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The Flip Side of Mutual Fund ESG Disclosure: Fueling a Green Bubble?

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Abstract

This study investigates the relationship between Environmental, Social and Governance (ESG) score and firm misvaluation, especially in the context of the introduction of the EU Sustainable Finance Disclosure Regulation (SFDR). This is done by analyzing a set of 274 firms, of which 101 are from the EU and 173 are from the US, that have continuously been part of the STOXX Europe 600 and the S&P500 throughout the period of 2005 to 2022. I perform a number of fixed effects regressions, including an analysis in a difference-in-differences setting and a split sample analysis. I find evidence that ESG scores affect stock prices positively, whereas ESG scores do not affect firm misvaluation structurally. However, I do find evidence that the announcement and introduction of the SFDR leads to a positive effect of ESG scores on firm misvaluation. This is mainly driven by the Telecommunications industry. These findings are highly relevant for policy makers, investors and managers, since unintended misvaluation due to the introduction of a regulation can become structural and could lead to a bubble on the equity market.

Keywords: ESG, SFDR, Misvaluation, Mutual fund, Market efficiency, Sentiment

Acknowledgements

This thesis marks the end of my studies at the Erasmus School of Economics, with which I had started in 2018. Ever since, I have grown academically and personally, of which I am proud. However, this would not have been possible without the support of my parents during difficult times. Combining two studies (Economics and Law) was at some points tough and therefore I am grateful for the comfort that they offered me throughout the years. I would also like to thank dr. (Ruben) R.H.G.M. Cox for his supervision and feedback during the process of writing my thesis. For now, my journey at the Erasmus University continues with the start of my Law master's.

Note: The views stated in this thesis are those of the author and not necessarily those of the supervisor, co-reader, Erasmus School of Economics or Erasmus University Rotterdam.

Contents

1 Introduction

> *"The European Green Deal is something – I am convinced – we owe to our children, because we do not own this planet. We just do have for certain time the responsibility and now it is time to act."*
>
> – Ursula von der Leyen, President of the European Commission, on the occasion of the adoption of the European Green Deal, 11 December 2019.

In 2019, the European Commission announced its revolutionary ambition to make the European Union (EU) the world's first climate-neutral continent by 2050. The European Green Deal, which came into effect in 2021, includes a wide set of policy initiatives to achieve this goal. Among these initiatives, the European Action Plan on Sustainable Finance plays a major role, as European legislators agree that financial flows are a crucial channel through which climate change can be reduced.

A key regulation within the action plan is the Sustainable Finance Disclosure Regulation (SFDR), which aims to achieve more transparency of sustainability risks among financial institutions. The SFDR applies to all EU financial market participants and provides a more standardized way for investors to distinguish between the sustainability efforts of asset managers. The regulation rates financial products by categorizing between products that do not promote environmental or social characteristics (Article 6), products that do promote environmental or social characteristics (Article 8) and products that exclusively have sustainable investment as their objective (Article 9).[2] Most likely, given the increasing investor attention towards Environmental Social and Governance (ESG) objectives in investment, this stimulates the effort of suppliers of financial products to make their products more 'green'. Also, individual investors might allocate more of their portfolio to these green products. This study attempts to answer the question: *Do ESG scores affect firms' stock price and firms' level of misvaluation, and to what extent does the implementation of the SFDR in the European Union affect this relationship?*

[2]Regulation (EU) 2019/2088 of the European Parliament and of the Council of 27 November 2019 on sustainability-related disclosures in the financial services sector.

If investors are indeed affected by the SFDR, it succeeds in its goal to stimulate capital flows towards sustainable investments. However, while this aids to achieve the EU's goal to become climate-neutral by 2050, it might cause unintended spillover effects on the equity market. Earlier research establishes that the introduction of ESG scores leads to firm misvaluation. Especially firms with high ESG scores tend to have a higher market value compared to their true value. In general, higher ESG market sentiment leads to a stronger effect of ESG score on firm misvaluation (Bofinger et al., 2022). Ultimately, this structural misvaluation can cause a bubble that is comparable to the dot-com bubble in the early 2000s, as some scientists argue (Lehnert, 2023; Foglia and Miglietta, 2024).

This study is relevant in numerous respects. It sheds light on the potential negative spillover effects of the applauded SFDR. Despite the fact that it appears to achieve its goal to mobilize capital flows towards sustainable investments, it possibly causes firm misvaluation. Such structural misvaluation can develop into a bubble on the equity market, of which there are examples from the near past. Therefore, the outcomes of this research are highly relevant for policy makers, as it offers knowledge and tools for them to prevent large scale misvaluation and its potential consequences from happening. Furthermore, the outcomes are also relevant for equity market participants. Investors that seek reliable long-term investment opportunities should be aware of possible structural misvaluation and the risk of an emerging bubble. As soon as investors become aware of the risks, this would improve market efficiency as investor demand for overvalued assets would drop. The equity market price would then converge towards the true value, making the equity market more efficient. Finally, the research could also be relevant to firm managers. Possible structural ESG misvaluation could influence their decision to engage in ESG activities, as they might want to ride the bubble or might not. Thus, this paper is relevant in many different ways and for a large variety of groups.

The main scientific contribution of this paper is that it reexamines the relationship between ESG score and firm misvaluation by analyzing an up-to-date dataset that accounts for recent changes in investor sentiment and regulation. Furthermore, it

specifically tests whether the SFDR influences the relationship by performing a novel and unique comparative analysis between the EU and the United States (US). The latter fills an important gap in the literature and could be highly valuable for parties that have an interest in this issue.

The first part of the research question is answered by performing a standard ordinary least squares (OLS) regression that analyzes the effect of ESG scores on stock price and on misvaluation. This is necessary to reexamine the relationship that is established in earlier research. Next, the second part of the research question is answered by focusing on the effect of the SFDR. To isolate this effect, the study makes use of a comparable sample of companies outside of the EU that is not affected by the regulation. Since there are similar economic circumstances in the US, but not a similar regulation, the study analyzes a set of US companies for comparison. The study employs a difference-in-differences analysis, which should indicate to what extent the SFDR influences the relationship between ESG score and misvaluation in the EU. Namely, if ESG scores affect misvaluation more severely in the EU than in the US after the introduction of the SFDR, this suggests that the effect is due to the SFDR. Thus, this method is used to eliminate possible endogeneity and to isolate the effect of the SFDR on European firm valuation, as there was no similar regulation announced in the US during the sample period.

After performing the analysis, I find that ESG score positively affects a firm's stock price. However, I do not find any evidence for a correlation between ESG score and firm misvaluation, which contradicts earlier research. Finally, and most interestingly, I find evidence that suggests a positive effect of ESG scores on firm misvaluation during the period in which the SFDR was announced and introduced. This shows that such a regulation can enhance the importance of ESG and increases investor attention towards ESG-friendly firms and funds. Even though this finding is on a relatively short term, it has important implications and offers new research possibilities. Finally, an additional industry analysis indicates that the Telecommunications industry is the main driver of the SFDR's effect, which also adds an interesting insight in light of future research.

The remainder of this paper is organized as follows. It continues with an extensive literature review (2), followed by the data (3) and methodology (4) sections, then reports and analyzes the results (5) and ends with a conclusion and discussion (6).

2 Literature review

2.1 Stakeholder versus shareholder view

This paper is based on a large strand of literature that focuses on investor behavior related to ESG disclosure and its effect on firm value and market efficiency. The concept of ESG is closely related to the concept of Corporate Social Responsibility (CSR) and their interconnectedness makes research in both areas relevant. In general, there are two opposing views about the effect of CSR activities on firm value and profitability. On the one hand there is the stakeholder theory, which was developed by Freeman (2010) and stresses the interconnected relationship between a firm and its customers, employees, suppliers, investors and others who have a stake in the organization. According to this theory, a firm must not only create value for its shareholders, but for all the parties involved. It is argued that stakeholder welfare increases a firm's reputation, which could result in better performance. Some studies with regards to the effect of CSR activities on firm value and performance reason from this stakeholder perspective.

As such, Hu et al. (2018) argue that CSR activities positively influence firm value, as it helps firms to gain positive stakeholder responses. By studying the Chinese manufacturing market, the authors confirm this theory and find that, ceteris paribus, CSR activities could positively influence firm value. Furthermore, Servaes and Tamayo (2013) suggest that the customer channel is a crucial channel through which CSR activities create value. They find evidence for this by showing that CSR and firm value are positively related for firms with high customer awareness, proxied by advertising expenditures. This finding also supports the stakeholder view, because it shows that the customer channel can add value under certain conditions.

Another important paper that underlines Freeman's view studies whether the level of CSR performance of acquirers in a merger creates value after the merger. Deng et al. (2013) find that high CSR acquirers realize higher returns in the short run as well as in the long run. Their results suggest that stakeholders have interest

in business operation and have the willingness to invest in operations that support the level of CSR engagement, which ultimately increases firm value and shareholder wealth. Thus, once again the stakeholder channel turns out to be crucial for value creation through CSR engagement. Moreover, Nguyen et al. (2020) find evidence for this channel and stress the important monitoring role of long-term investors. Namely, they argue and prove that long-term investors have the ability to ensure that managers choose the amount of CSR engagement that maximizes shareholder value. However, they mention mispricing, or overvaluation, as an alternative explanation for their findings, which provides opportunity for future research.

Opposing the stakeholder theory, Friedman et al. (1970) developed the shareholder theory, which stresses the importance of shareholders in corporate decision making. The Friedman doctrine states that the sole purpose of a corporation should be to maximize shareholder wealth. In relation to this theory, CSR expenditure is generally perceived as undesirable, because of the unknown direct financial implications of the increasing costs. However, Renneboog et al. (2008) argue otherwise, since they state that ignoring CSR could lead to higher funding costs, litigation costs and loss of reputation. Therefore, they argue that there is a direct link between CSR expenditure and potential costs, which could negatively affect shareholder wealth. Furthermore, Naughton et al. (2019) find that CSR activities generate positive abnormal returns during periods when investors place a valuation premium on CSR performance, which indicates a direct impact as well. Leite and Uysal (2023) show that investors react more positively to good news about firms with a high ESG score, suggesting confirmation bias. Also, Serafeim (2020) finds evidence that suggests that public sentiment significantly influences investor views about the value of sustainable activities and that this enhances a valuation premium for firms with a strong sustainability performance. In fact, he argues that big ESG data can be useful to identify high value stocks in advance, which offers attractive investment opportunities.

Alternatively, Chauhan and Kumar (2018) study the effect of nonfinancial disclosure on firm value among a sample of Indian firms. They find that the

Bloomberg ESG disclosure has positive valuation effects. They add that the main channel of this impact lies in the fact that a high level of ESG disclosure leads to lower funding costs and higher operating profits. So apart from investor sentiment, they state that increasing attention is justified and that there is a real valuation effect. Therefore, they also argue that CSR activities are important through the shareholder channel.

Concluding, both the stakeholder and the shareholder view are highly relevant to understand value creation through CSR engagement. It has become clear that the majority of literature agrees upon the fact that CSR activities impact firm value and performance. Even though scientists have different views about the channel through which, they do seem to agree that this effect is positive. Therefore this paper's first hypothesis is as follows.

I. ESG scores are positively related to firms' stock price.

2.2 Firm misvaluation

It is unclear, however, whether this possible positive effect on the equity market reflects firms' true value. Therefore, research that focuses on the effect of CSR disclosure on firm misvaluation remains. So far, this has not been studied equally as much as the general effect on firm market value, or stock price. Earlier literature suggests that ESG market sentiment influences how investors value CSR activities and that CSR activities generally affect firm value positively. Multiple studies examine the effect of nonfinancial (ESG) disclosure on equity market misvaluation.

Bofinger et al. (2022) largely impact the literature about the effect of CSR engagement on firm misvaluation and their study is therefore considered as the most important paper in this field. The authors study a sample of US firms over a large range of industries between 2004 and 2017. The authors choose to start in 2004, as earlier research shows that potential market inefficiencies arose when sustainable investing started to grow after 2003 (Cao et al., 2023). Next, the authors collect

detailed data on ESG scores and employ two distinct measures to calculate the firms' true value. These are the residual income model (RIM) and the Rhodes-Kropf and Viswanathan model (RRV), the former taking a forward-looking approach and the latter taking a more backward-looking approach. The models require different input that can be retrieved from companies' balance sheets in most cases. The ratio of a firm's stock price to its true value then indicates the level of misvaluation. A firm with a ratio of higher than 1 is overvalued, while a firm with a ratio of lower than 1 is undervalued. Next, by performing an ordinary least squares (OLS) regression, the authors assess the relationship between ESG scores and firm misvaluation. To eliminate the omitted variable bias, the authors add several control variables, such as leverage, analyst coverage and profitability. Their results indicate that a firm's ESG engagement, proxied by ESG score, positively affects misvaluation. They suggest that this effect is attributable to investor behavior and a strong sustainability trend. Also, they state that this seemingly irrational behavior is interesting and relevant from multiple perspectives and therefore requires more studying.

Somewhat later, Barka et al. (2023) perform a similar study in which they analyze the French stock market over a period of twenty years and find that ESG scores increase equity misvaluation. The study focuses on the RRV method and adds a number of control variables, such as capital expenditure, market-to-book value and firm risk. They find evidence that ESG scores exacerbate overvaluation and mitigate undervaluation, meaning that there is a positive influence of ESG scores on misvaluation. They state that this is due to a 'halo effect' of corporate sustainable activities, meaning that firms gain reputational advantages, which leads to investors overvaluing the firm and product value. This relationship confirms the findings of Hong et al. (2019), who show that socially responsible firms receive lower sanctions from prosecutors due to their reputational advantages. These findings imply that there is a general trend and growing interest in sustainable investment, while the value that it creates might not be justified.

Khan et al. (2024) perform a comparable analysis by examining a broader sample

of European firms and by employing the RIM model. They find similar results, which show that improvements in ESG profiles increase market prices in relation to their true value. Furthermore, their analysis suggests that information asymmetry and general market sentiment play a moderating role in the misvaluation effect, by which they isolate the effect of ESG disclosure and show that it is a friction to the equity market efficiency. Again, they attribute this effect to the apparent demand effect associated with ESG sentiment.

Considering the discussed literature that focuses on the effect of ESG disclosure on firm misvaluation, this paper hypothesizes the following.

II. ESG scores positively influence firm misvaluation.

2.3 The impact of the SFDR

Next, the goal is to study whether a law that enhances the importance of ESG engagement and disclosure, the SFDR, affects firm misvaluation and thereby equity market efficiency. Regarding literature about the SFDR, Birindelli et al. (2023) find that investor attention towards the SFDR significantly matters for European financial equity price predictions. They prove this by showing that investor attention between 2019 and 2022, proxied by the Google Search Volume Index, matters in price forecasting, especially during bearish and normal market conditions. Furthermore, Emiris et al. (2023) find that investors react as expected to the regulation. Namely, they show that institutional investors respond to the regulation by investing more sustainably and that ESG funds experience higher inflows after the regulation. On the other hand, Cremasco and Boni (2022) show that the European financial market context is still characterized by ambiguity and 'category fuzziness' and that the SFDR currently presents loose boundaries, therefore making it ineffective in fulfilling its objective.

My study is most closely related to two papers and essentially combines these. Firstly, as mentioned earlier, Bofinger et al. (2022) show that sustainable investment

increases equity market misvaluation and thereby reduces market efficiency. They find that ESG engagement expands existing overvaluation and reduces undervalued firms' deviation from the true value, which they attribute to the worldwide trend of sustainable investing. In the second relevant paper, Becker et al. (2022) examine the effectiveness of the SFDR by analyzing the mutual fund market. They find that affected mutual funds in the EU increased their ESG scores directly after the announcement of the SFDR in 2019. This shows that the mutual fund market directly adapted their own investment behavior to anticipate the possible effect of the regulation on individual investor behavior. Moreover, once the mutual fund ratings were released to the public in 2021, fund inflows towards the higher rated funds increased immediately. These findings indicate that the SFDR affected mutual fund and individual investor behavior in the short run, by mobilizing more capital flows towards sustainable investments. In their discussion, Becker et al. (2022) refer to the findings of Bofinger et al. (2022) and note that the introduction of the SFDR's new fund labels could enhance ESG misvaluation. Since the authors find significant evidence for such a short term effect on capital mobilization, I hypothesize the following, based on the combined findings of these two papers.

III. The introduction of the SFDR positively influences the misvaluation effect for companies in the EU.

Apart from the two papers that this study is closely related to, I expect the SFDR to affect the misvaluation of companies in the EU to a larger extent than companies in the US for two additional reasons. Firstly, Chan et al. (2005) show that, even though mutual funds differentiate their portfolio geographically, they do allocate a disproportionately larger fraction of investment to domestic stocks. That is why affected mutual funds within the EU are expected to invest more strongly in European companies with a high ESG score. Secondly, the announcement of a regulation that is relevant for European mutual fund investors could also lead to an immediate response of individuals in the EU. This has also been proven to be the case in earlier literature

that investigates investor response to policy announcements (Brzeszczyński et al., 2015). This response is expected to a lesser extent of mutual fund investors in the US, since they are less informed about and less affected by the announcement of the SFDR. Concluding, there are multiple reasons to expect an immediate effect of the SFDR on company misvaluation that differs between the EU and the US.

Furthermore, to deepen the understanding of a possible effect of the SFDR, an industry analysis is added to the study. Namely, earlier research shows that ESG performance can affect misvaluation differently across industries. For example, Ding et al. (2014) find that high market competition within an industry can weaken the effect of ESG performance on stock mispricing. Rahat and Nguyen (2024), on the other hand, are more specific and state that industries such as Technology and Telecommunications are ripe for innovation and growth, making the valuation of firms within those industries more sensitive to ESG performance. Therefore, it is plausible that these industries might drive a possible effect of the SFDR.

To conclude this section, this paper fills the gap in the literature by studying whether the SFDR increases firm misvaluation in the short run. Before diving into the specific effect of the SFDR, however, the paper reexamines the relationship between ESG score and firm (mis)valuation using an up-to-date dataset. The data and research design of this paper is based on a combination of earlier studies, which is set forth in the next sections.

3 Data and variables description

3.1 Sample selection

The sample of studied companies consists of the companies that are continuously included in the S&P500 and the STOXX Europe 600 throughout the studied time period, 2005 to 2022, for the US and the EU respectively. The S&P500 and the STOXX Europe 600 cover almost the entire market capitalization of the US and EU market respectively, making a selection of companies within these indices representative for the analysis. Consistent with literature, firms within the financial industry, identified by the Standard Industrial Classification (SIC) codes 6000-6799, are excluded from the sample (Barka et al., 2023). Furthermore, as the STOXX Europe 600 also includes companies in non-EU countries like the UK, Norway and Switzerland, these must also be excluded. Namely, these countries are not affected by EU regulations such as the SFDR, which would make the sample unsuitable for the examination of the effect of the regulation.

Table 1: Number of Firms by Region and Country

Region	**Country**	**No. of Firms**
Southern Europe	Italy	5
	Portugal	1
	Spain	9
Western Europe	Austria	1
	Belgium	3
	France	28
	Germany	20
	Netherlands	8
Northern Europe	Denmark	4
	Finland	7
	Ireland	2
	Sweden	13
Total no. of EU firms		**101**
North America	United States	173
Total no. of firms		**274**

After making the necessary adjustments, I end up with a sufficiently large and organised sample with a total of 274 firms, of which 173 are US firms and 101 are

EU firms. This results in a total of 4,932 firm-year observations over a time period between 2005 and 2022, which I consider sufficiently large based on earlier research. Table 1 provides an overview of the geographical distribution of the sample.

3.2 Dependent variables - stock price and misvaluation

For this study, the most important data to collect is the necessary data for the calculation of one of the dependent variables, misvaluation. In their paper, Bofinger et al. (2022) use two different methods to calculate misvaluation. One of these is the residual income model (RIM), which was developed by Ohlson (1995) and requires a company's book value, the cost of equity and the forecasted return on equity to calculate a firm's true value. Next, to calculate a firm's level of misvaluation, Bofinger et al. (2022) mainly base their calculation method on the study of Dong et al. (2006), who explain the calculation of misvaluation based on the RIM in greater detail. Ultimately, the ratio between a firm's market price and its true value indicates the level of misvaluation. A value that is higher than 1 indicates that a firm is overvalued, whereas a value that is lower than 1 indicates that a firm is undervalued. Thus, this is a clear method to examine potential inefficiencies on the equity market.

The market price, or stock price, is retrieved yearly from the Datastream database for all US and EU companies. The Datastream database is provided by the London Stock Exchange Group (LSEG) and offers comprehensive coverage of global companies and their financials (London Stock Exchange Group, 2024). The stock price data is used to perform the initial regression analysis, which tests for a relationship between ESG score and stock price. So, apart from being a part of the calculation of misvaluation, it is one of the dependent variables by itself.

Moving on to the calculation of the true value, as mentioned, the RIM is explained in the paper of Dong et al. (2006). Considering the fact that this valuation method is widely used in academic literature (Bofinger et al., 2022; Khan et al., 2024) and that the required data is relatively easily accessible for both US and EU firms, this study employs the RIM valuation method. Consistent with earlier research (Dong et al.,

2006; Dong et al., 2021; Bofinger et al., 2022), I assume that the expected residual earnings remain constant after three years. Therefore, I discount back the next three-year residual earnings as perpetuity. This results in the following calculation for the true value $V_i(t)$.

$$V_i(t) = B_i(t) + \frac{\left[f_i^{ROE}(t+1) - r_{e(i)}(t)\right] \cdot B_i(t)}{1 + r_{e(i)}(t)} + \frac{\left[f_i^{ROE}(t+2) - r_{e(i)}(t)\right] \cdot B_i(t+1)}{[1 + r_{e(i)}(t)]^2} + \frac{\left[f_i^{ROE}(t+3) - r_{e(i)}(t)\right] \cdot B_i(t+2)}{[1 + r_{e(i)}(t)]^2 \cdot r_{e(i)}(t)}$$

In this formula, $B_i(t)$ is the book value of equity, $r_{e(i)}(t)$ is the cost of equity and $f_i^{ROE}(t+n)$ is the forecasted return on equity.

Based on Bofinger et al. (2022) and Dong et al. (2006), the cost of equity ($r_{e(i)}(t)$) is calculated with use of the Capital Asset Pricing Model (CAPM). The following formula is employed to calculate the cost of equity.

$$r_{e(i)}(t) = R_f(t) + \beta_i(t) \cdot (R_m(t) - R_f(t))$$

In this case, $R_f(t)$ is equal to the risk-free rate, based on the 10-year U.S. Treasury bond yield. $R_m(t)$ is equal to the expected market return and $\beta_i(t)$ is the stock's volatility relative to the market. In line with Bofinger et al. (2022) and Dong et al. (2006), I use a 5-year historic β. Furthermore, $(R_m(t) - R_f(t))$ is called the 'equity risk premium', which can be retrieved directly from the Datastream database.

Also based on Bofinger et al. (2022) and Dong et al. (2006), $f_i^{ROE}(t+n)$ is estimated as follows.

$$f_i^{ROE}(t+n) = \frac{f_i^{EPS}(t+n)}{\bar{B}_i(t+n-1)}$$

According to Dong et al. (2006), $f_i^{ROE}(t+1)$ must be less than 1. In the few cases where $f_i^{ROE}(t+1)$ is higher than 1, I adjust this value to a value of 1. $f_i^{EPS}(t+n)$ equals a company's forecasted earnings per share in year $t+n$. This concerns an analyst's forecast and is computed for almost all listed companies in the Datastream

database. Since the book value at time $t+n$ is unknown, the calculation makes use of the previous two book values, as this is considered most accurate (Dong et al., 2006). The average is depicted as $\bar{B}_i(t+n-1)$ and is calculated with use of the following formula.

$$\bar{B}_i(t+n-1) = \frac{B_i(t+n-1) + B_i(t+n-2)}{2}$$

To estimate the future book value, which is used in the formula for $V_i(t)$, the book value is forecasted more precisely. This is done by making use of the dividend payout ratio and the forecasted earnings per share. Thus, the following formula is used.

$$B_i(t+n) = B_i(t+n-1) + (1 - k_i(t)) \cdot f_i^{EPS}(t+n)$$

Here, $k_i(t)$ represents the dividend payout ratio, which is calculated as follows.

$$k_i(t) = \frac{DPS_i(t)}{EPS_i(t)}$$

$DPS_i(t)$ represents the dividend per share at time t, whereas $EPS_i(t)$ equals the earnings per share. In line with Bofinger et al. (2022) and Dong et al. (2006), I eliminate $k_i(t)$ for the values that are greater than 1. This means that in such a case, the one-year forward book value is equal to the sum of the book value of the previous year and the one-year forecasted earnings.

Once the true value is calculated, the level of misvaluation is determined by taking the ratio between the stock price and the true value at the firm-year level, for which the following formula is used.

$$MV_i(t) = \frac{P_i(t)}{V_i(t)}$$

The necessary balance sheet information, as well as the data on the risk-free rate, β and equity risk premium, for the calculation of the true value is acquired from the Datastream database. The market price, or stock price, is gathered from the Datastream database as well, for both the US and EU firms. Every relevant piece of information is acquired on a firm-year level.

To provide a visualized representation of the accuracy and progression of both the stock price and the true value, the stock value and true value over the entire time period for US company Coca Cola and for EU company Koninklijke Philips N.V. are plotted in Figure 1 and 2.

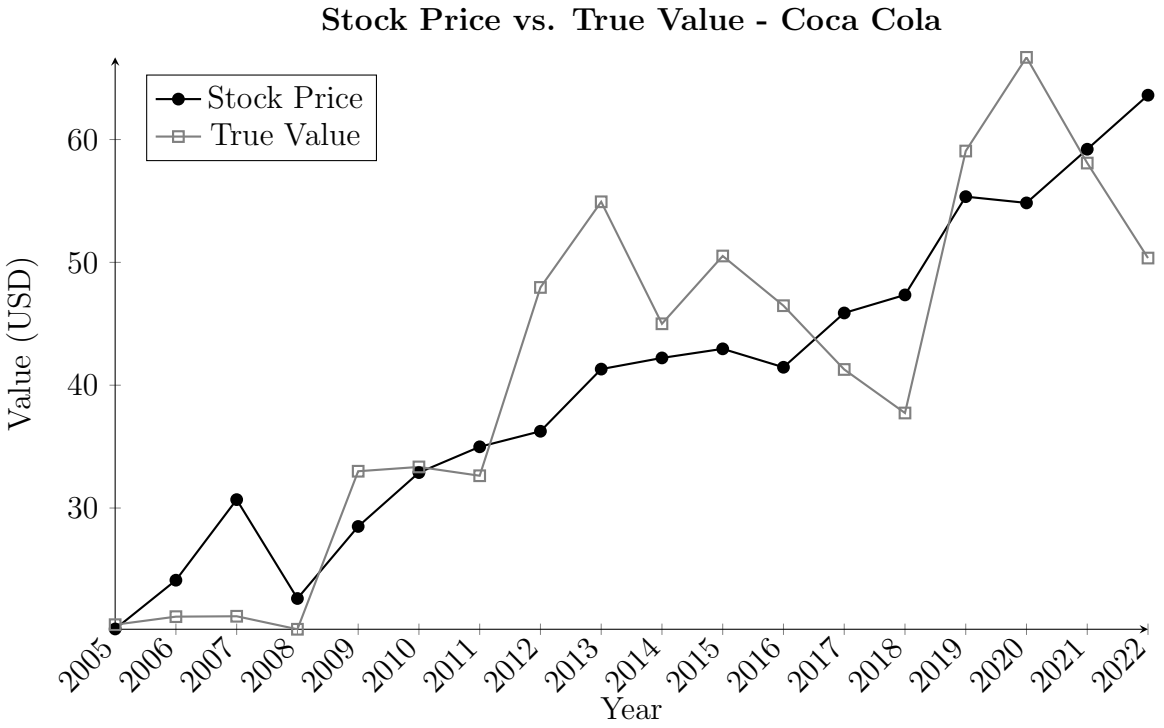

Figure 1: Stock Price vs. True Value - Coca Cola

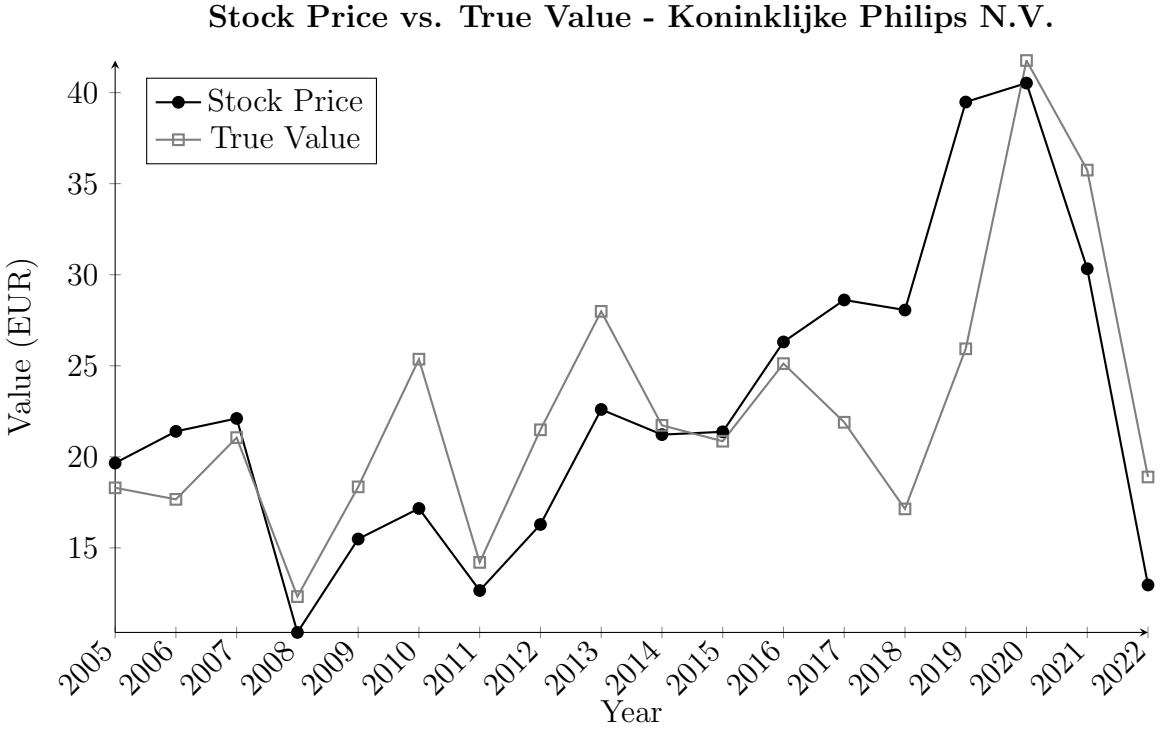

Figure 2: Stock Price vs. True Value - Koninklijke Philips N.V.

In these figures, it is visible that the true value calculations fluctuate around the companies' stock prices, varying in the level and direction of divergence. Interestingly, in both figures the true value seems to be more volatile than the stock price. This might be explained by the dependency of the RIM to analysts' forecasts of future earnings. Such forecasts are based on expectations of an unknown situation in the future, which can deviate from the actual situation that develops. So, the forecasts' inaccuracy can make the true value more volatile than the actual stock price. The model's dependency on these forecasts could justify the difference in volatility.

3.3 Independent variable - ESG score

Concerning the main explanatory variable, the firm specific ESG scores are provided by Thomson Reuters' Refinitiv ASSET4 database, which is well established and widely used in relevant academic research. The ASSET4 database provides objective environmental, social and governance information, which is based on more than 280 key performance indicators and is build on over 750 data points. Thomson Reuters gathers and verifies the necessary information for every known company in the universe (Thomson Reuters, 2024). Therefore, their ESG scores are widely available and very precise.

The score ranges from 0 to 100, with 0 being the lowest score and 100 being the the best achievable score. The score consists of three pillars, environmental, social and governance, that all specifically reflect a company's CSR performance with respect to the specific pillar. Each pillar consists of several categories, within which the firms' scores are calculated and ranked based on the key performance indicators. These indicators are weighted and benchmarked to other companies within the same industry, also making the scores suitable for sector-wide analysis. The database starts in 2002 and is updated frequently. However, relatively many scores are missing in the early stage, as well as in the most recent year 2023, which is why this paper studies the eighteen-year time period between 2005 and 2022.

3.4 Independent variables - dummy variables and interaction terms

Apart from the main explanatory variable, several other variables are included to conduct the analysis. When conducting the analysis that focuses on the effect of the SFDR, a set of dummies and interaction terms is created and added. With use of these dummies and interaction terms, the effect of the SFDR on the relationship between ESG score and misvaluation can be isolated and examined. Also, when performing the industry analysis, a set of interaction terms is added with use of industry dummies. The dynamics of these independent variables are explained in the part of the methodology section that focuses on the analysis of the SFDR (4.4), which includes the relevant regression equations.

3.5 Control variables

Furthermore, to reduce the likelihood of omitted variable bias, the analysis includes a set of control variables. The combined set of control variables that is included in the analysis is carefully based on earlier research that also examines the relationship between ESG scores and firm misvaluation. The relevant control variables are firm leverage (*Lev*), capital expenditure (*CapEx*), size (*Size*), profitability (*ROA*) and market-to-book ratio (*MB)*. The necessary information to calculate these variables is collected from the Datastream database. In all cases, though, a simple calculation is needed before the variable can be taken into account for the regression.

The calculations are based on earlier literature (Khan et al., 2024; Barka et al., 2023; Bofinger et al., 2022) and follow regular accounting principles (Delen et al., 2013). As such, leverage (*Lev*) is the ratio of a firm's total debt to total assets and is considered as highly relevant for a firm's value as shown by Cheng and Tzeng (2011). Capital expenditure (*CapEx*) is also included as a relative measure, being the ratio of capital expenditure to total assets. The importance of capital expenditure for firm value is also stressed by Trueman (1986). Size (*Size*) is calculated by taking the natural logarithm of a firm's total assets, which is a common way to account for firm size (Siahaan, 2013). The market-to-book ratio (*MB*) is commonly determined by taking the ratio of a firm's market value of equity to its book value of equity. Fang

et al. (2009) show that this ratio is important to include when determining firm value. Finally, the profitability (*ROA*) is proxied by dividing a firm's net income by its total assets, known as the return on total assets. This is also proven to be an important factor to incorporate in such analysis (Margono and Gantino, 2021). An overview of the definitions and measurement units of the control variables can be found in Table 4.

3.6 Descriptive statistics

The retrieved data is combined and summarized to provide a clear overview. Based on the data samples in earlier literature (Bofinger et al., 2022; Khan et al., 2024), I manually adjust the misvaluation outliers. I replace the values that are higher than 100 or lower than -100 with the value of the next highest or lowest value in the sample. I purposely do not eliminate these values, as many of the outliers occur during the period of the global financial crisis and the covid-crisis. Mainly the latter period is very important to include, as the SFDR had already been introduced during this crisis. Values that are relatively high or low are not uncommon during the crisis periods, making it important to include those that are not unrealistically high and to adjust the ones that are. Table 2 provides an overview of the dataset. As mentioned earlier, Table 4 defines all relevant variables and includes the measurement unit.

Table 3 presents the correlation matrix of the variables used in the base models. It provides an overview of the linear relationships between these variables. The correlation coefficient ranges from -1 to 1. A coefficient that is close to -1 suggests that there is a strong negative correlation between two variables, whereas a coefficient that is close to 1 suggests that there is a strong positive correlation between two variables. A coefficient that is close to zero suggests that there is very little correlation between two variables. The table aims to check whether there are any concerns with regards to multicollinearity. Based on the coefficients in the table, there are no signs of multicollinearity issues, since the coefficients are all close to zero. The highest coefficient is the one of *Size* and *ESG*, being 0.3899. The height of this coefficient is not problematically high, as it is still well below 0.5.

Concerning significance, Table 3 shows that many of the coefficients of *Misvaluation* are insignificant, indicating that there is no significant individual relationship in those cases. However, the combined set of explanatory variables can be useful in predicting misvaluation, which is why the sample remains unchanged. Moreover, the results of the variance inflation factor (VIF) test are favorable. The VIF-test is an additional measure of multicollinearity. A value that is close to 1 indicates that there is little correlation between the variables. As all coefficients are close to 1, it can be confirmed that there are no signs of multicollinearity. All variables can contribute useful information to the regression model.

Table 2: Descriptive statistics

Variable Type	**Variable**	**Obs.**	**Mean**	**St. Dev.**	**Minimum**	**Maximum**
Dependent variable (1)	Stock price	4,932	75.2604	106.4077	0.2163	2466.18
Dependent variable (2)	Misvaluation	4,932	1.0316	0.1784	-28.5106	84.5082
Independent variable	ESG score	4,932	62.7951	18.5158	3.21	95.16
Control variables	Leverage	4,932	0.6211	0.1895	0.0079	3.0142
	CapEx	4,932	0.0456	0.0351	0	0.5223
	Firm Size	4,932	17.0845	1.1505	12.3294	20.3045
	Market-to-book	4,932	4.2594	67.5956	-1992.8604	3399.4502
	ROA	4,932	0.0662	0.0674	-1.2270	0.7452

The table above represents a summary of the characteristics of the data sample that is used for this study.

Table 3: Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MV (1)	1							
SP (2)	0.0029	1						
ESG (3)	0.0032	0.0964***	1					
Lev (4)	-0.0162	0.0513***	0.0932***	1				
CapEx (5)	0.0080	-0.0914***	-0.0500***	-0.0592***	1			
Size (6)	-0.0315**	0.0667***	0.3899***	0.1101***	0.0351**	1		
MB(7)	-0.0028	0.0132	0.0095	0.0104	-0.0085	-0.0049	1	
ROA (8)	-0.0306**	0.2369***	0.0092	-0.1697***	-0.0123	-0.1932***	0.0461***	1
VIF-test		1.0936	1.2029	1.0520	1.0176	1.2528	1.0026	1.1552

The table above represents a correlation matrix that includes all variables from the base models. In the bottom row represents the results of a VIF-test. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 4: Table with variables, definition and measurement unit

Variables	Definition	Measurement Unit
MV	Level of misvaluation. Calculation of true value based on the RIM.	Ratio of market price to true value.
SP	Firm stock price at time t.	Measured in local currency.
ESG	Company ESG score, retrieved from the Refinitiv ASSET4 database.	Weighted score between 0 and 100.
L.MV	One-year lagged misvaluation variable.	Ratio of market price to true value.
L.ESG	One-year lagged ESG score variable.	Weighted score between 0 and 100.
Lev	Firm leverage.	Ratio of total debt to total assets.
CapEX	Firm capital expenditure.	Ratio of capital expenditure to total assets.
Size	Firm size.	Natural logarithm of total assets.
MB	Firm market-to-book ratio.	Ratio of market value of equity (market capitalization) to book value of equity.
ROA	Firm profitability.	Net income divided by total assets.
EU	Dummy for whether a firm is based in the EU or not.	Value of 1 if the firm is based in the EU and 0 otherwise.
SFDR	Dummy for whether the SFDR has been introduced in the EU.	Value of 1 for the years 2019-2022 and 0 otherwise.
SFDRxEUxESG	Interaction term that combines the dummy *EU* and the dummy *SFDR*, multiplied by the ESG score.	Value of the ESG score in case both dummies have a value of 1 and 0 otherwise.
SFDRxESG	Interaction term of the dummy *SFDR*, multiplied by the ESG score, but solely for the firms in the EU/US.	Value of the ESG score in the years 2019-2022 and 0 otherwise.
Indus	Interaction term of the dummy for Industrials, multiplied by the dummy *SFDR* and multiplied by the ESG score.	Value of the ESG score in the years 2019-2022 for the firms within the specific industry and 0 otherwise.
Health	Interaction term of the dummy for Health Care, multiplied by the dummy *SFDR* and multiplied by the ESG score.	Value of the ESG score in the years 2019-2022 for the firms within the specific industry and 0 otherwise.
ConsSt	Interaction term of the dummy for Consumer Staples, multiplied by the dummy *SFDR* and multiplied by the ESG score.	Value of the ESG score in the years 2019-2022 for the firms within the specific industry and 0 otherwise.
ConsDi	Interaction term of the dummy for Consumer Discretion, multiplied by the dummy *SFDR*and multiplied by the ESG score.	Value of the ESG score in the years 2019-2022 for the firms within the specific industry and 0 otherwise.
Energy	Interaction term of the dummy for Energy, multiplied by the dummy *SFDR* and multiplied by the ESG score.	Value of the ESG score in the years 2019-2022 for the firms within the specific industry and 0 otherwise.
Util	Interaction term of the dummy for Utilities, multiplied by the dummy *SFDR* and multiplied by the ESG score.	Value of the ESG score in the years 2019-2022 for the firms within the specific industry and 0 otherwise.
Tech	Interaction term of the dummy for Technology, multiplied by the dummy *SFDR* and multiplied by the ESG score.	Value of the ESG score in the years 2019-2022 for the firms within the specific industry and 0 otherwise.
BasMat	Interaction term of the dummy for Basic Materials, multiplied by the dummy *SFDR* and multiplied by the ESG score.	Value of the ESG score in the years 2019-2022 for the firms within the specific industry and 0 otherwise.
Telecom	Interaction term of the dummy for Telecommunications, multiplied by the dummy *SFDR* and multiplied by the ESG score.	Value of the ESG score in the years 2019-2022 for the firms within the specific industry and 0 otherwise.
RealEst	Interaction term of the dummy for Real Estate, multiplied by the dummy *SFDR* and multiplied by the ESG score.	Value of the ESG score in the years 2019-2022 for the firms within the specific industry and 0 otherwise.

The table above represents an overview of the variables that are used in the regressions. The left column depicts the label that is used, which is explained and defined in the middle column. The right column provides the measurement unit of each variable.

4 Research methodology

4.1 General setup

To answer the research question, the paper employs the following empirical strategy. The study analyzes a panel data structure within an eighteen-year time period between 2005 and 2022. The length of this time frame is comparable to the time frame of earlier studies. However, the dataset includes more recent observations, which allows me to test whether the SFDR influences the relationship between ESG scores and firm misvaluation. Furthermore, the panel data structure allows to perform a fixed effects regression, which accounts for the time-independent factors that could influence the results.

The analysis consists of three main steps, which are individually explained and accompanied by the relevant regression equations. These steps should test the three hypotheses and ultimately lead to an answer to the research question. As mentioned in the previous section (3.5), every regression equation includes a set of control variables. This is done to eliminate or reduce the possible omitted variable bias. Another important endogeneity concern is reverse causality in the relationship between ESG score and firm misvaluation. Namely, overvalued firms or firms with a high market value might have more funds available to invest in CSR activities, which means that misvaluation leads to a higher ESG score and not the other way around. In order to reduce this concern, every regression is copied and supplemented with a one-year lagged dependent variable (stock price or misvaluation) and a one-year lagged ESG score variable. This reduces possible reverse causality, as the lagged variable examines whether the preceding value of misvaluation or ESG score influences current misvaluation. In case the lagged dependent variable of misvaluation affects current misvaluation, this indicates a certain misvaluation persistence, which Avramov et al. (2020) find in their research. More importantly, if there is a difference between the coefficient of the lagged ESG score and the unlagged ESG score, this could indicate the presence of reverse causality. If so, the outcome must be interpreted cautiously. In case the coefficients are comparable, however, reverse causality is less probable and

this endogeneity concern is practically ruled out.

4.2 Stock price analysis

The study commences with a general analysis of the effect of ESG activities on market value, or stock price. This is done by performing a fixed effects regression model that includes the total sample of EU and US firms. In this stage, the analysis covers the combined sample of EU and US firms, because literature shows that the effect is equally expected in both areas. Leite and Uysal (2023) study and find such an effect in the US and Khan et al. (2024) show a comparable effect in the EU. Therefore, a joined analysis is suitable and also offers the opportunity to examine a large and novel cross-continental sample of companies. Furthermore, the economic, social and political circumstances are highly comparable in the EU and US, which also makes a joined analysis suitable. Thus, the sample of companies can be considered sufficiently large and representative.

The following regression is employed to test hypothesis **I**, which states that ESG scores are positively related to firms' stock price.

$$\mathrm{SP}_{i,t} = \beta_1 \mathrm{ESG}_{i,t} + \beta_2 \mathrm{Lev}_{i,t} + \beta_3 \mathrm{CapEx}_{i,t} + \beta_4 \mathrm{Size}_{i,t} + \beta_5 \mathrm{MB}_{i,t} + \beta_6 \mathrm{ROA}_{i,t} + \epsilon_{i,t}$$

Here, the dependent variable $\mathrm{SP}_{i,t}$ represents the market value, proxied by a firm's stock price at the end of the year. $\mathrm{ESG}_{i,t}$ is the most important explanatory variable, which is expected to be positive.

As mentioned, an additional regression is employed, which includes a lagged dependent variable of stock price (SP) and a lagged independent variable of the ESG score (ESG). This leads to the following regression equation.

$$\begin{aligned}\mathrm{SP}_{i,t} =& \beta_1 \mathrm{SP}_{i,t-1} + \beta_2 \mathrm{ESG}_{i,t-1} + \beta_3 \mathrm{Lev}_{i,t} + \beta_4 \mathrm{CapEx}_{i,t} + \\ & \beta_5 \mathrm{Size}_{i,t} + \beta_6 \mathrm{MB}_{i,t} + \mathrm{ROA}_{i,t} + \epsilon_{i,t}\end{aligned}$$

In this equation, $\mathrm{SP}_{i,t-1}$ and $\mathrm{ESG}_{i,t-1}$ are the lagged dependent and lagged independent variables respectively. The latter is the most important explanatory

variable, of which the coefficient indicates whether a firm's ESG score in the preceding year influences its stock price.

4.3 Misvaluation analysis

Next, the analysis focuses on the effect of ESG score on misvaluation specifically. Again, the entire sample of EU and US firms is used for similar reasons as in the previous analysis. Also, again to account for possible omitted variable bias, the set of control variables is included. The following regression equation is used to test the hypothesis **II**, which states that ESG scores positively influence firm misvaluation.

$$\mathrm{MV}_{i,t} = \beta_1 \mathrm{ESG}_{i,t} + \beta_2 \mathrm{Lev}_{i,t} + \beta_3 \mathrm{CapEx}_{i,t} + \beta_4 \mathrm{Size}_{i,t} + \beta_5 \mathrm{MB}_{i,t} + \beta_6 \mathrm{ROA}_{i,t} + \epsilon_{i,t}$$

In this equation, the dependent variable $\mathrm{MV}_{i,t}$ represents the level of misvaluation. The calculation of this variable is explained in detail in the data section (3.2). Again, $\mathrm{ESG}_{i,t}$ is the most important coefficient, which is expected to be positive.

The regression equation that includes the lagged dependent and lagged independent variable looks as follows.

$$\begin{aligned}\mathrm{MV}_{i,t} =& \beta_1 \mathrm{MV}_{i,t-1} + \beta_2 \mathrm{ESG}_{i,t-1} + \beta_3 \mathrm{Lev}_{i,t} + \beta_4 \mathrm{CapEx}_{i,t} + \\ & \beta_5 \mathrm{Size}_{i,t} + \beta_6 \mathrm{MB}_{i,t} + \mathrm{ROA}_{i,t} + \epsilon_{i,t}\end{aligned}$$

The crucial variable in this equation is $\mathrm{ESG}_{i,t-1}$, as this variable indicates whether or not a firm's ESG score in the preceding year influences the level of misvaluation. Furthermore, the lagged variables disclose and reduce any effect of reverse causality.

4.4 SFDR analysis

4.4.1 Total sample - DiD

Finally, the effect of the SFDR on the relationship between ESG score and firm misvaluation is examined. This is done in a difference-in-differences setting and includes a set of dummy variables and interaction terms. This setting isolates the effect of ESG scores on firm misvaluation during the years in which the SFDR was

announced and introduced.

The studied period is between 2005 and 2022 and the SFDR officially came into force in 2021, two years after its announcement in 2019. As mentioned earlier, Becker et al. (2022) show that the announcement of the regulation immediately affected mutual fund portfolios and their ESG score, which is why 2019 is used as the first treatment year. As the EU started working on the European Green Deal in early 2019, this directly incorporates any possible anticipatory effect. Considering the EU's relatively short run-up to the European Green Deal announcement, any anticipatory effect before 2019 is unlikely or very small. So, when using 2019 as the first treatment year, the studied period includes fourteen years prior to the announcement of the SFDR and four years post. The combination of these two periods allows me to isolate and analyze the specific effect of the SFDR.

The following regression equation is analyzed in a difference-in-differences setting, to test hypothesis **III**, which states that the SFDR positively influences the misvaluation effect for companies in the EU.

$$\begin{aligned} \mathrm{MV}_{i,t} =& \beta_1 \mathrm{ESG}_{i,t} + \beta_2 \mathrm{EU}_i + \beta_3 \mathrm{SFDR}_t + \beta_4 \mathrm{SFDR}_t \mathrm{x} \mathrm{EU}_i \mathrm{x} \mathrm{ESG}_{i,t} + \\ & \beta_5 \mathrm{Lev}_{i,t} + \beta_6 \mathrm{CapEx}_{i,t} + \beta_7 \mathrm{Size}_{i,t} + \beta_8 \mathrm{MB}_{i,t} + \beta_9 \mathrm{ROA}_{i,t} + \epsilon_{i,t} \end{aligned}$$

Again, the dependent variable $\mathrm{MV}_{i,t}$ in this equation represents the level of misvaluation.

However, the equation also includes a number of new variables that require explanation. Firstly, it is necessary to create a dummy to distinct the EU firms from the US firms. Therefore, the study makes use of dummy variable *EU*, which has a value of 1 if the firm is based in the EU and 0 otherwise. Next, the treatment years during which the SFDR was announced and came into effect must be distinct from the years before. Therefore, the analysis includes the dummy variable *SFDR*, with a value of 1 in the treatment years 2019-2022 and 0 otherwise.

However, solely these dummies would not offer the possibility to test whether ESG scores affect misvaluation in the EU during the treatment years. Therefore, an interaction term is created and included in the analysis, which is the most important

variable for the examination of the effect of the SFDR. It combines the two dummy variables with the variable *ESG*. The interaction term *SFDR*x*EU*x*ESG* is the product of the two dummies and the variable *ESG* and should indicate whether ESG scores positively affect misvaluation of the specific set of EU companies during the period when the SFDR was announced and introduced.

Again, a regression is added in which the lagged dependent and lagged independent variables are included. Furthermore, the interaction term also uses the lagged value of the ESG score. The following regression is employed.

$$\begin{aligned}\mathrm{MV}_{i,t} =&\beta_1 \mathrm{MV}_{i,t-1} + \beta_2 \mathrm{ESG}_{i,t-1} + \beta_3 \mathrm{EU}_i + \beta_4 \mathrm{SFDR}_t + \beta_5 \mathrm{SFDR}_t \mathrm{xEU}_i \mathrm{xESG}_{i,t-1} + \\ &\beta_6 \mathrm{Lev}_{i,t} + \beta_7 \mathrm{CapEx}_{i,t} + \beta_8 \mathrm{Size}_{i,t} + \beta_9 \mathrm{MB}_{i,t} + \beta_{10} \mathrm{ROA}_{i,t} + \epsilon_{i,t}\end{aligned}$$

Also in this regression, the interaction term $\mathrm{SFDR}_t \mathrm{xEU}_i \mathrm{xESG}_{i,t-1}$ is the most relevant. Furthermore, the lagged variables disclose and reduce any effect of reverse causality.

4.4.2 Split sample - EU and US

The next step is to split the sample between the EU firms and US firms. This is done to test separately whether there is any difference in the level of misvaluation between the EU and the US in the final years of the sample, 2019 to 2022.

In both regression equations, an interaction term is included to test whether the effect of the SFDR is observable. The following regression equation is employed for the sample of EU firms as well as the sample of US firms.

$$\begin{aligned}\mathrm{MV}_{i,t} =&\beta_1 \mathrm{ESG}_{i,t} + \beta_2 \mathrm{SFDR}_t \mathrm{xESG}_{i,t} + \beta_3 \mathrm{Lev}_{i,t} + \beta_4 \mathrm{CapEx}_{i,t} + \\ &\beta_5 \mathrm{Size}_{i,t} + \beta_6 \mathrm{MB}_{i,t} + \beta_7 \mathrm{ROA}_{i,t} + \epsilon_{i,t}\end{aligned}$$

Here, the crucial variable is the interaction term $\mathrm{SFDR}_t \mathrm{xESG}_{i,t}$, which shows whether ESG scores influence firm misvaluation since the introduction of the SFDR. For the EU, this coefficient is expected to be positive. For the US, the relationship is expected to be less positive or non-existent. Even though the interaction term seems different than in the earlier regression with the full sample, it serves the same job. However,

in this case it is unnecessary to include a geographical dummy, since the sample is already split between the EU firms and US firms. Thus, the interaction term tests whether ESG scores affected misvaluation during the years when the SFDR was announced and introduced. As the SFDR is not applicable in the US, I expect to see a different effect in the EU than in the US.

Just as in earlier regression analyses, a regression is added in which a lagged dependent and lagged independent variable are added. Also, the interaction term is adjusted and makes use of the lagged ESG score. This regression equation is as follows.

$$\begin{aligned}\mathrm{MV}_{i,t} =&\beta_1 \mathrm{MV}_{i,t-1} + \beta_2 \mathrm{ESG}_{i,t-1} + \beta_3 \mathrm{SFDR}_t \mathrm{xESG}_{i,t-1} + \beta_4 \mathrm{Lev}_{i,t} + \beta_5 \mathrm{CapEx}_{i,t} + \\ &\beta_6 \mathrm{Size}_{i,t} + \beta_7 \mathrm{MB}_{i,t} + \beta_8 \mathrm{ROA}_{i,t} + \epsilon_{i,t}\end{aligned}$$

The most important variable in this regression is $\mathrm{SFDR}_t \mathrm{xESG}_{i,t-1}$. The lagged variables disclose and reduce any effect of reverse causality.

4.4.3 Industry analysis

To dive deeper into the possible drivers of an observed effect in the EU, the study adds a model to analyse industry effects. This is done by differentiating between a set of ten different industries: *Industrials, Health Care, Consumer Staples, Consumer Discretion, Energy, Utilities, Technology, Basic Materials, Telecommunications* and *Real Estate*. For each of these industries, a dummy is created that has a value of 1 if a company falls within that particular industry and has a value of 0 otherwise. Next, these dummies are multiplied by the SFDR dummy and ESG score. This results in ten interaction terms that isolate the effect of ESG score on misvaluation during the time that the SFDR was announced and introduced, within a certain industry.

When including these interaction terms, the regression equation is as follows.

$$\begin{aligned}\mathrm{MV}_{i,t} =&\beta_1 \mathrm{ESG}_{i,t} + \beta_2 \mathrm{Lev}_{i,t} + \beta_3 \mathrm{CapEx}_{i,t} + \beta_4 \mathrm{Size}_{i,t} + \beta_5 \mathrm{MB}_{i,t} + \beta_6 \mathrm{ROA}_{i,t} + \\ &\beta_7 \mathrm{Indus}_{i,t} + \beta_8 \mathrm{Healthi,t} + \beta_9 \mathrm{ConsSt}_{i,t} + \beta_{10} \mathrm{ConsDi}_{i,t} + \beta_{11} \mathrm{Energy}_{i,t} + \\ &\beta_{12} \mathrm{Util}_{i,t} + \beta_{13} \mathrm{Tech}_{i,t} + \beta_{14} \mathrm{BasMat}_{i,t} + \beta_{15} \mathrm{Telecom}_{i,t} + \beta_{16} \mathrm{RealEst}_{i,t} + \epsilon_{i,t}\end{aligned}$$

In this case, the crucial variables are the interaction terms $\beta_7 \text{Indus}_{i,t}$ β_8Healthi,t, $\beta_9 \text{ConsSt}_{i,t}$, $\beta_{10} \text{ConsDi}_{i,t}$, $\beta_{11} \text{Energy}_{i,t}$, $\beta_{12} \text{Util}_{i,t}$, $\beta_{13} \text{Tech}_{i,t}$, $\beta_{14} \text{BasMat}_{i,t}$, $\beta_{15} \text{Telecom}_{i,t}$ and $\beta_{16} \text{RealEst}_{i,t}$. The coefficients of these variables indicate whether and to what extent firms within a certain industry are affected by the SFDR in the sense that ESG score affects misvaluation. I expect to see a significantly positive effect for the industries Technology and Telecommunications (Rahat and Nguyen, 2024).

Finally, a regression is run with the lagged misvaluation variable and the lagged ESG variable. Also, the interaction terms are all adjusted and make use of the lagged ESG score. The regression equation is as follows.

$$\begin{aligned} \text{MV}_{i,t} =& \beta_1 \text{MV}_{i,t-1} + \beta_2 \text{ESG}_{i,t-1} + \beta_3 \text{Lev} + \beta_4 \text{CapEx}_{i,t} + \beta_5 \text{Size}_{i,t} + \beta_6 \text{MB}_{i,t} + \\ & \beta_7 \text{ROA}_{i,t} + \beta_8 \text{Indus}_{i,t} + \beta_9 \text{Healthi,t} + \beta_{10} \text{ConsSt}_{i,t} + \beta_{11} \text{ConsDi}_{i,t} + \\ & \beta_{12} \text{Energy}_{i,t} + \beta_{13} \text{Util}_{i,t} + \beta_{14} \text{Tech}_{i,t} + \beta_{15} \text{BasMat}_{i,t} + \beta_{16} \text{Telecom}_{i,t} + \\ & \beta_{17} \text{RealEst}_{i,t} + \epsilon_{i,t} \end{aligned}$$

Again, the interaction terms are the most important variables to interpret in this model. They indicate whether an industry is specifically affected by the SFDR and whether an industry can be considered as a main driver of any observed effect.

5 Results

5.1 ESG and stock price

As postulated in the first hypothesis, I expect a positive relationship between ESG scores and stock price. Therefore, the analysis starts by performing a regression with the dependent variable *Stock Price (SP)* and the main explanatory variable *ESG*. Furthermore, all control variables, being *Leverage*, *Capital Expenditure*, *Size*, *Market-to-Book* and *Profitability* are included in the regression. The results of the base model are presented in column (1) of Table 5.

Table 5: Regression output stock price

	(1) SP	(2) SP
L.ESG		0.8236*** (0.0831)
ESG	0.8224*** (0.0894)	
Lev	74.9658*** (9.0844)	74.5059*** (9.0688)
CapEx	156.7793*** (52.6329)	167.4225*** (52.6238)
Size	72.1201*** (2.9116)	70.8510*** (2.9225)
MB	-0.0013 (0.0137)	-0.0014 (0.0137)
ROA	264.1954*** (19.1071)	264.5391*** (19.0705)
Obs.	4,932	4,932
R^2	0.2469	0.2491

The table above represents the fixed effects estimations of the relationship between ESG score and stock price, including a set of control variables. Column (1) is the base model. In column (2), the regression includes a one-year lagged ESG score variable. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

The regression output suggests evidence for a highly significant and positive relationship between ESG score and a firm's stock price. The coefficient indicates that when increasing the ESG score by one, the value of the stock price increases by 0.8224. Even though this effect appears to be relatively small compared to the

coefficients of the control variables, it is a quite sizable effect. Namely, ESG scores can increase a couple of points within a year, which could therefore be accompanied by a serious increase in stock price. Furthermore, *ESG* is a direct measure, whereas the control variables are a ratio or a natural logarithm. This means that a sizable increase of ESG score is more likely than a sizable increase of the control variables. The fact that most of the control variables have a large and significant effect on stock price, shows that their inclusion reduces the possible omitted variable bias of the analysis.

The results in column (2) of Table 5, with the lagged independent variable included, confirm the observed effect. All significant coefficients remain significant and their value remains practically equal. Therefore, there are no signs of reverse causality, meaning that ESG scores positively affect stock price and not the other way around.

Considering the results of Table 5, I can draw a conclusion for hypothesis **I**. This hypothesis can be accepted, as I observe a positive and significant relationship between ESG score and stock price.

5.2 ESG and misvaluation

The second regression analysis focuses on the correlation between ESG score and firm misvaluation. As it is now established that ESG scores positively impact a firm's stock price, it must be determined whether this increase in price on the equity market is justified and reflected in the true value. Based on earlier research, I hypothesize that ESG scores have a positive influence on firm misvaluation. This implies that ESG scores exacerbate overvaluation and mitigate undervaluation.

To test this, the regression model includes *Misvaluation (MV)* as the dependent variable and *ESG* as the main explanatory variable. Furthermore, the relevant control variables are included in the analysis as well. The entire sample of US and EU firms is used for this regression. The results of the base model are visible in column (1) of Table 6.

Table 6: Regression output misvaluation

	(1) MV	(2) MV	(3) MV	(4) MV
L.MV		-0.0975*** (0.0314)		-0.0989*** (0.0314)
L.ESG		0.0052 (0.0057)		0.0027 (0.0058)
ESG	0.0066 (0.0061)		0.0042 (0.0062)	
Lev	0.0275 (0.6204)	0.3010 (0.6196)	0.3352 (0.6331)	0.3832 (0.6323)
CapEx	6.9345* (3.5942)	6.9988* (3.5957)	7.9173** (3.6067)	8.0119** (3.6060)
Size	-0.2803 (0.1988)	-0.2852 (0.1998)	-0.4018* (0.2113)	-0.4062* (0.2116)
MB	-0.0002 (0.0009)	-0.0002 (0.0009)	-0.0002 (0.0009)	-0.0002 (0.0009)
ROA	-4.1683*** (1.3045)	-4.1691*** (1.3030)	-4.1935*** (1.3071)	-4.1874*** (1.3052)
SFDR			0.0297 (0.2266)	0.0062 (0.2267)
SFDRxEUxESG			0.0109*** (0.0042)	0.0121*** (0.0042)
Obs.	4,932	4,932	4,932	4,932
R^2	0.0032	0.0052	0.0054	0.0077

The table above represents the fixed effects estimations of the relationship between ESG score and Misvaluation, including a set of control variables. Column (1) is the base model. Column (2) includes a lagged dependent and lagged independent variable. Column (3) includes a dummy and interaction term to test the SFDR. Column (4) includes the lagged variables and the dummy and interaction term. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Despite the fact that the ESG score coefficient is slightly positive (0.0066), it is not significant. Therefore, unlike in earlier research, the results of this analysis do not indicate a positive and significant effect of ESG score on firm misvaluation. In fact, there does not seem to be any relationship between the two variables. This remains the same when regressing on the lagged ESG score variable and the lagged misvaluation variable in column (2) of Table 6. Therefore, the results of this analysis must be interpreted cautiously.

Based on the results in column (1) and (2) of Table 6, I reject hypothesis **II**. In contrast to earlier literature, the positive, but insignificant coefficient of ESG score does not show evidence for the expected positive effect of ESG score on firm misvaluation.

5.3 SFDR and misvaluation

5.3.1 Results total sample

Even though I do not find evidence for a positive effect of ESG score on misvaluation over the entire sample period, it is possible that ESG scores do impact misvaluation positively during times of increased ESG importance or high ESG market sentiment. The introduction of the SFDR is a recent example of such a case. Therefore, the third regression model is added, in which the effect of the SFDR is specifically examined. In this analysis, the dependent variable remains the same (*Misvaluation*) and the explanatory variable (*ESG*) is also included. However, the latter is no longer the main explanatory variable. I add two dummy variables and an interaction term in order to investigate whether ESG scores do positively influence misvaluation in the EU, during the years when the SFDR was announced and introduced. If so, the expectation is that firms in the EU are positively misvalued, in contrast to or to a larger extent than firms in the US. Namely, unlike mutual funds in the US, the mutual funds in the EU are affected by the regulation. Possibly, the mutual funds in the EU demand more European stocks with a relatively high ESG score. Moreover, investor attention towards ESG-friendly funds and companies with a higher ESG score might increase, which could also boost such an effect. Therefore, I hypothesize that the SFDR positively influences the misvaluation effect for companies in the EU.

The most important coefficient in this regression is the interaction term that combines the *SFDR* dummy, the *EU* dummy and the variable *ESG*, which is labeled as *SFDR*x*EU*x*ESG*. This combination should indicate whether ESG scores positively affect misvaluation of the specific set of EU companies since the announcement and introduction of the SFDR. The regression output of the base model is shown in column (3) of Table 6.

Like in column (1) of Table 6, the coefficient of the ESG score is slightly positive and insignificant. Again, this means that there is no evidence for a correlation between ESG score and misvaluation in this regression model. However, the main explanatory variable, the interaction term *SFDR*x*EU*x*ESG*, is positive and highly significant.

This indicates that ESG score positively affects firm misvaluation in the EU during the period of 2019 to 2022. The coefficient of the interaction term shows that an increase of the ESG score by one, leads to an increase in misvaluation by 0.0109. As misvaluation is a ratio of the stock price to the true value, this means that the level of misvaluation increases by roughly 1% compared to the preceding year. So, in case of an increase in ESG score, an undervalued firm becomes less undervalued and an overvalued firm becomes more overvalued. The results in column (4) of Table 6 are similar and even indicate a slightly higher effect. When including the lagged ESG score variable, the coefficient increases to 0.0121. Again, there is no evidence for reverse causality.

Additionally, the coefficients of the SFDR dummy in column (3) and (4) of Table 6 are interesting to interpret. Given that these are both insignificant, there seems to be no general misvaluation effect between the years 2019 and 2022. This means that the effect that I do observe, based on the interaction term, can be attributed to the ESG score specifically and not to general time effects.

The results in column (3) and (4) of Table 6 are in line with the expectation. However, before rejecting or accepting hypothesis **III**, I run additional regressions in which the sample is split between firms in the US and firms in the EU.

5.3.2 Results split sample

When separating the sample between US firms and EU firms, I expect similar results. Namely, if the SFDR specifically affects the misvaluation of firms within the EU, this should be visible when performing a separate regression analysis for EU firms only. On the other hand, when performing a separate analysis for US firms only, I expect the effect to be either smaller or non-existent. If that is indeed the case, the findings of the total sample are confirmed and conclusions can be drawn about the third hypothesis.

As such, I perform both regressions for the EU and the US sample, including the interaction term that combines the SFDR dummy and the ESG score variable, *SFDR*x*ESG*. The results of the base model of this analysis are provided in column

(1) and (3) of Table 7 for the US and the EU respectively.

Table 7: Regression output misvaluation US and EU split

	(1) MV	(2) MV	(3) MV	(4) MV
L.MV		-0.1008***		0.3265
		(0.0183)		(0.5458)
L.ESG		-0.0014		0.0079
		(0.0041)		(0.0154)
ESG	0.0037		0.0009	
	(0.0044)		(0.0167)	
Lev	0.1610	0.2480	-0.4809	-0.1956
	(0.4079)	(0.4055)	(2.4807)	(2.4838)
CapEx	-5.5147**	-5.6738**	27.9742***	27.9893***
	(2.7135)	(2.7010)	(8.3873)	(8.4062)
Size	-0.2488*	-0.2121	-0.5682	-0.6645
	(0.1512)	(0.1514)	(0.5320)	(0.5296)
MB	-0.0002	-0.0002	0.0146	0.0003
	(0.0005)	(0.0005)	(0.1089)	(0.1106)
ROA	-3.4301***	-3.4198***	-5.9393	-5.8330
	(0.8904)	(0.8860)	(4.0597)	(4.0612)
SFDRxESG	-0.0019	-0.0014	0.0155***	0.0155***
	(0.0019)	(0.0019)	(0.0058)	(0.0058)
Obs.	3,114	3,114	1,818	1,818
R^2	0.0084	0.0184	0.0110	0.0119

The table above represents the fixed effects estimations of the relationship between ESG score and Misvaluation, for the US and EU sample separately, including a set of control variables. Column (1) is the baseline model for the US. Column (2) includes a lagged misvaluation variable and a lagged ESG score variable for the US. Column (3) is the baseline model for the EU. Column (4) includes a lagged misvaluation variable and a lagged ESG score variable for the EU. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

The coefficient of the interaction term is positive and highly significant (0.0155) for the EU, whereas the coefficient of the interaction term is slightly negative and insignificant (-0.0019) for the US. These coefficients are in line with the expectation and show that the introduction of the SFDR does influence misvaluation of EU firms, whereas it does not influence misvaluation of US firms. The results in column (2) and (4), in which the lagged misvaluation variable and the lagged ESG score variable are included for the US and the EU respectively, are comparable and confirm the findings of the base models.

Overall, the results in Table 7 provide enough evidence to conclude as follows.

Hypothesis **III**, which states that the SFDR positively influences the misvaluation effect for companies in the EU, can be accepted. Irrespective of the effectiveness of the regulation in reaching its goal to mobilize capital towards sustainable investment, it positively influences firm misvaluation within the EU.

I attribute this effect to a sudden increase in investor attention towards firms with a high ESG score. On the one hand, mutual fund investors demand more assets from firms with a high ESG score, since they aim to receive a favorable sustainability label. On the other hand, individual investors perceive ESG compatibility to be more important as they read and hear about the introduction of the European Green Deal and the SFDR specifically. Also, the SFDR makes it easier for individual investors to distinct ESG-friendly funds from the less ESG-friendly funds. Thus, the combination of investor attention towards ESG, from the mutual fund perspective and from the individual perspective, results in an increase in firm misvaluation in the short run after the announcement and introduction of the SFDR.

The possible consequences in the long run remain to be seen and require additional research. For now, however, the results of this paper are valuable for many. Policy makers can use the findings to become aware and to monitor any possible negative spillover effects of the SFDR on the equity market. Investors can consider the observed effect when compiling their investment portfolio, knowing that companies with a high ESG score might be misvalued during times of increased investor sentiment. Finally, firm managers can incorporate the results in their decision making process. Large investments in corporate ESG activities can be followed by undesirable consequences, which might be relevant for a firm in the long run.

5.3.3 Results industry analysis

As I have established that the SFDR affects misvaluation positively in the EU, it becomes interesting to test what drives this effect. Therefore, I perform an analysis that includes industry interaction terms for the sample of EU firms specifically. Possibly, certain industries stand out and cause the majority of the observed effect. The results of the regression model are shown in Table 8. I only include the

coefficient of the interaction term of the Telecommunications industry, as the other industry interaction term coefficients are insignificant and therefore unnecessary to include.

Table 8: Regression output industry effects EU

	(1) MV	(2) MV
L.MV		0.7032
		(0.5492)
L.ESG		0.0061
		(0.0154)
ESG	-0.0006	
	(0.0168)	
Lev	-2.3195	-2.1080
	(2.5186)	(2.5168)
CapEx	27.7195***	27.2067***
	(8.5172)	(8.5283)
Size	-0.2300	-0.2530
	(0.5475)	(0.5459)
MB	0.0550	0.0331
	(0.1107)	(0.1117)
ROA	-6.2860	-6.1506
	(4.0389)	(4.0341)
Telecom	0.0919***	0.0983***
	(0.0154)	(0.0155)
Obs.	1,818	1,818
R^2	0.0276	0.0311

The table above represents the fixed effects estimations of the relationship between ESG score and Misvaluation, for the EU sample only, including a set of industry dummies. Column (1) is the baseline model and Column (2) includes a lagged misvaluation variable and a lagged ESG score variable. For clarity, Telecom is the only interaction term that is included in the table. In the total regression, all ten interaction terms were included. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Interestingly, and partly in line with earlier literature (Rahat and Nguyen, 2024), the Telecommunications industry appears to be the main driver of the observed effect of the SFDR in the EU. The coefficient of the interaction terms are positive and highly significant, 0.0919 and 0.0983, in column (1) and (2) respectively. The values of the coefficients are a multiple of the interaction term in Table 7 (0.0155), which indicates that the Telecommunications industry carries the effect of the SFDR and

can therefore be identified as main driver of the effect. As there are a total of ten firms within the Telecommunications industry within the EU sample, which is about ten percent of the total EU sample, it is plausible that this industry has a defining impact.

A possible explanation for this observation concerns two elements. First of all, firms within the Telecommunications industry require an extensive digital infrastructure that can be sensitive to high energy consumption and environmental impact. This means that firms can distinguish themselves by bringing down their environmental impact and by obtaining a favorable ESG score, which can be highly relevant to investors. Furthermore, other industries like Energy and Industrials have always been at the forefront of public and regulatory scrutiny. This might cause these industries to be less impacted by a regulation like the SFDR, since investments in these industries were already highly regulated and treated with caution at forehand. It is likely that this is to a lesser extent the case for the Telecommunications industry, which could explain its role as main driver of the effect of the SFDR.

5.4 Endogeneity

The study tries to deal with numerous possible endogeneity issues. As such, a correlation matrix is included to rule out any issues with regards to multicollinearity. Furthermore, every regression is copied and performed with a lagged dependent and lagged independent variable to check for reverse causality. Also, the interaction terms that are included are carefully created and the outcome in the initial difference-in-differences setting is verified by splitting the sample and performing a separate analysis for US and EU firms, which reduces endogeneity concerns.

Another endogeneity concern, which is difficult to rule out entirely, is non-random selection. This paper studies a sample of firms that are listed and have an ESG score. However, being listed can depend on different factors than having an ESG score. While being listed is more related to firm size, having an ESG score is

oftentimes more related to industry. Therefore, the observed relationship between ESG score and misvaluation could be (partly) driven by unobserved factors that also drive misvaluation. This concern is reduced by including a set of control variables, which also reduces possible omitted variable bias. Moreover, the use of a fixed effects model accounts for unobserved time-invariant factors that drive the relationship. Despite these measures, there is a probability that time-varying unobserved factors influence the relationship. To rule this out completely, an instrumental variable would be useful.

Finally, the inclusion of the industry analysis deepens the understanding of the relationship between ESG score and misvaluation, especially with regards to the SFDR. It addresses heterogeneity and omitted variable bias at the industry level.

Considering the measures that are taken to counter endogeneity concerns, the link that I find between ESG score and firm misvaluation during the treatment period can be considered trustworthy, which is why I can confirm the existence of the relationship. However, I do not claim the relationship to be causal. Future research could explore potential causality between the introduction of a regulation like the SFDR and the increased effect of ESG score on firm misvaluation.

6 Conclusion

6.1 Discussion of the findings

This paper examines the relationship between ESG scores and firm misvaluation, with a focus on the effect of the EU Sustainable Finance Disclosure Regulation (SFDR) on this relationship. In doing so, the research design is mainly based on two papers, written by Bofinger et al. (2022) and Becker et al. (2022), and essentially combines their methodology. The study analyses a set of 274 firms, of which 101 are based in the EU and 173 are based in the US, over an eighteen-year sample period between 2005 and 2022. To account for the companies' true value, the paper employs the residual income model (RIM), developed by Ohlson (1995). A variety of fixed effects regressions leads to the following results.

I find evidence for a positive correlation between ESG scores and a firms' stock price. However, I do not find evidence for a structural relationship between ESG scores and firm misvaluation, which is in contrast with earlier findings. When focusing on the effect of the SFDR, by performing regression analysis with the total sample in a difference-in-differences setting and by splitting the sample between firms that are based in the EU and firms that are based in the US, I find that ESG scores do positively affect firm misvaluation within the EU during the treatment period 2019 to 2022. This is the most valuable finding of this study and impacts multiple parties involved.

Summing this up, the research question '*Do ESG scores affect firms' stock price and firms' level of misvaluation, and to what extent does the implementation of the SFDR in the European Union affect this relationship?*' can be answered. This paper provides evidence for a positive relationship between firms' ESG score and stock price, whereas ESG scores do not seem to influence the level of misvaluation in any way. The study does, however, find evidence that the announcement and introduction of the SFDR is positively related to an increase in the level of misvaluation of firms within the EU. I attribute this effect to a sudden increase in investor attention towards ESG activities. Finally, a separate industry analysis shows that the SFDR's effect is mainly

driven by the Telecommunications industry.

A sufficiently large and persistent effect of the introduction of a regulation like the SFDR could lead to structural inefficiency on the equity market, which should be carefully considered by policy makers, investors and managers. Policy makers can become aware of the spillover effects of regulations like the SFDR and can also act upon this. Identifying possible negative consequences in an early stage is key to mitigate the risks involved. Furthermore, investors play a crucial role in managing market efficiency. The outcomes of this paper could make them aware of possible risks, which could balance things out on the equity market. Finally, firm managers should consider the consequences of investing in corporate ESG activities. Are such investments creating real value?

6.2 Limitations and suggestions for future research

As mentioned, this paper provides interesting and novel insights that are highly relevant for many. However, the results are also subject to a number of limitations.

Firstly, it is important to consider the studied time period, with special focus to the treatment years during which the SFDR was announced and introduced, 2019 to 2022. At the start of 2020, the EU and the US were hit by the covid-crisis, which also impacted firms and financial markets heavily. As this crisis persisted until the end of 2022, practically the entire treatment period is influenced by covid. However, there are reasons to believe that the crisis does not cause unrepresentative or biased results, one of them being that the main dependent variable of this study is a ratio of a firm's stock price to its true value. Therefore, it is likely that the covid-crisis does not disproportionately impact the dependent variable, as both a firm's stock price and its true value are affected (as visible in Figure 2). Moreover, Barka et al. (2023) find that ESG scores positively affect firm misvaluation and stress that this effect holds in times of crises. Still, however, there is a possibility that the consequences of the atypical covid-crisis do affect the results. For example, it could be the case that confidence on the stock market recovered more quickly than the companies themselves did. Possibly, the financial shock sustained in companies' balance sheets, while investor sentiment

picked up more quickly. This might affect the correlation between ESG score and firm misvaluation during the treatment period as well.

Another concern with regards to the studied time period, is the relatively short treatment period. The SFDR was announced in 2019, which immediately affected the ESG score of mutual funds' portfolios, as shown by Becker et al. (2022). Therefore, it is likely that this also caused an immediate effect on the equity market. It is also likely that the announcement and introduction of the European Green Deal, of which the SFDR is part, caused an increase in investor sentiment with respect to ESG efforts. Supporting this ratio, Becker et al. (2022) also find that individual investors mobilized their capital towards funds with an ESG-friendly label once the SFDR came into effect in 2021. Still, however, the treatment period is relatively short and only includes two years during which the regulation was applicable. At that time, the regulation was still in its infancy and improvements were still in the making. Therefore, the results of this study are very insightful, but do not provide a definitive conclusion about the consequences of the SFDR on the equity market.

There are multiple research suggestions to find out whether the above two concerns affect the outcome of this study. One of those is to simply wait and perform a comparable analysis in a couple of years from now. The treatment period will be longer and the effect of the covid shock will be reduced or gone by then. That would offer the opportunity to find out what the real and longer term effect of the SFDR is. A second possibility would be to study a different setting with comparable circumstances, but in a different time period. If the SFDR turns out to be effective in reaching its goal to mobilize capital towards green investments, it is likely that similar regulations will be introduced elsewhere. A comparable regulation in the US, for example, would offer an ideal research setting in which the effect of such a regulation can be studied and compared. Similar conclusions in suchlike research would strengthen the reliability of the observed effect.

A final limitation that was touched upon earlier is the problem of non-random selection. Given that this study focuses on a sample of firms that are listed and have an ESG score, it is possible that there are non-observed time-varying factors

that (partly) influence the effect of the SFDR. A suggestion for future research would therefore be to include an instrumental variable in the analysis, which aids to test the level of causality of the observed effect of the SFDR. Even though finding and using such an instrumental variable requires careful attention, this would improve the study's internal validity.

What are the potential negative consequences of the observed effect though? Is the fueling of a 'green bubble' a plausible scenario? Literature is divided on this matter. While some scientists recognize similar signals as during the emergence of the dot-com bubble and warn for a comparable scenario, others argue that a possible increase in popularity and investor sentiment does not lead to structural inefficiency. Foglia and Miglietta (2024) state that ESG scores are closely related to green investment and that investors use ESG scores as a tool to to measure the level of sustainability of stocks. Also, they find evidence for the presence of bubbles in ESG markets, especially during times when ESG sentiment is high. On the other hand, Jourde and Stalla-Bourdillon (2021) suggest that this effect is overdone and that there is no evidence for an ESG bubble, despite recent warnings. Thus, it is currently unclear whether the emergence of an ESG or 'green' bubble is at risk. It is, however, important to stay on guard and to keep studying possible problematic shifting on the equity market.

I would like to conclude this paper by referring to the opening quote (1). Ursula von der Leyen, President of the European Commission, rightfully calls for immediate action. It is up to the current generation to preserve the planet for the generations to come. This study, however, shows that we must be cautious. Sudden policy changes also give rise to sudden unintended spillover effects, of which the consequences might be detrimental. However, if recognized in an early stage, such consequences can be curbed. It is therefore up to science and politics to join forces and lead the way towards a healthy planet for the future generation.

References

Avramov, D., Cheng, S., & Hameed, A. (2020). Mutual funds and mispriced stocks. *Management Science*, *66*(6), 2372–2395.

Barka, Z., Hamza, T., & Mrad, S. (2023). Corporate ESG scores and equity market misvaluation: Toward ethical investor behavior. *Economic Modelling*, *127*, 106467.

Becker, M. G., Martin, F., & Walter, A. (2022). The power of ESG transparency: The effect of the new SFDR sustainability labels on mutual funds and individual investors. *Finance Research Letters*, *47*, 102708.

Birindelli, G., Chiappini, H., & Jalal, R. N.-U.-D. (2023). SFDR, investor attention, and European financial markets. *Finance Research Letters*, *56*, 104–135.

Bofinger, Y., Heyden, K. J., & Rock, B. (2022). Corporate social responsibility and market efficiency: Evidence from ESG and misvaluation measures. *Journal of Banking & Finance*, *134*, 106322.

Brzeszczyński, J., Gajdka, J., & Kutan, A. M. (2015). Investor response to public news, sentiment and institutional trading in emerging markets: A review. *International Review of Economics & Finance*, *40*, 338–352.

Cao, J., Titman, S., Zhan, X., & Zhang, W. (2023). ESG preference, institutional trading, and stock return patterns. *Journal of Financial and Quantitative Analysis*, *58*(5), 1843–1877.

Chan, K., Covrig, V., & Ng, L. (2005). What determines the domestic bias and foreign bias? Evidence from mutual fund equity allocations worldwide. *The Journal of Finance*, *60*(3), 1495–1534.

Chauhan, Y., & Kumar, S. B. (2018). Do investors value the nonfinancial disclosure in emerging markets? *Emerging Markets Review*, *37*, 32–46.

Cheng, M.-C., & Tzeng, Z.-C. (2011). The effect of leverage on firm value and how the firm financial quality influence on this effect. *World Journal of Management*, *3*(2), 30–53.

Cremasco, C., & Boni, L. (2022). Is the European Union (EU) Sustainable Finance Disclosure Regulation (SFDR) effective in shaping sustainability objectives? An analysis of investment funds' behaviour. *Journal of Sustainable Finance & Investment*, 1–19.

Delen, D., Kuzey, C., & Uyar, A. (2013). Measuring firm performance using financial ratios: A decision tree approach. *Expert systems with applications*, *40*(10), 3970–3983.

Deng, X., Kang, J.-k., & Low, B. S. (2013). Corporate social responsibility and stakeholder value maximization: Evidence from mergers. *Journal of financial Economics*, *110*(1), 87–109.

Ding, B., Luo, S., & Zhou, G. (2014). Corporate ESG performance and stock mispricing: Governance weapon or self-serving tool? *Available at SSRN 4830065*.

Dong, M., Hirshleifer, D., Richardson, S., & Teoh, S. H. (2006). Does investor misvaluation drive the takeover market? *The Journal of Finance*, *61*(2), 725–762.

Dong, M., Hirshleifer, D., & Teoh, S. H. (2021). Misvaluation and corporate inventiveness. *Journal of Financial and Quantitative Analysis*, *56*(8), 2605–2633.

Emiris, M., Harris, J., & Koulischer, F. (2023). The effect of environmental preferences on investor responses to ESG disclosure. *Available at SSRN 4457989*.

Fang, V. W., Noe, T. H., & Tice, S. (2009). Stock market liquidity and firm value. *Journal of financial Economics*, *94*(1), 150–169.

Foglia, M., & Miglietta, F. (2024). Does every cloud (bubble) have a silver lining? An investigation of ESG financial markets. *Journal of Behavioral and Experimental Finance*, 100928.

Freeman, R. E. (2010). *Strategic management: A stakeholder approach*. Cambridge University Press.

Friedman, M., et al. (1970). A Friedman doctrine: The social responsibility of business is to increase its profits. *The New York Times*, *13*(1970), 17.

Hong, H. G., Kubik, J. D., Liskovich, I., & Scheinkman, J. A. (2019). Crime, punishment and the value of corporate social responsibility. *Available at SSRN 2492202*.

Hu, Y., Chen, S., Shao, Y., & Gao, S. (2018). CSR and firm value: Evidence from China. *Sustainability*, *10*(12), 45–97.

Jourde, T., & Stalla-Bourdillon, A. (2021). Is there a bubble in "green" equities. *Banque de France, Eco Notepad*, *235*.

Khan, M. A., Hassan, M. K., Maraghini, M. P., Paolo, B., & Valentinuz, G. (2024). Valuation effect of ESG and its impact on capital structure: Evidence from Europe. *International Review of Economics & Finance*, *91*, 19–35.

Lehnert, T. (2023). The green stock market bubble. *Circular Economy and Sustainability*, *3*(3), 1213–1222.

Leite, B. J., & Uysal, V. B. (2023). Does ESG matter to investors? ESG scores and the stock price response to new information. *Global Finance Journal*, *57*, 100851.

London Stock Exchange Group. (2024). Datastream [Accessed: May 26, 2024]. https://www.lseg.com/datastream

Margono, F. P., & Gantino, R. (2021). The influence of firm size, leverage, profitability, and dividend policy on firm value of companies in Indonesia stock exchange. *Copernican Journal of Finance & Accounting*, *10*(2), 45–61.

Naughton, J. P., Wang, C., & Yeung, I. (2019). Investor sentiment for corporate social performance. *The Accounting Review*, *94*(4), 401–420.

Nguyen, P.-A., Kecskés, A., & Mansi, S. (2020). Does corporate social responsibility create shareholder value? The importance of long-term investors. *Journal of Banking & Finance*, *112*, 105217.

Ohlson, J. A. (1995). Earnings, book values, and dividends in equity valuation. *Contemporary accounting research*, *11*(2), 661–687.

Rahat, B., & Nguyen, P. (2024). The impact of ESG profile on firm's valuation in emerging markets. *International Review of Financial Analysis*, *95*, 103361.

Renneboog, L., Ter Horst, J., & Zhang, C. (2008). Socially responsible investments: Institutional aspects, performance, and investor behavior. *Journal of banking & finance*, *32*(9), 1723–1742.

Serafeim, G. (2020). Public sentiment and the price of corporate sustainability. *Financial Analysts Journal*, *76*(2), 26–46.

Servaes, H., & Tamayo, A. (2013). The impact of corporate social responsibility on firm value: The role of customer awareness. *Management science*, *59*(5), 1045–1061.

Siahaan, F. O. (2013). The effect of good corporate governance mechanism, leverage, and firm size on firm value. *GSTF Journal on Business Review (GBR)*, *2*(4), 137–142.

Thomson Reuters. (2024). ASSET4 Database [Accessed: May 26, 2024]. https://www.refinitiv.com/en/financial-data/company-data/esg-research-data

Trueman, B. (1986). The relationship between the level of capital expenditures and firm value. *Journal of Financial and Quantitative Analysis*, *21*(2), 115–129.