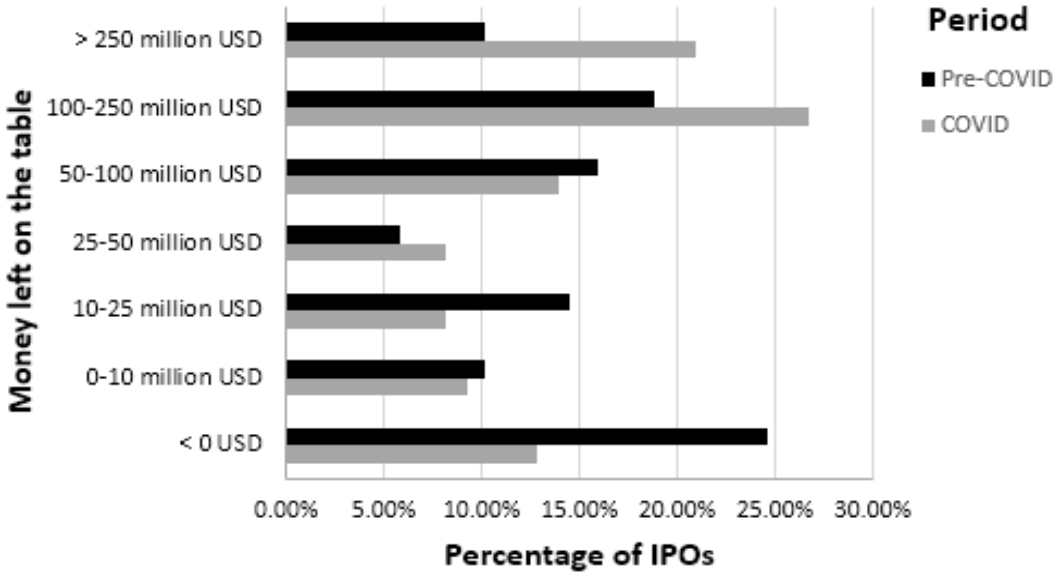


Figure 3 *Differences in money left on the table between the two periods*

Table 7 presents the correlations between the variables used in the regression models in the form of a Pearson correlation matrix. Here the most noteworthy correlations are discussed and compared to prior studies, and when possible, an attempt is made to explain the correlations. All statistically significant correlations are highlighted in bold. Offer price, media volume and positive sentiment show significant correlations with the underpricing of an IPO. All correlations are below 0.3 but above 0.1, displaying a weak relationship. Increases in media coverage and positive sentiment in this media coverage is associated with higher underpricing. This is in line with the findings of Bajo & Raimondo (2017). A higher offer price also shows a positive relationship with underpricing. This is in line with the results of Boulton et al. (2017) and Mazumder and Saha (2021) that found a positive relationship between the offer price and IPO underpricing, possibly due to higher offer prices signalling a higher quality IPO firm. A higher offer price can also signal to investors that they are willing and can afford to take a risk. Offer prices and offer sizes are also moderately to highly correlated with the independent media coverage variables. Higher offer prices and offer sizes are an indicator of larger IPOs and thus also likely of larger firms that are deemed more relevant by the media to cover and thus receive more media coverage[48]. This is in line with the findings of Guldiken et al. (2017) and Bajo & Raimondo (2017). Larger and older firms tend to list on the NYSE instead of the NASDAQ, with the stock exchange dummy showing moderately strong significant correlations with both firm age and firm size. This could be explained due to the NASDAQ generally being home to highly innovative technology firms that have emerged in recent times and has listing requirements that are easier to comply to for newer companies as opposed to the NYSE that is home to more vested and stable companies. This is line with the findings

[48] The product of these two variables is the proceedings of the IPO which is generally a measurement for the size of an IPO.

of Guldiken et al. (2017) that found negative correlations between size and age of the IPO firm and listings on the NASDAQ. Since firms listed on the NYSE are generally older and larger firms it reasonably follows that firms listed on the NYSE receive more media coverage. There are positive correlations between firms listed on the NYSE and the media coverage variables further supporting this. There are also moderately strong correlation between positive and negative sentiment and volume. Due to these correlations, these variables are tested in the full regression models and separately to prevent these correlations from influencing the results. Since there exist some moderate to strong correlations between control variables and independent variables, which could influence the results[49], this is taken into account when conducting the tests. Further correlations in table 7 are not surprising

4.2 Assumptions

Before conducting the multivariate regression analyses, the assumptions of linear - and OLS regression are verified to establish the value of the results. The sample size of 155 is at least 10 times the observations of the number of variables used in the regression models (Hair et al. 2010). The non-metric variables were converted into dummy variables. Influential observations are dealt with by taking the natural logarithm of most variables. This limits the effect of extreme values that variables display (Hair et al. 2010). Three outliers were removed due to data-errors that influenced the results greatly. Some smaller outliers remain in the sample. There is no valid reason for removing these outliers since these are legitimate observations and represent natural variations in the dataset. Smaller size outliers were also not removed by Bajo & Raimondo (2017) and Guldiken et al. (2017). Linearity is assumed based on the scatterplot shown in appendix C. While some variations occur, the models are mostly linear and should not result in any serious violation of the models on account of linearity. The p-p plots and histograms also depict mostly normal distributions in appendix C. It could be argued that the models are not completely normally distributed. This should be taken into account when interpreting the results[50] (Hair et al. 2010). Since the sample size is of a sufficient size, this assumption can largely be ignored. Due to the central limit theorem, a slight violation of the normality assumption should not lead to biased results (Hair et al. 2010). The assumption of homoscedasticity is also met for the regression models. Appendix C shows scatterplots with standardized residuals and predicted values for the regression model. The scatterplots show no clear signs of heteroscedasticity. Additionally the Breusch Pagan test shows insignificant results for both models which provides additional evidence that the assumption of homoscedasticity for the regression models are met (Breusch & Pagan, 1979). Multicollinearity appears to give no issues. All VIF-values are below 5 which is generally accepted (Hair et al. 2010). Appendix C two tables of the VIF values for the regression models.

[49] Mostly the media volume independent variable that shows moderate to strong significant correlations with the offer price and offer size variables.
[50] While normality is not necessarily important for the interpretation of the full model, it is important for interpreting individual P-values (Hair et al. 2010).

Table 7
Correlation matrix. Values ranging from -1 to 1 showing the positive and negative correlation between the variables of the regression model. Significant correlations are in bold. Two-tailed significance levels. VIF-values are well below 5 indicating that multicollinearity is not an issue in the regression models as shown in appendix C.

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1 Underpricing	1											
2 Offer price	**0.279****	1										
3 Offer size	0.032	0.133	1									
4 Age	-0.054	-0.009	**0.452****	1								
5 Firm size	-0.075	0.017	**0.163***	**0.276****	1							
6 Duration	-0.098	-0.152	0.046	0.030	0.104	1						
7 Stock exchange dummy	0.005	**0.241****	**0.377****	**0.294****	**0.212****	-0.015	1					
8 VC-backed dummy	0.117	0.153	**-0.214****	**-0.491****	**-0.195***	**-0.343****	**-0.195***	1				
9 Media volume	**0.167***	**0.651****	**0.295****	0.050	0.096	-0.057	**0.257****	0.072	1			
10 Positive sentiment	**0.233****	**0.281****	**0.182***	0.115	0.036	-0.004	**0.216****	-0.085	**0.282****	1		
11 Negative sentiment	0.045	**0.250****	**0.278****	-0.087	0.094	-0.001	**0.189***	0.088	**0.524****	**0.409****	1	
12 Year	**0.245****	0.126	-0.070	-0.005	0.055	-0.070	-0.087	-0.001	-0.002	-0.102	**-0.235****	1

** Denotes significance at the 1% level.
* Denotes significance at the 5% level.

4.3 Multivariate results

Table 8
Media coverage predictors and IPO underpricing. This table displays the regression results for a set of four ordinary least square regressions in which the dependent variable is first-day IPO underpricing, with the independent variables of media coverage volume, positive sentiment and negative sentiment, and control variables often attributed to explanations of IPO underpricing, as well as industry and year effects. In models 1-3 the independent variables are measured independently in the model. Model 4 displays the full regression model. Underpricing is the difference between the first day closing price and the offer price divided by the offer price. Media coverage volume is the total count of news articles received by the IPO firm one week prior the IPO. Positive and negative sentiments are the averages of the positive and negative tones of the news articles. Offer price is the price the IPO offered its shares for to the public. Offer size is the total number of shares offered by the IPO firm to the public. Firm age is measured in years from the founding date to the IPO date. Firm size is the number of employees in the year of the IPO. The duration in days is the total duration of the IPO from announcement date to completion date. The stock exchange dummy assumes a value of 1 if the IPO was listed on the NYSE and a value of 0 if the IPO was listed on the NASDAQ. The VC-backing dummy assumes a value of 1 if the company was backed by venture capital prior to the IPO or 0 if the company was not backed by venture capital.

	(1)	(2)	(3)	(4)
	First-day underpricing	First-day underpricing	First-day underpricing	First-day underpricing
ln(Media coverage volume)	-0.047 (-0.451)			-0.029 (-0.268)
Positive sentiment (tone)		0.215** (2.542)		0.228** (2.481)
Negative sentiment (tone)			0.035 (0.399)	-0.038 (-0.386)
ln(Offer price)	0.459*** (3.684)	0.388*** (3.396)	0.436*** (3.790)	0.399*** (3.160)
ln(Offer size)	0.065 (0.474)	0.047 (0.354)	0.053 (0.391)	0.055 (0.682)
ln(Firm age)	-0.006 (-0.056)	-0.005 (-0.047)	0.013 (0.121)	-0.024 (-0.213)
ln(Firm size)	-0.156 (-1.017)	-0.206 (-1.372)	-0.178 (-1.135)	-0.187 (-1.213)
ln(Duration)	-0.023 (-0.262)	-0.054 (-0.614)	-0.029 (-0.325)	-0.050 (-0.572)
Stock exchange dummy	-0.043 (-0.469)	-0.053 (-0.598)	-0.050 (-0.547)	-0.049 (-0.539)
VC-backed dummy	0.011 (0.112)	0.040 (0.399)	0.014 (0.139)	0.040 (0.369)
Year and industry fixed effects	Yes	Yes	Yes	Yes
F-statistic	2.644***	3.179***	2.640***	2.793***
Observations	155	155	155	155
Adjusted R-squared	0.138	0.175	0.138	0.165

Standardized coefficients with t-statistics in parentheses
*** Denotes significance at the 1% level.
** Denotes significance at the 5% level.
* Denotes significance at the 10% level.

Table 8 presents the regression results of the first empirical model for the media coverage predictors:

$$(I)\ Underpricing_{i,t} = \alpha + \beta 1MedVol_{i,t} + \beta 2MedPos_{i,t} + \beta 3MedNeg_{i,t} + \beta 4OfferPrice_{i,t} + \beta 5OfferSize_{i,t} + \beta 6FirmAge_{i,t} + \beta 7FirmSize_{i,t} + \beta 8Duration_{i,t} + \beta 9StockEx_{i,t} + \beta 10Vc_{i,t} + \beta 11Industry_{i,t} + \beta 12Year_{i,} + \varepsilon_{i,t}$$

Models 1-3 present the models in which the media coverage predictors are tested individually while model 4 displays the full model including all three media coverage predictors[51]. Model 1 uses the total count of news articles written about an IPO firm a week prior to the IPO as a proxy for media coverage volume. Media coverage volume, in terms of the total count of news articles written about an IPO firm a week prior to the IPO, appears insignificant when controlling for a multitude of variables that have served as explanations for IPO underpricing in prior research.

The sheer volume of media coverage appears to not negatively affect the first-day underpricing of IPOs as predicted by the information asymmetry literature (e.g., Baron & Holstrom, 1980; Beatty & Ritter, 1986; Rock, 1986) nor positively or negatively affect first-day underpricing as predicted by the body of literature on marketing considerations of underpricing (e.g., Welch, 1992; Habib & Ljungqvist, 2001; Demers & Lewellen, 2002). The results found are in contrast to the results of Pollock & Rindova (2003); Chen et al. (2020) who found a significant negative effect of media coverage volume measured by the number of articles. The paper of Pollock & Rindova (2003) does however not mention what time period was used for the collection of news articles and the paper of Chen et al. (2020) does not make use of IPO specific control variables e.g., offer price or offer size. The results are also not in line with the positive relationships between media coverage volume and IPO underpricing found by DuCharme et al. (2001); Liu et al. (2007); Liu et al. (2008); Liu et al. (2014b). The papers of Liu et al. only found a positive relationship between media coverage volume and IPO underpricing when the original offer price was revised upwards. The results are in line with the findings of Bajo & Raimondo (2017) that found a positive relationship between media coverage volume measured by the count of news articles on the IPO day itself but found that the effect becomes insignificant when extending the time period of media coverage, which is possibly related to the attention span of investors. Investors mainly focus on the news closest to the IPO (Bajo & Raimondo, 2017). In the paper of Pollock & Rindova (2003) it however mentioned that media coverage volume appears to matter until the threshold of exposing investors to the firm is met, then the effect decreases. This can also be observed in this sample[52], although no significance is found due to the limited sample size.

Measuring media volume exclusively by the count of news articles ignores the length of the articles. An alternative method for measuring media coverage volume is by considering the word count. Articles in this sample vary in length from 100 words to over 2000 words. By utilizing the total word count as a measure for media coverage volume, the length of the articles are considered (Bajo & Raimondo, 2017).

[51] This is done due to the correlation that exists between the independent variables as can be observed in table 7.
[52] A conducted test that excluded IPOs with >10 articles in news coverage, reveals an almost significant effect.

When measured by total word count, the effect of media coverage volume becomes weaker and remains statistically insignificant, but the sign of the effect changes ($\beta = 0.013$, $p = 0.901$). A lot of IPOs also received duplicate news coverage, articles were republished by other news outlets that were almost, or completely identical. Tetlock (2011) found that investors react to stale news, despite it containing no new information. A final measurement for media coverage volume is to include all these duplicate media articles. The result does not change and remains statistically insignificant ($\beta = -0.079$, $p = 0.420$). These two results are not present in table 8 due to the insignificance of these results compared to the first measurement. Hypotheses 1a and 1b stated that media coverage a week prior the IPO should have, respectively, a positive or negative effect on first-day IPO underpricing. Based on the empirical results the hypotheses 1a and 1b are not supported. This implies that the volume of media coverage in and of itself does not impact first-day underpricing of an IPO[53].

Model 2 depicts the OLS regression for the media coverage positive sentiment predictor. The effect of positive sentiment on first-day IPO underpricing is significant at the 5% level. Not only is it significant but the economic magnitude is relevant, as one standard deviation in positive sentiment is associated with an increase of 0.215 standard deviations of IPO underpricing or, 10.55% in IPO underpricing. The same statistical significance level was found by Bajo & Raimondo (2017). These results hold when controlling for firm – and IPO specific variables as well as industry and year fixed effects. In addition, the result also holds in model 4 in which all media coverage predictors are included. This result does not support the theories on information asymmetry but is more in line with the investor attention theories. Zou et al. (2020) found that positive sentiment negatively affects IPO underpricing due to information value of positive sentiment that bridges the gap of information asymmetry. Pollock & Rindova (2003) found that low amounts of positive sentiment barely affects IPO underpricing but after reaching a critical point will affect IPO underpricing. It appears that receiving positive tones in the media, one week prior to the IPO has an effect on investors' attention for the IPO shares. Positive media coverage sentiment appears to further drive the sentiment of willing investors to overpay for the shares. Hypothesis 3 stated that positive sentiment one week prior to the IPO should have a positive effect on first-day IPO underpricing. Based on the empirical results, hypothesis 3 is supported. An increase in positive sentiment in the week prior to the IPO appears to increase the amount of first-day underpricing.

On the contrary, negative tones appear to have little impact on IPO underpricing as depicted in model 3. The result is statistically insignificant with a positive sign. This is quite surprising since the sample of media articles contains, on average similar negative sentiment to positive sentiment as depicted in table 3. This finding is in line with the result reported by Bajo & Raimondo (2017). Investors do not seem to mind negative sentiment presented to them a week prior to the IPO and do not respond to it. Hypothesis 4 stated that negative sentiment one week prior to the IPO should have a negative effect on

[53] Due to the high correlation between media coverage volume and the offer price, offer size variables, this effect was tested excluding the offer price and offer size. The media coverage volume variables remained insignificant.

first-day IPO underpricing. Based on these empirical results, hypothesis 4 is not supported. An increase in negative sentiment appears to have no significant effect on IPO first-day underpricing.

As for the noteworthy control variables, the offer price positively impacts first-day IPO underpricing and is significant at the 1% level. The economic magnitude of this is also noteworthy, as one standard deviation increase in the offer price is associated with a 0.399 standard deviations increase in IPO underpricing or 19.5% in IPO underpricing. The offer price appears to signal the quality of the issuing firm to investors. The insignificant coefficient of age is surprising. Bajo & Raimondo (2017) report significant coefficients at the 1% level for age but the size of the effect is very similar and Pollock & Rindova (2003) report significant coefficients at the 10% level with also similar size. VC-backing also shows no significance while Bajo & Raimondo (2017) report positive results. VC-backing showed no significant results in the study of Pollock & Rindova (2003) that also collected a sample with a high VC-backing proportion. The rest of the control variable results are in line with previous studies.

Table 9
This table displays the moderating effects of the media coverage variables with the COVID-19 period. COVID-19 is a dummy variable in which 0 = the pre-COVID-19 period and 1 = the COVID-19 period. All controls variables are included in the model. The metric independent variables in these models are mean centered to aid with interpretation. The same set of control variables are used but not reported for the sake of space.

	(1)	(2)	(3)	(4)
	First-day underpricing	First-day underpricing	First-day underpricing	First-day underpricing
ln(Media coverage volume)	0.016 (0.122)			0.078 (0.562)
ln(Media coverage volume)*COVID	-0.091 (-0.811)			-0.181 (-1.444)
Positive sentiment (tone)		0.064 (0.590)		0.085 (0.692)
Positive sentiment (tone)*COVID		0.203** (1.982)		0.211* (1.888)
Negative sentiment (tone)			-0.011 (-0.100)	-0.054 (-0.421)
Negative sentiment (tone)*COVID			0.050 (0.502)	0.046 (0.403)
COVID	0.199** (2.487)	0.258*** (3.300)	0.233*** (2.814)	0.228*** (2.830)
Control variables	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
F-statistic	2.514***	3.301***	2.541***	2.689***
Observations	155	155	155	155
Adjusted R-squared	0.136	0.193	0.138	0.180

Standardized coefficients with t-statistics in parentheses
*** Denotes significance at the 1% level.
** Denotes significance at the 5% level.
* Denotes significance at the 10% level.

In table 9 the moderating effect between the COVID-19 period and the media coverage variables are displayed following the second empirical model:

$$(II)\ Underpricing_{i,t} = \alpha + \beta 1 MedVol_{i,t} + \beta 2 MedVol_{i,t} * COVID + \beta 3 MedPos_{i,t} + \beta 4 MedPos_{i,t} * COVID + \beta 5 MedNeg_{i,t} + \beta 6 MedNeg_{i,t} * COVID + \beta 7 OfferPrice_{i,t} + \beta 8 OfferSize_{i,t} + \beta 9 FirmAge_{i,t} + \beta 10 FirmSize_{i,t} + \beta 11 Duration_{i,t} + \beta 12 StockEx_{i,t} + \beta 13 Vc_{i,t} + \beta 14 Industry_{i,t} + \beta 15 COVID + \varepsilon_{i,t}$$

Similar to table 8, models 1-3 present the media coverage predictors individually while model 4 displays the results of the full model which includes all three media coverage predictors. Due to space constraints the control variables are not reported. The moderation between media coverage volume a week prior to the IPO and the COVID-19 interaction does not appear significant as displayed in model 1. Despite the moderating variable between media coverage volume and the COVID-19 period boasting a stronger coefficient which shows that the effect is somewhat more pronounced in the COVID-19 period, it is not significantly so. This is at first glance contrary to the findings of e.g., Bonsall et al. (2020), media coverage volume does not seem to alleviate the uncertainty of the COVID-19 period. In addition, investors also do not seem to have a harder time to evaluate news during the COVID-19 period as was argued by Haroon & Rizvi (2020). Hypothesis 2 stated that the effect of media coverage volume on first-day IPO underpricing should be more pronounced during the COVID-19 period. The empirical results do not indicate this. Media coverage volume does not have a significantly different effect on first-day underpricing in the COVID-19 period as opposed to the pre-COVID-19 period. Hypothesis 2 is thus not supported. The sheer volume of media coverage a week prior to the IPO does not seem to have an impact on first-day IPO underpricing in either a 'normal' period or a highly uncertain period like that of COVID-19.

In model 2, in table 9 the difference between the effects of positive sentiment on first-day IPO underpricing between the pre-COVID-19 period and COVID-19 period are reported. When including a moderating variable in the model, the original positive sentiment variable becomes insignificant ($p = 0.590$). The moderating variable between positive sentiment one week prior to the IPO and the COVID-19 interaction is significant at the 5% level. It appears that the effect of positive sentiment one week prior to the IPO is more pronounced during the COVID-19 period as opposed to the pre-COVID-19 period. This offers some support for the findings and arguments of Bai et al. (2023) and Smales (2020), that, respectively, positive sentiment can alleviate the uncertainty of the COVID-19 period to some degree and that positive sentiment can attract investors to favourable companies that dominate the IPO sample. When calculating the coefficients for both periods the difference between the two periods becomes apparent[54]. The coefficient of positive sentiment, for the COVID-19 period is a lot higher as opposed to the coefficient of the pre-COVID-19 period. Figure 3 displays the interaction between

[54] Pre-COVID period : 0.203*0+0.064 = 0.064 COVID period: 0.203*1+0.064 = 0.267.

positive sentiment and the two periods. In this figure the metric positive sentiment variable is dichotomized into a low and high group for display purposes. The graph shows that the lines of the two periods, pre-COVID-19 and COVID-19 are not parallel, and the effect appears significantly stronger during the COVID-19 period as opposed to the pre-COVID-19 period. Even low amounts of positive sentiment appear to have a strong effect during the COVID-19 period. Hypothesis 5 stated that during the COVID-19 period the impact of positive media tones a week prior to the IPO should be more pronounced on first-day IPO underpricing. The results support this. The impact of positive media tones, or sentiment, a week prior to the IPO is significantly strong during the COVID-19 period when compared to the pre-COVID-19 period. Hypothesis 5 is thus supported by the empirical findings.

Model 3 in table 9 displays the difference between the effects of negative sentiment on first-day IPO underpricing between the pre-COVID-19 period and COVID-19 period. The interaction between negative sentiment and COVID-19 is not significant. While, just as with media coverage volume, the coefficient and t-value is larger, it remains statistically insignificant. This is contrary to the findings and arguments of Cevik et al. (2022) and Bai et al. (2023). Negative media tones/sentiments do not seem to exacerbate the uncertainty of the COVID-19 period nor does it appear to affect the IPO stock prices. Hypothesis 6 stated that during the COVID-19 period the impact of negative media tones or sentiment one week prior to the IPO should be more pronounced as opposed to the pre-COVID-19 period. This does not appear to be the case, while the effect on first-day IPO underpricing is stronger during the COVID-19 period, it is not significantly so. Hypothesis 6 is thus not supported by the empirical findings.

Model 4 displays the full empirical model with all media coverage variable and interactions included. The coefficients and significance levels remain very similar. The positive sentiment period interaction just drops down to the 10% significance level ($p = 0.056$), the coefficient and t-value however are still very similar.

In terms of model fit, the models explain about 13% to 18% of the variance in first-day IPO underpricing. While generally, R-squared values below 0.4, are regarded as low and interpreted as the independent variables not explaining a sufficient amount of the variance in the dependent variable, it must be taken into account that a lot of factors influence the prices of shares. The models in this study explain more variance than the models of e.g., Guldiken et al. (2017) but less than the modelsof Bajo & Raimondo (2017) and Pollock & Rindova (2003)[55]. Additional control variables can contribute to explaining more of the variance in first-day IPO underpricing, but due to the smaller sample size, this can introduce the problem of model overfitting.

Finally, in table 10, the hypotheses as formulated in chapter 2 section 2.7 are shown and compared to the empirical results of this section. The study finds support for hypotheses 3 and 5 but does not find support for hypotheses 1, 2, 4 and 6.

[55] These models explained respectively, 11%, 33% and 34% of the variance in first-day IPO underpricing.

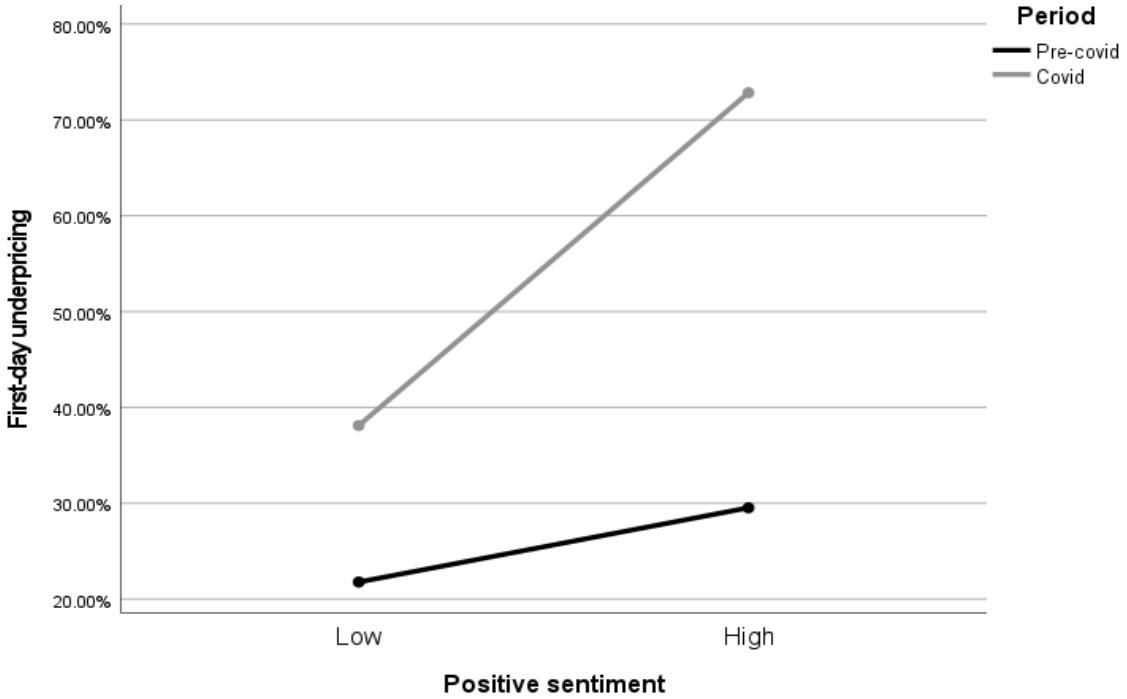


Figure 3 *Interaction effect positive sentiment and COVID-19*

Table 10
This table displays the hypotheses as formulated in chapter 2 section 2.6. The hypothesis is shown with the expected sign followed by the sign that was found in the empirical results and whether the hypothesis is supported and rejected based on the empirical results.

Hypothesis	Expected sign	Sign	Supported/rejected
H1: Media coverage volume in the week prior to the IPO completion has a positive (negative) effect on IPO underpricing during the first trading day.	+/-	-	Rejected
H2: During the COVID-19 period, the impact of media coverage volume in the week prior to the IPO completion is more (less) pronounced on IPO underpricing during the first trading day.	+	-	Rejected
H3: The positivity of the tone of media coverage in the week prior to the IPO completion has a positive effect on IPO underpricing during the first trading day.	+	+	Supported
H4: The negativity of the tone of media coverage in the week prior to the IPO completion has a negative effect on IPO underpricing during the first trading day.	-	+	Rejected
H5: During the COVID-19 period, the impact of the positivity of the tone of media coverage in the week prior to the IPO completion is more pronounced on IPO underpricing during the first trading day.	+	+	Supported
H6: During the COVID-19 period, the impact of the negativity of the tone of media coverage in the week prior to the IPO completion is more pronounced on IPO underpricing during the first trading day.	-	+	Rejected

4.4 Robustness checks

This section presents several robustness checks to test whether the results hold under different conditions. The primary concern is that of endogeneity, or reverse causality, between media coverage and IPO underpricing. Underpricing on the day of the IPO can influence media coverage on this day (Bajo & Raimondo, 2017)[56]. In this way underpricing can influence the number of news articles the IPO firm receives, and the sentiment (positive) contained within (Bajo & Raimondo, 2017). To this end a separate OLS regression is run which excluded the media coverage on the IPO date. The media coverage sample thus consists exclusively out of media coverage from the period -1 to -7[57]. If the results do not hold (severely weaken), then this presents the possibility of the existence of an endogeneity problem. If an IPO firm exclusively received news on the IPO date, it is removed from this sub-sample as also done by Bajo & Raimondo (2017). The results are reported in table 11.

Table 11
This table displays the results of the effect of media coverage volume and positive sentiment within on first-day IPO underpricing, excluding the media coverage received on the IPO date. The IPOs were covered by a total of 874 news articles in the -1 to -7 period of the IPO. One IPO firm received no media coverage in the period of -1 to -7 and was thus removed from the sample resulting in a total sample of 154 IPO firms. For the interaction models (2 and 4), the metric independent variables were mean centered.

	(1) First-day underpricing	(2) First-day underpricing	(3) First-day underpricing	(4) First-day underpricing
ln(Media coverage volume)	-0.124 (-1.296)	-0.012 (-0.086)		
ln(Media coverage volume)*COVID		-0.146 (-1.156)		
Positive sentiment (tone)			0.179** (2.284)	0.048 (0.411)
Positive sentiment (tone)*COVID				0.173 (1.527)
COVID	0.209*** (2.616)	0.209*** (2.623)	0.215*** (2.722)	0.212*** (2.696)
Control variables	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
F-statistic	2.709***	2.630***	3.011***	2.996***
Observations	154	154	154	154
Adjusted R-squared	0.144	0.146	0.165	0.173

Standardized coefficients with t-statistics in parentheses
*** Denotes significance at the 1% level.
** Denotes significance at the 5% level.
* Denotes significance at the 10% level.

[56] Bajo & Raimondo (2017) state that no sizeable differences were found when only including media coverage 1-3 days before the IPO date but did not report the results.
[57] 0 is the IPO date.

While still statistically insignificant, the effect of media coverage volume (model 1) is a lot stronger when excluding the media coverage volume on the IPO date, and it boasts a higher coefficient. Looking to the interaction effect of media coverage volume in model 2, it remains insignificant, but its coefficient is likewise higher than the previous tests in which all media coverage a week prior to the IPO date was included. Interestingly, both coefficients are negative. The effect of positive media coverage prior to the IPO remains significant at the 5% level while the coefficient is slightly lower. This is not surprising since a weakening of the effect is expected. The timing of the media coverage is relevant due the investor attention increasing close to the IPO date and weakening when further removed from the IPO date (Bajo & Raimondo, 2017). It is thus not surprising that by excluding the media coverage closest to the IPO, on the IPO date itself, the effect of positive sentiment becomes weaker. When looking at the interaction effect between positive media sentiment and first-day IPO underpricing, it becomes weaker and drops slightly below the 10% significance level ($p = 0.129$). The coefficient, however, remains strong. The weaker effect is also likely attributed to the previously mentioned effect of investor attention. An indication of the effect of investor attention can also be found in table 12. Overall, there is no direct cause to believe that underpricing developing on the first trading day is affecting the media coverage of an IPO firm significantly, but a concern arises for the positive sentiment and COVID-19 interaction effect which will be discussed in chapter 5.

Table 12
This table displays the effect of media coverage volume and positive sentiment for three different time brackets of media coverage. Period 1 includes the media coverage on the IPO date itself. Period 2 includes the media coverage 1 to 3 days before the IPO date (-1 to -3) and period 3 includes the media coverage 4 to 7 days before the IPO date (-4 to -7).

	Period 1 (0)	Period 2 (-1 to -3)	Period 3 (-4 to -7)
	First-day underpricing	First-day underpricing	First-day underpricing
Positive sentiment (tone)	0.187**	0.113	0.099
	(2.095)	(1.357)	(1.121)
Control variables	Yes	Yes	Yes
Industry and year fixed effects	Yes	Yes	Yes
F-statistic	2.990***	2.350***	2.337***
Observations	151	144	123
Adjusted R-squared	0.166	0.124	0.133

Standardized coefficients with t-statistics in parentheses
*** Denotes significance at the 1% level.
** Denotes significance at the 5% level.
* Denotes significance at the 10% level.

The second concern is that the significant positive effect of positive media coverage sentiment on IPO underpricing is not caused by media coverage one week prior to the IPO, but by media coverage that is closer to the IPO date. Bajo & Raimondo (2017) found that the effect of positive sentiment in

media coverage on IPO underpricing diminished as the media coverage was distanced from the IPO date. This forms the investor attention hypothesis, in which the attention of the investor is higher closer to the IPO day and diminishes as it moves further away (Bajo & Raimondo, 2017). To this end three additional tests are run to analyse the diminishing effect media coverage might have on IPO underpricing as the media coverage moves further away from the IPO date. One for media coverage on the IPO date, one for media coverage 1-3 days from the IPO date and one for media coverage 4-7 days from the IPO date. If a company did not receive media coverage in the specific time period, it is excluded from that subsample as was also done by Bajo & Raimondo (2017). Table 12 displays the results of these tests for positive sentiment[58]. Period 1 shows the strongest effect of positive sentiment in media coverage on IPO first-day underpricing. The effect is significant at the 5% level. For periods 2 and 3 the effect becomes insignificant. This offers some support for the notion of investor attention argued by Bajo & Raimondo (2017). Positive media coverage sentiment closer to the IPO date appears to have a stronger effect than positive media coverage sentiment further removed from the IPO date. The effect of positive sentiment in media coverage on IPO underpricing diminishes as it moves further away from the IPO date. It is quite surprising that the effect becomes insignificant for the second time period. Bajo & Raimondo (2017) found a similar effect for the first two periods. However, this is based on a larger subsample for the second period as opposed to the first period. In this case the subsample for period 1 is larger than that of period 2. This could also be due to the smaller media coverage sample. The coefficients remain positive across all three periods. This holds while controlling for the same variables used in the previous tests and industry and year fixed effects.

Bajo & Raimondo (2017) also argue the possibility of newspapers changing the tone of the articles as the IPO date approaches. This would imply that positive sentiment of media coverage is higher when the media coverage is closer to the IPO date which can affect the effect of the positive sentiment in these periods, instead of the attention of the investors. However, for this sample that is not the case. The mean positive tone of the media coverage in period 1 is 0.30% (0.23% median) while the mean positives tones in periods 2 and 3 are 0.46% (0.31% median) and 0.42% (0.20% median), respectively. The media coverage seems to contain more positive sentiment when further removed from the IPO date.

A third robustness test regards the overall sentiment measurement and its effect on IPO first-day underpricing using the Janis-Fader coefficient of imbalance (Janis & Fader, 1965). This is the same measurement used by Pollock & Rindova (2003) to measure the overall sentiment of an article and the total sentiment received by a firm prior to the IPO. Instead of treating positive and negative sentiment separately, this measure combines both sentiments into an overall sentiment -, or tenor score, of an article (Pollock & Rindova, 2003). If positive sentiment is higher than negative sentiment, the tenor score will be positive, and vice versa. The results of this robustness test will give insights in whether the

[58] Negative sentiment and media coverage volume were tested, but the results are insignificant and thus not reported.

overall sentiment of media coverage plays a role in first-day IPO underpricing as opposed to treating sentiments separately.

Table 13
This table displays the effect of overall media sentiment (tenor) of media coverage one week prior to the IPO on first-day IPO underpricing. The sentiment (tenor) is calculated as follows based on the formulas provided by Pollock & Rindova (2003): Sentiment (tenor) = $(P^2 – PN)/V^2$ if P > N and $(PN-N^2)/V^2$ if N > P. In this P is positive sentiment, N is negative sentiment and V is the number of articles written about the IPO one week prior to the IPO[59]. Model 1 includes media sentiment (tenor) variable and all control variables that were previously used including industry and year controls. Model 2 reports the interaction between tenor and COVID-19.

	(1)	(2)
	First-day underpricing	First-day underpricing
Media sentiment (tenor)	0.172**	0.078
	(2.126)	(0.789)
Media sentiment (tenor)*COVID		0.154
		(1.613)
Control variables	Yes	Yes
Industry and year fixed effects	Yes	Yes
F-statistic	3.013***	3.020***
Observations	155	155
Adjusted R-squared	0.164	0.173

Standardized coefficients with t-statistics in parentheses
*** Denotes significance at the 1% level.
** Denotes significance at the 5% level.
* Denotes significance at the 10% level.

Model 1 displays a significant effect of media sentiment (tenor) on IPO first-day underpricing at the 5% level. This provides additional support that positive sentiment of media coverage one week prior to the IPO plays a role in first-day IPO underpricing. The economic magnitude is slightly weaker than the economic magnitude of the positive sentiment variable, but one standard deviation in media sentiment (tenor) still leads to about 8.42% more underpricing. However, unlike positive sentiment, the effect is not more pronounced during the COVID-19 period. A discussion of this follows in chapter 5.

Appendix D presents two additional robustness tests. Due to some existing outliers a robustness test with a winsorization of 90% of the continues variables is shown in tables 15 and 16. This mitigates the effect of outliers in this variable. The results remain unchanged. Finally, in table 17, an additional test is done for the interaction effect between COVID-19 and the media coverage variables which excludes the IPOs prior to the mid of March 2020. The results remain unchanged except for a slight drop in t-values[60].

[59] In the original formula the news articles are dichotomized as positive or negative and P would represent number of positive articles and N the number of negative articles. In this case P is total positive sentiment from the news articles and N the total negative sentiment from the news articles. This should not lead to large discrepancies in the calculation of sentiment (tenor), but the results should be interpreted with care.
[60] Understandable due to the lower sample size.

5. Discussion

In this chapter an attempt is made to further explain the results of chapter 4 using literature and the authors own interpretation. Section 5.1 discusses the main results and implications of hypotheses 1, 3 and 4. Section 5.2 discusses the main results and implications of hypotheses 2, 5 and 6. Section 5.3 delves into the meaning of the results of the robustness tests. In section 5.4, the theoretical and practical implications of the study are considered. In section 5.5, the limitations of the study. Finally, in section 5.6 a few avenues for future research are discussed.

5.1 Media coverage and IPO underpricing

The investigation of the effect of ex-ante media coverage one week prior to an IPO on IPO underpricing has resulted in mixed findings. The sheer volume of media coverage does not appear to move investors directly, but the sentiments contained within the media coverage can. Investors thus appear to place more value on the content of the news articles as opposed to the quantity of news articles written about an IPO or IPO firm. Higher numbers of ex-ante news articles do not seem to directly influence the behaviour of investors when it comes to investing in IPOs. Investors valuing the content of the article, was also found by Bajo & Raimondo (2017). A higher count of ex-ante news articles should consistently decrease the amount of existing information asymmetry between investor and issuing firm and through this, the first-day IPO underpricing as per the information asymmetry literature. This does not appear to be the case, which is in line with Tetlock (2007). Tetlock (2007) similarly found results that are not in line with the hypothesis of ex-ante news coverage lowering the information asymmetry gap. On the contrary, ex-ante news articles do not seem to aid investors in making a better judgement about the pricing of the IPO at all (in terms of fairness). While the results of this paper do not signify that ex-ante news coverage contains no (new) information for investors[61], it does indicate that the theories of information asymmetry do not serve as an adequate explanation for the effect of media coverage volume on IPO underpricing.

The findings are also not in line with the marketing-centric literature in which ex-ante media coverage can serve as a means to strengthen a cascade effects or as a substitute for deliberate underpricing to attract investors. Support for this body of literature was found by some articles like e.g., Pollock & Rindova (2003); Guldiken et al. (2017); Bajo & Raimondo (2017) and Chen et al. (2020). But these significant results were only found under specific circumstances. Pollock & Rindova (2003) used a small sample of media coverage and noted that once media coverage increased above a certain threshold, the effect becomes insignificant. Bajo & Raimondo (2017) only found a positive result of

[61] Unlike the results of Tetlock (2007), that clearly indicate that the media does not serve as a proxy for new information on asset valuation.

media coverage volume on the IPO date itself, while Guldiken et al. (2017) only found a positive relationship for the presence of credible media coverage prior to the IPO and Chen et al. (2020) did not include multiple firm and IPO specific control variables. When accounting for multiple firm – and IPO specific control variables and including news from all outlets, an increase in media volume does not lead to an increase or decrease in first-day underpricing. Based on the results of this study, the number of news articles written about an issuing firm one week prior to the IPO, has no direct effect on first-day IPO underpricing. It seems that media coverage volume only affects first-day IPO underpricing until a certain volume is met for sufficient content suppliance to investors and the attraction of investors to the IPO firm as per Pollock & Rindova (2003). While the sample in this study is too small to obtain significant results, it can be clearly observed that the coefficient and statistical significance improve greatly as the sample is limited to firms that received less or equal to ten articles in media coverage one week prior to the IPO.

The sentiment of news articles appears more relevant as sentiment contained in these news articles can affect the amount of first-day underpricing. This offers support for the investor attention theories. The most interesting finding is that positive sentiment does have a positive effect on first-day IPO underpricing while on the contrary, negative sentiment does not appear to have an effect. This asymmetric effect is contrary to the findings of Zou et al. (2020) that found that both positive and negative sentiment has a negative effect on IPO underpricing. Investors respond to positive tones in ex-ante media coverage but do not respond to negative tones. This is also contrary to expectations, but an explanation for this can be found in the article of Barber and Odean (2008). In this article it is argued that attention-attracting shares are the shares focused on by investors. The investors will primarily consider shares that have high attention attraction (Barber & Odean, 2008). Investors are likely on the lookout for underpriced shares[62] and thus pay little attention to negative news, and more to positive news[63] (Bajo & Raimondo, 2017). This finds some support, since the large majority of this sample of IPOs (127 out of 155) is underpriced. Preferences for shares only influence the investor' choice after this selection has been made (Barber & Odean, 2008). In this way more attention is paid to positive, attention grabbing news, than to negative news, limiting the effect of negative sentiment and possibly exacerbating the effect of positive sentiment. It is also implied by Barber & Odean (2008) that investors do not pay a lot of attention to subsequent sentiment after the selection has been made, but chooses the investments based on other indicators, this could limit the effect of negative sentiment even further[64].

[62] Because of the large skewness towards positive underpricing, and not the opposite, it is possible that investors are on the lookout for these underpriced shares and pay more attention to the positive sentiments displayed in news coverage (Bajo & Raimondo, 2017).
[63] Bajo & Raimondo (2017) do not explain why, but it is likely that investors believe that positive sentiment results in a high demand for shares and thus possible profits.
[64] Since the choice has already been made, largely based on positive sentiment, and subsequent negative sentiment is ignored.

This could also be attributed to investors, overall, paying more attention to positive news as opposed to negative news when investing in (IPO) shares (Barber & Odean, 2008).

Another explanation for this can be found in the article of Baker & Wurgler (2007). Investors overreact to positive and negative news based on the sentiment they hold towards a certain company (Baker & Wurgler, 2007). When the sentiment is high, they overreact to positive news and downplay negative news and vice versa, when the sentiment is low, they overreact to negative news and downplay positive news (Baker & Wurgler, 2007). Since IPO firms are already inherently successful[65], investors are likely already positively dispositioned towards the IPO firm. In this way investors overreact to the positive news and downplay the negative news an IPO firm receives. The possibility of positive news overpowering negative news does not seem very likely since the IPO firms, on average, received a similar amount of positive and negative sentiment.

A final explanation for this can possibly be found in the disposition effect. The disposition effect is the tendency of investors to ride losses and realise gains (Frazzini, 2006). Investors are unlikely to sell shares at a loss and hold on to them but are inclined to dispose of shares once they can make gains (Frazzini, 2006). As was seen in the robustness test, the positive news on the IPO date is the most important for the effect of media coverage sentiment on IPO underpricing. Even if a lot of negative news is received during the first trading day of the IPO, possibly affecting the demand for the shares, due to the disposition effect, many shareholders that have already purchased shares prior to the influx of negative news on the IPO date, or investors becoming aware of negative news that they were previously unaware of, will not sell their shares even if they are looking at a loss[66]. On the contrary, when a lot of positive news is received on the IPO date, the demand for the shares might increase and investors are not looking at a loss and are willing to take capital gains and sell the shares, leading to more liquidity and more trading, and likely a higher first-day closing price. This limits the effect that negative sentiment can have on IPO underpricing, while it allows for a stronger effect of positive sentiment. Based on the findings of Barber & Odean (2008), even if negative news trickles in slightly before the IPO, investors have likely already made a selection of IPO investments, and incurred investigation costs in acquiring this selection, and will likely stick to it and ride potential losses later.

The disposition effect can also induce an underreaction of investors to certain news depending on how the stock is moving (Frazzini, 2006). Frazzini (2006) found that bad news travels slowly when stocks are trading at capital losses and positive news travels slowly when stocks are trading at capital gains. This however does not adequately explain the significant statistical effect of positive news and insignificant effect of negative news since only 18% of the sample of IPOs traded at capital losses. In that case, positive news is unlikely to display statistically significant results as well. Frazzini (2006) also

[65] In general, only the best companies offer their shares to the public.
[66] This prevents the 'dumping' of shares, in which investors dispose of the shares quickly which can greatly lower the price of the shares when also coupled with a lower demand. In this case the supply increases while the demand possibly decreases due to the negative sentiment surrounding the issuing firm.

found that the time for investors to respond to positive and negative news is nearly equal, so a difference in response time to certain news does also not appear to be an adequate explanation. Nofsinger (2000) however did find that investors are quicker to respond to good news than to bad news. Negative news could thus very well have an effect on IPO shares, just not on the first-day of trading.

5.2 Media coverage and IPO underpricing during the COVID-19 period

The effect of media coverage one week prior to the IPO on first-day IPO underpricing was different during the COVID-19 period as opposed to periods before. Media coverage volume and negative sentiment do not appear to have had a more pronounced effect during the COVID-19 period and remain insignificant. The result of media coverage volume is still in line with the findings of Tetlock (2007). No support was found for a more pronounced effect of media coverage volume due to possibly larger amounts of uncertainty and fear being channelled by the media during this period as per e.g., Mazumder & Saha (2021) or media coverage alleviating the uncertainty of the COVID-19 period as per Bonsall et al. (2020) or an increased investor attention for firms that dominate the IPO market as per Smales (2020). During the COVID-19 pandemic, investors still did not seem to pay much attention to negative sentiments displayed in the media. While an explanation for this can be found in Haroon & Rizvi (2020), that argue that investors had a more difficult time assessing information sources during the COVID-19 period, this does not sufficiently explain it, since positive sentiment in media coverage does appear to have had a more pronounced effect during the COVID-19 pandemic on first-day IPO underpricing. This insignificant effect can still be attributed to the previously given explanations in section 5.1. This is a further testament to investors not paying much attention to negative sentiment when it comes to the trading of IPO shares; even in times of great uncertainty and bordering on fear.

Media coverage with positive sentiment a week prior to the IPO however did have a more pronounced effect during the COVID-19 period. Bai et al. (2023) provides an initial explanation for this. During times of great uncertainty and fear, positive sentiment can alleviate this uncertainty and fear on top of attracting the attention of investors (Bai et al., 2023). This is however only half of the equation as Bai et al. (2023) also found that negative sentiment exacerbates the uncertainty and should thus display a more pronounced negative effect. This is especially concerning since Bai et al. (2023) found that the impact of negative sentiment is higher than that of positive sentiment. It is however worth noting that the sample of Bai et al. (2023) consisted out of financial markets from 47 different countries which is not completely comparable with the sample used in this study.

Another explanation for this lies in the increased information uncertainty[67] during the COVID-19 period. Baig & Chen (2022) found that the COVID-19 pandemic, while seemingly positively affecting the IPO market in terms of underpricing and proceedings, led to a greater information uncertainty for

[67] IPO firms are especially susceptible to this since these firms are generally newer with less existing information and often lacking a track-record.

investors. Due to this greater information uncertainty it is possible that investors became more reliant on sentiments in the media which could serve as a partial explanation for the pronounced effect of positive sentiment on first-day IPO underpricing[68]. This closely resembles the findings of Haroon & Rizvi (2020) in which investors appear to have had difficulty during the COVID-19 pandemic to adequately assess information sources due to the onslaught of COVID-19 news dominating practically every media channel. This could have paved the way for a more pronounced effect of positive sentiment during the COVID-19 period.

Due to the COVID-19 pandemic generating a tremendous amount of uncertain and negative news, there exists the possibility that investors actively seek out 'safe haven' investments. Baur & McDermott (2016) indicate that investors prefer safe(r) investments during stressful times. In this way, investors focus more on positive information than negative information (Baur & McDermott, 2016). This could serve as an additional explanation for investors seeking out safer IPO investments that receive a lot of positive sentiment during the COVID-19 period. This also resembles the findings of Smales (2020), in which investors actively sought out information on the impact of the COVID-19 pandemic on possible investments. Investors may have chosen the IPO firms from the technology and healthcare sectors, those least affected by the COVID-19 pandemic, or even gaining from it, that reasonably to assume, received more positive sentiment due to this than IPO firms that were (heavily) negatively affected by the COVID-19 pandemic. Since these two sectors dominate the IPO market, positive sentiment will have a more profound impact on first-day IPO underpricing.

5.3 Investor attention, timing of media coverage, and overall sentiment

When excluding the media coverage on the IPO date, to primarily check for possible endogeneity issues, positive sentiment in the media coverage remained statistically and economically significant. This largely alleviates the endogeneity concern of the possibility of underpricing on the first trading day influencing the media coverage of IPO firms. However, the interaction effect between positive sentiment and the COVID-19 period, while still economically significant, dropped below the 10% statistical significance. Now it could be concluded that there is an endogeneity issue when it come to the interaction effect between positive sentiment and the COVID-19 period. However, there are two other possible reasons as to why the statistical significance has dropped. The first reason is that the COVID-19 sample received a higher proportion of the positive sentiment on the IPO date as opposed to the pre-COVID sample[69]. On top of that, it is not surprising that the statistical significance drops to some degree. As was noticeable, the effect of media coverage on first-day IPO underpricing lowers as the media coverage

[68] This could be interpreted as being more susceptible to positive sentiments as opposed to before due to not being able to obtain the desired information.
[69] The pre-COVID-19 sample received in proportion to the total positive sentiment, more positive sentiment on the IPO date as opposed to the COVID-19 sample (approximately 15% more)

moves further away from the IPO date. This was also found in this study and by Bajo & Raimondo (2017). The sentiment expressed in media coverage closest to the IPO date appears the most influential due to the heightened investor attention during that period. By excluding the media coverage closest to the IPO date, it is thus not surprising that the significance drops to some degree. In this way it cannot be stated with great certainty that the effects of positive sentiment on first-day IPO underpricing during the COVID-19 period are affected by endogeneity.

Overall the sentiment or tenor positively impacts first-day IPO underpricing. This adds further robustness to the study, indicating that investors do respond to sentiments contained in the media one week prior to the IPO. Similar to the findings of Pollock & Rindova (2003), it suggests that the media, through displayed sentiment, exposes investors to companies. The sentiment, or the tenor of the media, can create both legitimacy and 'buzz' for the IPO firm if it is positive (Pollock & Rindova, 2003). A higher tenor, indicating more positive sentiment relative to negative sentiment influences first-day underpricing positively. However, this effect does not appear to be significantly more pronounced during the COVID-19 period. This does weaken the support for the increased pronounced effect of positive media sentiment on first-day IPO underpricing. This indicates that the choice of how to measure media coverage sentiment is not arbitrary and plays a role in obtaining different results.

5.4 Implications

The results of this study present a number of implications. First, the volume of media coverage plays no direct role in influencing first-day IPO underpricing. It is the content of articles that matters, not the sheer generation of news. Second, positive sentiment in media coverage a week prior to the IPO has a positive effect on first-day IPO underpricing while negative sentiment appears to have no effect. This is in line with the findings of e.g., Bajo & Raimondo (2017) but not in line with the findings of e.g., Zou et al. (2020) and overall supports the investor sentiment body of literature. These results suggest that investors respond to positive sentiments displayed in media coverage one week prior to the IPO, impacting first-day IPO underpricing while investors tend to be unresponsive to negative sentiments displayed in media coverage one week prior to the IPO, in the same context. Third, the positive sentiment displayed in media coverage is more significant closer to the IPO date, becoming insignificant when the media coverage is further removed from the IPO date. This is in support of the investor attention hypothesis as formulated by Bajo & Raimondo (2017) and argued by Liu et al. (2014a), in which media coverage affects IPO underpricing when coupled with the attention of investors. These findings suggest that investors pay more attention to media coverage closer to the IPO date and implicates the importance of the timing of the media coverage when it comes to the marketing of an IPO. Four, the effect of positive sentiment in media coverage was found to be more pronounced during the COVID-19 period as opposed to the period before. This is in line with e.g., Bai et al. (2023). These findings indicate that positive sentiment displayed in media coverage one week prior to the IPO can alleviate some of the uncertainty

and fear of a global crisis like the COVID-19 pandemic. Five, the choice of measurement for media sentiment plays an important role, as becomes clear from the different results obtained when treating sentiments as separate variables and when using the Janis-Fader coefficient. A final important theoretical implication is that a possible endogeneity issue affects the interaction between positive sentiment in the media coverage and first-day IPO underpricing. Due to the investor attention hypothesis and much of the covid positive sentiment being concentrated on the IPO date, further research is required to establish this possible endogeneity issue.

For IPO issuing firms it is thus important to keep in mind the effect of positive sentiment closely concentrated around the IPO date and how it affects the willingness of investors to (over) pay for the shares. This is especially important during a period of worldwide distress. While directly influencing positive media coverage is difficult, an issuing firm should take note of the positive sentiment that it receives in the media to possibly align its offer price to this displayed sentiment to possibly increase the proceedings of the IPO to some degree. Furthermore, issuing firms could attempt to influence the media coverage they receive shortly before the IPO in an attempt to positively influence the IPO.

5.5 Limitations

First, the measurement of sentiment is based on the comprehensive word list of Loughran & McDonald (2022). While this word list is comprehensive, and adequately tested, a trained coder, with a more subjective view of the article could come to different conclusions about the sentiment of an article. This should be taken into account, since for example some positive sentimental words might occasionally not actually portray positive sentiment in an article. In this way the results can differ from that of a study in which a trained coder codes the articles.

Second, while the LexisNexis (Nexis Uni) database provided a comprehensive number of articles on the IPO firms one week prior to the IPO date, the ‘news’ filter did not always filter out all items that did not resemble news coverage. These were then removed. It should be noted that this is somewhat subjective, and a different researcher could decide to leave some of these items in the media coverage sample. Overall, due to the size of the media coverage sample, and that almost every IPO firm received an adequate amount of news coverage, the effect of this is quite limited. It should also be noted that this research exclusively considered news articles published by news outlets and for example not social media posts.

Third, it is important to note that, based on SIC-codes, two industries dominate this sample of IPOs: services and manufacturing. This means that the results of this study might not be fully representative of all IPOs on the American market. The results should thus be interpreted with care when it pertains to other industries in which IPO firms operate. However, this is not a large issue since the great majority of the IPOs on the American market operate within these two industries. It should also be noted that the IPO landscape can change over time. The IPO landscape is now largely dominated by technology firms,

that either manufacture or service technology for the digital world. The representativeness of these results can thus be compromised if the IPO landscape changes. A larger sample in addition could be beneficial for both sample periods.

Fourth, while a lot of effort went into obtaining the data for relevant control variables, that have in the past served as explanations for IPO underpricing, this study by no means considered every control variable that was found to be relevant in prior research.

Fifth, this study did not consider the credibleness of news articles which was found to be of some importance by e.g., Bajo & Raimondo (2017) and Guldiken et al. (2017) when measuring the effect of media coverage on first-day IPO underpricing.

Sixth, the study could not completely rule out a possible endogeneity issue between positive sentiment in media coverage a week prior to the IPO date and IPO underpricing for the positive sentiment COVID-19 interaction. While endogeneity is not the likeliest explanation for the drop in significance, it should be taken in account when interpreting the results of the interaction between positive sentiment in media coverage a week prior to the IPO date and the COVID-19 period.

5.6 Future research

Future research should consider obtaining the data for the independent variables from different sources, most notably social media. While a lot of sentiment is contained in news articles and investors still appear to regularly read these news articles, social media platforms are becoming increasingly important for the supply of information and sentiments, also on the financial markets. On top of that, it could be considered to use a trained coder for the sentiment analysis of obtained news articles or social media posts. This can serve as an additional and, perhaps, more accurate method to obtain data on the sentiment displayed of an IPO firm.

This research can also be extended by considering a broader range of IPO firms by perhaps including the year 2021 in which the COVID-19 pandemic was still raging. Not only does this expand the sample size but it can also shed light on the longevity of the effect of COVID-19 on media coverage and IPO underpricing, and perhaps lead to a more diversified representation of industries in the sample. This could also possibly aid in establishing more conclusive results on the possible previously mentioned endogeneity issue.

Finally, due to the conflicting results of many prior studies, often due to the analyzation of different financial markets, the research could be replicated using a sample from a different financial markets for example, European or Asian markets.

6. Conclusion

This research aimed to investigate the effect of ex-ante media coverage on short-term IPO underpricing during the COVID-19 period, and to this end, made an attempt to answer the following research question:

What is the effect of ex-ante media coverage on short-term underpricing when a company issues an IPO during the COVID-19 pandemic?"

The study employed textual analysis in the form of a bag of words approach to determine the sentiment of over 1,800 news articles on 155 IPOs one week prior to the IPO. The results found by the study indicate that positive sentiment displayed in media coverage one week prior to the IPO is positively associated with first-day IPO underpricing and has a more pronounced effect during the COVID-19 pandemic. These results were found to be statistically significant and economically meaningful. One increase in the standard deviation of positive sentiment is associated with an increase of 10.55% first-day underpricing while the COVID period displays a coefficient of 0.267 and the pre-COVID period a coefficient of 0.064. The effects of the volume (count) of media articles and negative sentiment displayed in media coverage one week prior to the IPO were found to be insignificant. These results are robust to winsorization of the continuous variables at 90% to contain the effect of spurious outliers and the exclusion of IPOs in the COVID-19 period that might not have been affected by the COVID-19 pandemic (prior to the mid of March 2020).

The effect of positive sentiment on first-day IPO underpricing in ex-ante media coverage is more significant closer to the IPO date. This offers additional support for the findings of Bajo & Raimondo (2017), who claimed that sentiment contained in media coverage is only important when coupled with investor attention. Investor attention tends to increase as the IPO date comes closer (Bajo & Raimondo, 2017). In this way investor attention is highest on the IPO date itself, and the few days before the IPO.

A slight endogeneity problem may influence the results of the COVID-19 and positive sentiment interaction. This could not be ruled out by this study. Results may differ using a different selection of news articles or using different measurements of media sentiment and might not be fully representative of all IPOs on the American market. Regardless, the results point to the importance of ex-ante media coverage for IPO firms, especially during troubling and uncertain times like the COVID-19 pandemic. Future researchers could consider using different measurements for the sentiment analysis and extend the research to different news platforms like social media as opposed to exclusively sentiment contained in news articles from well-established news outlets. Additionally, other markets across the world could be considered for the research instead of exclusively the American market.

Appendix A - Examples of sentiment analyses

Positive
GoodRx IPO Shows Low Drug Prices Can Still Mean Big Money
By: Leah Rosenbaum, Forbes Staff
Forbes, 23-09-2020

Shares of drug pricing company GoodRx soared on Wednesday, up 53% from its initial IPO list price of $33 at market close. The company **best** known for its drug discount coupons is also cashing in on the virtual care **boom** set off by the Covid-19 pandemic through its telemedicine services. The company started trading at $46 per share, $13 above its expected price, and ended at $50.50 per share. The company market cap was $19.4 billion.

This is my first time going through an IPO and it is definitely arduous and painful at times, says co-CEO and cofounder Doug Hirsch. But the net result was **positive** and now I can go back to my day job."

The Santa Monica, California-based company was founded in 2011 with a mission to make drug prices more transparent. Since then, the company has expanded into multiple sectors of healthcare, including atelemedicine marketplace feature where patients can compare the costs of different telemedicine providers. Just before the pandemic the company acquired telemedicine provider HeyDoctor.

The Covid-19 pandemic is changing the way people deal with healthcare," Hirsch says. More people are reluctant to leave their homes to go to the doctor or pharmacy, and virtual health services have **boomed**. Hirsch says that GoodRx customers can make a telehealth appointment on the platform, see a physician, and then get medications delivered directly to their homes. "We're trying to give people options beyond the usual ways of doing business," he says.
Though it may seem counterintuitive to build a company around lowering prices, the idea has clearly worked. GoodRx has been **profitable** since 2016, and revenue grew 48% in the first half of 2020 to $257 million according to the company's S-1 filing. Hirsch says the company has found **success** by patching a hole in the healthcare industry. Healthcare [in America] is so broken and so messed up, he says, that there's an **opportunity** for us to help people and create a **successful** business **opportunity** along the way.

And **successful** it is. Hirsch and cofounder Trevor Bezdek each own 4.5 million shares of the company, a stake worth about $225 million each as of Wednesday's market close. Hisch, Bezdek and a third cofounder Scott Marlette are also managing members of Idea Men, LLC, which holds 60 million shares. If the ownership of Idea Men is evenly split between the three, each could be a billionaire. Another 1 million shares are reserved to fund the company's philanthropic arm, GoodRxHelps, which works to provide access to healthcare in low-income communities according to Hirsch.

Though it's been an **exciting** day for the company, the work is far from over. Hirsch says that the company's next steps include expanding their reach to brand-name drug discounts and more telemedicine services.

Negative
Uber faces class action lawsuit in Australia
By: By Sherisse Pham, CNN Business
CNN, 03-05-2019

Uber is facing a new legal **challenge** Down Under.

More than 6,000 taxi drivers and car-hire operators are **suing** Uber in Australia, signing on to a major class action lawsuit. The suit **alleges** that Uber defied regulations and operated **illegally** in Australia, giving it an **unfair** advantage over local taxi drivers and other industry players that complied with the law. Australian law firm Maurice Blackburn said it filed the case in the Victorian Supreme Court on Friday.

“Uber sells the idea that it does things differently, but in reality, and as we **allege**, this has meant operating **unlawfully**, using devious programs like 'Greyball,” Maurice Blackburn lawyer Elizabeth O'Shea said in a statement. Greyball was a software program that prevented regulators and law enforcement from monitoring Uber's app. Uber used it in countries around the world, including Australia, China and South Korea, according to The New York Times, which first reported on Greyball in 2017. Uber said at the time that the software wasn't meant to target regulators, but to protect its drivers. After the Times report, the company prohibited the use of Greyball to target local regulators.

A spokesperson for Uber said the company had not yet been served with a class action claim in Australia but was aware of media reports about the lawsuit **alleging** it had operated **illegally**. Uber **denies** this **allegation** and, if a claim is served making it, the claim will be vigorously defended, the spokesperson added. The law firm did not **disclose** how much it was seeking in **damages**, but a spokesman told CNN Business that the case has the potential to "run into the hundreds of millions" of Australian dollars.

Uber's conduct “led to horrible **losses** being **suffered** by our group members”. For those reasons, we are targeting the multi-billion dollar company Uber and its associated entities to provide **redress** to those affected, O'Shea said.

The lawsuit comes as Uber revs up for a highly anticipated public offering. The blockbuster IPO could value the Silicon Valley start-up at $84 billion.

In a US regulatory filing, Uber **warned** investors that it is involved in "**litigation** in a number of the jurisdictions in which we operate." The company noted that the "expensive and time consuming" lawsuits pose a potential risk to its business.

Australia is a key market for Uber. The company sold its operations in Southeast Asia, Russia and China in recent years, cutting **losses** in **unprofitable** markets to focus on business in regions like the United States, Europe, Latin America and Australia.

Australia's ride hailing industry is expected to grow about 14% to $543 million by 2024, according to research firm IBIS World.

Uber is already facing pressure from rival ride-hailing companies in Australia. Chinese start-up Didi Chuxing and Indian firm Ola both launched services in the country last year.

Appendix B - IPO firms sample

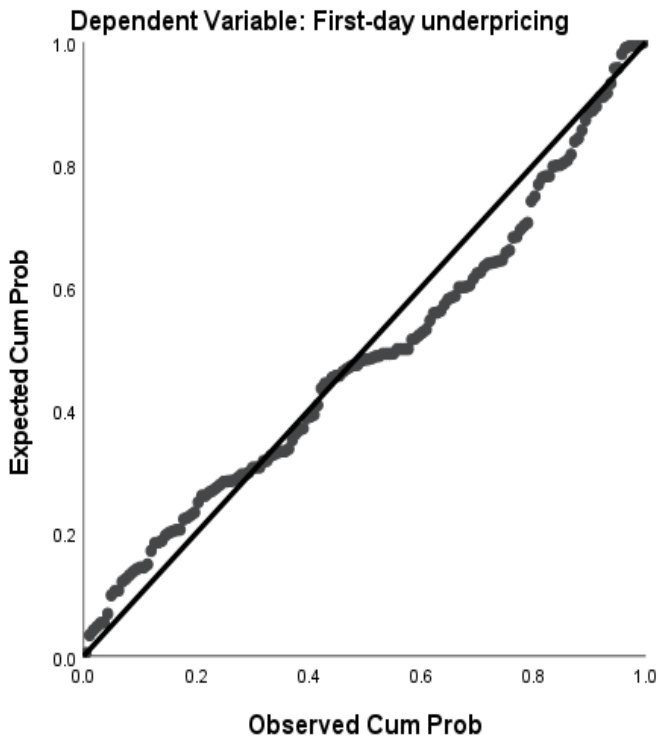
Table 14
IPO firms represented in the sample.

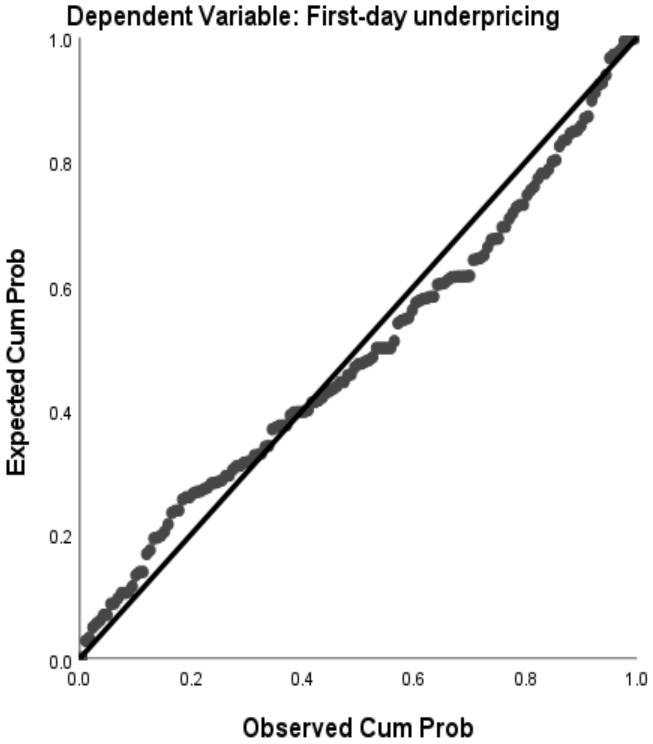
IPO firm	IPO date	IPO firm	IPO date
1LIFE HEALTHCARE	04/02/2020	CASPER SLEEP	06/02/2020
4D MOLECULAR THERAPEUTICS	11/12/2020	CASTLE BIOSCIENCES	25/07/2019
908 DEVICES	18/12/2020	CHANGE HEALTHCARE	27/06/2019
ACCOLADE	02/07/2020	CHECKMATE PHARMACEUTICALS	07/08/2020
ACUTUS MEDICAL	06/08/2020	CHEWY	14/06/2019
ADITX THERAPEUTICS	30/06/2020	CLOUDFLARE	13/09/2019
AIRBNB	10/12/2020	CORSAIR GAMING	23/09/2020
AKERO THERAPEUTICS	20/06/2019	CROWDSTRIKE HOLDINGS	12/06/2019
AKOUOS	26/06/2020	DATTO HOLDING CORPORATION	21/10/2020
ALBERTSONS COMPANIES	26/06/2020	DOORDASH	09/12/2020
ALECTOR	07/02/2019	DUCK CREEK TECHNOLOGIES	14/08/2020
ALIGOS THERAPEUTICS	16/10/2020	DUN & BRADSTREET HOLDINGS	01/07/2020
ALLEGRO MICROSYSTEMS	29/10/2020	DYNATRACE	01/08/2019
ALLOVIR	30/07/2020	DYNE THERAPEUTICS	17/09/2020
ALX ONCOLOGY HOLDINGS	17/07/2020	EXAGEN	19/09/2019
AMERICAN WELL CORPORATION	17/09/2020	FASTLY	17/05/2019
APPLIED THERAPEUTICS	14/05/2019	FOGHORN THERAPEUTICS	23/10/2020
APREA THERAPEUTICS	03/10/2019	FREQUENCY THERAPEUTICS	03/10/2019
ARCUTIS BIOTHERAPEUTICS	31/01/2020	FULCRUM THERAPEUTICS	18/07/2019
ARRAY TECHNOLOGIES	15/10/2020	GALERA THERAPEUTICS	07/11/2019
ASANA	30/09/2020	GATOS SILVER	28/10/2020
ATEA PHARMACEUTICALS	30/10/2020	GENERATION BIO COMPANY	12/06/2020
ATHIRA PHARMA	18/09/2020	GOODRX HOLDINGS	23/09/2020
ATRECA	20/06/2019	GOSSAMER BIO	08/02/2019
AVANTOR	17/05/2019	GREENWICH LIFESCIENCES	25/09/2020
AVEDRO	11/02/2019	GROCERY OUTLET HOLDING	20/06/2019
AVIDITY BIOSCIENCES	12/06/2020	HEALTH CATALYST	25/07/2019
AZEK COMPANY THE	12/06/2020	HYDROFARM HOLDINGS GROUP	10/12/2020
AZIYO BIOLOGICS	08/10/2020	IDEAYA BIOSCIENCES	23/05/2019
BEAM THERAPEUTICS	06/02/2020	IGM BIOSCIENCES	18/09/2019
BELLRING BRANDS	17/10/2019	IMMUNOME	02/10/2020
BENTLEY SYSTEMS	23/09/2020	INARI MEDICAL	22/05/2020
BERKELEY LIGHTS	21/07/2020	INMUNE BIO	04/02/2019
BEYOND MEAT	02/05/2019	JAMF HOLDING CORPORATION	22/07/2020
BIGCOMMERCE HOLDINGS	05/08/2020	KALEIDO BIOSCIENCES	28/02/2019
BILL.COM HOLDINGS	12/12/2019	KARUNA THERAPEUTICS	28/06/2019
BLACK DIAMOND THERAPEUTICS	30/01/2020	KINNATE BIOPHARMA	03/12/2020

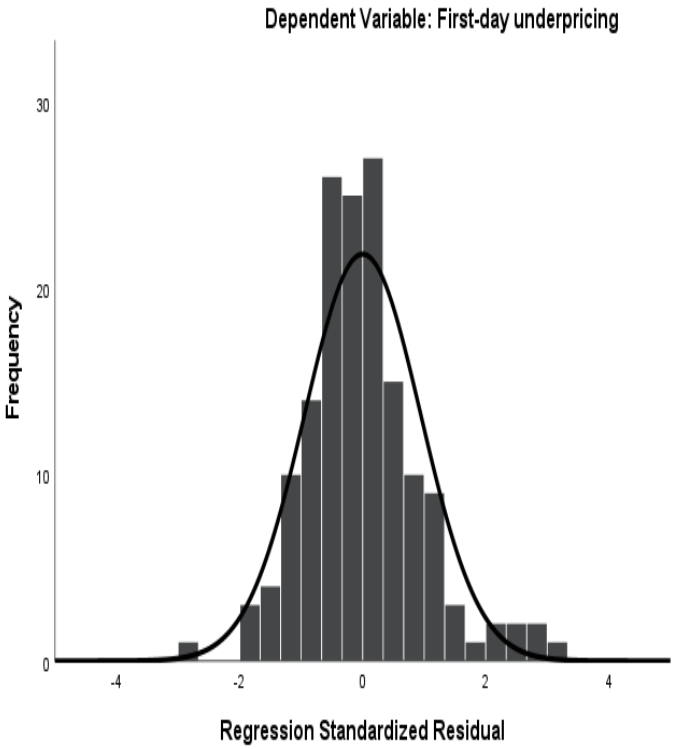
C4 THERAPEUTICS	02/10/2020	KIROMIC BIOPHARMA	16/10/2020
CABALETTA BIO	25/10/2019	KRONOS BIO	09/10/2020
KURA SUSHI USA	01/08/2019	RAPT THERAPEUTICS	31/10/2019
KYMERA THERAPEUTICS	21/08/2020	RATTLER MIDSTREAM LP	23/05/2019
LAIRD SUPERFOOD	23/09/2020	REALREAL, THE	28/06/2019
LANTERN PHARMA	11/06/2020	REVOLUTION MEDICINES	13/02/2020
LEVI STRAUSS & COMPANY	21/03/2019	REVOLVE GROUP LLC	06/06/2019
LIVONGO HEALTH	25/07/2019	REYNOLDS CONSUMER PRODUCTS	31/01/2020
LMP AUTOMOTIVE HOLDINGS	05/12/2019	SATSUMA PHARMACEUTICALS	17/09/2019
LYFT	29/03/2019	SCHRODINGER	06/02/2020
MEDALLIA	19/07/2019	SCOPUS BIOPHARMA	16/12/2020
MEDIAALPHA	28/10/2020	SEER	04/12/2020
MISSION PRODUCE	01/10/2020	SHATTUCK LABS	09/10/2020
MORPHIC HOLDING	27/06/2019	SHOCKWAVE MEDICAL	07/03/2019
NCINO	14/07/2020	SILK ROAD MEDICAL	04/04/2019
NEXTCURE	09/05/2019	SITIME CORPORATION	21/11/2019
NGM BIOPHARMACEUTICALS	04/04/2019	SNOWFLAKE	16/09/2020
NKARTA INC.	10/07/2020	SONIM TECHNOLOGIES	10/05/2019
NURIX THERAPEUTICS	24/07/2020	SOTERA HEALTH COMPANY	20/11/2020
OLEMA PHARMACEUTICALS	19/11/2020	SPRINGWORKS THERAPEUTICS	13/09/2019
ONEWATER MARINE	07/02/2020	SPRUCE BIOSCIENCES	09/10/2020
ORIC PHARMACEUTICALS	24/04/2020	STOKE THERAPEUTICS	19/06/2019
OUTSET MEDICAL	15/09/2020	SUMO LOGIC	17/09/2020
OYSTER POINT PHARMA	31/10/2019	SUNNOVA ENERGY	25/07/2019
PAGERDUTY	11/04/2019	SUPER LEAGUE GAMING	26/02/2019
PANDION THERAPEUTICS	17/07/2020	TARSUS PHARMACEUTICALS	16/10/2020
PARSONS CORPORATION	08/05/2019	TAYSHA GENE THERAPIES	24/09/2020
PERSONALIS INC.	20/06/2019	TELA BIO	08/11/2019
PHATHOM PHARMACEUTICALS	25/10/2019	TRANSMEDICS GROUP	02/05/2019
PING IDENTITY HOLDING	19/09/2019	TREVI THERAPEUTICS	07/05/2019
PINTEREST	18/04/2019	TURNING POINT THERAPEUTICS	17/04/2019
PLIANT THERAPEUTICS	03/06/2020	UBER TECHNOLOGIES	10/05/2019
PMV PHARMACEUTICALS	25/09/2020	UNITY SOFTWARE	18/09/2020
POSEIDA THERAPEUTICS	10/07/2020	VAXCYTE	12/06/2020
PPD	06/02/2020	VIELA BIO	07/10/2019
PRAXIS PRECISION MEDICINES	16/10/2020	VIR BIOTECHNOLOGY	11/10/2019
PRECISION BIOSCIENCES	28/03/2019	VIRIOS THERAPEUTICS	17/12/2020
PRELUDE THERAPEUTICS	25/09/2020	VIVOS THERAPEUTICS	11/12/2020
PREVAIL THERAPEUTICS	20/06/2019	VROOM	09/06/2020
PROGENITY	19/06/2020	ZOOM VIDEO COMMUNICATIONS	18/04/2019
PUBMATIC	11/12/2020		

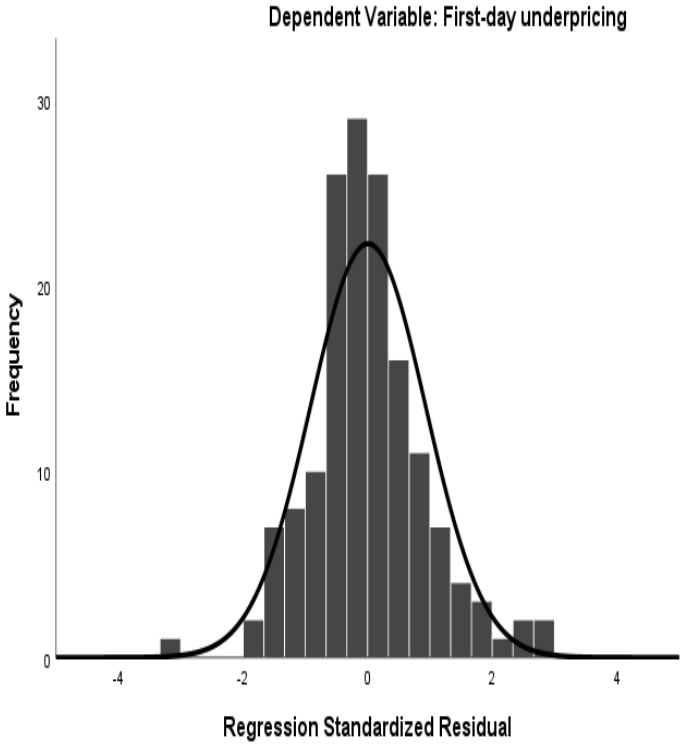
Appendix C - Assumption testing

** Regression model (I) on the left, regression model (II) on the right.

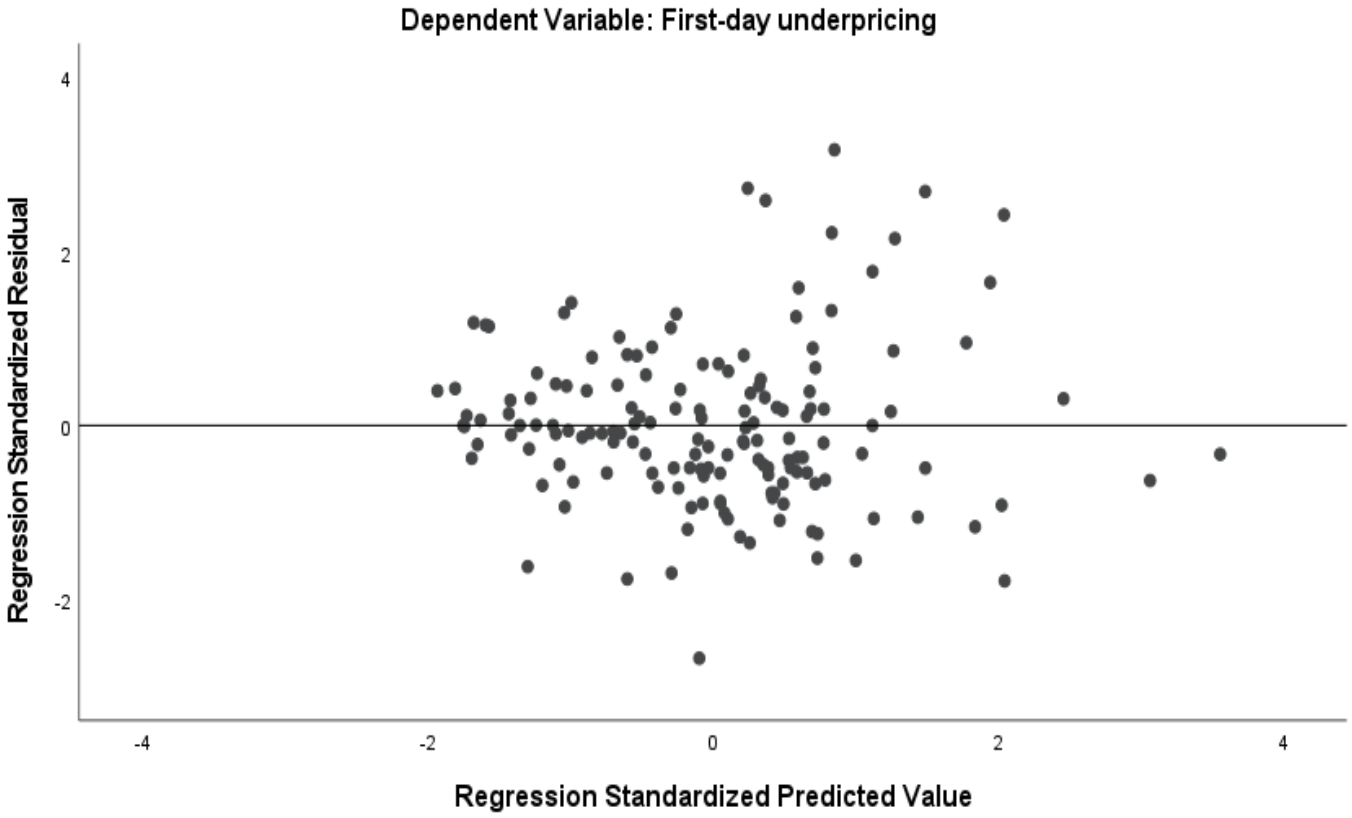


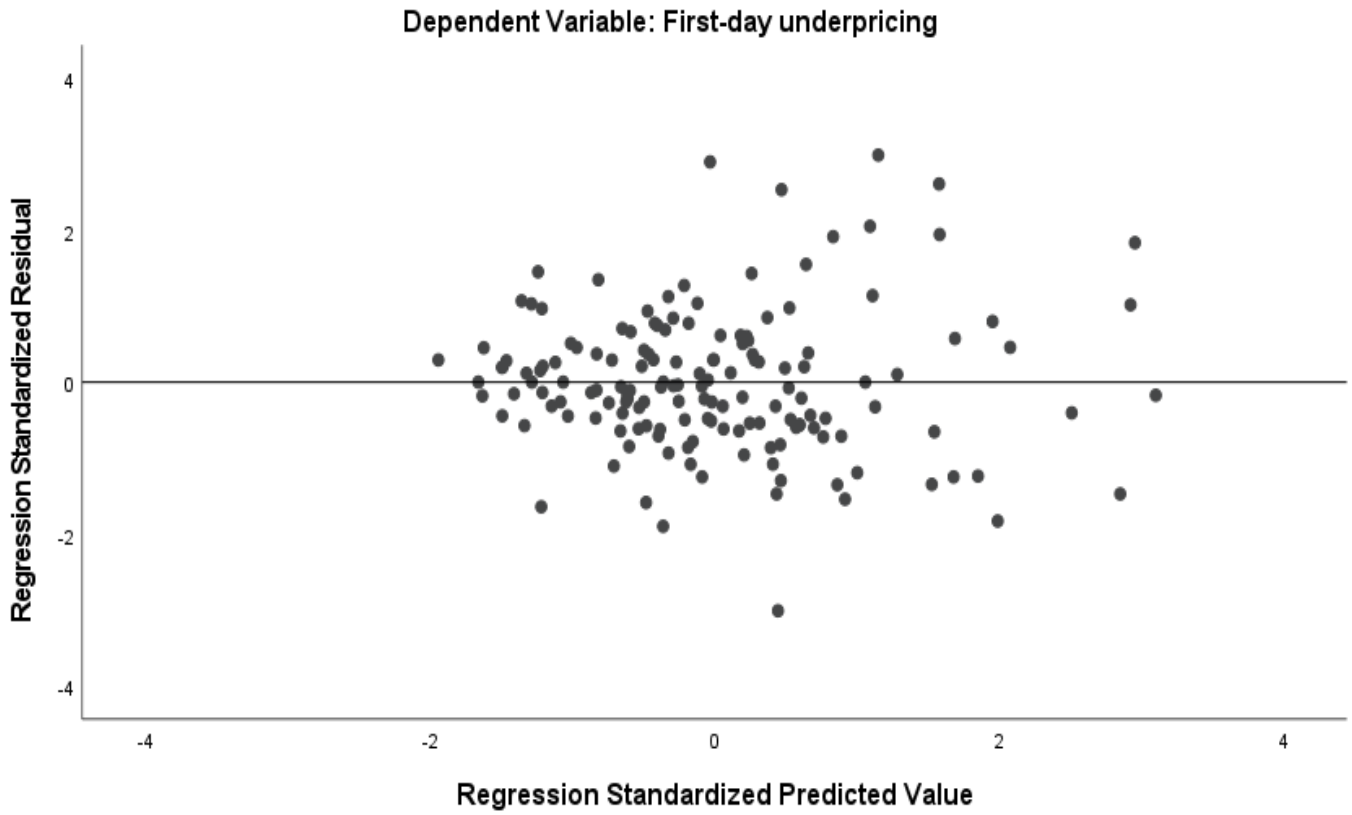






** Regression model (I) on top, regression model (II) on the bottom.





VIF values model (I)

Model	Tolerance	**VIF**
ln(media volume)	0.450	**2.220**
Positive sentiment	0.642	**1.558**
Negative sentiment	0.548	**1.826**
ln(offer price)	0.339	**2.947**
ln(age)	0.441	**2.270**
ln(employees)	0.227	**4.396**
ln(duration)	0.669	**1.431**
ln(number of shares)	0.301	**3.336**
Stock exchange dummy	0.663	**1.509**
VC-backing dummy	0.537	**1.862**
Industry dummy 1	0.892	**1.121**
Industry dummy 2	0.839	**1.192**
Industry dummy 3	0.856	**1.168**
Industry dummy 4	0.809	**1.236**
Industry dummy 5	0.735	**1.360**
Industry dummy 6	0.722	**1.385**
Period dummy	0.819	**1.221**

VIF values model (II)

Model	Tolerance	**VIF**
ln(media volume)	0.280	**3.574**
ln(Media volume)*COVID	0.340	**2.940**
Positive sentiment	0.357	**2.803**
Positive sentiment (tone)*COVID	0.425	**2.352**
Negative sentiment	0.326	**3.067**
Negative sentiment (tone)*COVID	0.409	**2.443**
ln(offer price)	0.331	**3.067**
ln(age)	0.440	**2.237**
ln(employees)	0.225	**4.447**
ln(duration)	0.662	**1.510**
ln(number of shares)	0.283	**3.538**
Stock exchange dummy	0.656	**1.525**
VC-backing dummy	0.527	**1.896**
Industry dummy 1	0.887	**1.127**
Industry dummy 2	0.830	**1.204**
Industry dummy 3	0.843	**1.186**
Industry dummy 4	0.781	**1.281**
Industry dummy 5	0.722	**1.385**
Industry dummy 6	0.715	**1.399**
COVID dummy	0.819	**1.221**

Appendix D - Additional robustness tests

Table 15
Robustness test of the results reported in table 8. The continues variables are winsorized at 90%. Standardized coefficients with t-statistics in parentheses significance of ***, **, * indicates 1%, 5% and 10% respectively.

	(1) First-day underpricing	(2) First-day underpricing	(3) First-day underpricing	(4) First-day underpricing
ln(Media coverage volume)	-0.054 (-0.563)			-0.073 (-0.739)
Positive sentiment (tone)		0.213** (2.564)		0.213** (2.402)
Negative sentiment (tone)			0.064 (0.764)	0.010 (0.107)
Control variables	Yes	Yes	Yes	Yes
Year and industry fixed effects	Yes	Yes	Yes	Yes
F-statistic	3.287***	3.851***	3.311***	3.395***
Observations	155	155	155	155
Adjusted R-squared	0.182	0.217	0.184	0.209

Table 16
Robustness test of the results reported in table 9. The continues variables are winsorized at 90%. Standardized coefficients with t-statistics in parentheses significance of ***, **, * indicates 1%, 5% and 10% respectively.

	(1) First-day underpricing	(2) First-day underpricing	(3) First-day underpricing	(4) First-day underpricing
ln(Media coverage volume)	0.005 (0.045)			0.049 (0.397)
ln(Media coverage volume)*COVID	-0.087 (-0.820)			-0.187 (-1.649)
Positive sentiment (tone)		0.068 (0.621)		0.042 (0.349)
Positive sentiment (tone)*COVID		0.203** (1.998)		0.245** (2.200)
Negative sentiment (tone)			0.023 (0.210)	-0.010 (-0.080)
Negative sentiment (tone)*COVID			0.058 (0.576)	0.044 (0.392)
COVID	0.197** (2.489)	0.226*** (2.923)	0.209** (2.581)	0.227*** (2.890)
Control variables	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
F-statistic	3.116***	3.927***	3.110***	3.312***
Observations	155	155	155	155
Adjusted R-squared	0.180	0.234	0.180	0.231

Table 17
Robustness test of the results reported in table 9. The IPOs prior to the mid of March are excluded from the sample.

	(1)	(2)	(3)	(4)
	First-day underpricing	First-day underpricing	First-day underpricing	First-day underpricing
ln(Media coverage volume)	0.001 (0.010)			0.060 (0.434)
ln(Media coverage volume)*COVID	-0.077 (-0.685)			-0.174 (-1.393)
Positive sentiment (tone)		0.052 (0.478)		0.071 (0.575)
Positive sentiment (tone)*COVID		0.199* (1.935)		0.213* (1.880)
Negative sentiment (tone)			0.011 (0.104)	-0.043 (-0.338)
Negative sentiment (tone)*COVID			0.058 (0.590)	0.049 (0.432)
COVID	0.193** (2.356)	0.238*** (2.981)	0.211** (2.485)	0.217*** (2.615)
Control variables	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
F-statistic	2.543***	3.274***	2.540***	2.646***
Observations	149	149	149	149
Adjusted R-squared	0.143	0.187	0.143	0.182

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