

A Work Project, presented as part of the requirements for the Award of a Master's degree in
Impact Entrepreneurship and Innovation from the Nova School of Business and Economics.

AN INVESTIGATION OF THE RELATIONSHIP BETWEEN IPO UNDERPRICING AND
ESG SCORE IN THE HEALTHCARE INDUSTRY

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Abstract

This investigation aims to explore the correlation between companies' ESG score and their underpricing at IPO, with a focus on the healthcare sector.

Using regression analysis and considering several control variables associated with underpricing, it was found that ESG score can significantly influence underpricing: the results obtained from the study suggest that there is a positive relationship between the two variables, indicating that companies that invest in ESG tend to have higher levels of underpricing than others.

Keywords: ESG, Underpricing, IPO, Investors, Correlation

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1. Introduction

1.1 Research questions

This thesis seeks to explore and understand the relationship between companies ESG score and their underpricing at IPO. The investigation also aims to contribute to the broader debate on the real impact of ESG factors and the growing interest in sustainable investments.

Much of the previous research on this topic has focused primarily on the relationship between ESG information and firm financial performance, whereas this analysis concentrates specifically on the underpricing phenomenon.

Furthermore, the following investigation differs from others by focusing exclusively on the healthcare industry. The choice to take in consideration a single sector is motivated by the fact that the characteristics and cyclicity of each industry can significantly influence the price of new stock issued, leading to different relationship dynamics between the variables.

Moreover, the healthcare industry represents a steadily growing sector with a high rate of technological and scientific innovation with an annual growth rate (CAGR 2023-2027) of 10.95% and a projected market volume of \$92.01 billion by 2027 (Statista, 2023). This has led to increased investment in this field, especially in the pre-IPO stages, where companies are trying to raise funds to develop and commercialize their products.

Eventually, the industry at issue has a significant impact on society at large: many companies operating in the field have an important social mission, ranging from finding cures for rare diseases to providing essential drugs at affordable prices.

The implication of an ESG score analysis in this context could therefore provide important information on how these companies are addressing environmental, social, and governance issues.

1.2 Importance of IPOs and the phenomenon of underpricing

Initial public offerings (IPOs) have long been a key part of the financial market, as they represent the first time a company issues shares to the public, but more importantly, they are a way for companies to raise capital and access public equity markets, expanding and growing their business. At the same time, these transactions offer investors the opportunity to invest in these firms and benefit, depending on their performance, from their growth and success.

However, IPOs are also known to be risky operations as a loss of control or increased costs can result. Indeed, a public company is expected to comply with various regulatory requirements, such as financial reporting and disclosure, legal and accounting fees that can be time-consuming and costly. Generally, this process can also result in a reduction in management and company's founders decision-making autonomy, as shareholders and board members may have conflicting interests.

Indeed, during this transaction, several stakeholders come into play, each with a specific role and different purposes.

First, there is the company itself, which decides to go public to obtain financing and access greater sources of capital. A company that plans to go for an IPO is responsible for providing accurate and complete information about its business, financial performance, growth prospects, and other factors relevant to evaluating the investment.

Afterwards, a key role is the one played by the underwriter. The underwriter is the investment bank that generally determines the price, acts as an intermediary between the issuing company and investors and facilitates the process of stock issuing. In addition, it actively promotes the IPO among investors by arranging meetings, presentations, and publishing a detailed prospectus.

Institutional investors, including pension funds, hedge funds, and mutual funds, represent another category of essential actors in the IPO. These investors purchase the company's shares during the initial offering, thereby influencing the price and success of the IPO itself. Additionally, they may take an active role in the governance of the company after the IPO by joining the board of directors or exercising voting rights at shareholder meetings.

Private investors are another category of individuals who participate in the IPO. These investors purchase the company's shares before the initial offering, but in generally smaller amounts than institutional investors. Private investors may include high-income individuals, entrepreneurs, angel investors, and other non-institutional parties.

Finally, there are also regulatory bodies, such as the SEC in the United States, that regulate IPOs and set the rules and requirements for listing companies.

IPO brings numerous benefits to the company such as access to financial markets to obtain financing for expansion, investment, or debt reduction and growth of company visibility. However, it also has some disadvantages to consider, mainly including associated costs.

In addition to the direct costs mentioned early in the chapter, there are also several indirect costs related to this operation (Ritter, 1998). While the former encompasses legal, administrative, and advisory fees, and those paid to financial intermediaries responsible for managing the transaction, the latter refer especially to costs associated with the phenomenon known as underpricing.

Underpricing occurs when the offering price of the company's new stock at the first market listing turns out to be below the price at which the same stock trades at the end of the first day of trading. To measure the "degree" of underpricing, a common measure turns out to be the percentage change that the offer price (price at which the security is offered for subscription) results to have at the end of the first day of trading in the market, whether deliberate or unintentional.

There are several situations where the underpricing phenomenon can occur: first, the shares may have been underpriced on purpose to stimulate demand, which means that sometimes it is simply inflating the real value of the company. In fact, low-priced shares can act as free publicity: they are more likely to be picked up by journalists and speculators thus driving up the price on day one.

Another possibility to consider is information asymmetry. Due to the unavailability or poor disclosure of IPO information, investors may not have the ability to properly evaluate an investment in a particular company. The situation creates uncertainty for investors who do not have access to the same information as the issuing company and therefore, they may be reluctant to accurately evaluate whether to invest in the company or may demand a discount on the issue price to compensate for the additional risk associated with the uncertainty, leading to a price lower than the company's actual value.

On one side, the issuing company has an interest in not disclosing information that could adversely affect investors' judgment. On the other hand, investors may be aware of information about factors external to the company and may or may not decide to disclose it because of their interest in obtaining an offering price below the perceived market value of the stock in order to obtain a positive return.

Throughout history, the average underpricing of IPOs has risen from about 7% in the 1960s to more than 18% in the 1990s, and then dropped to about 12% in the 2000s. Loughran and Ritter (2004) attribute these changes to several factors, including changes in the regulatory environment, in investor sentiment, in the composition of IPOs, and, in general, alterations in the institutional structure of the IPO market. In particular, an important factor to consider is the emergence of a more active aftermarket for IPOs, which has led to major changes in the way underwriters are compensated.

Moreover, in recent years, among the several aspects that the stakeholders involved take into consideration at the time of IPO, such as company valuation, market conditions, pricing structure, etc., there has been an increasing focus on ESG (environmental, social, and governance) factors.

Investors are increasingly aware of companies' impact on ESG issues and, as a PWC (2022) research stated, 79% of institutional investors plan to increase ESG products in their portfolios in the next two years. Overall, the growth of ESG managed assets will grow faster than other asset classes, coming to represent 21.5 % of all assets globally.

1.3 Background and context of ESG score

Environmental, social, and governance investments have become progressively popular in recent years and investors have shown increasing interest in allocating their capital to companies that not only produce good economics performances, but also demonstrate a commitment to sustainability, ethical business practices, and good corporate governance.

These types of investments are called ESG investments; but what does ESG stands for?

The first letter, E, represents the "Environmental" aspects and addresses issues closely related to sustainability in environmental terms, such as environmental restrictions, the circular

economy, carbon emissions, energy consumption, or natural resource preservation. S stands for "Social" and covers issues that affect its impact in the social environment of the global or local community, such as human rights, employment conditions, interactions with suppliers and personnel, or anything concerning workforce diversity and inclusion. Lastly, G symbolize the "Governance" and alludes to corporate governance, including shareholder benefits, executive income, salaries, internal controls, and ethics.

While socially responsible investing (SRI) has been applied for several decades, ESG investing was born out of the United Nations Principles for Responsible Investment (PRI) in April 2006, released to the New York Stock Exchange. Since 2006, the totality of PRI signers has increased from 100 to over 3,000, and assets managed according to ESG regulation, have grown massively. SRI and ESG investments have thus gone from being available only to institutional investors to being within the reach of retail investors as well, thanks to data that are now widely public. They can be defined as a niche approach aimed at avoiding mediocre companies and allocating capital to companies committed to social and environmental change.

ESG investments are growing rapidly and increasingly focus on both investment performance and long-term sustainability indeed, investors are using them to create informed portfolios, as sustainability is also becoming an alternative to risk management (Lenssen, 2014).

In addition, markets and clients have a growing expectation that financial institutions and firms should have a watchful eye on sustainability (Sheth, 2011), and a real desire to develop and preserve something valuable for future generations (Lagoarde-Segot and Paraque, 2018).

In today's society, all stakeholders in the financial sector seek to create purposeful and

beneficial links to sustainability and consider the sustainability consequences of their actions, whether out of a brand theme or a personal desire to fund more socially responsible projects. Previous investigations have also shown that investors weight ESG score with sustainability when evaluating a company (Friede, 2015; Pedersen, 2020).

According to the Global Sustainable Investment Alliance (2022), the global sustainable investment is ready to reach an assessment market of US\$ 39.3 billion by the end of 2023, with a CAGR% of 6.8%. This trend is driven by several factors, including concerns about climate change, social inequality, and the growing interest for corporate governance issues. As a result, investors are getting progressively more interested in finding methods to match their beliefs with their investments and have a beneficial social and environmental effect.

The inclusion of ESG criteria in the evaluation of companies prior to an initial public offering could be of great importance. This indicator can be calculated for both private and public companies, making it a versatile and effective valuation parameter.

Consequently, when evaluating investments, investment funds have updated their guidelines to include ESG factors and conduct due diligence in accordance with global ESG requirements and frameworks, such as the Task Force on Climate-related Financial Disclosures (TCFD) or the Sustainability Accounting Standards Board (SASB).

It's important to point out that consumers also attach great importance to corporate values: with the growing need for sustainable development, consumers expect companies to contribute to the improvement of the environment and society.

Therefore, ESG could play a crucial role in the success of an IPO, to provide integrity values

to all parties involved, not just shareholders, and to reduce the risk of underpricing stocks. Analysis of ESG criteria can provide investors with a more comprehensive idea of a company's performance, helping them to make more informed and responsible investment decisions, positively influencing the share issue price and mitigating the underpricing risk that can lead to loss of value for the company.

2. Literature review & hypothesis

2.1 Evidence on the correlation

Although previous studies on the relationship between ESG investments and initial public offerings (IPOs), particularly underpricing, has been relatively limited, prior research has investigated the correlation between ESG and financial performance.

A recent study by Serafeim, and Yoon, dating back to 2021, analyzes both the stock price response to the ESG score and whether these reactions can be predicted through a company specific ESG index. The research might be particularly relevant as investors are increasingly incorporating ESG information into their portfolios, firms are devoting more funds to improving their ESG performance, and policy makers are paying more attention to understanding how ESG information is disseminated to the market to gauge how financial players will respond to it.

Investigation results show that stock prices react only to ESG score classified as financially relevant to a particular sector by the Sustainability Accounting Standards Board (SASB), demonstrating that investors react to scores selectively. Moreover, the more positive ESG news involving social capital issues, the greater the price reaction.

Another study carried out the same year (2021) is that of Baker, Boulton, Braga-Alves and Morey.

The information asymmetry hypothesis and the investor attention hypothesis are two opposing theories developed around the link between country-level ESG ratings and firm-level IPO underpricing. The researchers found that better ESG ratings are linked to decreased underpricing of IPOs, rejecting the investor attention hypothesis, and validating the information asymmetry theory. The study also reports significant relationships between underpricing and other determinants such as hot markets, underwriter rank, and lockup duration. Overall, the research provides evidence that ESG ratings are related to information asymmetry and have an impact on IPO underpricing.

On the other hand, the study by Dhasmana, Ghosh, Kanjilal (2023) has deepened the relationship between an emerging economy's investor sentiment and its ESG score, stating that variables investigated have a long-term association (ESG index and investor sentiment), but this relationship is not symmetrical. Specifically, the study found that an increase or improvement in the ESG score weakens investor sentiment, while a decrease or deterioration in the ESG score strengthens it. In other words, investors may view companies with better ESG performance as less attractive investments: this means that changes in investor sentiment, whether positive or negative, do not seem to have a significant effect on a company's ESG performance.

Overall, although there is no definitive consensus on the relationship between ESG investment and underpricing, studies suggest that investors may place a higher value on companies that

focus on ESG factors and that companies with better ESG performance may be more likely to attract investors and outperform their peers in the long run.

Further research is needed to explore this relationship and determine the factors that determine underpricing in the context of ESG investing.

2.2 Research hypothesis

Before turning to the regression models, some research hypotheses were made based on the previously conducted studies.

The first hypothesis suggests the existence of a negative association between the ESG score and underpricing. This could be dependable with the theory of reducing information asymmetries: the disclosure of new information, such as ESG information, could help in decreasing the level of information asymmetry among outside investors the company itself and, incentivizing them to invest more informedly in the firm. In addition, as suggested by a good review of the literature (Friede, Busch, and Bassen 2015), ESG reporting could improve firms' financial and business performance, hence there should be a negative correlation with underpricing, in that a decrease in information asymmetries is linked to a more accurate estimate of the bid price, causing lower first-day stock market returns.

The second hypothesis might suggest a positive correlation with underpricing, as investors who are more focused on environmental, social, and governance risks might prefer to invest in companies with sound ESG policies, but these companies might also have greater long-term growth potential and thus require more upfront investment, leading to higher underpricing at the beginning of their growth path.

A final hypothesis could be that there is no correlation between the two variables: despite the rise in popularity of ESG issues in recent years, doubt often arises as to whether ESG investments are actually effective or whether there is misleading or incomplete information. In this case, investors may be concerned that ESG investments may have a lower return than traditional investments because companies that meet ESG criteria may be less profitable.

3. Data collection & methodology

3.1 Data Collection

A data sampling was conducted for model analysis, which included 255 observations represented by publicly traded companies in the healthcare industry from January 1, 2018 to the end of December 2022, reported in full in the appendix at the end of the paper (*Appendix exhibit 1*).

The temporal choice of observation period was made in order to take into account the increased attention on the ESG topic, which is relatively new, and the fact that ESG scoring is often only available from the year 2018.

The objective of the research, as already mentioned earlier, is to assess the influence of ESG disclosure on institutional and retail investor behavior, and for this only companies that have IPOed on the Nasdaq or NYSE were considered since these are the largest and most well-known stock markets in the United States and account for the majority of IPOs in this country. Secondly, NASDAQ and the NYSE are known for having a high number of listed technology and healthcare companies, two sectors that often exhibit a high level of innovation and attention

to ESG. Third, companies listed on the NASDAQ and NYSE are often under greater pressure and attention from investors and financial analysts, which may make it more interesting to explore the relationship between IPO underpricing and ESG score in these markets.

The Refinitiv database was used to obtain all the data and check for discrepancies.

3.2 Dependent variable

For the dependent variable, the underpricing of each observation was considered. This phenomenon, which happens when the offer price is lower than the shares' market price at the time of listing, was calculated by taking the price at the end of the first trading day, then subtracting the initial offering price on the day of the IPO and dividing by the initial offering price.

$$(I) [(P_m - P_0) / P_0]$$

- P_m : share price at the end of the first trading session.

- P_0 : indicates the offering price of the stock.

3.3 Independent variable

For each of the 255 companies listed in the time frame, the combined ESG score was collected. Based on data from the ESG pillars and ESG issues observed from worldwide media sources, Refinitiv's ESG Combined score (ESGC) offers a comprehensive, balanced evaluation of a company's ESG performance. In order to mitigate the risk of greenwashing and information asymmetry, the ESGC score was created to reduce the ESG score based on negative media

stories by incorporating the impact of significant and relevant ESG controversies into the overall ESGC score. (Refinitiv, 2022)

This score was then used as an independent variable in the following way:

- 1 = for the companies with ESG score
- 0 = for the companies with no ESG score

To clarify, a hypothesis has been made that companies that currently have an ESG score also had it when they were publicly traded (*Appendix exhibit 2*).

3.4 Label controls

To ensure the highest level of detail and precision in the regression analysis, some control variables were identified within the sample. These variables are used to control for correlated factors that might influence the dependent variable Y but have no causal effect on it. In other words, the control variables are used to control the presence of any causal variables omitted in the regression of Y on X: these have been used in the literature by different authors such as Loughran and Ritter (2004), Lowry and Shu (2002) or Ljungqvist and Wilhelm (2003).

The first of these variables concerns the type of the stock market. These elements can have a major impact on the level of underpricing of IPOs, indeed, market conditions and investor demand can significantly affect the amount of funds raised by IPOs, with direct consequences on the level of underpricing.

The NASDAQ and NYSE represent the most important and influential stock markets in the United States, and their impact on IPOs has been the subject of numerous studies. In particular, it has been shown that during periods of high investor demand and favorable market conditions, IPOs tend to be oversubscribed, resulting in an increased level of underpricing.

Therefore, the choice of including market type as a control variable in the regression was made to control the influence of market conditions on the amount of underpricing and to guarantee better correctness of the results. This will lead to a more detailed understanding of how the dependent variable underpricing is affected by the independent variable ESG score.

Considering the existence of two separate stock markets, label control was performed as by making the dummy variable as follows:

- 0 = NASDAQ;
- 1 = NYSE.

In terms of stock exchanges, shares of 12 companies have been traded on the NYSE, while the last 243 on the NASDAQ. (*Appendix exhibit 3*)

The second controlling factor considered is company size, which is an important factor in influencing the underpricing of IPOs. Larger companies with an established reputation and a long track record of success are generally considered less risky investments, leading to lower levels of underpricing. Company size was measured by the offering size, a common metric used to assess company size.

The use of offering size as a control variable is a common practice in IPO analysis and helps to provide a more accurate estimate of the level of underpricing.

The third control variable chosen for the analysis is the reputation of the lead underwriter, which is an important factor in determining the underpricing of IPOs. In particular, the experience and reputation of the lead underwriter can influence the price performance of the

IPO. In order to make the control variable quantifiable, it was decided to create a dummy variable that takes the value "1" if the lead underwriter is among the top 5 on the list of most reputable lead underwriters, otherwise it takes the value "0."

The use of this control variable makes it possible to assess the effect of the lead underwriter's reputation on underpricing: the reputation of the lead underwriter can affect investors' perceptions of the quality of the offering and the firm's ability to generate future profits, thereby influencing investor demand and the level of underpricing.

According to the scores set by the underwriter rank, the ranking was as follows:

<i>Lead Underwriter</i>	<i>Scores</i>
<i>Goldman Sachs & Co</i>	9,001
<i>JP Morgan & Co Inc</i>	9,001
<i>Morgan Stanley & Co LL</i>	9,001
<i>Citigroup Global Markets LL</i>	9,001
<i>Bank of America Merrill Sync</i>	8,501

Figure 1 – Rank of Lead Underwriters based on the score (Warrington college of Business, UF Warrington Faculty 2022)

The *age of the company at the time of the IPO* was identified as another control factor for this regression analysis. The choice of this variable assumes that more mature companies may be considered less risky and therefore less susceptible to underpricing. In addition, younger companies may have higher stock price volatility, which could lead to increased underpricing.

To define the company age dummy variable, the average age of all companies included in the sample was calculated. Then, two options were considered: "0" if the average age of the company was less than *average*, and "1" if it was greater than or equal to *average*. In this way,

the dummy variable of company age was created to be used as a control variable in the regression analysis.

3.5 Model definition

Following previous studies (Loughran and Ritter, 2004), to better understand the correlation between ESG investment and underpricing, a regression analysis was conducted. The analysis includes a multiple linear regression with one dependent variable, one independent variable, and 4 controls.

For this step, the Stata platform was used, which offers a wide range of commands specific to linear regression, allowing detailed data analysis, including diagnosis of multicollinearity issues. In addition, Stata also offers the ability to perform multivariate regression analysis, which can be useful for examining the relationships between multiple independent variables and the dependent variable.

The general formula of the regression would be:

$$(2) Y = b_0 + b_1X_1 + b_2X_2 + \dots + b_nX_n$$

where Y represents the dependent variable (in this case, underpricing), β_0 represents the intercept, which is the value of underpricing when all other independent variables are equal to zero and thus the value of the intercept, and β_1 - β_5 are the regression coefficients associated with the independent variables.

The significance of the results was assessed using the F-test, which assesses the significance of the regression model, and the t-test, which assesses the individual significance of each independent variable.

4. Results

reg underpricing esgscore offeringsize i.stockmarket i.reputation i.new_companyage

<i>Number of OBS</i>	255
<i>F (5, 249)</i>	7.41
<i>Prob >F</i>	0.0000
<i>R-squared</i>	0.1295
<i>Adj R-squared</i>	0.1121
<i>Root MSE</i>	3.5007

<i>Source</i>	<i>SS</i>	<i>df</i>	<i>MS</i>
<i>Model</i>	454.082657	5	90.8165314
<i>Residual</i>	3051.52004	249	12.2551005
<i>Total</i>	3505.60269	254	13.8015854

<i>underpricing</i>	<i>Coefficient</i>	<i>Std. err.</i>	<i>t</i>	<i>P> t </i>	<i>[95% conf. interval]</i>
<i>esgscore</i>	2.10752	.4991269	4.22	0.000	1.124471 3.090569
<i>Offering size</i>	1.485162	.5026806	2.95	0.003	.4951142 2.47521
<i>Stockmarket. NYSE</i>	.6460613	1.041887	0.62	0.536	-1.405974 2.698096
<i>Reputation. Top #5 Ranking</i>	-1.215377	.4781464	-2.54	0.012	-2.157104 -.2736497
<i>New_companyage < 6 years</i>	1.056251	.477327	2.21	0.028	.1161378 1.996364

Figure 2 – Regression results (Stata)

The regression coefficient associated with ESG score is 2.10, with a standard deviation of 0.49 and a t-statistic value of 4.22. The p-value for this coefficient is less than 0.05, indicating that the ESG score is a significant independent variable in the regression.

The 95% confidence interval for the ESG score ranges from 1.12 to 3.09. This interval represents an estimate of the range of values within which the true regression coefficient for the ESG score would probably fall 95% of the time if the regression were repeated on many different collections of data randomly sampled from the population of interest.

In general, the positive coefficient for the ESG score indicates that a company with a higher ESG score tends to have a higher level of underpricing at IPO. This result could be interpreted as showing that investors are willing to pay a premium for companies that are seen as socially responsible and sustainable. However, it is important to note that the coefficient alone does not provide an accurate measure of the effect of the ESG score on underpricing, as the coefficient also depends on the other independent variables included in the regression.

In the regression, the variable *offeringsize* has a coefficient of 1.48, with a standard error of 0.5. This coefficient indicates that when the offering size is high, underpricing increases, holding the other independent variables included in the model constant. The p-value associated with this coefficient is 0.003, indicating that the coefficient is statistically significant at the 5% significance level.

Regarding the controls entered, the coefficient for the NYSE category is 0.64, which means that, holding all other variables constant, a company listed on the NYSE tends to have higher underpricing than a company listed on the NASDAQ. However, the value of $P > |t|$ (0.53) indicates that this coefficient is not statistically significant, so we cannot be sure that this relationship is real and not random. In addition, the 95% confidence interval for the coefficient (-1.4 to 2.6) is quite wide, suggesting some uncertainty about the true value of the coefficient. In general, the *stockmarket* variable seems to have little impact on underpricing.

The *reputation* parameter measures the effect of the lead underwriter's membership in the top 5 ranking of companies with higher reputation. The estimated coefficient is -1.21, which means that companies that are not in the top 5 reputation ranking have an average underpricing 1.21

higher than companies that are in the top 5 ranking, holding other variables in the model constant. The parameter has a standard error of 0.47 and a t-value of -2.54, with a p-value of 0.012. This indicates that the parameter is statistically significant, meaning that the effect of reputation on IPO undervaluation is probably real, rather than random.

Finally, the parameter *new_companyage* estimated coefficient of 1.05 indicates that, holding all other variables constant, firms with less than 6 years in business have, on average, an underpricing rate of initial offerings higher than older firms. In other words, younger firms tend to have a higher underbid rate than older firms, holding other variables in the model constant. The parameter is significant at the 5 % level of significance.

The results show that the model has overall statistical significance (Prob > F = 0.0) and a good ability to explain the variation in underpricing (R-squared = 0.12).

In general, the *ESG score* variable has a significant positive effect on underpricing, suggesting that companies with ESG scores tend to have higher underpricing. In contrast, the *lead underwriter reputation* variable with a ranking in the top 5 has a significant negative effect on underpricing, suggesting that companies with better reputation tend to have lower underpricing. In addition, the *age of the company at the time of IPO (new_company age)* variable with companies less than 6 years old has a significant positive effect on underpricing, suggesting that younger companies tend to have higher underpricing.

In conclusion, the results indicate that *ESG score*, *reputation*, and *new_companyage* are important factors to consider when analyzing the relationship between underpricing and the independent variables. However, there is a need to further investigate the effects of these variables.

5. Limitations, future research opportunities & conclusions

5.1 Limitations

It is fair to point out, as with any statistical research, that the model analyzed has some limitations that may affect the interpretation of the results. First, the sample size may not be sufficient to ensure adequate representativeness, especially considering that the model uses only 255 observations. Also, the choice to use only data from U.S. IPOs may limit the generalizability of the results to other geographic settings.

Moreover, it should be noted that the model considers only five independent variables, but there are many other variables that could influence the underpricing of IPOs such as the ownership structure, the degree of uncertainty of the company, the competitive analysis or the presence of VCs at the moment of IPO. Although an attempt was made to be as precise as possible to include all relevant controls that might be associated with the dependent variable, it is possible that some key controls were omitted. The motivation behind this omission is the difficulty in finding the necessary data due to lack of access to suitable databases.

Certainly, to be considered is the risk of greenwashing, which could be a possible significant limitation of the study. Since the ESG score assessment is largely based on public information provided by companies, there is a risk that companies use greenwashing practices to artificially improve their ESG rating. In other words, companies could communicate misleading or deceptive information about their ESG practices to enhance their reputation. This could lead to an overestimation of the relationship between underpricing and ESG score. However, this risk

might be mitigated by using reliable data sources and independently verifying the information provided by companies.

Finally, it should be considered that the model does not account for any interaction effects between the independent variables, which could lead to an underestimation or overestimation of their effect on the dependent variable.

In general, it is important to keep in mind that every statistical model has limitations and that the results obtained should be interpreted with caution considering these limitations.

5.2 Areas of future research

Regarding the relationship between underpricing and ESG score, there are several possible areas of future research that could be explored. For example, one possible direction might involve assessing how the type of industry and sector in which the company operates might influence the relationship between underpricing and ESG score. In particular, it might be interesting to analyze whether the relationship is stronger in industries considered to have high environmental or social impact, such as energy, mining, or infrastructure, than in other industries.

Another area of research could be to analyze the link between underpricing and ESG score at the geographical level. It might be worthwhile to see if there are significant differences in the relationship between different countries or continents, for example due to differences in the regulatory and institutional environments in which companies operate.

Furthermore, it might be useful to investigate the temporal dynamics of the relationship between underpricing and ESG score, with a specific focus on the change in this relationship over time. For example, seeing whether the relationship has become stronger or weaker over the years, due to factors such as changing public awareness of ESG issues or the increasing focus of financial institutions on responsible investing.

5.3 Conclusions

This thesis focused on the relationship between underpricing of IPOs and ESG scores of issuing companies, while also examining the impact of other factors such as offering size, type of stock market, lead underwriter reputation, and company age.

Several hypotheses regarding the relationship between the amount of ESG information and underpricing were examined. Based on the results obtained, it can be stated that the first hypothesis was not supported, namely that the amount of ESG information has a negative correlation with underpricing. This suggests that ESG disclosure even though it may help reduce the information asymmetry between the company and investors, it does not lead to a more accurate assessment of the bid price and thus a reduction in underpricing.

Regarding the second hypothesis, the correlation between the amount of ESG information and underpricing is confirmed to be positive since an investment in ESG according to the study leads to a higher level of underpricing. In fact, companies that invest in ESG may also require a higher initial investment, resulting in higher underpricing at the beginning of their growth path.

Finally, the third hypothesis was confirmed as not true, that is, the lack of correlation between the two variables was not demonstrated, but the opposite. This suggests that investors are not necessarily skeptical about the effectiveness of ESG investments, but carefully evaluate the available ESG information before making an investment decision.

In summary, the findings suggest that the amount of ESG information can influence underpricing, but investors need to be careful how they evaluate ESG issues and available information.

The results obtained from the data analysis suggest a significant and positive relationship between ESG scores and underpricing of IPOs, indicating that companies that invest in ESG tend to have higher levels of underpricing than others. This relationship could be explained by the fact that companies that pay more attention to ESG issues might be perceived as more responsible and therefore more attractive to investors but on the other hand also riskier since the initial investment might be higher. On the one hand, therefore, high underpricing may create a sense of enthusiasm and confidence in the company, which may help to improve its reputation and public perception but on the other hand it could lead to loss of value for investors who have subscribed to the public offering and a possible decline in the share price in the long run.

Indeed, it would appear that investors place particular emphasis on ESG scores when evaluating the underpricing potential of IPOs.

In conclusion, this thesis provides insights into the role of ESG scores in underpricing IPOs and highlights the importance of considering these factors when evaluating investment opportunities.

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7. Appendix

Exhibit 1

Company name	Company name	Company name	Company name
Greenwich Lifesciences Inc	Atea Pharmaceuticals Inc	Morphic Holding Inc	Silk Road Medical Inc
Verrica Pharmaceuticals Inc	Oric Pharmaceuticals Inc	Caribou Biosciences Inc	Inspire Medical Systems Inc
Equillium Inc	NGM Biopharmaceuticals Inc	BridgeBio Pharma Inc	PMV Pharmaceuticals Inc
Evolus Inc	Privia Health Group Inc	Fulcrum Therapeutics Inc	Vir Biotechnology Inc
Rxsight Inc	Annexon Inc	Inozyme Pharma Inc	Progyny Inc
Eton Pharmaceuticals Inc	Surface Oncology Inc	Applied Therapeutics Inc	TCR2 Therapeutics Inc
Aligos Therapeutics Inc	Kezar Life Sciences Inc	4D Molecular Therapeutics Inc	Outset Medical Inc
Cytek Biosciences Inc	Apra Therapeutics Inc	Evelo Biosciences Inc	Allogene Therapeutics Inc
Shattuck Labs Inc	Prometheus Biosciences Inc	Lyell Immunopharma Inc	Sotera Health Co
IDEAYA Biosciences Inc	Lifestance Health Group Inc	Stoke Therapeutics Inc	Alignment Healthcare Inc
Kodiak Sciences Inc	agilon health inc	TELA Bio Inc	Elanco Animal Health Inc
Karuna Therapeutics Inc	Talaris Therapeutics Inc	Cue Biopharma Inc	Provention Bio Inc
Treace Medical Concepts Inc	Rapt Therapeutics Inc	Phathom Pharmaceuticals Inc	Exagen Inc
Alpha Teknova Inc	Prelude Therapeutics Inc	Eliem Therapeutics Inc	Envista Holdings Corp
Allovir Inc	Sana Biotechnology Inc	Rallybio Corp	Iteos Therapeutics Inc
Ikena Oncology Inc	C4 Therapeutics Inc	Nkarta Inc	Schrodinger Inc
Vaxcyte Inc	Y-mAbs Therapeutics Inc	Harpoon Therapeutics Inc	Arcutis Biotherapeutics Inc
Biomea Fusion Inc	Landos Biopharma Inc	BioXcel Therapeutics Inc	Avantor Inc
Caballetta Bio Inc	Pliant Therapeutics Inc	Talis Biomedical Corp	Relay Therapeutics Inc
Reneo Pharmaceuticals Inc	Allakos Inc	Keros Therapeutics Inc	Moderna Inc
Acutus Medical Inc	SQZ Biotechnologies Co	Sensei Biotherapeutics Inc	Vaccinex Inc
Instil Bio Inc	Oncorus Inc	Cyteir Therapeutics Inc	Sonendo Inc
89Bio Inc	Neuronetics Inc	Tarsus Pharmaceuticals Inc	Cognition Therapeutics Inc
Inhibrx Inc	Frequency Therapeutics Inc	Personalis Inc	Annovis Bio Inc
Mirum Pharmaceuticals Inc	Graphite Bio Inc	SI-BONE Inc	Minerva Surgical Inc
Harmony Biosciences Holdings Inc	Erasca Inc	Guardant Health Inc	Genelux Corp
Acumen Pharmaceuticals Inc	Finch Therapeutics Group Inc	Black Diamond Therapeutics Inc	Angion Biomedica Corp
Design Therapeutics Inc	Eargo Inc	Kymera Therapeutics Inc	Aura Biosciences Inc
Axcella Health Inc	Pulmonx Corp	Homology Medicines Inc	Lipella Pharmaceuticals Inc
Bioatla Inc	Verve Therapeutics Inc	Genprex Inc	Femasys Inc
Spruce Biosciences Inc	Aerovate Therapeutics Inc	Alector Inc	Adial Pharmaceuticals Inc
Bionano Genomics Inc	ALX Oncology Holdings Inc	Kronos Bio Inc	Inhibikase Therapeutics Inc
Poseida Therapeutics Inc	HOOKIPA Pharma Inc	Lyra Therapeutics Inc	Aclarion Inc
Scholar Rock Holding Corp	Gossamer Bio Inc	Sigilon Therapeutics Inc	Olema Pharmaceuticals Inc
Satsuma Pharmaceuticals Inc	Day One Biopharmaceuticals Inc	Century Therapeutics Inc	Miromatrix Medical Inc
Avidity Biosciences Inc	Terns Pharmaceuticals Inc	Nurix Therapeutics Inc	Neximmune Inc
Aveanna Healthcare Holdings Inc	Sight Sciences Inc	Generation Bio Co	Tenon Medical Inc
Singular Genomics Systems Inc	Beam Therapeutics Inc	Crinetics Pharmaceuticals Inc	Trevi Therapeutics Inc

Janux Therapeutics Inc	NextCure Inc	Galera Therapeutics Inc	Kiromic Biopharma Inc
Aquestive Therapeutics Inc	Inari Medical Inc	Tenaya Therapeutics Inc	SeqLL Inc
Omega Therapeutics Inc	Neuropace Inc	Castle Biosciences Inc	Aridis Pharmaceuticals Inc
Monte Rosa Therapeutics Inc	Athira Pharma Inc	Icosavax Inc	Amylyx Pharmaceuticals Inc
Immunome Inc	Edgewise Therapeutics Inc	Adaptive Biotechnologies Corp	Journey Medical Corp
SpringWorks Therapeutics Inc	Werewolf Therapeutics Inc	Twist Bioscience Corp	Lantern Pharma Inc
Arcus Biosciences Inc	CVRx Inc	Transmedics Group Inc	Eyenovia Inc
Praxis Precision Medicines Inc	AVROBIO Inc	Precision BioSciences Inc	Biofrontera Inc
IGM Biosciences Inc	Dyne Therapeutics Inc	Vapotherm Inc	Nexalin Technology Inc
UNITY Biotechnology Inc	Passage Bio Inc	Biodesix Inc	Monopar Therapeutics Inc
Taysha Gene Therapies Inc	Replimune Group Inc	Kinnate Biopharma Inc	Decibel Therapeutics Inc
Absci Corp	Revolution Medicines Inc	Sutro Biopharma Inc	Dice Therapeutics Inc
Cadrenal Therapeutics Inc	ASP Isotopes Inc	Xilio Therapeutics Inc	Airsculpt Technologies Inc
Vor Biopharma Inc	Tivic Health Systems Inc	TScan Therapeutics Inc	PepGen Inc
Immix Biopharma Inc	Movano Inc	Third Harmonic Bio Inc	Coya Therapeutics Inc
Arcellx Inc	AN2 Therapeutics Inc	Tyra Biosciences Inc	Pasithea Therapeutics Corp
Motus GI Holdings Inc	TFF Pharmaceuticals Inc	Lucid Diagnostics Inc	Mineralys Therapeutics Inc
Entrada Therapeutics Inc	Virpax Pharmaceuticals Inc	HCW Biologics Inc	Paragon 28 Inc
Alzamend Neuro Inc	Acrivon Therapeutics Inc	Anebulo Pharmaceuticals Inc	Thorne Healthtech Inc
Context Therapeutics Inc	IMAC Holdings Inc	PaxMedica Inc	Dermata Therapeutics Inc
Hoth Therapeutics Inc	Theseus Pharmaceuticals Inc	Gain Therapeutics Inc	Cadre Holdings Inc
INmune Bio Inc	Transcode Therapeutics Inc	Ventyx Biosciences Inc	Ocean Biomedical Inc
Akoya Biosciences Inc	Vivos Therapeutics Inc	Vigil Neuroscience Inc	Hillevarx Inc
Bolt Biotherapeutics Inc	Pyxis Oncology Inc	Longboard Pharmaceuticals Inc	Mink Therapeutics Inc
CNS Pharmaceuticals Inc	Elevation Oncology Inc	Prime Medicine Inc	PROCEPT BioRobotics Corp
Nuvectis Pharma Inc	Cingulate Inc	Hillstream BioPharma Inc	

Exhibit 2

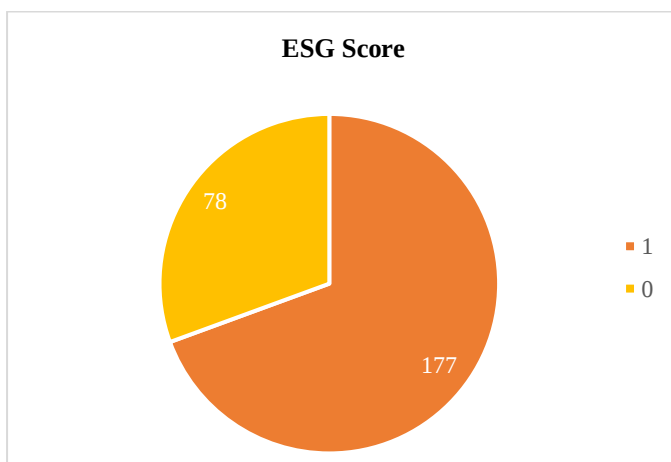


Exhibit 2 - Companies that have invested or are investing in ESG versus those that have not.

Exhibit 3



Exhibit 3 - Companies on NASDAQ or NYSE