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# Sentimental Sustainability: Does What Companies Say Tell More Than What Companies Do?

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## Abstract

Based on a sample of more than eleven thousand unique 10-K reports of US companies filed with SEC in period 2013 to 2018, this study examines the relationship between actual sustainability performance of companies, evaluated by MSCI ESG performance scores, and the extent and the scope of environmental, social, and governance information disclosure in their annual reports. The study shows empirical evidence supporting the signalling theory view of voluntary disclosure of ESG information in annual reports for most industries, while environmentally unfriendly companies belonging to the Mining industry division show excessive reporting behavior favoring environmental topics, which is consistent with incentives to improve public image and mitigate social, political, and legal risks in line with the legitimacy theory of information disclosure. When differentiating between forward-looking and non-forward-looking ESG statements, the study shows that companies providing more forward-looking ESG information in annual reports show better next-year ESG performance. This study implements established content analysis techniques with focus on ESG reporting and performance, building up on the study of Baier, Berninger, and Kiesel (2020) that proposed an ESG-tailored dictionary for textual analysis purposes.

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## 1 | INTRODUCTION

In recent years, the topic of sustainable economic activity and corporate social responsibility has become firmly rooted in the daily agenda of companies from all industries, including the investment and asset management universe. The main aspect of these concepts implies the reassessment of economic behavior of companies and other economic actors in terms of their impact on the environment and society as a whole, thus urging the integration of environmental, social, and governance (ESG) principles into operational and strategic choices of companies and government entities (Liang and Renneboog (2020)). Following the global economic sustainability trend, the investment management industry has been vigorously shifting its focus towards sustainable investing, with currently more than 80% of institutional investors adapting their investment decisions based on ESG factors (Morgan Stanley (2020)). While the integration of sustainable investment principles into investment processes continues to gain momentum year after year, with the global adoption rate of ESG principles among asset owners growing from 70% to 80% between 2017 and 2019, the investors are looking for better methodologies and more profound data to measure the impact of sustainability policies and activities of their investment targets and thus the success prospects of their investment strategies. The recent studies indicate that almost a third of institutional investors are not satisfied with available ESG data and assessment methodologies, citing this factor as one of the most crucial challenges for sustainable investing (Morgan Stanley (2020)).

Besides difficulties in assessment of actual ESG performance of companies, both the research community and professional investors struggle with an exact definition of sustainability and its factors, which complicates the consideration and subsequent implementation of ESG policies in companies as well as their accurate performance assessment, thus leaving companies and rating agencies a lot of leeway in interpretation of sustainability criteria (Kotsantonis and Serafeim (2019), Trahan and Jantz (2023)). This vagueness also exacerbates the agency problems between the investment managers and the beneficiaries they represent, which ignites debates about the usefulness of imperative disclosure requirements of ESG practices that could be introduced by regulatory agencies, such as the Securities and Exchange Commission (SEC) (Mahoney and Mahoney (2021)).

While the implementation of ESG policies in business operations entails many difficulties for company's management, the communication with investors and reporting of sustainability topics to a wide circle of stakeholders constitutes an equally challenging task (Aluchna, Hussain, and Roszkowska-Menkes (2019)). Especially in the US market, the investors have been putting pressure on companies to provide them with more information regarding sustainability efforts and their impact on businesses, leading to increased adaptation of such disclosure practices in corporate America (KPMG (2017)). As an example of investors' interest and activism in disclosure of ESG information by companies serves the appeal of a number of asset management companies (with more than 5 trillion dollars of managed assets) to the SEC in year 2018, in which they advocated for the need of reconsideration of official disclosure regulations towards a comprehensive integration of sustainability-related information into reporting practices of companies listed on US stock exchanges (Ho (2020)). However, a simple disclosure of separate sustainability reports without inclusion of relevant financial information doesn't meet all the informational needs of investors, since the detachment of financial figures can lead to distortion of the whole business picture and thus contribute to a misjudgment of the role of ESG-driven achievements in the overall performance results of a company (Aluchna et al. (2019)). To avoid possible misinterpretation of advances in sustainable business development that investors may get, companies embraced new forms of delivering relevant information to the stakeholders by integrating ESG-related information into established financial reporting practices, thus paving the way for new "integrated reporting" standards. With annual report being one of the most important communication channels with investors, companies have been incorporating relevant qualitative ESG information into their 10-K<sup>1</sup> forms along with standard financial and performance figures (KPMG (2017)).

While the disclosure of financial information largely constitutes a highly standardized and regulated process, the reporting of sustainable issues still rests essentially upon incentives and willingness of companies' management to

bring this information to the stakeholders (Cannon, Ling, Wang, and Watanabe (2020)). Therefore, with enough room to manoeuvre within publication of ESG-related materials, the management can adapt the degree of transparency of sustainability disclosure according to company's strategic interests or for their personal advantages (McBrayer (2018)). The diversity of communication strategies being at management's disposal, ranging from purposeful vocabulary and semantic manipulation to limitation of information disclosure<sup>2</sup> (Fyodorova, Sayakhov, Demin, and Afanasyev (2019)), is largely covered in the research under two fundamental theories of information disclosure, which embrace predominantly opposing set of behavior incentives influencing the managers of exchange-listed companies. While the signalling theory implies that managers of successful companies are encouraged to disseminate as much information as possible to inform their investors of accomplished work and future perspectives and thus increase company's valuation on the market, the legitimacy theory postulates, in contrary, that predominantly the management of bad performing companies is motivated to cultivate public opinion through extensive reporting and thus improve company's reputation and smooth out negative impressions of failures and adverse events by investors (Cannon et al. (2020)). The latter behavior of managers is characterized in the literature under the term "corporate impression management", which describes the divergence between actual activities of a company and their depiction and characterization in communication with various stakeholders, with some papers arguing that such strategies can bring in comparable gains in terms of investors' satisfaction as in cases with real, unembellished adjustments in company's actions (Roman, Mocanu, and Hoinaru (2019)). The proponents of the legitimacy theory readily use this argument in determination of the root causes of consistently expanding sustainability disclosure levels of public companies over the past forty years (O'Donovan (2002)). One of the key instruments in the arsenal of managers seeking to impress investors is company's own annual report, which describes firm's activities and performance throughout the year and thus constitutes a perfect opportunity for the management to shape company's image in the eyes of its stakeholders (Roman et al. (2019)). While the annual report serves as a source of key performance indicators and general financial figures, the overwhelming part of it consists of verbal messages prepared by the management, with a high degree of leeway in formulation of the narrative (Ben-Amar and Belgacem (2018); Lo, Ramos, and Rogo (2017)).

However, the empirical studies do not provide overwhelming support for the legitimacy theory in the field of sustainability disclosure and reporting practices, recording rather mixed evidence in terms of dependency between the actual ESG performance and the extent of companies' sustainability disclosure (Nazari, Hrazdil, and Mahmoudian (2017)). Depending on the sample, methodology, as well as the period of time investigated, several researchers document positive relationship between those factors (i.a. Clarkson, Fang, Li, and Richardson (2013); Lys, Naughton, and Wang (2015); Nazari et al. (2017); Plumlee, Brown, Hayes, and Marshall (2015)), whereas other studies (i.a. Cho and Patten (2007); Cho, Guidry, Hageman, and Patten (2012); Muslu, Mutlu, Radhakrishnan, and Tsang (2017)) predominantly find support for the legitimacy theory. The latest research studies in the ESG field indicate the significance of more extensive examination of semantic and linguistic formats in reports prepared by the management (Nazari et al. (2017)). While the analysis of ESG activities and performance of companies is routinely conducted by rating agencies and data providers based on various metrics determined and compiled by them<sup>3</sup>, the content analysis of companies' ESG disclosure has long been burdened by a lack of a standardized linguistic toolkit that could enable the researchers to make a highly granular examination of ESG reporting practices on large data sets<sup>4</sup> (Baier et al. (2020)). However, the recent publication of a comprehensive ESG dictionary, with more than four hundred words and thirty-four sub-categories by Baier et al. (2020), is determined to mitigate described difficulties within research on textual analysis and enables to implement established techniques of natural language processing (NLP) in the context of sustainability disclosure and reporting practices on large data samples.

This paper aims to re-examine the fundamental theories of information disclosure by public companies in the ESG context, namely the signalling and the legitimacy theories, using an automated processing of annual reports of US companies based on recently proposed dictionary of ESG terms by Baier et al. (2020) and thus provide new evidence in support of one of the theories in an objective and standardized framework on a large data sample. Analyzing more than eleven thousand unique 10-K reports of US companies filed with SEC in period 2013 to 2018, this study examines the relationship between actual ESG performance of companies evaluated by means of MSCI ESG Research

performance scores<sup>5</sup>, and the extent and the scope of their sustainability reporting assessed by textual disclosure scores based on a term weighting scheme following Loughran and McDonald (2011). The regression analysis shows support for the signalling theory for the majority of industries according to Standard Industrial Classification (SIC) division structure, whereas companies belonging to the Mining industry division (with rather bad environmental performance) favor extensive reporting of the environment-related topics, which is consistent with the reasoning underlying the legitimacy theory. Besides the examination of the overall disclosure of ESG information, the implemented framework allows to investigate each ESG pillar category separately in terms of the relationship between actual performance levels and the extent of information disclosure. Thus, this study shows evidence for a positive relationship of environmental, social, and governance disclosure scopes with their respective actual ESG pillar performance categories. By differentiating ESG sentences from annual reports between forward-looking and non-forward-looking statements using the forward-looking word list proposed by Li (2010), this study also finds evidence for a better next-year ESG performance of companies that provide more forward-looking ESG information in annual reports in comparison to companies with lower levels of forward-looking ESG disclosure.

This paper contributes to the literature in the fields of information disclosure of public companies, ESG performance and reporting, as well as textual and sentiment analyses. Apart from providing empirical evidence on theoretical concepts of information disclosure in the context of sustainability, the framework and results presented in this paper can also find useful applications in the asset and investment management industries, along with the regulatory environment. The inclusion of ESG disclosure models together with standard ESG performance scores from established data providers into investment decision-making could enhance investors' stance with regards to data availability and reduce boundaries to sustainable investing (Morgan Stanley (2020); Van Duuren, Plantinga, and Scholtens (2016)), especially in investment cases where ESG performance scores are not available for particular companies, thus mitigating the possibility of a selection bias (Baier et al. (2020)). Besides that, the regulatory agencies could enhance their frameworks by paying closer attention to environmentally unfriendly industries, companies in which could tend to polish up relatively bad performance by means of extensive reporting.

The remainder of this paper is structured as follows. Section II discusses the theoretical framework this paper is based upon, along with an overview of the related literature. Section III presents methodology of the empirical part of this paper. Results with robustness analysis are presented in Section IV. Section V discusses the results and provides limitations of this study. Finally, Section VI concludes the paper and provides further thoughts on future research.

## 2 | THEORETICAL FRAMEWORK AND HYPOTHESES

The relationship between actual performance and reporting of related information and thus management's motivation for disclosure can be generally summarized in the finance literature under two streams of research (Nazari et al. (2017)). While voluntary disclosure assumptions imply that managers disclose as much information as possible for the benefit of the company and its stakeholders, the legitimacy theory alleges that managers adapt their disclosure behavior and the use of language according to their own opportunistic interests. By voluntarily informing the shareholders and other stakeholders about company's activities via extensive reporting, the management contributes to the reduction of information asymmetry and thus agency costs (Shehata (2014); Zhang, Shan, and Chang (2021)), gaining additional trust of investors (Clarkson, Ponn, Richardson, Rudzici, Tsang, and Wang (2020))<sup>6</sup> and encouraging new investments into the company (Mittelbach-Hörmanseder, Hummel, and Rammerstorfer (2021); Shehata (2014); Verrecchia (1983)). Companies with good performance face lower operational costs of additional information disclosure in comparison with bad-performing firms, which serves as additional stimulus for managers to report more and differentiate themselves from bad-performers (Lopez-de Silanes, McCahery, and Pudschedl (2019)). As a result of increased trust of investors and broadening of the investor base, company could also benefit from lower<sup>7</sup> cost of capital (Aluchna et al. (2019); Dhaliwal, Li, Tsang, and Yang (2011); Lambert, Leuz, and Verrecchia (2007); Shehata (2014)). In addition, extensive disclosure of information during good times can further strengthen company's reputation, creating a

reputational buffer that could serve the company during a crisis<sup>8</sup> and mitigate the public relations damage from it (e.g., Zhang et al. (2021)). The recent research also shows that higher degree of sustainable information disclosure favourably affects company-specific crash risk (Da Silva (2021)), providing further evidence for the insurance characteristic of information disclosure practices (Darnell (2021)). Altogether, all these factors should bring additional value for a company and thus enhance its market valuation, which is also beneficial for company's management, especially in case of a performance-based compensation (Brogi and Lagasio (2019); Mittelbach-Hörmanseder et al. (2021)), and should motivate good-performing companies to disclose more information.

In contrast to the signalling theory<sup>9</sup>, the incentives underlying the legitimacy theory of information disclosure imply that the management acts predominantly opportunistic in their own interest<sup>10</sup> and uses information disclosure as an instrument for impacting shareholders' perception of their actual performance (e.g., Cho, Roberts, and Patten (2010); Cho, Mittelbach-Hörmanseder, Hummel, and Matten (2019); Deegan (2002)). Apart from shareholders, company's management also seeks to influence other stakeholders and general public through tailored disclosure of non-financial narratives in order to restore company's legitimacy and thus oppose the negative news sentiment (Cho et al. (2019); Hummel and Szekely (2021); Nakao, Kokubu, and Nishitani (2019)). The concept of legitimacy implies that society generally approves the existence and operations of the company within socially admissible limits, thus allowing it to exist and function on a "legit" basis (O'Donovan (2002); Roman et al. (2019)). Thus, managers can adapt the tone and the narrative of disclosed information for opportunistic reasons of legitimization of company's poor financial or ESG-related results (Cannon et al. (2020); Nazari et al. (2017)). In order to achieve this effect, the management can use plenty of communication and lexical strategies, such as intentional complication<sup>11</sup> of lexical constructions that can impress or confuse investors. Apart from the intentional difficulty of text comprehension, Fyodorova et al. (2019) provides general overview of other communication and reporting strategies at management's disposal, among them rhetorical manipulation, visual and thematic distortion, biased choice of benchmarks for comparison purposes, as well as deliberate inclusion or exclusion of certain information and performance indicators. Jin, Shi, and Zhang (2019), for example, discuss reporting practices of several Chinese meat producers that omitted critical information in their sustainability reports about the use of chemical substances in meat production and the subsequent investigation by the Chinese authorities in 2010s. Managers can turn to such tactics since stakeholders find it often difficult or are unable to get to the bottom of things through distorted information – an action that also induces additional costs of information processing (Beretta, Demartini, and Trucco (2019); Clatworthy and Jones (2001)).

The recent research also shows that elevated reporting of ESG-related topics serves as one of the strategies to repair company's legitimacy and improve its image in the eyes of stakeholders. Zhang et al. (2021), for example, find that companies focusing on corporate social responsibility (CSR) reporting reduce the value losses associated with disclosure of financial restatements, thus providing evidence for legitimacy function of sustainability disclosure. Roman et al. (2019) argue that such behavior suits worse-performing companies more than their more successful rivals, managers in which may try to take advantage of their information handicap as opposed to investors and other stakeholders and, therefore, make a subjective image of their company that deviates from the objective state of things. Feng and Gao (2020) provide several examples<sup>12</sup> of studies that present evidence for more extensive environmental disclosure by companies with rather bad environmental performance, pointing to support of the legitimacy theory in terms of the negative relationship between disclosure and actual performance.<sup>13</sup>

However, the empirical research also provides contradictory<sup>14</sup> evidence in favor of the signalling theory, which implies the opposite (positive) relationship between ESG disclosure and actual performance levels. For example, Ajina and Bacha (2019) show positive connection of annual reports' readability measures with actual CSR performance of French companies using computational linguistics measures. Hummel and Szekely (2021) provide further evidence from Europe, showing that more sustainable companies from the STOXX Europe 600 index are inclined to dedicate more attention to topics related to sustainable development goals in their annual reports. Beretta et al. (2019) also find evidence in support of the voluntary disclosure based on integrated annual reports of European public companies. In Canada, Ben-Amar and Belgacem (2018) find that management discussion and analysis sections of public companies with better sustainability performance are longer in comparison with companies falling behind. Lopez-de Silanes et al.

(2019) report cross-country (both the US and international) evidence for positive relationship between ESG scores and disclosure levels by examining companies with equity market values exceeding \$0.7 bn. Adding to the US evidence, Nazari et al. (2017) also find positive link between performance and disclosure by focusing on CSR disclosure documents of S&P 500<sup>15</sup> companies. In addition, Clarkson et al. (2020) explore CSR disclosure of US companies by implementing linguistics features analysis on their sustainability reports and find evidence for elevated disclosure levels by more sustainability-oriented firms. In contrast to these studies, Patten (2002) documents negative link between disclosure levels and environmental performance while analyzing annual reports of 131 US companies from the Toxic Release Inventory list of 1988. Also adding to the US evidence, Crowley, Huang, Lu, and Luo (2019) find that companies with bad sustainability performance publish more ESG-related messages on Twitter than their better-performing peers, which is consistent with the legitimacy theory of information disclosure.

Thus, the empirical research to date has presented mostly mixed data with regard to the evidence in support of the signalling and the legitimacy theories in the realm of ESG disclosure and performance. Such divergence in results can be justified by several factors, including deviations in samples and time periods examined<sup>16</sup>, differences in study designs and methodologies<sup>17</sup>, and disagreements in definitions of disclosure metrics and thus the interpretation of findings<sup>18</sup>. Nevertheless, the mentioned studies all share in common the lack of a comprehensive and unified ESG corporate lexicon in their methodology<sup>19</sup> that could be used for determination of ESG disclosure levels in reports issued by companies. In order to close this research gap, Baier et al. (2020) developed a broad, granular dictionary with ESG terms based on a sample of annual reports of companies from the S&P 100 index, providing an opportunity to explore the ESG disclosure of public companies in more detail on a large scale. This paper implements the dictionary from Baier et al. (2020), along with established textual analysis and NLP techniques, to examine the theories of information disclosure in the ESG context and thus to provide empirical evidence using a large sample of companies' documents. Thus, this paper offers an empirical framework for analysis of the ESG disclosure of companies that can be implemented in a standardized automated way for both practical and academic purposes.

Consistent with the legitimacy and the signalling theories, this paper examines the relationship between ESG performance and ESG disclosure extent of companies, which leads to the following hypotheses<sup>20</sup>:

Hypothesis 1: Companies with good ESG performance have high ESG disclosure levels, consistent with the signalling theory and implying a positive relationship between performance and disclosure.

Besides the analysis of the overall ESG performance, the framework implemented in this paper allows the analysis to be extended to each category of ESG performance by focusing on environmental, social and governance dimensions of sustainability separately. Thus, the hypotheses with respect to the relation between the ESG performance and disclosure are extended as follows:

Hypothesis 2: Companies with good environmental performance have high environmental disclosure levels, consistent with the signalling theory and implying a positive relationship between performance and disclosure.

Hypothesis 3: Companies with good social performance have high social disclosure levels, consistent with the signalling theory and implying a positive relationship between performance and disclosure.

Hypothesis 4: Companies with good governance performance have high governance disclosure levels, consistent with the signalling theory and implying a positive relationship between performance and disclosure.

Some research articles argue that linguistic features of companies' ESG disclosure can have predictive power for ESG performance<sup>21</sup>, which provides further motivation for analysis of the relationship between forward-looking ESG information disclosure and the next-period ESG performance. Thus, the following hypothesis is proposed:

Hypothesis 5: Companies with high ratio of forward-looking ESG information in their disclosure have higher next-year ESG performance.

### 3 | METHODOLOGY AND DATA SAMPLE

#### 3.1 | ESG disclosure

Companies generally have at their disposal many instruments for communication with investors and other stakeholders, including i.a. press releases, investor presentations and conferences, sustainability reports, and conference calls. However, the annual report remains the major in-depth source of information for markets and the public about the past activities and future developments of a company (Hummel and Szekely (2021); Mittelbach-Hörmanseder et al. (2021)). Besides general financial key figures and performance commentaries, the annual report also serves as the most informative disclosure of ESG-related information about company's actions and implemented sustainability policies (Baier et al. (2020)). Thus, this study focuses on annual reports as a source of ESG information disclosure of companies.

In order to assess the amount and the extent of ESG information disclosed in annual reports, the qualitative data in textual form should be quantified by means of textual analysis techniques from linguistics and computer sciences that have found application in the field of financial research. This study implements an established bag of words, dictionary-based framework with term weighting scheme following Loughran and McDonald (2011). In this way, the text content is transformed into a matrix consisting of vectors of term counts, where the terms represent words from the text that are also included in a pre-specified dictionary<sup>22</sup>. The weighting scheme ensures that the textual analysis model accounts for differences in relative importance of words in both single text and the entire lexicon used in the sample of documents, while also normalizing the weight of each word according to the document's length. By using the term document matrix with words' frequencies and their estimated weights, one can calculate the disclosure score for each annual report, thus quantifying the scope and the extent of information disclosure.

Jegadeesh and Wu (2013) formally summarize the model used by Loughran and McDonald (2011), which is also implemented in this study, as follows:

$$w_j^{idf} = \log \frac{N}{df_j} \quad (1)$$

where  $w_j^{idf}$  denotes the inverse document frequency (*idf*) weight of a word  $j$ ,  $N$  is the overall number of annual reports in the study sample, and  $df_j$  is the number of reports where term  $j$  appears at least once.

The *idf* weighting model ensures that larger weights are not assigned to the words which are used in many documents too often and thus do not have much informational value. Since the weighting scheme is applied to the words from a dictionary, the word weights are adjusted as follows:

$$w_{ij}^{tf,idf} = \begin{cases} 1 + \log (tf_{ij}) w_j^{idf} & \text{if } tf_{ij} > 0, \\ 0 & \text{otherwise,} \end{cases} \quad (2)$$

where  $tf_{ij}$  denotes the frequency of appearance of term  $j$  from a dictionary in annual report  $i$ ,  $w_{ij}^{tf,idf}$  is the weight of a word from the dictionary.

Using this weighting scheme, the ESG disclosure score of annual report is calculated as follows:

$$ESG\text{DisclosureScore}_i^{tf,idf} = \frac{1}{(1 + \log a_i)} \sum_{j=1}^J w_{ij}^{tf,idf} \quad (3)$$



where  $ESGDisclosureScore_i^{tf.idf}$  is the ESG disclosure score of annual report  $i$  based on *idf* weighting scheme,  $a_i$  is the total count of words in annual report  $i$ , and  $J$  is the total number of words in the ESG dictionary.

Since the focus of this paper lies on the disclosure of ESG-related information in annual reports, the dictionary applied in this framework should consist of sustainability lexicon used by companies in formal<sup>23</sup> reports. Baier et al. (2020) recently proposed a comprehensive, manually<sup>24</sup> compiled ESG dictionary, using a broad sample of annual reports of companies-members of the S&P 100 index, that offers a broad classification of forty ESG subcategories in addition to general categorization into environmental, social, and governance pillars of sustainability. With 482 words<sup>25</sup>, the dictionary allows a precise quantification of broad ESG topics disclosed by companies in their annual reports and thus the assessment of their disclosure efforts in the ESG context. Tables A1, A2, and A3 show all the three ESG dictionary subcategories proposed by Baier et al. (2020). While we rely on a third-party lexicon in our analysis, this ESG dictionary was derived from annual reports of US companies and has been peer-reviewed and recognized by independent researchers, which lessens the chance of a misidentification of ESG terms used by companies in our sample. Hence, the ESG disclosure score serves as an estimate of the extent and the scope of companies' ESG disclosure based on their annual reports.

### 3.2 | ESG performance

In order to juxtapose the ESG disclosure with actual performance of companies and thus examine our hypotheses with regards to the signalling and the legitimacy theories, an assessment of companies' ESG activities and initiatives is necessary. Since the ESG agenda has taken on great importance in the economy and financial markets in the last decades, the rating agencies and financial data providers have established various methodologies of consistent assessment of companies in terms of their ESG performance, which allowed their ratings to become the benchmark for determination of companies' sustainability performance in both academia and industry settings (Escrig-Olmedo, Fernández-Izquierdo, Ferrero-Ferrero, Rivera-Lirio, and Munoz-Torres (2019)). Although the definition and especially quantification of sustainability factors are a source of controversy, with different methodologies of performance assessment leading to sometimes completely different outcomes on both the industry and firm levels (Dimson, Marsh, and Staunton (2020), Billio, Costola, Hristova, Latino, and Pelizzon (2021)), the necessity to assess companies' ESG actions both internally and externally created a competitive environment for various analysis techniques, thus giving a choice to the markets and regulatory agencies to assess the rating agencies and their methodologies in the search of the most comprehensive one. Besides divergent methods of estimation and dissimilarity in the definition of ESG criteria with an imperfect transparency of choices (Kotsantonis and Serafeim (2019)), some ratings can be also affected by conflict of interests with companies they assess due to the nature of other branches of rating agencies' business, such as consulting and other paid services for the rated companies.<sup>26</sup> However, the comparison of various companies in different industries in terms of their ESG performance on a large scale is hardly manageable without involvement of rating agencies and data providers specialized in the ESG area. While there is a plenty of ESG data providers, the vast majority of asset managers and academic research studies refer to the MSCI as their primary source of ESG performance data, which is considered to be the largest vendor of ESG performance metrics for financial markets and academic institutions (Christensen, Serafeim, and Sikochi (2021); Serafeim (2020)). MSCI ESG Research implements a variety of methodologies, ranging from simple assessment of corporate data and news media to advanced analytical techniques from machine learning and artificial intelligence fields, in order to evaluate sustainability performance of companies in environmental, social, and governance areas, taking into account the specifics of all industries<sup>27</sup> to compile the overall annual ESG performance score of a company (Pastor, Stambaugh, and Taylor (2021); Glück, Hübel, and Scholz (2021)). Thus, the MSCI ESG Research performance scores are used in this study as an estimator of actual annual ESG performance of companies and are put in comparison to estimated ESG disclosure scores of annual reports to analyze the relationship between the real performance and the level of disclosure in annual reports.

Besides the aggregated ESG score, the MSCI ESG Research also provides individual scores for environmental, social, and governance pillars, which are also used in this study to extend the analysis into singular sustainability categories.

### 3.3 | Data sample construction and descriptive statistics

We start our data sample construction with the MSCI ESG Research database<sup>28</sup>, focusing on the US companies<sup>29</sup> included in the database from January 2013 to December 2018. Our choice of the time frame as well as concentration on the US market has several reasons. While the ESG thematic has started gaining considerable momentum especially in the last decade<sup>30</sup>, the SEC issued an explanatory guidance for disclosure of climate change related topics targeted at filings of public companies in February 2010, which led to changes in reporting practices of companies way beyond the environmentally sensitive industries (Feng and Gao (2020)). Furthermore, in the aftermath of acquisitions of multiple ESG data providers<sup>31</sup>, MSCI significantly increased its ESG coverage of US companies at the end of 2012, also expanding the rating methodologies on small companies from the MSCI US Investable Market Index (Pastor et al. (2021)). Thus, the data sample starts on January 2013 to analyze as many annual reports of US companies as possible.<sup>32</sup> The sample's focus on US companies is due to a relatively high efficiency<sup>33</sup> of the US capital market, consistency in the format and quality of annual reports filed with the SEC, as well as the availability and the accessibility of data from the SEC's EDGAR<sup>34</sup> data base.

MSCI ESG Research provides quantitative performance scores for each ESG category (Environmental, Social, and Governance scores) of a company taking into account its industry specifics, which is reflected in the proportional weightings (from 0% to 100%) of each ESG pillar used to compute the overall ESG weighted score. Besides that, MSCI ESG Research also considers the ESG performance of company's peers in the same industry to assess its relative performance and thus to come up with industry-adjusted ESG scores that incorporate differences of companies in terms of their within-industry performance (Pastor et al. (2021)).<sup>35</sup> This paper uses both the weighted and the industry-adjusted MSCI ESG Research scores, including individual ESG pillar scores, since there is no consensus in the literature which scores are more suitable to use<sup>36</sup>, and for the purpose of conducting more granular analysis of companies' disclosure behavior within each core sustainability category.

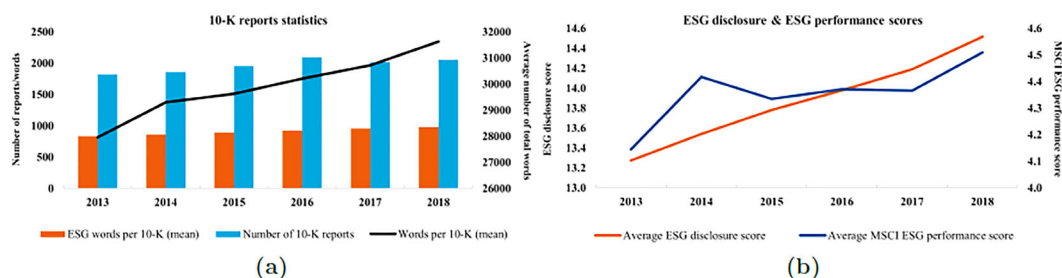
In order to access the 10-K reports of US companies from the MSCI ESG data set in SEC's EDGAR, a unique Central Index Key (CIK) identifier is necessary, which is obtained for each company by merging companies' tickers with a ticker/CIK matching table provided by Compustat<sup>37</sup>. The companies whose CIK numbers could not be identified are excluded from the dataset. Once the unique CIK numbers of companies are identified, the 10-K reports are downloaded from EDGAR using customized algorithm implemented in Python. In the next step, the 10-K documents that represent refilings of company's annual report within the same year are eliminated from the data set, thus leaving one 10-K report per year for each company. Then, the MSCI ESG data set with annual ESG scores is merged with the 10-K sample, while 10-K reports with a missing annual ESG score pair<sup>38</sup> are removed. Following Loughran and McDonald (2011), annual reports with less than 2000 words are also excluded from the sample. In the last step, resulting dataset is merged with the fundamentals data from Compustat that are necessary for construction of control variables<sup>39</sup>, while 10-K observations with missing fundamentals data are omitted. Table 1 summarizes the process of data sample derivation.

To convert the documents into a term-document matrix for subsequent estimation of disclosure scores, the resulting sample of 10-K reports is processed and cleaned following Jegadeesh and Wu (2013) and Loughran and McDonald (2011). Specifically, tables, graphs, HTML language units as well as other non-text objects and exhibits are deleted from each 10-K text file. Once the files have been cleaned, the 10-K texts are tokenized, i.e. decomposed into single words, and each text item is then compared with the English language dictionary<sup>40</sup> to verify its affiliation with English words, while abbreviations and stop words are omitted from the text corpus. To diminish the influence of inflected versions of words on estimated word weightings that serve as one of the inputs for the disclosure score, each token from the text corpus as well as from the ESG dictionary is transformed to its stem form using Porter's stemming algorithm<sup>41</sup>.

**TABLE 1** Derivation of the data sample.

Data sample/adjustment	Number of companies/reports	Removed companies/reports
MSCI ESG unique US companies (2013-2018)	4495	
Compustat CIK/Ticker matching	3396	1099
EDGAR CIK matching	3280	116
EDGAR 10-K 2013–2018 US sample	16224	
<i>without duplicates</i>	16209	15
<i>merge with annual MSCI ESG scores</i>	11927	4282
<i>10-K reports with at least 2000 words</i>	11921	6
<i>merge with Compustat control variables</i>	11793	128
<b>10-K MSCI ESG sample</b>	<b>11793</b>	

This table reports the compilation of the data sample, consisting of annual reports with corresponding MSCI ESG performance scores and firm-specific control variables of US companies in period 2013 to 2018, with the effect of data sample adjustments on the final number of observations. The final sample is constructed by merging EDGAR, MSCI ESG Research, and Compustat databases using CIK and CUSIP numbers as unique identifiers. All 10-K reports are preprocessed and cleaned prior to the match with other data.



**FIGURE 1** Data sample statistics. Figure 1a reports annual sample statistics of 10-K (annual) reports of US companies in period 2013 to 2018. Figure 1b reports annual average ESG disclosure score computed based on the inverse document frequency weighting scheme and ESG topic dictionary using the complete sample (11 793 annual reports), and annual average MSCI ESG performance score in sample. [Color figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

The resulted text corpus serves as the basis for a term matrix of each 10-K report. Figure 1 provides a yearly overview of the final 10-K reports sample.

The number of unique companies in the final dataset fluctuates around 2000 items throughout the observation period, with companies issuing, on average, larger reports year after year. In addition, the average ESG disclosure score also increases during the whole period of observation. Figure 1 also shows both the development of the average ESG performance and ESG disclosure scores in the sample.

The MSCI ESG performance scores take on values from 0 to 10, whereas the ESG disclosure score values range between 4.9 and 32.2. Table 2 summarizes descriptive statistics of the dataset variables.

The 10-K sample covers nine industries according to the SIC division structure, whereas the three largest industry groups (“Manufacturing”; “Finance, Insurance and Real Estate”; “Services”) account for almost 75% of the sample. The “Mining”, “Wholesale Trade”, “Construction”, and “Agriculture, Forestry and Fishing” divisions each amount to less than 5% of the sample, with “Agriculture” companies representing the smallest group (less than 1%) in the sample. Financial

**TABLE 2** Summary statistics for 10-K reports sample (2013 – 2018).

Variable	Observations	Mean	SD	Min.	25%	50%	75%	Max.
ESG disclosure score	11793	13.9	3.12	3.37	11.72	13.34	15.58	33.36
Environmental disclosure score	11792	2.14	2.04	0.1	0.83	1.44	2.59	13.71
Social disclosure score	11793	4.16	1.74	0.57	3.01	3.71	4.72	13.49
Governance disclosure score	11791	7.87	1.23	2.9	7.08	7.72	8.53	15.99
MSCI ESG weighted score	11793	4.36	1.01	0	3.7	4.4	5	9.2
MSCI industry-adjusted ESG score	11793	4.11	1.88	0	2.86	3.9	5.4	10
MSCI Environmental score	11792	4.5	2.14	0	2.9	4.5	6	10
MSCI Social score	11793	4.18	1.58	0	3.2	4.1	5.1	10
MSCI Governance score	11791	5.35	2.02	0	4	5.2	6.5	10
Book-to-Market	11793	0.44	0.72	-65.1	0.21	0.39	0.63	10.33
Size	11793	7.85	1.5	0.46	6.75	7.67	8.74	13.69
Asset Productivity	11793	0.00	1.48	-156.3	0.01	0.04	0.07	3.01
Leverage	11790	8.63	253.57	0.01	0.85	1.98	4.48	26495.5

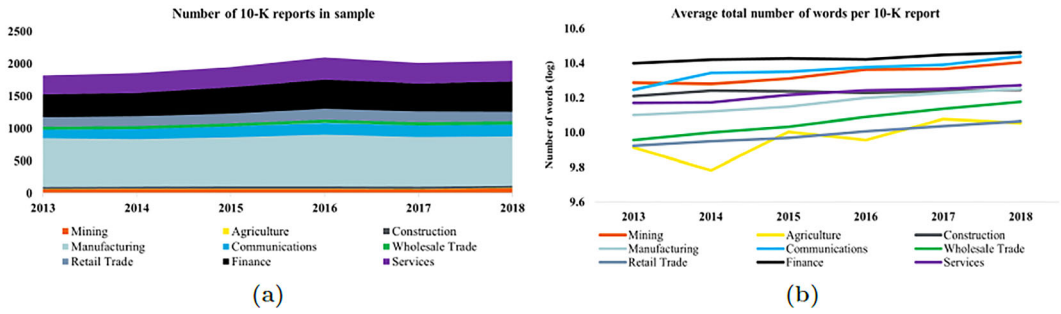
The table reports overall statistics, such as the number of observations, mean, minimum, maximum, and 25%/75% quantiles of variables used in the study. ESG, Environmental, Social, and Governance disclosure scores are computed based on the inverse document frequency weighting scheme and the ESG topic dictionary. MSCI ESG performance score is the pillar-weighted annual ESG performance score of a company. MSCI ESG industry-adjusted score is the annual MSCI ESG performance score of a company normalized relative to its industry peers. MSCI Environmental, Social, and Governance scores are annual weighted pillar performance scores of a company. Book-to-market is the ratio of the book value of equity to the market value of equity at the end of the quarter before annual report filing. Size is the natural logarithm of the market capitalization of company at the end of the quarter before annual report filing. Asset productivity is the ratio of earnings before interest and taxes (EBIT) to total assets at the end of the quarter before annual report filing. Leverage is the ratio of the market value of equity to the total liabilities of company at the end of the quarter before annual report filing. The extreme values of book-to-market, asset productivity, and leverage variables do not affect the coefficients and their significance in econometric models.

companies have the longest reports on average in terms of the number of words contained in each document, followed by “Transportation, Communications, Electric, Gas and Sanitary service” and “Mining” divisions. While the length of an annual report differs between industries, the average number of words used in a sentence ranges between 18 and 19 regardless of the division. Figure 2 shows industries-related sample statistics.

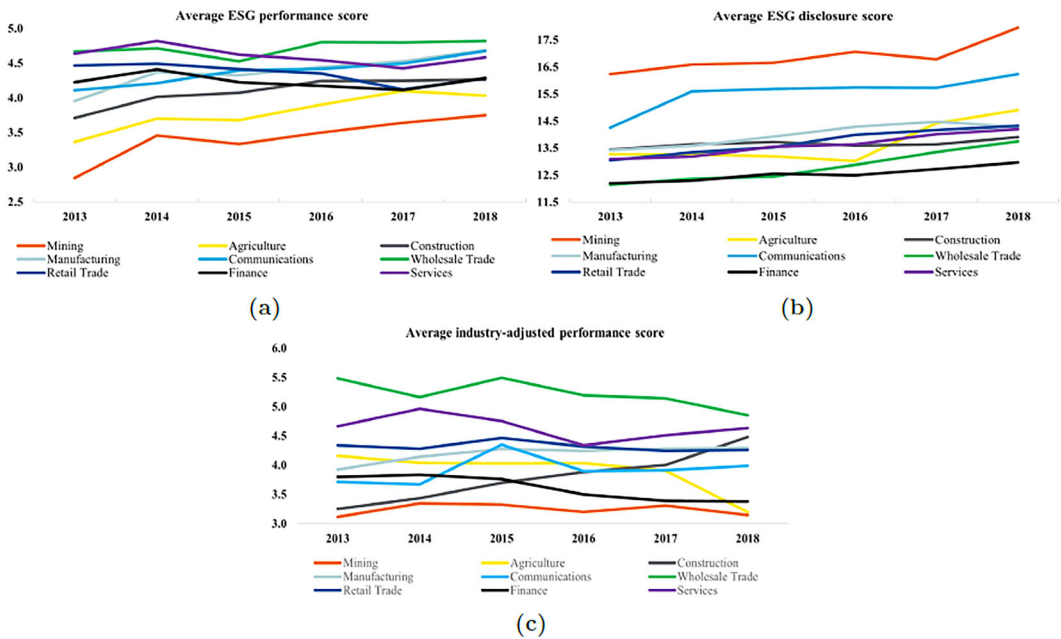
## 4 | EMPIRICAL TESTS AND RESULTS

### 4.1 | Analysis of industries

To explore the disclosure behavior of companies with different ESG performance levels, the descriptive analysis focuses first on the industry groups presented in the sample. Specifically, we are interested in comparison of industries with rather bad sustainability reputation (e.g., Mining) to other industrial categories with respect to their need for legitimacy seeking. According to the legitimacy theory, companies belonging to “bad” industries should exhibit higher average disclosure scores relative to better-performing firms from other industries. Thus, we compare the average ESG performance scores of each industry group with their respective average ESG disclosure scores, which is illustrated in Figure 3.

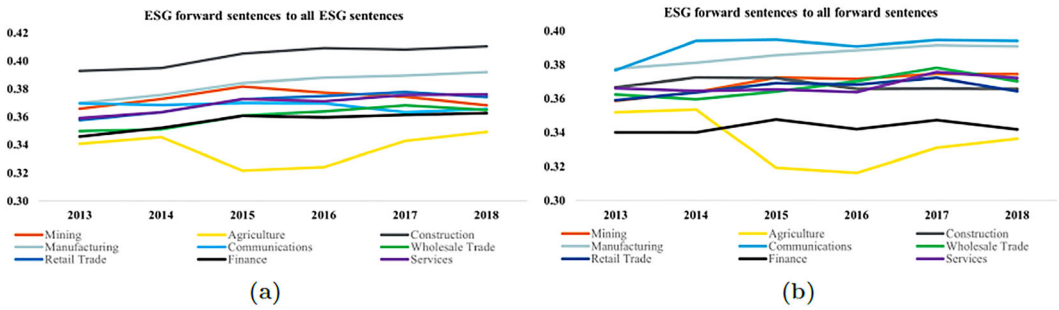


**FIGURE 2** 10-K reports statistics. Figure 2a reports annual industrial composition of the 10-K reports sample according to the Standard Industrial Classification (SIC) codes. Figure 2b presents annual logged average number of words in a 10-K report for each industry group in the sample. “Communications” category represents the “Transportation, Communications, Electric, Gas and Sanitary service” division. [Color figure can be viewed at wileyonlinelibrary.com]



**FIGURE 3** ESG performance and disclosure scores. Figure 3a reports annual average MSCI ESG performance score for each industry group in the sample. Figure 3b presents annual average ESG disclosure score for each industry group, with ESG disclosure score estimated with the inverse document frequency weighting scheme and the ESG topic dictionary based on 11 793 annual reports as presented in Eq. (3). Figure 3c reports annual average MSCI ESG performance score normalized relative to industry peers for each industry group in the sample. “Communications” category represents the “Transportation, Communications, Electric, Gas and Sanitary service” division. [Color figure can be viewed at wileyonlinelibrary.com]

In Figure 3, the Mining division<sup>42</sup> stands out from all the rest by showing highest average ESG disclosure scores and lowest ESG performance scores relative to other divisions. While the Mining industry is considered among the worst businesses in terms of the environmental impact, companies have strong incentives to improve public opinion and mitigate social, political, and legal risks through extensive disclosure. The use of industry-adjusted MSCI ESG performance



**FIGURE 4** ESG forward-looking information. Figure 4a presents average ratio of ESG forward-looking sentences to all ESG sentences contained in a 10-K report for each industry group in the sample. Figure 4b reports yearly average ratio of ESG forward-looking sentences to all forward-looking sentences contained in a 10-K report for each industry group in the sample. A forward-looking ESG sentence is defined as a sentence which contains at least one word from the forward-looking dictionary and at least one word from the ESG topic dictionary. A forward-looking sentence is defined as a sentence which contains at least one word from the forward-looking dictionary. “Communications” category represents the “Transportation, Communications, Electric, Gas and Sanitary service” division. [Color figure can be viewed at wileyonlinelibrary.com]

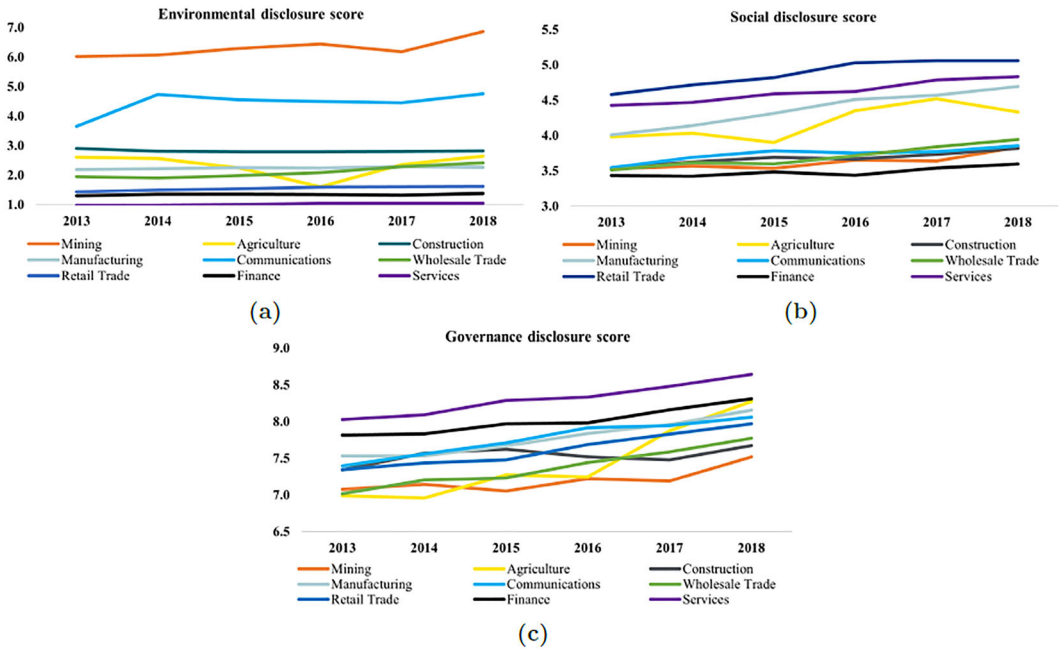
scores, which also consider the performance of company’s peers within the industry, also confirms initial observations with unadjusted scores.

However, relatively high disclosure scores of the Mining division could also be driven by companies’ efforts to elaborate more on future commitments and projects in the ESG area that should tackle existing challenges and provide the stakeholders with company’s roadmap towards more sustainable future, with excessive disclosure performing the signalling rather than the legitimacy function in such a case. Thus, to examine this alternative further, we analyze the relative amount of future-related information contained in annual reports, focusing on forward-looking ESG sentences. For that purpose, we use the forward-looking dictionary<sup>43</sup> proposed by Li (2010) for identification of forward-looking statements in 10-K reports, while the ESG sentences are identified using the ESG dictionary from Baier et al. (2020). Thus, a forward-looking ESG sentence is defined as a sentence which contains at least one word from the forward-looking dictionary and at least one word from the ESG dictionary. Figure 4 summarizes the analysis of forward-looking ESG statements.

The Mining industry shows median ratio of forward-looking ESG sentences to all ESG sentences in 10-K reports compared to other divisions, with the share of ESG sentences in forward-looking statements also being in line with the average across all industries. The same pattern is seen by the Communications division, which also exhibits elevated levels of ESG disclosure relative to the industries’ average. Therefore, the analysis of forward-looking ESG statements shows no significant dominance of any industry in the sample in terms of communicating future-related ESG information in annual reports.

To further understand the drivers of increased overall ESG disclosure in the Mining and Communications industries, we decompose the ESG disclosure into sustainability pillars, computing the disclosure scores for environmental, social, and governance categories separately. Figure 5 presents the average disclosure scores for each SIC division presented in the sample, whereas Figure 6 provides the average performance scores<sup>44</sup> of industries in each sustainability category.

In line with the expectations from a broad ESG topic analysis, the Mining industry shows a significantly higher environmental disclosure score relative to other industries in the sample. Besides that, the Communications division also shows elevated levels of disclosure in environmental topics; however, it also has a higher industry-adjusted Environmental pillar performance in comparison with other divisions. Thus, the Mining industry division can be considered as an outlier in the sample, which shows high levels of ESG disclosure along with low ESG performance scores. With



**FIGURE 5** ESG pillars disclosure. The graphs represent annual average Environmental, Social, and Governance disclosure scores of 10-K reports based on the environmental, social, and governance topic parts of the ESG dictionary for each industry division in the sample according to the SIC. The disclosure scores are computed based on the inverse document frequency weightings as presented in Eq. (3). “Communications” category represents the “Transportation, Communications, Electric, Gas and Sanitary service” division. [Color figure can be viewed at wileyonlinelibrary.com]

regards to other sustainability categories and industries, there are no obvious patterns that can be detected using descriptive analysis, which provides motivation to further examine the sample using the econometric models.

## 4.2 | Econometric analysis

To explore the relationship between the level of ESG disclosure and the actual ESG performance of companies, we implement the ordinary least squares (OLS) regressions with year dummy variables and the standard errors clustered on the firm level<sup>45</sup> in our analysis. Since the firms belonging to the Mining division showed a clear negative relationship between performance and disclosure, we treat the Mining industry as a sample outlier<sup>46</sup> and thus run the regressions for the Mining division companies separately. We examine the relationship between ESG performance and disclosure using the following regression

$$ESGPerf_i = a + b \times ESGDisc_i + \epsilon_i \tag{4}$$

where  $ESGPerf_i$  is the MSCI ESG performance score of company  $i$  in the year in which the annual report is released, and  $ESGDisc_i$  is company’s dictionary based  $idf$ -weighted ESG disclosure score of the annual report. Model 1 in Table 3 provides estimated coefficients and significance levels of the regression. The coefficient of  $ESGDisc_i$  is 0.1927 and significant at the 5% level, implying a positive relationship between performance and disclosure in the main sample. The Mining division (Model 9), in turn, shows a clear negative relationship between the variables, with  $-2.0587$  coefficient

TABLE 3 ESG performance regressions.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9) <sup>†</sup>	(10) <sup>†</sup>	(11) <sup>†</sup>	(12) <sup>†</sup>	(13) <sup>†</sup>	(14) <sup>†</sup>	(15) <sup>†</sup>	(16) <sup>†</sup>
ESGDisc	0.1927**				0.2281***				-2.0587***				-0.2677			
	(0.095)				(0.059)				(0.474)				(0.294)			
EDisc	3.1345***				0.8768***				-1.0831**					-0.2001		
	(0.176)				(0.051)				(0.474)					(0.176)		
SDisc	1.7599***				0.5950***				0.3433					0.4099		
	(0.107)				(0.043)				(0.684)					(0.283)		
GDisc	0.2697**				-0.0964**				-0.2223					-0.0317		
	(0.117)				(0.044)				(0.706)					(0.238)		
ESGPerf <sub>(t-1)</sub>	6.5954***				7.5961***											
	(0.070)				(0.297)											
EPerf <sub>(t-1)</sub>	5.5304***				5.4722***											
	(0.055)				(0.327)											
SPerf <sub>(t-1)</sub>	5.0568***				4.5593***											
	(0.055)				(0.353)											
GPerf <sub>(t-1)</sub>	3.5886***				3.4551											
	(0.034)				(0.154)											

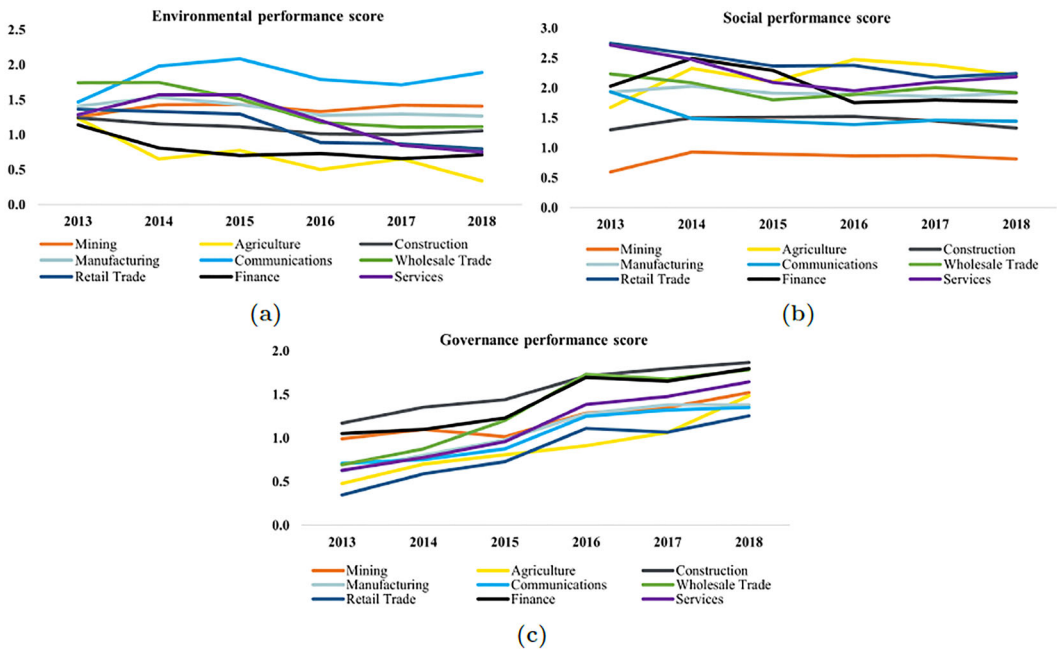
(Continues)



TABLE 3 (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9) <sup>†</sup>	(10) <sup>†</sup>	(11) <sup>†</sup>	(12) <sup>†</sup>	(13) <sup>†</sup>	(14) <sup>†</sup>	(15) <sup>†</sup>	(16) <sup>†</sup>
Size					0.1450** (0.05)	0.0592 (0.038)	-0.0788 (0.049)	-0.0963*** (0.035)					0.0368 (0.260)	-0.2082 (0.222)	-0.0963 (0.159)	0.2648** (0.107)
BM					-1.3032*** (0.327)	-0.6776*** (0.221)	0.4453 (0.320)	-0.8523*** (0.241)					0.1754 (1.101)	-0.7165 (0.597)	0.2059 (0.633)	0.8962 (0.645)
AssetProd					2.6806 (5.801)	6.4317** (3.110)	-1.2977 (5.093)	3.9240 (4.122)					48.0566 (33.044)	59.7428** (22.452)	-3.3242 (20.965)	-13.7980 (20.094)
Lev					2.9771 (2.103)	-0.4926 (0.529)	4.2660*** (0.556)	-1.0897*** (0.265)					0.4052*** (0.117)	0.1612 (0.101)	0.6234*** (0.093)	-0.1075** (0.042)
Observations	11393	11391	11392	11391	8742	8742	8742	8741	400	400	400	400	297	297	297	297

This table presents the regression estimates of MSCI ESG performance scores on 10-K disclosure scores with various control variables. ESGDisc, EDisc, SDisc, and GDisc are the ESG, environmental, social, and governance disclosure scores of annual reports estimated using the Eq. (3) based on the ESG topic dictionary. The regression models with "†" sign denote the regressions run only on the Mining division companies according to the SIC. See Eqs. (5), (11), (12), and (13) for the definition of control variables. All independent variables are standardized to a mean of 0 and a standard deviation of 1. The coefficients' estimates are not affected by the presence of outliers in the control variables. All regression models are estimated using year dummy variables and standard errors clustered on the firm level. The number of observations changes throughout the models due to the availability of control variables for each regression model. "\*\*\*\*" denotes the 1% significance level, "\*\*\*\*" the 5%, and "\*\*\*\*" the 10% level, respectively. The values in parantheses report the standard errors of estimated coefficients.



**FIGURE 6** ESG pillars performance. The graphs represent annual average Environmental, Social, and Governance MSCI performance scores of companies for each industry division in the sample according to the SIC. The respective pillar scores are weighted according to the MSCI ESG weightings for each pillar category within the overall ESG score. “Communications” category represents the “Transportation, Communications, Electric, Gas and Sanitary service” division. [Color figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

significant at the 1% level and thus confirming initial descriptive observations. To control for other company-specific effects that can influence the level of ESG performance according to the literature<sup>47</sup>, we include in our regression control variables, thus extending the regression to

$$\begin{aligned}
 ESGPerf_i = & a + b \times ESGDisc_i + c \times ESGPerf_{i,t-1} + d \times Size_i + e \times BM_i \\
 & + f \times AssetProd_i + g \times Lev_i + \varepsilon_i
 \end{aligned}
 \tag{5}$$

where  $ESGPerf_{i,t-1}$  is the previous-year MSCI ESG performance score of company  $i$ ,  $Size_i$  is the natural logarithm of the market capitalization of company at the end of the quarter before annual report filing,  $BM_i$  is the ratio of the book value of equity to the market value of equity at the end of the quarter before annual report filing,  $AssetProd_i$  is the ratio of earnings before interest and taxes (EBIT) to the total assets at the end of the quarter before annual report filing, and  $Lev_i$  is the ratio of the market value of equity to the total liabilities of company at the end of the quarter before annual report filing. Model 5 in Table 3 also confirms the positive relationship between performance and disclosure observed in Model 1, with coefficient of 0.2281 significant at the 1% level. Furthermore, the regression model indicates positive effect of companies’ size on ESG performance. Having more financial and operational resources, larger firms show significantly higher levels of ESG performance in line with expectations and empirical evidence<sup>48</sup>. Furthermore, the book-to-market ratio shows significant negative slope coefficient, implying positive relationship between expectations of future growth, which is reflected in higher market valuations and thus lower book-to-market ratios, and ESG performance of companies.

**TABLE 4** ESG industry-adjusted performance regressions.

	Models			
	(1)	(2)	(3) <sup>†</sup>	(4) <sup>†</sup>
ESGDisc	0.6738**	0.3220***	-1.1584	-0.2788
	(0.338)	(0.111)	(1.265)	(0.431)
ESGAdjPerf <sub>(t-1)</sub>		8.2685***		8.5037***
		(0.063)		(0.295)
Size		0.6601***		0.6988
		(0.094)		(0.434)
BM		-2.9347***		1.1753
		(0.661)		(1.619)
AssetProd		-1.3735		57.1217
		(9.841)		(48.203)
Lev		1.8179***		0.3500**
		(0.574)		(0.171)
Observations	11393	8742	400	297

This table presents the regression estimates of MSCI ESG industry-adjusted performance scores on 10-K ESG disclosure scores with various control variables. Industry-adjusted ESG scores are ESG performance scores of companies normalized relative to their industry peers. *ESGDisc* is the ESG disclosure score of annual report estimated using the Eq. (3) based on the ESG topic dictionary. The regression models with “t” sign denote the regressions run only on the Mining division companies according to the SIC. See Eqs. (5) and (7) for the definition of control variables. All independent variables are standardized to a mean of 0 and a standard deviation of 1. The coefficients' estimates are not affected by the presence of outliers in the control variables. All regression models are estimated using year dummy variables and standard errors clustered on the firm level. The number of observations changes throughout the models due to the availability of control variables for each regression model. “\*\*\*” denotes the 1% significance level, “\*\*” the 5%, and “\*” the 10% level, respectively. The values in parantheses report the standard errors of estimated coefficients.

We consider the industry effects to check the robustness of the results by using MSCI industry-adjusted ESG performance scores in regressions presented above.<sup>49</sup> Thus, Eqs. (4) and (5) are adjusted to

$$ESGAdjPerf_i = a + b \times ESGDisc_i + \varepsilon_i \quad (6)$$

$$ESGAdjPerf_i = a + b \times ESGDisc_i + c \times ESGAdjPerf_{i,t-1} + d \times Size_i + e \times BM_i + f \times AssetProd_i + g \times Lev_i + \varepsilon_i \quad (7)$$

where *ESGAdjPerf<sub>i</sub>* is the MSCI industry-adjusted ESG performance score of company *i*. Table IV summarizes the regression results for industry-adjusted ESG scores. Models 1 and 2 also show a positive relationship between performance and disclosure in the main sample, with coefficients 0.6738 and 0.3220 significant at the 5% and 1% levels, respectively. The coefficients of size and book-to-market ratio remain significant with unchanged sign of the relationship with ESG performance. Leverage, in turn, has significant positive slope coefficient in both the main and the Mining (Model 4) division samples. As expected, the regressions within the Mining division show negative coefficients of ESG disclosure in both Model 3 and Model 4 of Table 4; however, the coefficients are not statistically significant.

To further explore the drivers of the overall relationship between ESG performance and disclosure, we look at singular pillar components of the ESG performance and the respective disclosure levels of companies by

differentiating between environmental, social, and governance areas of sustainability. Using the MSCI Environmental, Social, and Governance weighted pillar scores and the disclosure scores estimated based on the three main categories of the ESG dictionary, the regressions (4) and (5) are adjusted to

$$EPerf_i = a + b \times EDisc_i + \varepsilon_i \quad (8)$$

$$SPerf_i = a + b \times SDisc_i + \varepsilon_i \quad (9)$$

$$GPerf_i = a + b \times GDisc_i + \varepsilon_i \quad (10)$$

where  $EPerf_i$ ,  $SPerf_i$ , and  $GPerf_i$  are the Environmental, Social, and Governance MSCI weighted performance scores of company  $i$  in the year in which the annual report is released, and  $EDisc_i$ ,  $SDisc_i$ , and  $GDisc_i$  are the estimated environmental, social, and governance disclosure scores of the annual report. Models 2, 3, and 4 in Table 3 show the results of the regressions run on the main sample, with all coefficients being significantly positive and implying a positive relationship between performance and disclosure levels in respective sustainability topics. The estimation results in the Mining division sample show significant negative coefficient by the environmental disclosure score, consistent with the descriptive evidence. To control for firm-specific effects, we include the control variables and extend the regressions to

$$\begin{aligned} EPerf_i = & a + b \times EDisc_i + c \times EPerf_{i,t-1} + d \times Size_i + e \times BM_i \\ & + f \times AssetProd_i + g \times Lev_i + \varepsilon_i \end{aligned} \quad (11)$$

$$\begin{aligned} SPerf_i = & a + b \times SDisc_i + c \times SPerf_{i,t-1} + d \times Size_i + e \times BM_i \\ & + f \times AssetProd_i + g \times Lev_i + \varepsilon_i \end{aligned} \quad (12)$$

$$\begin{aligned} GPerf_i = & a + b \times GDisc_i + c \times GPerf_{i,t-1} + d \times Size_i + e \times BM_i \\ & + f \times AssetProd_i + g \times Lev_i + \varepsilon_i \end{aligned} \quad (13)$$

where  $EPerf_{i,t-1}$ ,  $SPerf_{i,t-1}$ , and  $GPerf_{i,t-1}$  are the previous-year Environmental, Social, and Governance MSCI weighted performance scores of company  $i$ . The regression estimates in Models (6), (7), and (8) confirm the results obtained without consideration of control variables, with significantly positive coefficients for environmental and social disclosure scores providing evidence for a positive relationship between performance and disclosure. The coefficient for the governance disclosure remains significant, however, with a changed sign which is caused by the influence of previous-year governance performance score.<sup>50</sup> Furthermore, the negative coefficient of the environmental disclosure score in the Mining division loses its significance, probably due to a smaller sample size caused by inclusion of control variables.

In the last step, we analyze the relationship between forward-looking ESG statements and the next-year sustainability performance of companies. Using both the forward-looking and the ESG dictionaries, the proportion of forward-looking ESG statements is estimated for each annual report in the entire sample, including the Mining industry since there is no evidence in descriptive analysis for elevated levels of future-related disclosure by companies belonging to this division. The impact of future-related ESG information on performance is examined using the

regressions<sup>51</sup>

$$ESGPerf_{i,t+1} = a + b \times ESGForwDisc_i + \varepsilon_i \quad (14)$$

$$ESGPerf_{i,t+1} = a + b \times ESGForwDisc_i + c \times ESGPerf_{i,t-1} + d \times Size_i + e \times BM_i \\ + f \times AssetProd_i + g \times Lev_i + \varepsilon_i \quad (15)$$

where  $ESGPerf_{i,t+1}$  is the next-year MSCI ESG performance score of company  $i$  following annual report filing with SEC, and  $ESGForwDisc_i$  is the ratio of forward-looking to non-forward-looking ESG statements contained in annual report of company  $i$ . In addition, to control for industry effects and check the robustness of results, we use the industry-adjusted MSCI ESG performance scores in the regressions

$$ESGAdjPerf_{i,t+1} = a + b \times ESGForwDisc_i + \varepsilon_i \quad (16)$$

$$ESGAdjPerf_{i,t+1} = a + b \times ESGForwDisc_i + c \times ESGAdjPerf_{i,t-1} + d \times Size_i + e \times BM_i \\ + f \times AssetProd_i + g \times Lev_i + \varepsilon_i \quad (17)$$

where  $ESGAdjPerf_{i,t+1}$  is the next-year industry-adjusted MSCI ESG performance score of company  $i$  following annual report filing with SEC. Table 5 reports the estimation results of regressions. Both (14) and (15) regression estimations presented in Models 1 and 2 in Table 5 show significantly positive coefficients of forward-looking ESG disclosure, implying that companies with a higher ratio of forward-looking statements in annual reports show better next-year ESG performance. The coefficient of ESG forward-looking disclosure of 0.2309 in Model 2 is significant at the 1% level. The results of regression (17) shown in Model 4 with industry-adjusted performance scores confirm the robustness of results, with ESG forward-looking disclosure coefficient of 0.3429 significant at the 10% level. While the slope coefficients of size and book-to-market ratio show results similar to the regressions with same-year ESG scores, the leverage variable shows significant negative coefficients in both Model 2 (−0.4584, 5% level) and Model 4 (−1.3540, 1% level) of Table 5, implying a negative relationship between the level of corporate debt burden and the next-year ESG performance. This outcome implies that heavily indebted companies can face difficulties in directing enough resources to sustainability-related projects, which in turn hurts their yearly improvement in ESG performance.

## 5 | DISCUSSION AND LIMITATIONS

The results of regressions (4), (5), (6), and (7) provide evidence for a positive relationship between the extent of ESG disclosure and the level of actual ESG performance, supporting the Hypothesis 1 and thus the signalling theory. This result contributes to the stream of literature that finds empirical evidence for a signalling behavior of companies with good ESG performance, thus supporting the view that the management of good companies tends to pursue extensive high-quality disclosure in annual reports to inform the stakeholders about their real sustainability-oriented activities and achievements. However, the examination of the Mining division sample also provides contrary evidence against the Hypothesis 1, implying a negative relationship between the ESG performance and the extent of ESG reporting in line with the legitimacy theory. The analysis shows that this relation is mostly driven by the environmental pillar of sustainability, consistent with other research studies on environmentally sensitive sectors. Roman et al. (2019) and Feng and Gao (2020) argue that language of companies belonging to the environmentally unfriendly industries can

**TABLE 5** ESG next-year performance regressions.

	Models			
	(1)	(2)	(3) <sup>‡</sup>	(4) <sup>‡</sup>
ESGForwDisc	0.2921***	0.2309***	0.6281***	0.3429*
	(0.095)	(0.086)	(0.207)	(0.176)
ESGPerf <sub>(t-1)</sub>		5.3378***		
		(0.078)		
ESGAdjPerf <sub>(t-1)</sub>				7.1884***
				(0.082)
Size		0.2458***		1.1453***
		(0.066)		(0.135)
BM		-1.6134***		-4.4675***
		(0.425)		(0.813)
AssetProd		0.2980		6.7365
		(8.979)		(18.563)
Lev		-0.4584**		-1.3540***
		(0.177)		(0.162)
Observations	9044	6611	9044	6611

This table presents the regression estimates of the next-year ( $t + 1$ ) MSCI ESG performance scores on 10-K ESG forward-looking disclosure scores with various control variables. *ESGForwDisc* is the ratio of forward-looking to non-forward-looking ESG sentences contained in annual reports based on the ESG and the forward-looking topic dictionaries. The regression models with “+” sign denote the regressions run with MSCI industry-adjusted ESG performance scores. Industry-adjusted ESG scores are ESG performance scores of companies normalized relative to their industry peers. See Eqs. (5) and (7) for the definition of control variables. All independent variables are standardized to a mean of 0 and a standard deviation of 1. The coefficients' estimates are not affected by the presence of outliers in the control variables. All regression models are estimated using year dummy variables and heteroskedasticity-robust (MacKinnon and White (1985)) standard errors. The number of observations changes throughout the models due to the availability of control variables for each regression model. “\*\*\*” denotes the 1% significance level, “\*\*” the 5%, and “\*” the 10% level, respectively. The values in parantheses report the standard errors of estimated coefficients.

be biased towards manipulation because of management's incentives; however, other researchers emphasize external public pressure on companies to release more information as the main reason for such reporting practices (Clarkson, Overell, and Chapple (2011); Hummel and Szekely (2021)).<sup>52</sup> While the Mining division is a clear outlier in our sample and thus this result cannot be generalized and applied to companies from other industries, the investors and regulatory agencies should still pay a close attention to information disclosure in environmentally harmful industries, companies in which have incentives to polish up relatively bad performance with extensive reporting. Overall, our results predominantly show the support for the signalling theory, confirming the Hypothesis 1. With regards to the singular pillar analysis of sustainability reporting practices, the regressions (8) to (13) also provide evidence for a positive relationship between actual performance and the extent of disclosure in pillar categories, thus supporting Hypotheses 2, 3, and 4 and hence also the signalling theory. The relationship between environmental disclosure and performance in the Mining division sample deviates from the overall results, showing a negative direction. Thus, the results of the ESG pillars analysis also contribute to the signalling theory view of ESG disclosure practices. The regression analysis of forward-looking ESG statements contained in annual reports, implemented using the regressions (14) to (17), shows significant positive relationship between future-related ESG information and the next-year ESG performance, providing evidence in support of Hypothesis 5. This result serves as further evidence for the importance of linguistic features

as one of the factors explaining future ESG performance of companies, adding to the recent literature that explores the prediction features of ESG performance (Clarkson et al. (2020)).

Nevertheless, this study is also subject to several limitations. We limit our data sample by the year end of 2018 due to the availability of ESG performance data conditioned on the licensing agreement with MSCI ESG Research. In addition, our research focuses on annual reports of companies as the only source of ESG disclosure, while further application of NLP analysis techniques on other documents/sources of ESG information could complete the picture of the overall disclosure practices of companies. Furthermore, the study includes only public US companies with annual reports accessible through the SEC's EDGAR database, while non-public US firms and other regions of the world are not the focus of this study. The European companies could be the object of particular interest for future studies, since the ESG disclosure in Europe became a higher priority for the economy in recent years in comparison to North America due to political discussions and subsequent regulatory policies, with increasing commitment of companies to disclose ESG-related information (Hummel and Szekely (2021); Nazari et al. (2017)). Also, the ESG disclosure metrics used in this study are constrained by the implemented ESG dictionary, with estimators of annual reports' disclosure scores being dependent on the composition of word lists and sensitive to the sample of documents used. Besides that, we rely on a third-party sustainability lexicon which could be biased by subjective opinions of authors that derived the ESG terms from other annual reports of US companies, while the implementation of other lexicons could lead to results different from this paper. Last but not least, the use of ESG performance scores from other data providers could serve as validation of empirical results obtained in this study; however, the comparison of results can be complicated by limited transparency with regards to a detailed methodology of ESG performance quantification and a low correlation of ESG scores between different vendors, while the choice of ratings should also account for potential conflicts of interest between data providers and rated companies.

## 6 | CONCLUSION

This study sheds light on ESG information disclosure behavior of US companies based on annual reports filed with the SEC using NLP techniques and the recently proposed ESG topic dictionary by Baier et al. (2020). The empirical results obtained on a sample of more than eleven thousand unique 10-K reports from 2013 to 2018 show support for the signalling theory of sustainability-related information disclosure, except for the environmentally unfriendly companies belonging to the Mining division that have incentives to improve their public image through extensive reporting and thus legitimize their operations. Furthermore, the scope of forward-looking ESG information contained in annual reports showed positive relation to the next-year ESG performance, while companies from the Mining division do not exhibit higher levels of future-related sustainability information disclosure in comparison to other industries. The results of this study could provide useful input for investment and regulatory decisions in terms of the enhancement of current ESG performance assessment of companies and tailoring of regulatory disclosure requirements to specific industries. The proposed framework could also serve as an indicator of ESG performance of companies not covered by rating agencies and data providers, thus enhancing sustainability-focused investment strategies and portfolio allocation.

This study offers a wide range of topics for future research opportunities, including the validation of results on other ESG disclosure sources and geographical regions, with focus on divergences between different types of economies (Cho et al. (2019)) and companies, such as business-to-consumer vs business-to-business types (Hummel and Szekely (2021)). Furthermore, it would be interesting to analyse the effect of the gender composition of executive boards on ESG disclosure (Tapver (2019)) as well as the impact of CEO turnover on changes in reporting practices of companies (McBrayer (2018)), with particular attention to the role of short-term incentives for the management (Lin, Wei, Yang, and Zhang (2021)). Last but not least, the extension of ESG performance frameworks that do not take into account linguistic features by the assessment of companies with approach implemented in this study could provide new evidence for already existing studies (Clarkson et al. (2020)).

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## DATA AVAILABILITY

The data used in this paper can be provided upon request, except for MSCI ESG ratings which are subject to the licensing agreement with MSCI ESG Research UK Limited.

## DECLARATIONS OF INTEREST

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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## ENDNOTES

- <sup>1</sup>We use the terms “annual report” and “10-K” interchangeably throughout this article.
- <sup>2</sup>While managers actively use different communication strategies to sway stakeholders’ opinion, they do not generally include illegal deceptive practices of information distortion (Fyodorova et al. (2019)), which can put managers at legal risks of prosecution as in cases of, e.g., Enron Corporation, Volkswagen AG, and Wirecard AG.
- <sup>3</sup>Clarkson et al. (2020) argue that some providers (e.g., ASSET4) do not completely take into account the linguistic characteristics of companies’ reports that have predictive power for future ESG performance, thus providing further motivation for development of linguistic analysis frameworks.
- <sup>4</sup>Baier et al. (2020) also argue that without an appropriate framework that could be used in a standardized procedure on a large number of documents, the researchers’ work is largely bounded by subjectivity and small sample sizes because of manual processing of reports and opinion-based classification of textual tone and linguistic structures.
- <sup>5</sup>The data are used under the license agreement with MSCI ESG Research UK Limited.
- <sup>6</sup>See also Barnett and Solomon (2012), Da Costa, Liu, Rosa, and Tiras (2020), and Sharma and Vredenburg (1998) for further details.
- <sup>7</sup>Yet, some researchers argue that particular kinds of information disclosure can lead to a contrary result (Botosan (2006); Shehata (2014)).
- <sup>8</sup>For example, environmental or social crises (Darnell (2021); Godfrey, Merrill, and Hansen (2009); Sharfman and Fernando (2008)).
- <sup>9</sup>While in some articles (see, e.g., Shehata (2014)) the voluntary disclosure practices are subdivided into several theories, such as i.a. agency, signalling, capital need theories, according to a precise aim the good-performing managers strive for via extensive disclosure practices, this paper groups these categories under the signalling theory concept, since the focus of the paper lies on the general distinction between incentives behind the reporting of good- and bad-performing companies and not on the specific incentives of good-performing managers.
- <sup>10</sup>Deegan (2002) also emphasizes fundamental differences in motivation of managers who aim to restore the legitimacy and public image, and those who act responsibly and disclose information necessary for stakeholders.
- <sup>11</sup>However, in some cases the text complexity can be associated with the complexity of the industry a company operates in, which forces the management to explain complex business environment and operations and thus unintentionally increase the content difficulty (Loughran and McDonald (2016)).
- <sup>12</sup>See, e.g., Cho and Patten (2007), Cho et al. (2010), Hughes, Sander, and Reier (2000), Hughes, Anderson, and Golden (2001), Patten (2002).
- <sup>13</sup>However, some papers (see, e.g., Hummel and Szekely (2021)) argue that such dependencies can be explained by “environmental-related public pressure” that urges environmentally unfriendly companies to report more about sustainability issues. Nevertheless, in both cases the management of a company tries to win back or improve its legitimacy status in the society and the shareholders’ assessment of the company.
- <sup>14</sup>Nazari et al. (2017) p. 167 and Hummel and Szekely (2021) provide comprehensive overview of empirical studies focusing on the connection between ESG performance and disclosure levels.
- <sup>15</sup>See, e.g., Dawkins and Fraas (2011) for further evidence that includes companies from the S&P 500 index.



- <sup>16</sup> See, e.g., Patten (2002), Nazari et al. (2017), Clarkson et al. (2020).
- <sup>17</sup> See, e.g., Feng and Gao (2020), Clarkson et al. (2020), Crowley et al. (2019).
- <sup>18</sup> See, e.g., Ben-Amar and Belgacem (2018), Cho et al. (2019), Lopez-de Silanes et al. (2019).
- <sup>19</sup> Some studies, e.g., Nazari et al. (2017), use broadly defined metrics of disclosure (such as general word count) in the ESG context without focusing on an ESG-tailored lexicon.
- <sup>20</sup> To avoid the inclusion of competing hypotheses, we formulate our hypotheses with accordance to the signalling theory based on a slightly greater weight of evidence found in the literature.
- <sup>21</sup> See, e.g., Clarkson et al. (2020) and Qian and Schaltegger (2017).
- <sup>22</sup> Depending on the research objectives and the thematic focus of a study, the choice of a dictionary can range between general lexicons, such as the Harvard Dictionary, and domain-specific word lists, such as the one proposed by Loughran and McDonald (2011) for finance and accounting studies.
- <sup>23</sup> Loughran and McDonald (2020) and Renault (2017) discuss the importance of domain-specific lexicons in application of dictionary-based methods of textual analysis, which are tailored to the type of the disclosure source, specifically emphasizing the difference between formal language used in official reports, such as an annual report, and, for example, informal language in online communication via social media.
- <sup>24</sup> Loughran and McDonald (2020) argue that manual preparation of dictionaries has advantages over procedures relying on machine learning algorithms since they are based on idiosyncratic characteristics of the sample used, which leads to a bias of "pseudo-dummy variables" in created dictionaries.
- <sup>25</sup> See the Appendix A for a complete list of ESG subcategories and words in the dictionary proposed by Baier et al. (2020) and implemented in this study.
- <sup>26</sup> "Wall Street's Green Push Exposes New Conflicts of Interest", The Wall Street Journal, 29.01.2022, (<https://www.wsj.com/articles/wall-streets-green-push-exposes-new-conflicts-of-interest-11643452202>).
- <sup>27</sup> Especially with regards to varying importance of individual factors within each sustainability category (environmental, social, and governance pillars) for different industrial settings.
- <sup>28</sup> Reproduced by the permission of MSCI ESG Research LLC, ©2020 MSCI ESG Research LLC All rights reserved. The ESG data contained herein is the property of MSCI ESG Research LLC (ESG). ESG, its affiliates and information providers make no warranties with respect to any such data. The ESG data contained herein is used under license and may not be further used, distributed or disseminated without the express written consent of ESG.
- <sup>29</sup> Companies with country domicile in the United States of America.
- <sup>30</sup> See, e.g., Hummel and Szekely (2021), Morgan Stanley (2020).
- <sup>31</sup> See Escrig-Olmedo et al. (2019) for further details.
- <sup>32</sup> The December 2018 sample limitation is due to the ESG data licensing agreement with MSCI ESG Research LLC.
- <sup>33</sup> See, e.g., Fama (1991).
- <sup>34</sup> Electronic Data Gathering, Analysis, and Retrieval System; see <https://www.sec.gov/edgar/> about for further information.
- <sup>35</sup> For additional information on the MSCI ESG Research methodology, see <https://www.msci.com/documents/1296102/21901542/MSCI+ESG+Ratings+Methodology++Exec+Summary+Nov+2020.pdf>.
- <sup>36</sup> See, e.g., Serafeim (2020) and Pastor et al. (2021).
- <sup>37</sup> The data from Compustat and CRSP databases are obtained through Wharton Research Data Services.
- <sup>38</sup> MSCI coverage of companies has increased throughout the observation period from 2013 to 2018.
- <sup>39</sup> We control for size, book-to-market, asset productivity, and leverage factors in our regressions.
- <sup>40</sup> We use 2of12inf English dictionary following Jegadeesh and Wu (2013).
- <sup>41</sup> For example, ESG dictionary words "discriminate", "discriminated", "discriminating", and "discrimination" are transformed to the stem form "discrimin", leading to a reduction of the number of dictionary words from 482 to 299.
- <sup>42</sup> According to the SIC, the Mining division includes companies operating in metal mining, coal mining, oil and gas extraction, mining and quarrying of nonmetallic minerals areas.
- <sup>43</sup> The forward-looking dictionary consists of the following words: "will", "should", "can", "could", "may", "might", "expect", "anticipate", "believe", "plan", "hope", "intend", "seek", "project", "forecast", "objective", "goal". See Li (2010) for further information regarding the dictionary compilation.
- <sup>44</sup> We compute average performance scores for each ESG pillar based on their weightings that are used in calculation of the overall MSCI ESG score, because the importance of certain factors/issues in each industry varies throughout the observation period, which is, in turn, captured by the weightings.
- <sup>45</sup> We control for the time effect using dummy variables for each year and cluster the errors by firm to eliminate the firm effect in the sample (see Petersen (2009); Loughran and McDonald (2011)).
- <sup>46</sup> Mining division represents only 3.4% of the whole sample.
- <sup>47</sup> See, e.g., Ben-Amar and Belgacem (2018), Drempetic, Klein, and Zwergel (2020), Li (2008), and Roman et al. (2019) for a detailed reasoning regarding the choice of control variables.
- <sup>48</sup> See, e.g., Drempetic et al. (2020).

- <sup>49</sup>We use the industry-adjusted performance scores instead of industry fixed effects due to multicollinearity concerns in the regressions. Furthermore, our tests with industry fixed effects showed no significant changes in results obtained without fixed effects.
- <sup>50</sup>The estimates of the regression without previous-year governance performance score show significant positive coefficient of the governance disclosure (0.2789), consistent with prior results. The regressions with environmental and social scores in our tests are not affected by inclusion or exclusion of respective previous-year performance scores.
- <sup>51</sup>In this case, we run an OLS regression with MacKinnon and White (1985) heteroskedasticity robust standard errors, since there is no assumption of unspecified correlation between ESG forward-looking disclosure datapoints of the same company in different years (see Petersen (2009)).
- <sup>52</sup>These concepts, however, are not mutually exclusive, which complicates their clear distinction in empirical studies.

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## APPENDIX A

## ESG dictionary (Baier et al. (2020))

The following pages present the Environmental, Social, and Governance categories of the ESG dictionary proposed by Baier et al. (2020). The dictionary consists of 34 subcategories that include 482 words. The categories include: *Biofuels, climate change strategy, emissions management and reporting, access to land, biodiversity management, water, pollution control, waste and recycling, access to medicine, HIV and AIDS, nutrition, product safety, community relations, privacy and free expression, security, diversity, health and safety, ILO core conventions, supply chain labor standards, charity, education, employment, audit and control, board structure, remuneration, shareholder rights, transparency, talent, bribery and corruption, political influence, whistle-blowing system, disclosure and reporting, stakeholder engagement, UNGC compliance.*

The tables in appendix are taken from Baier, P, Berninger, M, Kiesel, F. Environmental, social and governance reporting in annual reports: A textual analysis. *Financial Markets, Inst & Inst.* 2020; 29: 93–118.

TABLE A1 ESG dictionary: Environment

Topic	Category	Subcategory
Environmental: clean, environmental, epa, sustainability	Climate change: Climate, warming	Biofuels: biofuels, biofuel
		Climate change strategy: green, renewable, solar, stewardship, wind
	Ecosystem service: agriculture, deforestation, pesticide, pesticides, wetlands	Emissions management and reporting: emission, emissions, ghg, ghgs, greenhouse, atmosphere, emit
		Access to land: zoning
	Environmental management: cleaner, cleanup, coal, contamination, fossil, resource	Biodiversity management: biodiversity, species, wilderness, wildlife
		Water: freshwater, groundwater, water
		Pollution control: air, carbon, nitrogen, pollution, superfund
		Waste and recycling: biphenyls, hazardous, householding, pollutants, printing, recycling, toxic, waste, wastes, weee, recycle

**TABLE A2** ESG dictionary: Social

Topic	Category	Subcategory
<b>Social:</b> citizen, citizens, csr, disabilities, disability, disabled,		
human, nations, social, un, veteran, veterans, vulnerable	<b>Public health:</b> children, epidemic, health, healthy, ill, illness,	<b>Access to medicine:</b> childbirth, drug, medicaid, medicare,
	Pandemic	medicine, medicines
		<b>HIV and AIDS:</b> hiv
		<b>Nutrition:</b> alcohol, drinking
		<b>Product safety:</b> bugs, conformance, defects, fda,
		inspection, inspections, minerals, standardization,
		warranty
	<b>Human rights:</b> dignity, discriminate, discriminated,	<b>Community relations:</b> communities, community
	discriminating, discrimination, equality, freedom,	
	humanity, nondiscrimination, sexual	<b>Privacy and free expression:</b> expression, marriage, privacy
		<b>Security:</b> peace
	<b>Labor standards:</b> bargaining, eeo, fairness, fla, harassment,	<b>Diversity:</b> bisexual, diversity, ethnic, ethnically, ethnicities,
	injury, labor, overtime, ruggie, sick, wage, wages,	ethnicity, female, females, gay, gays, gender, genders,
	workplace	homosexual, immigration, lesbian, lesbians, lgbt,
		minorities, minority, ms, race, racial, religion, religious,
		sex, transgender, woman,women
		<b>Health and safety:</b> occupational, safe, safely, safety
		<b>ILO core conventions:</b> ilo, labour
		<b>Supply chain labor standards:</b> eicc
	<b>Society:</b> endowment, endowments, people, philanthropic,	<b>Charity:</b> charitable, charities, charity, donate, donated,
	philanthropy, socially, societal, society, welfare	donates, donating, donation, donations, donors,

(Continues)

**TABLE A2** (Continued)

Topic	Category	Subcategory
		foundation, foundations, gift, gifts, nonprofit, poverty
		<b>Education:</b> courses, educate, educated, educates,
		educating, education, educational, learning, mentoring,
		scholarships, teach, teacher, teachers, teaching, training
		<b>Employment:</b> employ, employment, headcount, hire, hired,
		hires, hiring, staffing, unemployment

**TABLE A3** ESG dictionary: Governance

Topic	Category	Subcategory
<b>Governance:</b> align, aligned, aligning, alignment, aligns,		
bylaw, bylaws, charter, charters, culture, death, duly,	<b>Corporate governance:</b> compliance, conduct, conformity,	<b>Audit and control:</b> approval, approvals, approve, approved,
parents, independent	governance, misconduct, parachute, parachutes,	approves, approving, assess, assessed, assesses,
	perquisites, plane, planes, poison, retirement	assessing, assessment, assessments, audit, audited,
		auditing, auditor, auditors, audits, control, controls, coso,
		detect, detected, detecting, detection, evaluate,
		evaluated, evaluates, evaluating, evaluation, evaluations,
		examination, examinations, examine, examined,
		examines, examining, irs, oversee, overseeing, oversees,
		oversight, review, reviewed, reviewing, reviews, rotation,
		test, tested, testing, tests, treadway
		<b>Board structure:</b> backgrounds, independence, leadership,
		nomination, nominations, nominee, nominees,
		perspectives, qualifications, refreshment, skill, skills,

(Continues)

**TABLE A3** (Continued)

Topic	Category	Subcategory
		succession, tenure, vacancies, vacancy
		<b>Remuneration:</b> appreciation, award, awarded, awarding,
		awards, bonus, bonuses, cd, compensate, compensated,
		compensates, compensating, compensation, eip, iso, isos,
		payout, payouts, pension, prsu, prsus, recoupment,
		remuneration, reward, rewarding, rewards, rsu, rsus,
		salaries, salary, severance, vest, vested, vesting, vests
Topic	Category	Subcategory
		<b>Shareholder rights:</b> ballot, ballots, cast, consent, elect,
		elected, electing, election, elections, elects, nominate,
		nominated, plurality, proponent, proponents, proposal,
		proposals, proxies, quorum, vote, voted, votes, voting
		<b>Transparency:</b> brother, clicking, conflict, conflicts, family,
		grandchildren, grandparent, grandparents, inform,
		insider, insiders, inspector, inspectors, interlocks,
		nephews, nieces, posting, relatives, siblings, sister, son,
		spousal, spouse, spouses, stepchildren, stepparents,
		transparency, transparent, visit, visiting, visits, webpage,
		website
		<b>Talent:</b> attract, attracting, attracts, incentive, incentives,
		interview, interviews, motivate, motivated, motivates,
		motivating, motivation, recruit, recruiting, recruitment,

(Continues)



**TABLE A3** (Continued)

Topic	Category	Subcategory
		retain, retainer, retainers, retaining, retention, talent,
		talented, talents
	<b>Business ethics:</b> cobc, ethic, ethical, ethically, ethics, honesty	<b>Bribery and corruption:</b> bribery, corrupt, corruption,
		crimes, embezzlement
		<b>Political influence:</b> grassroots, influence, influences,
		influencing, lobbied, lobbies, lobby, lobbying, lobbyist,
		lobbyists
		<b>Whistle-blowing system:</b> whistleblower
Topic	Category	Subcategory
	<b>Sustainability management and reporting:</b> announce,	<b>Disclosure and reporting:</b> asc, disclose, disclosed,
	announced, announcement, announcements, announces,	discloses, disclosing, disclosure, disclosures, fasb, gaap,
	announcing, communicate, communicated,	objectivity, press, sarbanes
	communicates, communicating, erm, fairly, integrity,	<b>Stakeholder engagement:</b> engagement, engagements,
	liaison, presentation, presentations, sustainable	feedback, hotline, investor, invite, invited, mail, mailed,
		mailing, mailings, notice, relations, stakeholder,
		stakeholders
		<b>UNGC compliance:</b> compact, ungc

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