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ESG Controversies, ESG Disclosure and Analyst Forecast Accuracy

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ABSTRACT

We investigate whether an environmental social governance (ESG) disclosure moderates the relation between ESG controversies and analyst forecast accuracy. The previous literature has shown that ESG controversies increase uncertainty about a firm's future prospects, while ESG disclosure decreases this uncertainty. We therefore take the next step and integrate ESG controversies, ESG disclosure and uncertainty into one model. Our study is based on 8,369 firm-year observations across 51 countries from 2008 to 2017, containing data from RepRisk, Bloomberg and the Institutional Brokers' Estimate System. We find that analyst forecast errors are generally higher for firms with higher exposure to ESG controversies. More importantly, we establish ESG disclosure as a moderator that mitigates the strength of the relation between ESG controversies and analyst forecast errors. Additionally, we identify that the most important pillar for the relation derives from social controversies and disclosure.

1. Introduction

This study investigates the association between environmental social governance (ESG) controversies, ESG disclosure[2] and analyst forecast accuracy. Research suggests that better ESG disclosure is related to positive financial consequences, such as higher firm value (Ioannou & Serafeim, 2011; Matsumura, Prakash, & Vera-Muñoz, 2014), lower information asymmetry (Bernardi & Stark, 2018; Dhaliwal, Radhakrishnan, Tsang, & Yang, 2012; Muslu, Mutlu, Radhakrishnan, & Tsang, 2019; Schiemann & Sakhel, 2019), greater analyst coverage (Gao, Dong, Ni, & Fu, 2016) and lower firm risk (Albuquerque, Koskinen, & Zhang, 2018). However, the underlying mechanisms of the relation between ESG disclosure and financial consequences remain ambiguous.

We analyse these mechanisms by connecting the literature of ESG disclosure and financial consequences to the literature of ESG controversies. Both Hummel, Mittelbach-Hoermanseder, Rammerstorfer, and Weinmayer (2019) and Kölbel, Busch, and Jancso (2017) reveal that ESG controversies translate into financial risks. Furthermore, ESG controversies seem to conflict investor expectations and lead to increased investor uncertainty regarding firm value. Based on interviews, Amel-Zadeh and Serafeim (2018) report that capital market participants use ESG disclosure to identify and evaluate the impact of ESG related controversies.

Our study connects Amel-Zadeh and Serafeim (2018), who find that investors use ESG disclosure as a risk-screening tool, with the studies of Dhaliwal et al. (2012) and Muslu et al. (2019), who show that higher ESG disclosure leads to lower analyst forecast errors. Moreover, we build upon the research of Gao et al. (2016), who demonstrate that the capital market is able to appropriately evaluate CSR disclosure for capital market benefits. Consequently, we conduct an empirical analysis of international capital market data to investigate whether ESG disclosure is helpful in improving analyst forecasts, especially after the occurrence of ESG controversies. Our overarching research question is as follows: *Does ESG disclosure moderate the relation between ESG controversies and analyst forecast accuracy?*

Empirically, we utilise an international panel dataset to regress analyst forecast accuracy on ESG controversies, ESG disclosure and their interaction. Our sample consists of 1,614 companies (8,369 firm-year observations) from 51 countries over a 9-year period (2008–2017). Our analyses build on data from RepRisk, Bloomberg, Thomson Reuters'

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[2] In this document, we refer to ESG disclosure and ESG controversies. However, the literature often uses synonymous terms, such as corporate social responsibility (CSR), and environmental, social and governance (ESG) or simply sustainability performance and disclosure. We intentionally use the term ESG disclosure in this research because it relates best to the methodology that we have used as our main variable (i.e., the Bloomberg ESG disclosure score).

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Worldscope and the Institutional Brokers Estimate System (I/B/E/S). The research design allows us to investigate the relation of ESG disclosure on the association between ESG controversies and analyst forecast accuracy through the interaction term.

The results ascertain that firms experiencing higher ESG controversies are associated with higher uncertainty. However, we also find that the strength of this uncertainty increasing relation is mitigated for firms with good ESG disclosure. Additional analyses show that this relation is especially strong for social controversies and social disclosure. Further analyses highlight that external pressure through the occurrence of controversies in the three distinct ESG pillars lead to increases in disclosure in all respective pillars.

Our study entails three main contributions. To the best of our knowledge, this study is the first to investigate the association of ESG controversies with information asymmetry. While previous research has investigated the effect of ESG controversies on capital market consequences, such as firm value (Hummel et al., 2019) and credit default swaps (Kölbel et al., 2017), we shift the research lens towards studying information asymmetry. This is a vital contribution to understand how the ESG controversies are priced into estimations of capital market participants.

Second, we contribute to the literature on ESG disclosure and information asymmetry (Bernardi & Stark, 2018; Dhaliwal et al., 2012; Muslu et al., 2019) by adding ESG controversies to the equation. This provides a deeper understanding of the mechanics of the relation of ESG controversies and ESG disclosure on analyst forecast accuracy. We failed to find a general relation of ESG disclosure with analyst forecast accuracy. The positive relation of ESG disclosure only manifests in firms experiencing high ESG controversies. By applying the findings of Amel-Zadeh and Serafeim (2018) to an international capital market setting, we confirm that ESG disclosure acts as a risk-screening tool because it mitigates uncertainty caused by ESG controversies. Therefore, we show that ESG disclosure can be relevant in assessing and forecasting ESG controversies.

Third, we add to the literature of the different pressures on firms to increase ESG disclosure (Cho, Michelon, Patten, & Roberts, 2015; Deegan, 2002; Patten, 1991) by introducing the measure of ESG controversies as a proxy for legitimacy threats. Moreover, our research reveals that mandatory ESG disclosure regulations can enhance the information environment of a firm. As we find that above average ESG disclosure has an uncertain mitigating effect in the capital market, we argue that firms should be motivated to proactively provide high-quality ESG disclosures. Our findings suggest that enforcing firms to disclose ESG information can improve analysts' predictions of a firm's future earnings, especially after the occurrence of ESG controversies. The results are therefore relevant to the current worldwide proceedings for mandatory ESG disclosure regulation.

2. Previous literature and hypothesis development

2.1. Previous literature

Disclosure theory and legitimacy theory are two prominent concepts in the relation between ESG disclosure and financial consequences. Disclosure theory describes how disclosure reduces information asymmetries (Verrecchia, 1983; Verrecchia, 2001), which can lead to common adverse selection and moral hazard problems (Akerlof, 1970; Jensen & Meckling, 1976; Ross, 1973). Firms reduce information asymmetries through regulated financial reports and voluntary communication, such as management forecasts, press releases and analysts' presentations (Healy & Palepu, 2001). Additionally, intermediaries (e.g., financial analysts, industry experts and the media) can provide external disclosures about firms. Empirical research provides strong evidence that the availability and quantity of financial disclosures are related to lower information asymmetries (Abarbanell & Bushee, 1997; Behn, Choi, & Kang, 2008; Brown, Richardson, & Schwager, 1987; Hope, 2003). Additionally, higher quality disclosures are connected to lower information asymmetry (Brown, Hillegeist, & Lo, 2009).

Researchers have also analysed whether and how far non-financial disclosures facilitate the monitoring of managers by corporate outsiders, such as analysts or investors (Christensen, Hail, & Leuz, 2019), thus reducing information asymmetry. Dhaliwal et al. (2012) rely on a worldwide sample containing firms from 31 countries and show that issuing a stand-alone ESG report is associated with lower information asymmetry between a company and its shareholders, which is measured as an analyst forecast error. However, the information in CSR reports can vary immensely, especially due to the mainly voluntary nature of ESG disclosure. Nonetheless, Cho, Lee, and Pfeiffer (2013) find that ESG performance plays a positive role for investors by reducing information asymmetry. Focusing on climate-related physical risk reporting, Schiemann and Sakhel (2019) report a reduction in information asymmetry for firms reporting more (or more serious) physical risks for firms operating in high carbon-emitting sectors. Muslu et al. (2019) developed a score to measure ESG disclosure quality via textual analysis. Their analysis combines the firm's scope of ESG disclosure with information asymmetry, and the authors find that higher substantial content in ESG reports leads to lower forecast accuracy. In addition, Bernardi and Stark (2018) provide evidence that the introduction of mandatory integrated reporting (IR) regimes can lead to lower information asymmetry; their research focuses on the mandatory reporting regime change in South Africa for the period 2008–2012. Although empirical research confirms that more or better non-financial disclosure can lead to enhanced analyst forecast errors, analyst processing of ESG information remains a black box.

Legitimacy theory provides another important theoretical anchor for the determinants and effects of sustainability reporting (Suchman, 1995). Legitimacy is a generalized perception or assumption that the actions of an entity are desirable, proper or appropriate within some socially constructed system of norms, values, beliefs and definitions (e.g., Elsbach & Sutton, 1992; Perrow, 1970). To survive as a company, the necessity to respond to external pressures and influences is essential according to legitimacy theory (Aras & Crowther, 2009). Accordingly, firms aim to report their activities with regard to society's expectations to prove that they do not jeopardise the environment or society. Cho et al. (2015) argue that ESG disclosure appears to largely function as a means to assure legitimacy. We contribute to their study in three ways. First, we employ a new measure to capture a firm's exposure to legitimacy pressure. Second, we analyse an international sample, which allows us to explore cross-country differences that could be influential in the association between legitimacy and ESG disclosure (Cho et al., 2015; Dhaliwal et al., 2012). Third, we investigate the consequences of previous findings by using forecast accuracy as a dependent variable.

Controversies can seriously threaten a firm's legitimacy. Indeed, Kölbel et al. (2017) provide empirical evidence by showing that ESG controversies negatively translate into financial risk. They argue that firms should have a strategy in place to avoid the negative impacts of ESG controversies. Hence, Kölbel et al. (2017) suspect that firms might respond to ESG controversies by increasing their ESG disclosure. Meanwhile, Hummel et al. (2019) find that ESG controversies lead to a subsequent increase of ESG disclosure in annual reports. Furthermore, their empirical analysis reveals that firms with higher ESG disclosure are better protected against negative market reactions after the occurrence of an ESG controversy. Further research suggests that ESG disclosure helps to develop an “ethical” capital, which can act as an insurance or protection for firms against negative crisis-related consequences. Zhang, Shan, and Chang (2020) investigate firms that have lost their reputation after making financial restatements, and identify that these firms subsequently make substantial improvements to their overall ESG disclosure. In line with this finding, de Oliveira, Cunha, and Maçaira (2020) report that sustainability indices can mitigate the negative impact of uncertainty-increasing developments. Gómez-Carrasco, Guillamón-

Saorín, and García Osma (2020) find a legitimacy-based use for ESG disclosure in social media, which appears to be biased towards favourable information, ascertaining that firms would rather distribute supplementary ESG information than focus on core ESG issues, even though these practices may mislead analysts.

In summary, studies building on the influence of ESG controversies have not yet investigated their effect on information asymmetry. Furthermore, studies building on ESG disclosure and information asymmetry have not yet investigated whether ESG disclosures can have an uncertainty mitigating effect (e.g., from uncertainty through ESG controversies).

2.2. Hypothesis development

The first hypothesis focuses on the relation between ESG controversies and analyst forecast accuracy. As previously explained, ESG disclosure is mostly part of a firm's voluntary disclosure activities. Based on disclosure theory, more and/or better ESG disclosure can lead to lower information asymmetry and consequently to decreased analyst forecast errors. In contrast, ESG controversies increase analyst forecast errors because negative events make it more difficult for analysts to estimate a firm's future earnings. Additionally, ESG controversies and ESG disclosure are likely to be connected. For example, if a firm becomes entangled in a serious controversy, then it might be pressured to disclose more information about the controversial issue and describe how it plans to resolve the underlying problems to regain legitimacy (Hummel et al., 2019). More generally speaking, controversies create various pressures (e.g., social or political) and firms respond to these pressures through increased reporting (Cho et al., 2015; Deegan, 2002; Patten, 1991). The underlying argument from the perspective of legitimacy theory is that ESG disclosure is a tool to increase or safeguard legitimacy, while accountability is only a secondary function (Cho et al., 2015; Gray, 2006).

Recent research suggests that ESG controversies translate into financial risks (Kölbel et al., 2017) because ESG controversies may put firms under scrutiny for stakeholder sanctions. Possible stakeholder sanctions can include boycotts by environmental groups (Zyglidopoulos, 2002), whistleblowing (Dyck, Morse, & Zingales, 2010) or community resistance against a firm's operations (Henisz, Dorobantu, & Nartey, 2014). Kölbel et al. (2017) argue that although negative stakeholder reactions are common for ESG controversies, their occurrence is not always predictable. They mention the example of the Exxon Valdez oil spill in 1989, which resulted in worldwide protests and legal consequences (Barnett, 2014), while the Burmah Agate oil spill in 1979, which was of equal magnitude, was barely noted (Hoffman & Ocasio, 2001). In addition, Kölbel et al. (2017) argue that stakeholders have limited capability to monitor firms regarding ESG controversies. Therefore, only a subsection of firms might receive serious stakeholder and media attention. This shows that ESG controversies cannot impede the forecasting of a firm's future earnings because it is unclear whether and how stakeholders will react and sanction the firm. Cui, Jo, and Na (2018) found that ESG controversies decrease information asymmetry. Building on their findings and their measures of information asymmetry, we employ analyst forecast accuracy as an indicator of uncertainty, which further contributes to a better understanding of information asymmetry. Earnings forecast accuracy measures the expected earnings per share of analysts based on the current information environment and connects these to the real-market earnings per share. We formulate the following hypothesis:

H1. *ESG controversies decrease analyst forecast accuracy*

The second hypothesis focuses on whether the relation of ESG controversies and analyst forecast accuracy is mitigated by ESG disclosure. Overall, both theoretical and empirical evidence support the argument that there is a significant relation between ESG disclosure and information asymmetry (Bernardi & Stark, 2018; Dhaliwal et al., 2012; Muslu et al., 2019). Conflicting evidence is rare. For example, Birkey, Guidry, and Patten (2017) investigate first-time issuances of ESG reports by US firms and failed to find a significant relation with future earnings response coefficients.

While various settings have been analysed to shed light on the relation between ESG disclosure and information asymmetry, the extent to which ESG disclosure adds value in the face of existing ESG controversies has not been fully investigated. The research of Amel-Zadeh and Serafeim (2018) offers two valuable insights for our empirical predictions. First, they find that the most frequently used approach for ESG information is negative screening (i.e., excluding sin stocks and/or firms following ESG controversies); this evidences that analysts use ESG information, especially when firms face a higher risk of ESG controversies. Second, they find that the majority of investors (82%) examine ESG information because they expect it to be financial material; this finding leads us to expect that analysts will be better able to forecast the firm's future earnings for firms disclosing more ESG information. In addition, Zhang et al. (2020) argue that ESG disclosure builds reputational capital, which is especially useful when controversies occur. They reveal that ESG disclosure protects the organisation in the eye of the public when firms encounter financial restatements. Consequently, any negative financial consequences of controversies are less serious for firms with better ESG disclosure, which makes it easier for analysts to forecast firm performance. This is in line with Zhang et al. (2020), who find that restating firms with ESG disclosure have fewer analyst forecast errors than non-ESG disclosers. In combination with the findings of Amel-Zadeh and Serafeim (2018), we therefore expect that analysts will be better informed and less surprised when firms provide more ESG disclosure. However, Zhang et al. (2020) find that an increase in ESG disclosure after restatements does not further improve forecast accuracy. In conclusion, we expect that when firms face higher ESG controversies, higher ESG disclosure helps analysts to evaluate the specific ESG controversies and therefore make more highly accurate forecasts. Hence, based on disclosure and legitimacy theory, and also on previous empirical research, we formulate the following hypothesis:

H2. *The negative relation between ESG controversies and analyst forecast accuracy is mitigated by ESG disclosure.*

3. Data and research design

3.1. Sample selection and data sources

The sample contains firms from the Bloomberg ESG disclosure dataset from 2008 to 2017. We downloaded financial data from Thomson Reuters Eikon, ESG disclosure data from Bloomberg and Compustat World, analyst forecast data from Institutional Brokers' Estimate System (I/B/E/S) and data on ESG controversies from RepRisk. To include all observations in our analyses, we require information about all variables (as subsequently explained). Table 1 summarises our data collection and data merging processes, and indicates how missing data and missing matches from the different databases impacted our

Table 1
Sample composition.

	Number of firms	Number of firm-year observations
(1) Observations in the Bloomberg ESG disclosure dataset	12,012	84,656
(2) Observations after merging the dataset with the forecast data from the Thomson Reuters I/B/E/S dataset	4,885	21,913
(3) Observations after merging the dataset with the ESG controversies of RepRisk	3,075	15,632
(4) Final sample after merging the dataset with the fundamentals dataset from Thomson Reuters Eikon	1,614	8,369

sample. Our starting point was the Bloomberg ESG disclosure dataset for the independent variable, with 12,012 firms and 84,656 firm-year observations. After merging the dataset to the analyst data from I/B/E/S and the controversies database from RepRisk, we obtained a remaining dataset of 3,075 firms and 15,632 firm-year observations. After merging the dataset for control variables to Thomson Reuters Eikon, the final sample amounts to 1,614 firms with 8,369 firm-year observations across 51 countries. Table 2 illustrates the observations per country for the 15 countries with the most firm-year observations. We report the most firm-year observations for the United States (24.03%), Japan (21.72%) and China (8.36%).

3.2. Main variables and model description

3.2.1. Dependent variable

The dependent variable is analyst forecast accuracy. We follow Dhaliwal et al. (2012) and use the analyst forecast error *(forecast error)* as an inverse measure of forecast accuracy. For each individual earnings forecast *j* for firm *i* made during the year *t*, we calculate the forecast error by subtracting the real earnings per share (*EPS*) reported at the end of the forecast horizon *Y* from the forecasted target earnings (*FC*) with the corresponding forecast horizon. The forecast horizon can range from the same year up to two-year forecasts. We scale this difference by the stock price (*P*) at the beginning of year *t*. The variable *forecast error* is the average of all individual forecast errors of firm *i* in year *t* with the same forecast horizon *Y*:

$$Forecast\ error Y_{i,t=}\frac{1}{n}\sum_{j=1}^{N}\frac{\left|FC_{i,t,j}^{Y}-EPS_{i,t}^{Y}\right|}{P_{i,t}}$$

Forecast data is obtained from the IBES database, whilst EPS and share price data are obtained from Thomson Reuters (Bernardi & Stark, 2018; Dhaliwal et al., 2012; Muslu et al., 2019). In line with Bond and Thaler (1990), we distinguish between different forecast horizons because analyst forecast errors tend to be larger over longer forecast horizons. For our main analyses, we follow Dhaliwal et al.'s (2012) approach and limit the forecast horizon to a maximum of two years because the sample size dramatically shrinks for forecasts made three years ahead. We also follow Dhaliwal, Li, Tsang, and Yang (2011) and Muslu et al. (2019), who use three dependent analyst forecast error variables in their research design. Therefore, Y takes the values of 0 (i.e., forecast horizon is the end of t), 1 (i.e., forecast horizon is the end of t + 1) or 2 (i.e., forecast horizon is the end of t + 2). This defines *forecast error0* as the analyst forecast error for the end-of-year for year t, *forecast error1* as the analyst forecast error with the forecast horizon for the following year (t + 1) and *forecast error2* as the analyst forecast error with the forecast horizon for the second year (t + 2).

Table 2
Frequency of observations per country.

Country	Firm-year observations	Percent
Brazil	249	2.99
China	714	8.53
Denmark	103	1.24
Finland	223	2.68
Germany	441	5.29
India	194	2.33
Japan	1,810	21.72
South Korea	359	4.31
Mexico	116	1.39
Norway	162	1.94
Spain	113	1.36
Sweden	201	2.41
Taiwan	390	4.66
United Kingdom	100	1.13
USA	1,996	23.84
Other	1,205	18,05
Total	8,369	100

Notes
This table comprises firm-year observations categorised by countries.
The table reports statistics on the 15 most comprehensive countries in terms of observations in the total sample. "Other" comprises all countries that are not reported separately. These are (in descending order of observations) Thailand, France, Switzerland, Singapore, Italy, Indonesia, Turkey, Malaysia, Philippines, Netherlands, Chile, Austria, Greece, Poland, Portugal, Belgium, Hong Kong, South Africa, Israel, Saudi Arabia, Luxembourg, Canada, Colombia, United Arab Emirates, Lebanon, Lebanese Republic, Republic of Ireland, Russia, Czech Republic, Hungary, Australia, Jersey, Macau, Pakistan, Slovenia and Estonia.

3.2.2. Independent variables of interest

The first variable of interest is ESG controversies *(ESG controversies)*, which is measured as the yearly average of the RepRisk score. The score combines a company's own ESG risk exposure with the ESG risk exposure of the companies and sectors in which the company has been exposed to controversies. On the other hand, RepRisk provides ESG controversies for >84,000 private and public companies in 34 sectors globally. The data is gathered by analysts in combination with a proprietary algorithm, which is used to scan media sources and news. The risk rating score is updated on a daily basis and ranges from 0 to 100. A score of 100 means that the firm has experienced the highest degree of media coverage for its ESG controversies within its respective sector. The measure is influenced by the reach and severity of a news item (Kölbel et al., 2017). The reach of an article is categorised as either high, medium or low, depending on whether the article has been covered by news outlets with a strong international presence (such as Financial Times, Wall Street Journal, South China Morning Post, etc.), print media of national or regional importance (circulation of at least 150 k) or local newspapers (circulation of <150 k). The severity of an article is based on three equal-weighted subcategories, namely (1) the extent of negative consequences, (2) the extent of culpability and (3) the extent of irresponsibility. Additionally, the RepRisk score has recently gained attention in research because it is able to capture the perception of a firm's ESG controversies (Hummel et al., 2019; Kölbel et al., 2017).

The second variable of interest is ESG disclosure (*ESG disclosure*), which we measure as a binary variable based on the Bloomberg ESG disclosure score. The Bloomberg ESG disclosure score is quantified on a scale from 0 to 100, where 0 indicates no disclosure about any ESG issues and 100 indicates the highest level of ESG disclosure (Bloomberg, 2016). The Bloomberg ESG disclosure score is based on the three subscores (i.e., environment, social and corporate governance) to quantify (de Oliveira et al., 2020) a company's transparency in reporting ESG information (Ioannou & Serafeim, 2011). Nearly all of the data points are traceable back to the original source in a company's document (Serafeim & Ioannou, 2017). The variable *ESG disclosure* is necessary to test H2, which focuses on the interaction between ESG controversies and ESG disclosure. For a straightforward interpretation of the results, we measure *ESG disclosure* as a binary variable in our basic analyses, meaning that *ESG disclosure* equals 1 for firms with good ESG disclosure and 0 otherwise. This is useful to facilitate the meaningful interpretation of the interaction analysed in H2 (Wooldridge, 2013). In addition, applying a ranking can mitigate potential noise in measurements and it enables a meaningful aggregation (Muslu et al., 2019). Of course, any ranking will simplify the more complex information within a continued variable. In our case, the advantage of a straightforward interpretation of the interaction term outweighs this caveat. In addition, to assure that the choice of a binary variable does not affect the significance of the results, we also carry out robustness tests based on continued variables. Accordingly, firm-year observations with an ESG disclosure score in the respective year in the top 67% are coded as *ESG disclosure* = 1, while the remaining 33% are coded *ESG disclosure* = 0. We run several robustness tests with the continuous ESG disclosure score and alternative cut-off values to ensure that this decision does not affect our results. To achieve higher granularity, we also performed the analysis with a focus on the three sub-scores of environmental, social and corporate governance disclosure.

3.2.3. Model description and control variables

To test our hypotheses, we build on previous research (Bernardi & Stark, 2018; Dhaliwal et al., 2012; Kölbel et al., 2017) and apply panel regressions, with an unbalanced panel and firm-clustered standard errors. To investigate the association of ESG controversies, ESG disclosure and forecast accuracy, we establish the vector C*i,k,t* (with k being the control variables *analyst following, size, earnings loss, propcosts, financial transparency, ROA, ROA volatility*). First, we test H1 by investigating the relation between *ESG controversies* and *forecast error* based on the following regression model:

$$Forecast\ error Y_{i,t} = \beta_0 + \beta_1 ESG\ controversies_{i,t} + \sum_{k=1}^{m} \delta_k C_{ikt} + Ind\ Fe + Year\ Fe + Count\ Fe + \varepsilon_{1i,t} \quad (1)$$

H1 is supported if β_1 is significantly positive, indicating that more serious ESG controversies (higher values of *ESG controversies*) are related to lower analyst forecast accuracy (higher value of *forecast error*).

To test H2 and analyse whether *ESG disclosure* has a moderating effect on the relation between *ESG controversies*and *forecast error*, we follow Bernardi and Stark's (2018) approach and employ an interaction term for *ESG controversies* and *ESG disclosure* in model (2):

$$Forecast\ error Y_{i,t} = \gamma_0 + \gamma_1 ESG\ controversies_{i,t} + \gamma_2 ESG\ disclosure_{i,t} + \gamma_3 ESG\ controversies_{i,t} * ESG\ disclosure + \sum_{k=1}^{m} \delta_k C_{ikj} + Ind\ Fe + Year\ Fe + Count\ Fe + \varepsilon_{1i,t} \quad (2)$$

Similarly to model (1), a significantly positive coefficient γ_1 is in support of H1. Additionally, H2 is supported if γ_3 is significantly negative, which indicates that *forecast error* is lower for firms experiencing controversies if they have sufficiently good ESG disclosure (*ESG disclosure* = 1).

We include *forecast error* as the dependent variable and consider three different forecast error horizons for the current-year earnings *forecast error0*, one-year-ahead earnings *forecast error1* and two-year-ahead earnings *forecast error2*. Our models contain control variables to capture other well-known factors that could potentially influence the *forecast error* variable (e.g., Bernardi & Stark, 2018; Dhaliwal et al., 2012). We include a control variable capturing firm size *(size)*, measured as the logarithm of total assets, to proxy for a firm's general information environment (Atiase, 1985) and various correlated factors (Hope, 2003). We also control for the number of analysts following the firm through the year *(analyst following)* by calculating the natural logarithm of that number. A larger analyst following generally leads to more accurate forecasts (Dhaliwal et al., 2012; Lys & Soo, 1995). We include the median forecast horizon *(forecast horizon),* which measures the average number of days between the earnings announcement date and the forecast date of analyst forecasts for each firm year. Previous research has demonstrated that larger forecast horizons lead to higher forecast errors (Bernardi & Stark, 2018; Dhaliwal et al., 2012; Muslu et al., 2019). We include a variable to indicate loss years (*earnings loss*), which equals 1 if the firm reports negative earnings in the year and 0 otherwise. Earnings forecasts are more difficult, and therefore inaccurate, for loss years (Dhaliwal et al., 2012). Moreover, we capture financial transparency *(financial transparency)* based on industry-year accruals because industries with more transparent financial disclosures generally experience more accurate forecasts (Dhaliwal et al., 2012). We use the Herfindahl-Hirschman Index, which measures industry concentration as a proxy for proprietary costs (*propcosts*) because firms face higher competition. Industry concentration captures any potential proprietary costs of disclosure (Ott, Schiemann, & Günther, 2017). Additionally, if an industry is more concentrated, then it is more likely that the performance of its member firms is interrelated (Hutton, Lee, & Shu, 2012). Leverage *(lev)* captures the information demand from debtholders who are particularly concerned about a firm's downside risk, which is especially important in our setting because ESG controversies can lead to unexpected losses (Goss & Roberts, 2011; Simnett, Vanstraelen, & Chua, 2009). Moreover, profitable firms have more financial resources for ESG activities and CSR disclosures than less profitable firms (Orlitzky, Schmidt, & Rynes, 2003; Roberts, 1992). Accordingly, we include return on assets (*ROA*), which is measured as the net income prior to financing costs divided by total assets. We also control for earnings volatility (*ROAVOL*), which is measured as the standard deviation of a firm's *ROA* for the previous five years. Therefore, we consider that more volatile earnings are more difficult to forecast. The control variables are collected from the I/B/E/S and Thomson Reuters Datastream.

Table 3 summarises the measurements of all of the variables used in this study, as well as their data sources. Note that we winsorize all continuous variables at the top and bottom 1%-levels. We estimate all regressions with industry, country and year-fixed effects. All of the regression models are applied to the total sample.

4. Results and discussion

4.1. Descriptive statistics and correlations

Table 4 shows the descriptive statistics for the dependent variables *forecast error0 (1,2),* the independent variables of interest *ESG controversies*and *ESG disclosure*, as well as the control variables. The mean values of *forecast error* increase with the forecast horizon, with the smallest value for *forecast error0* (1.153), increasing for *forecast error1* (2.702) and *forecast error2* (5.606). As expected, it is more difficult to forecast the EPS for longer forecast horizons. The mean for the *ESG controversies* variable is 12.514 and further statistics indicate that 25% of firm-year observations have a controversy score of 0, while the 1% of the highest *ESG controversies* have a score of over 52.167, with a maximum score of 60.5. Note that *ESG disclosure* has a mean value of 0.67; that is, according to its definition, the observations with the top 67% of Bloomberg's ESG disclosure score (*ESG disclosure*) receive a value of 1 for *ESG disclosure*. As additional information, we report descriptive statistics for the Bloomberg ESG disclosure score (*Bloomberg ESG*) with a mean value of 30.961 and a maximum score of 68.88. Although almost all firms report some ESG information (i.e., the bottom 5th-percentile of *Bloomberg ESG* has a score of 10.33), even the best ESG disclosers do not receive scores that are close to the theoretical maximum of 100.

Table 5 displays the correlations between the variables. We find significant positive Pearson correlations between all of the forecast variables, which is consistent with the assumption that certain firms are predetermined to be harder to forecast, based on their underlying business model. The correlations between the *forecast error* variables and *ESG controversies* show the expected positive sign but are not significant. However, regression models are better suited to isolate the explanatory relation of the *ESG controversies* variable on the forecast accuracy measures by controlling for other factors.

ESG disclosure demonstrates a significant negative correlation with all three *forecast error* variables, which is in line with the previous literature (e.g., Dhaliwal et al., 2012). The correlations table also shows a significantly positive correlation for *ESG controversies* and *ESG disclosure* (0.351), which indicates that firms experiencing more controversies are more likely to fall into the category of good ESG disclosures. Additionally, the correlations between independent variables are generally quite low, with the highest correlation being −0.411 (*earnings loss* and *ROA*), but are often significant. Although low values for correlations between independent variables signal that multicollinearity should not pose any problems, the correlation table does not consider more complex dependencies.

Table 3
Variables.

Name	Variable	Measurement	Data source	Expected sign
Analyst forecast error	*forecast error*	We use analyst forecast error as an inverse measure of forecast accuracy. Forecast error (forecast error) is defined as the average of the absolute errors of all forecasts made in the year for earnings, scaled by the stock price at the beginning of the year.	Bloomberg	(d.v.)
Bloomberg ESG disclosure score	*ESG disclosure score*	The Bloomberg ESG disclosure Score, which rates companies on their level of ESG disclosure from 0 to 100.	Bloomberg	(+)
ESG, environmental, social or governance disclosure	*ESG disclosure, ENV disclosure, SOC disclosure, GOV disclosure*	The Bloomberg environmental, social and governance Disclosure Score, which rates companies on their respective level of environmental, social or governance disclosure from 0 to 100.	Bloomberg	(+)
RepRisk index	*ESG controversies*	The RepRisk Index (RRI), which is a quantitative measure (0 to 100) of a company's or project's reputational risk exposure to ESG issues.	RepRisk	(−)
Environmental, social and governance RepRisk Index	*ENV controversies, SOC controversies, GOV controversies*	A quantitative measure (0−100) of a company's or project's reputational risk exposure to the respective environmental, social or governance issue.	RepRisk	(−)
Mandatory ESG disclosure regulation	*mandatory reporting*	The variable captures whether the firm is subject to environmental, social or governmental disclosure regulations (one to three) and equals zero if otherwise.	Carrot and Sticks Report	(−)
Firm size	*size*	Natural logarithm of firm size, computed as common shares outstanding multiplied by fiscal year-end price.	Thomson Reuters Eikon	(+)
Number of analysts following	*analyst following*	The natural logarithm of the number of analysts following the firm through the year.	Thomson Reuters Eikon	(+)
Forecast horizon	*forecast horizon*	The median forecast horizon (the number of days between earnings announcement and forecast date) of analyst forecast for each firm year.	Thomson Reuters Eikon	(−)
Earnings loss	*earnings loss*	Indicator variable that equals 1 if the firm reports negative earnings in the year and 0 otherwise.	Thomson Reuters Eikon	(−)
Variables (continued)				
Financial Transparency	*Financial transparency*	Measure of financial transparency based on industry-year-adjusted scaled accruals. Scaled accruals are calculated as the absolute value of a firm's accruals averaged over the past three years scaled by total assets of the last year. Scaled accruals are computed as follows: ΔCA - ΔCL - ΔCASH + ΔSTD - DEP + ΔTP, where ΔCA (ΔCL) is change in total current assets (liabilities); ΔCASH is change in cash; ΔSTD is change in the current portion of long-term debt; DEP is depreciation and amortisation expense; and ΔTP is change income taxes payable. Financial transparency takes the value of 1 if a firm has higher than industry-year mean of scaled accruals, and 0 otherwise (Bhattacharya et al. 2003).	Thomson Reuters Eikon	
Proprietary costs	*propcosts*	Herfindahl-Hirschman Index, measured as the sum of squared market shares of all firms in each industry group.	Thomson Reuters Eikon	(+)
Leverage	*lev*	Long-term debt scaled by total assets.	Thomson Reuters Eikon	(+)
Return on assets	*ROA*	Net income scaled by lagged total assets	Thomson Reuters Eikon	(+)
Return on assets volatility	*ROA volatility*	Earnings volatility, computed as the standard deviation of the previous five-year ROA; at least three non-missing annual observations are required to calculate earnings volatility.	Thomson Reuters Eikon	(−)

4.2. Hypotheses tests

4.2.1. ESG controversies decrease analyst forecast accuracy

The results of our basic analysis are summarised in Table 6, where columns 1, 2 and 3 of Panel A show the results of model (1), columns 1, 2 and 3 of Panel B show the results of model (2) with the continuous *ESG disclosure score* variable and columns 4, 5 and 6 the binary *ESG disclosure* variable. We identify strong support for our H1 because the *ESG controversies* variable shows positive and significant coefficients in all models. An increase of *ESG controversies* by 1 point is connected to a 0.0063 percentage point increase in *forecast error0*. While this effect might seem small, it is worth noting that a change by one standard deviation of *ESG controversies* is thus connected to an increase of 0.0063 percentage points with a median *forecast error0* of 0.544. Note that coefficients seem to increase with longer forecast horizons from 0.0063 ($p < 0.05$) for *forecast error0* to 0.0157 ($p < 0.05$) for *forecast error1* and 0.0235 ($p < 0.1$) for *forecast error2*. The explanation seems to be somewhat technical because *forecast error2* (mean: 5.606 st. dev.: 9.717; see Table 3) is, in general, larger and shows a higher standard deviation than *forecast error0* (mean: 1.153; st. dev.: 2.009). Relative to the mean and standard deviation of the dependent variable, the coefficient of *ESG controversies* is approximately the same across all three forecast horizons.

The significantly positive coefficients of *ESG controversies* indicate that serious ESG controversies are related with larger forecast errors for current, next-year and two-years ahead earnings forecasts. These results support the previous literature. First, they contribute to Kölbel et al. (2017), who show that ESG controversies translate into financial risk. We ascertain that controversies also increase uncertainties in analysts' earnings forecasts. Second, Hummel et al. (2019) show that ESG controversies lead investors to update their perception of a firm, while we add that analysts are also affected by ESG controversies. Third, we contribute to Cui et al. (2018), who report that ESG controversies increase the differences between investors' opinions, the price impact measure and the bid ask spread. Additionally, we find that ESG controversies also decrease analyst forecast accuracy.

4.2.2. ESG disclosure moderates the relation between ESG controversies and analyst forecast accuracy

The results on H2 are presented in columns 1–6 of Table 6 (Panel B). The hypothesis test focuses on the interaction term *ESG controversies x ESG disclosure(score)*, which captures a potential moderating relation of *ESG disclosure(score)* on the association of *forecast error* and *ESG controversies*. We identify that the interaction term with the continuous variable *ESG controversies x ESG disclosure score* is associated with significantly smaller *forecast error0* (−0.0002; $p < 0.1$) and *forecast error1* (−0.0007; $p < 0.1$), but we do not find an effect for *forecast error2*. Therefore, we find that a percentage change in the *ESG disclosure score*

Table 4
Summary statistics.

	N	Mean	Median	St.Dev	p5	p25	p75	p99	max
Forecast error0	8,369	1.153	0.544	2.009	0.024	0.207	1.24	11.348	20.763
forecast error1	8,369	2.702	1.214	5.329	0.074	0.442	2.862	23.891	103.725
forecast error2	8,369	5.606	2.892	9.717	0.213	1.158	6.299	53.486	179.522
ESG controversies	8,369	12.514	12.083	12.309	0	0	20.667	52.167	60.5
ESG disclosure	8,369	0.67	1	0.47	0	0	1	1	1
ESG disclosure score	8,369	30.961	29.75	15.141	10.33	17.77	42.56	66.04	68.88
analyst following	8,369	2.56	2.639	0.639	1.386	2.197	2.996	3.664	3.784
size	8,369	17.882	17.471	2.704	14.069	15.759	19.862	24.363	24.645
earnings loss	8,369	0.071	0	0.258	0	0	0	1	1
forecast horizon0	8,369	47.204	43	29.449	7	21	70	124	136
forecast horizon1	8,369	186.085	187	104.539	21	98	278	364	439
forecast horizon2	8,369	546.436	545	105.674	384	454	637	728	799
proprcosts	8,369	−0.001	0	0.006	−0.002	0	0	0	0
financial transparency	8,369	0.341	0	0.474	0	0	1	1	1
lev	8,369	0.286	0.264	0.142	0.096	0.178	0.366	0.694	0.743
ROA	8,369	6.223	5.31	6.191	−2.09	2.93	9.04	25.83	29.56
ROA volatility	8,369	3.222	2.289	3.149	0.436	1.201	3.988	17.201	20.713
ENV controversies	8,369	2.452	0	4.679	0	0	3.199	20.192	35.419
SOC controversies	8,369	4.46	0	6.54	0	0	7.951	24.833	46.082
GOV controversies	8,369	4.621	0	7.277	0	0	7.167	28.509	48.728
ENV disclosure	8,369	0.696	1	0.46	0	0	1	1	1
SOC disclosure	8,369	0.712	1	0.453	0	0	1	1	1
GOV disclosure	8,369	0.294	0	0.456	0	0	1	1	1
ENV disclosure score	8,369	23.812	20.93	19.545	0	5.43	40.31	66.67	88.37
SOC disclosure score	8,369	28.497	28.07	19.01	0	14.04	40.63	76.56	94.74
GOV disclosure score	8,369	20.643	0	25.31	0	0*f*	48.21	69.64	85.71

Notes
This table reports the summary statistics before winsorizing the top and bottom 1%.

Table 5
Correlations.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) forecast error0	1											
(2) forecast error1	**0.471**	1										
(3) forecast error2	**0.463**	**0.691**	1									
(4) ESG controversies	0.001	0.008	0.000	1								
(5) ESG disclosure	**−0.036**	*−0.024*	**−0.052**	**0.351**	1							
(6) analyst following	**0.085**	**−0.055**	*−0.0239*	**0.358**	**0.272**	1						
(7) size	0.018	−0.011	**−0.063**	**0.168**	**0.279**	**0.117**	1					
(8) earnings loss	**0.258**	**0.314**	**0.267**	−0.001	0.013	**0.101**	**0.033**	1				
(9) propcosts	−0.007	0.000	0.001	**−0.086**	**−0.053**	**−0.057**	**−0.275**	**−0.038**	1			
(10) financial transparency	−0.003	*0.028*	**0.039**	**0.063**	*0.026*	**0.126**	**0.109**	−0.007	*−0.026*	1		
(11) lev	**0.144**	**0.138**	**0.089**	0.002	0.015	−0.007	**0.059**	*0.025*	0.002	**−0.038**	1	
(12) ROA	**−0.099**	**−0.137**	**−0.130**	**−0.045**	**−0.106**	**0.144**	**−0.152**	**−0.411**	*0.032*	−0.001	**−0.071**	1
(13) ROA volatility	**0.147**	**0.204**	**0.284**	**−0.022**	**−0.099**	**0.048**	**−0.147**	**0.175**	*0.029*	**0.056**	**−0.105**	0.000

Notes
This table reports Pearson correlations among *forecast error (0,1,2), ESG controversies, ESG disclosure* and the control variables. Coefficients for all correlations are based on $N = 8369$ (total sample). Coefficients in bold are significant at $p < 0.01$. Coefficients in bold and italics are significant at $p < 0.05$. Coefficients in italics are significant at $p < 0.1$. Coefficients in plain text are not significant ($p > 0.1$). Pearson (Spearman) correlation coefficients are reported above (below) the diagonal. Variable definitions are provided in Section 4.2 and Table 1.

can lead to significant changes in analysts' forecast errors. In order to granularly interpret the effect sizes, we therefore run the analysis in column 4–6 with the binary *ESG disclosure* variable.

We find significantly negative interaction terms for *forecast error0* in column 4 (coefficient: −0.0095; $p < 0.05$) and for *forecast error1* in column 5 (−0.0201; $p < 0.05$). For the longer forecast horizon captured by *forecast error2*, we find the negative sign but no significance for the coefficient of the interaction term (−0.0199; $p > 0.1$). Therefore, H2 is supported for current and next-year analyst earnings forecasts, but is not supported for longer forecast horizons. Note that *ESG controversies* still shows significant positive coefficients for all *forecast error* variables, meaning that firms experience increased analyst forecast errors when ESG controversies occur. This increased analyst uncertainty can be mitigated to some degree by increased ESG disclosure, at least for shorter forecast horizons. However, ESG disclosure is not able to fully mitigate the association between *ESG controversies* and *forecast error* because the overall interaction of *ESG controversies x ESG disclosure* is still positive: for *forecast error0*, the overall relation is 0.0044 (0.0139–0.0095), and for *forecast error1* it is 0.0113 (0.0314–0.0201). An increase by one standard deviation of *ESG controversies* is thus connected to an increase of 0.0314 percentage points with a median *forecast error1* of 1.214, while the interaction of *ESG controversies x ESG disclosure* mitigates the *forecast error1* by −0.0201%age points. A possible concern in our regressions could be multicollinearity problems, especially for eq. 3. Cui et al. (2018) show that ESG disclosures can be related to lower ESG controversies in a firm. Although they report a rather weak relation ($p < 0.1$), we cannot rule out that multicollinearity affects our results. Therefore, we focus on the maximum variance inflation factors (VIF), which is indeed found for *ESG controversies x ESG disclosure*, with a VIF of 7.3. This is well below the threshold (10) of being labelled an econometrical problem. These results contribute to the findings of Amel-Zadeh and Serafeim (2018), who discover that analysts use ESG

Table 6
ESG controversies, ESG disclosure and analyst forecast accuracy.

Panel A: regression analysis of ESG controversies on analyst forecast accuracy

Model	*Model 1*		
	(1)	(2)	(3)
VARIABLES	*Forecast error0*	*Forecast error1*	*Forecast error2*
ESG controversies	0.0063**	0.0157**	0.0235*
	(0.003)	(0.006)	(0.013)
analyst following	−0.2417***	−0.2789**	0.1327
	(0.053)	(0.123)	(0.219)
size	−0.0174	−0.1104**	−0.4143***
	(0.020)	(0.056)	(0.101)
earnings loss	1.7251***	5.2761***	6.9827***
	(0.192)	(0.470)	(0.809)
forecast horizon	0.0035***	0.0076***	0.0056***
	(0.001)	(0.001)	(0.001)
propcosts	2.4020	15.3018**	17.1538
	(3.910)	(7.258)	(12.115)
financial transparency	0.0130	0.2690*	0.6207***
	(0.047)	(0.138)	(0.240)
lev	2.0352***	5.4678***	7.5012***
	(0.257)	(0.651)	(1.200)
ROA	0.0037	−0.0224	−0.0898***
	(0.006)	(0.016)	(0.030)
ROA volatility	0.0890***	0.2911***	0.7419***
	(0.012)	(0.031)	(0.062)
Constant	0.8945**	2.0566	7.7725***
	(0.405)	(1.265)	(2.337)
Country FE	YES	YES	YES
Industry FE	YES	YES	YES
Year FE	YES	YES	YES
Observations	8,369	8,369	8,369
R-squared	0. 147	0.206	0.193

Notes
This table reports the results of regression models with *forecast error(Y)* as the dependent variable. Thereby, *forecast error(Y)* is the analyst forecast error for same year (*forecast error0*), next year (*forecast error1*) and two-year (*forecast error2*) analyst forecast errors. Columns (1)–(3) summarise results for regression model (1) with the ESG Controversies *(ESG controversies)* as an independent variable.
This table reports the coefficients of the respective regression models. Standard errors are clustered by firm to account for heteroscedasticity, and are reported in parenthesis below the coefficient values.
All of the continuous variables are winsorized at the 1 percent and 99% levels to mitigate the influence of outliers. The sample consists of 8,369 observations.
Significance levels at $p < 10\%$, 5% and 1%, one-tailed, are indicated by *, ** and ***, respectively.

Panel B: moderations of ESG controversies and ESG disclosure on analyst forecast accuracy

Model	Model 2 with continuous ESG disclosure			Model 2 with binary ESG disclosure		
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	*forecast error0*	*forecast error1*	*forecast error2*	*forecast error0*	*forecast error1*	*forecast error2*
ESG controversies	0.0131***	0.0412***	0.0487*	0.0139***	0.0314***	0.0399*
	(0.005)	(0.014)	(0.028)	(0.005)	(0.012)	(0.024)
ESG disclosure	−0.0008	0.0100	0.0032	0.0463	0.1759	0.0024
	(0.003)	(0.007)	(0.013)	(0.080)	(0.173)	(0.379)
ESG controversies x ESG disclosure score	−0.0002*	−0.0007**	−0.0007			
	(0.000)	(0.000)	(0.001)			
ESG controversies x ESG disclosure				−0.0095*	−0.0201*	−0.0199
				(0.005)	(0.011)	(0.024)
analyst following	−0.2312***	−0.2927**	0.1459	−0.2355***	−0.2746**	0.1561
	(0.054)	(0.125)	(0.222)	(0.054)	(0.122)	(0.220)
size	−0.0107	−0.1085*	−0.4005***	−0.0126	−0.1041*	−0.3996***
	(0.020)	(0.056)	(0.101)	(0.020)	(0.054)	(0.101)
earnings loss	1.7284***	5.2790***	6.9904***	1.7256***	5.2766***	6.9844***
	(0.192)	(0.469)	(0.808)	(0.192)	(0.470)	(0.809)
forecast horizon	0.0034***	0.0076***	0.0056***	0.003***	0.008***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
propcosts	2.5152	15.6465**	17.5280	2.3278	15.1702**	16.9662
	(3.897)	(7.245)	(12.167)	(3.902)	(7.196)	(12.053)
financial transparency	0.0077	0.2692*	0.6108**	0.0108	0.2675*	0.6125**
	(0.048)	(0.139)	(0.241)	(0.047)	(0.139)	(0.240)
lev	2.0277***	5.4442***	7.4754***	2.0502***	5.4855***	7.5494***
	(0.257)	(0.649)	(1.201)	(0.256)	(0.644)	(1.186)
ROA	0.0038	−0.0216	−0.0892***	0.0039	−0.0217	−0.0893***

(*continued on next page*)

Table 6 (*continued*)

Panel B: moderations of ESG controversies and ESG disclosure on analyst forecast accuracy						
Model	Model 2 with continuous ESG disclosure			Model 2 with binary ESG disclosure		
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	*forecast error0*	*forecast error1*	*forecast error2*	*forecast error0*	*forecast error1*	*forecast error2*
	(0.006)	(0.016)	(0.030)	(0.006)	(0.016)	(0.030)
ROA volatility	0.0882***	0.2912***	0.7404***	0.0888***	0.2913***	0.7407***
	(0.012)	(0.032)	(0.062)	(0.012)	(0.032)	(0.062)
Constant	0.072	−0.446	1.836	0.0467	−0.3782	1.8372
	(0.319)	(0.848)	(1.599)	(0.331)	(0.830)	(1.627)
Country FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Observations	8,369	8,369	8,369	8,369	8,369	8,369
R-squared	0.147	0.207	0.193	0.147	0.206	0.193

Notes: This table reports the results of regression models with *forecast error(Y)* as the dependent variable. Thereby, *forecast error(Y)* is the analyst forecast error for same year (*forecast error0*), next year (*forecast error1*) and two-year (*forecast error2*) analyst forecast errors. Columns (1)–(3) comprise the results for model (2), including the moderation analysis with the Bloomberg ESG disclosure score (*ESG disclosure score*). Columns (4)–(6) comprise the results of regression model (2), which includes the moderation analysis with the binary ESG disclosure variable (*ESG disclosure*).
This table reports the coefficients of the respective regression models. Standard errors are clustered by firm to account for heteroscedasticity, and are reported in parenthesis below the coefficient values.
All of the continuous variables are winsorized at the 1% and 99% levels to mitigate the influence of outliers. The sample consists of 8,369 observations.
Significance levels at $p < 10\%$, 5% and 1%, one-tailed, are indicated by *, ** and ***, respectively.

disclosure as a risk-screening tool. We show that ESG disclosure can mitigate but not completely offset the negative impact of ESG controversies on forecast accuracy. In addition, it is interesting to note that *ESG disclosure* itself does not show any significant coefficients. This implies that better ESG disclosers do not per se experience lower forecast errors. While this seems somewhat contradictory to the results of Dhaliwal et al. (2012), it is vital to note that our empirical setting distinguishes between good ESG disclosers (top 67%) and others, whereas Dhaliwal et al. (2012) report the significant negative association of analyst forecast errors for first-time issuances of stand-alone sustainability reports.

Our results seem to be more in line with Birkey et al. (2017), who argue that ESG reports are likely to be issued for reasons other than informing investors and that the low average quality of ESG reports makes it unlikely that companies will use them to inform investors of actual social and environmental performance. They find no significant relation between first-time ESG report publication and the future earnings response coefficient. Our focus on the disclosure quality and the interaction *ESG controversies x ESG disclosure* enables us to show that better quality ESG disclosures can indeed be useful to inform analysts in cases where ESG controversies typically complicate accurate forecasts.

Focusing on the control variables, we see significant positive coefficients across all of the regression models for *earnings loss*, *forecast horizon, lev* and *ROA volatility*. These results are as expected because for loss years, longer forecast horizons, higher leverage and higher volatility of earnings we expected higher analyst forecast errors based on theory and prior literature (Dhaliwal et al., 2012; Muslu et al., 2019). Indeed, *size* only has a significantly negative coefficient for longer forecast horizons (*forecast error1* and *forecast error2*), indicating that larger firms are easier to forecast. The variable *financial transparency* shows a positive significant coefficient for *forecast error1* and *forecast error2*, which indicates that firms with more accruals are generally more difficult to forecast (Dhaliwal et al., 2012).

In summary, our results are in line with disclosure theory and show that ESG disclosure acts as a moderator to reduce analyst forecast errors arising from ESG controversies. Our results contribute to the research of Dhaliwal et al. (2012) and Muslu et al. (2019); however, we extend their research by showing that the relation between ESG disclosure and forecast accuracy is fundamental in the face of ESG controversies. Moreover, our results support the findings of Zhang et al. (2020) and show that ESG disclosure can act as an insurance-like protection for ESG controversies. Further, they contribute to Cui et al. (2018) by showing that both ESG activities and ESG disclosure are able to mitigate information asymmetry, and that the latter can be used by firms to mitigate the negative, uncertainty-increasing effects of ESG controversies. Our results are also in line with the claims of Kölbel et al. (2017) that executives can seek to influence the emergence and the severity of ESG controversies through transparent reporting. Although we do not focus on capital market effects as direct consequences for firms, we do investigate information asymmetry. Our results posit that transparent reporting helps analysts to access the severity of ESG controversies, which could also lead to lower agency costs.

5. Additional analysis and robustness tests

5.1. Disentangling environmental, social and governance controversies

We aim to exploit the granularity of our dataset in the first additional analysis, which will enable us to gather a more detailed understanding of the dimensions of ESG controversies and their relation to analyst forecast errors. This analysis will allow us to understand and compare which of the dimensions are the most relevant to analysts. Bernardi and Stark (2018) build on a similar idea for their focus on IR using a sample of 41 firms in South Africa; they find that before the introduction of IR, higher social disclosure significantly improved analyst forecast accuracy. However, they did not find this effect for environmental or corporate governance disclosure.

RepRisk provides detailed information about what percentage of ESG controversies have been influenced by environmental, social or corporate governance issues. Therefore, we multiply the ESG controversy score (i.e., *ESG controversies*) with the respective percentage values and create variables for environmental (*ENV controversies*), social (*SOC controversies*) and corporate governance issues (*GOV controversies*). Similarly, Bloomberg provides distinct scores for environmental, social and corporate governance disclosure. Analogous to our definition of *ESG disclosure*, we dichotomise the disclosure variables into high versus low disclosure by creating dummy variables capturing environmental (*ENV disclosure*), social (*SOC disclosure*) and corporate governance disclosure (*GOV disclosure*), which equal one for the respective highest 67th percentile of Bloomberg's environmental, social and corporate governance disclosure scores. Based on the three variations of the dependent variable (i.e., *forecast error0*, *forecast error1*, *forecast error2*) and the three ESG components, we run a total of nine regressions.

Table 7
Environmental, social and governance controversies and environmental, social and governance disclosure and analyst forecast accuracy.

Panel A: moderations of environmental and social controversies and environmental and social disclosure on analyst forecast accuracy

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	*forecast error0*	*forecast error1*	*forecast error2*	*forecast error0*	*forecast error1*	*forecast error2*
ENV controversies	0.014	−0.03	−0.045			
	(0.013)	(0.018)	(0.047)			
ENV disclosure	−0.017	−0.071	−0.312			
	(0.070)	(0.169)	(0.353)			
ENV disclosures x ENV controversies	0.004	0.029	0.065			
	(0.014)	(0.026)	(0.052)			
SOC controversies				0.017**	0.048**	0.066*
				(0.007)	(0.029)	(0.053)
SOC disclosure				−0.019	0.347**	0.444
				(0.070)	(0.155)	(0.309)
SOC disclosure x SOC controversies				−0.017***	−0.057**	−0.031
				(0.007)	(0.028)	(0.050)
analyst following	−0.222***	−0.233**	0.234	−0.219***	−0.282**	0.132
	(0.053)	(0.119)	(0.216)	(0.053)	(0.126)	(0.221)
size	−0.003	−0.073	−0.326***	0.003	−0.093*	−0.370***
	(0.020)	(0.051)	(0.092)	(0.020)	(0.054)	(0.101)
earnings loss	1.735***	5.300***	7.012***	1.734***	5.288***	7.013***
	(0.192)	(0.471)	(0.812)	(0.192)	(0.470)	(0.810)
forecast horizon	0.003***	0.008***	0.006***	0.003***	0.008***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
propcosts	2.032	14.287**	15.073	1.876	15.563	15.279**
	(3.881)	(7.151)	(11.924)	(3.930)	(7.346)	(7.281)
financial transparency	0.016	0.281**	0.634***	0.013	0.274**	0.269*
	(0.047)	(0.140)	(0.240)	(0.241)	(0.139)	(0.138)
lev	2.092***	5.590***	7.679***	2.080***	5.488***	5.507***
	(0.257)	(0.656)	(1.196)	(1.198)	(0.647)	(0.653)
ROA	0.004	−0.023	−0.092***	0.003***	−0.023	−0.023
	(0.006)	(0.016)	(0.030)	(0.030)	(0.016)	(0.016)
ROA volatility	0.089***	0.292***	0.724***	0.739***	0.295***	0.294***
	(0.012)	(0.032)	(0.062)	(0.063)	(0.012)	(0.032)
Constant	−0.034	−0.644	0.966	−0.164	−0.489	2.011
	(0.314)	(0.796)	(1.527)	(0.318)	(0.870)	(1.701)
Country FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Observations	8,369	8,369	8,369	8,369	8,369	8,369
R-squared	0.146	0.206	0.194	0.146	0.206	0.193

Notes
This table reports the results of regression models with *forecast error(Y)* as the dependent variable. Thereby, *forecast error(Y)* is the analyst forecast error for same year (*forecast error0*), next year (*forecast error1*) and two-year (*forecast error2*) analyst forecast errors. Columns (1)–(3) summarise results for the regression model, including the moderation analysis with the environmental controversies variable (*ENV controviersies*) and the environmental disclosure variable (*ENV disclosure*). Columns (4)–(6) summarise results for the regression model, which includes the moderation analysis with the social controversies variable (*SOC controversies*) and the social disclosure variable (*SOC disclosure*). This table reports the coefficient of the respective regression models. Standard errors are clustered by firm to account for heteroscedasticity, and are reported in parenthesis below the coefficient values. All of the continuous variables are winsorized at the 1% and 99% levels to mitigate the influence of outliers. The sample consists of 8,369 observations. Significance levels at $p < 10\%$, 5% and 1%, one-tailed, are indicated by *, ** and ***, respectively.

Panel B: moderations of environmental and social controversies and environmental and social disclosure on analyst forecast accuracy

	(1)	(2)	(3)
VARIABLES	*forecast error0*	*forecast error1*	*forecast error2*
GOV controversies	0.008**	−0.003	0.017
	(0.004)	(0.009)	(0.017)
GOV disclosure	−0.010	−0.050	−0.188
	(0.082)	(0.176)	(0.371)
GOV disclosure x GOV controversies	−0.002	0.024	−0.011
	(0.006)	(0.015)	(0.027)
analyst following	−0.230***	−0.229**	0.203
	(0.053)	(0.120)	(0.216)
size	−0.005	−0.064	−0.341***
	(0.019)	(0.053)	(0.095)
earnings loss	1.726***	5.282***	7.001***
	(0.193)	(0.471)	(0.814)
forecast horizon	0.003***	0.008***	0.006***
	(0.001)	(0.001)	(0.001)
propcosts	1.679	14.273**	14.713

(*continued on next page*)

Table 7 (*continued*)

Panel B: moderations of environmental and social controversies and environmental and social disclosure on analyst forecast accuracy			
	(1)	(2)	(3)
VARIABLES	*forecast error0*	*forecast error1*	*forecast error2*
	(3.860)	(7.105)	(11.844)
financial transparency	0.015	0.278**	0.623***
	(0.047)	(0.139)	(0.240)
lev	2.039***	5.538***	7.586***
	(0.259)	(0.666)	(1.221)
ROA	0.004	−0.016	−0.090***
	(0.006)	(0.016)	(0.030)
ROA volatility	0.089***	0.292***	0.741***
	(0.012)	(0.032)	(0.062)
Constant	−0.001	−0.766	1.144
	(0.320)	(0.849)	(1.623)
Observations	8,369	8,369	8,369
R-squared	0.146	0.205	0.192
Country FE	YES	YES	YES
Industry FE	YES	YES	YES
Year FE	YES	YES	YES

Notes
This table reports the results of regression models with *forecast error(Y)* as the dependent variable. Thereby, *forecast error(Y)* is the analyst forecast error for same year (*forecast error0*), next year (*forecast error1*) and two-year (*forecast error2*) analyst forecast errors. Columns (1)–(3) summarise results for the regression model, which includes the moderation analysis with the environmental controversies variable (*GOV controversies*) and the environmental disclosure variable (*GOV disclosure*).
This table reports the coefficient of the respective regression models. Standard errors are clustered by firm to account for heteroscedasticity, and are reported in parenthesis below the coefficient values.
All of the continuous variables are winsorized at the 1% and 99% levels to mitigate the influence of outliers. The sample consists of 8,369 observations.
Significance levels at $p < 10\%$, 5% and 1%, one-tailed, are indicated by *, ** and ***, respectively.

Table 7 presents the results of the regressions. We find that *SOC controversies* has a significantly positive coefficient for *forecast error1* (0.017, $p < 0.05$) and *forecast error2* (0.048, $p < 0.1$). Additionally, the interaction term *SOC disclosure x SOC controversies* shows significantly negative coefficients for *forecast error0* (−0.017, $p < 0.1$) and *forecast error1* (−0.057, $p < 0.05$), but the coefficient does not attain significance in the model for *forecast error2*. This finding for social controversies and disclosure is in line with the findings of the main analysis for *ESG controversies* and *ESG disclosure*. However, higher social disclosure itself seems to be associated with higher *forecast error1* (0.347, $p < 0.05$), indicating that social disclosure without the risk context might lead to increased uncertainty within the capital market. With the exception of the coefficient for *GOV controversies* (0.008, $p < 0.05$) in the *forecast error0* model, none of the coefficients for environmental and governance controversies, disclosure or their interactions are significant. This is in line with the results for IR from Bernardi and Stark (2018), who show that social controversies and disclosure influence analyst forecast accuracy but this effect fades in a mandatory reporting setting. Cormier, Ledoux, and Magnan (2011) also find that social disclosure can reinforce the informativeness of environmental disclosure for stock markets, and under certain conditions may even substitute it.

5.2. Disentangling environmental social and governance controversies and disclosure

Our basic analyses consider ESG disclosure and ESG controversies simultaneously. However, legitimacy theory suggests that firms increase their ESG disclosure after legitimacy-damaging events (Cho et al., 2015; Hummel & Schlick, 2016). Our empirical setting allows an analysis of ESG disclosure as a consequence of ESG controversies. Subsequently, we disentangle whether the environmental, social or corporate governance controversies are related to the respective disclosure score variables. Based on these variables, we run regression analyses to investigate to what extent the disclosure for the environmental, social and corporate governance items depends on the environmental, social and corporate governance controversies.

Table 8 reports the results for nine regression models that capture all of the potential relations between disclosure and controversies regarding environmental, social and corporate governance issues. We find that the disclosure after each environmental, social and corporate governance controversy is related to significant increases in the subsequent disclosure of environmental, social and corporate governance information. First, *ENV controversies* reveals significant coefficients in the regression on *ENV disclosure sore* (0.514, $p < 0.01$), *SOC disclosure score* (0.560, $p < 0.01$) and *GOV disclosure score* (0.139, $p < 0.01$). This means that after environmental controversies, firms typically show higher disclosure along all three ESG dimensions. Second, after social controversies firms also show higher values for *ENV disclosure score* (0.408, $p < 0.01$), *SOC disclosure score* (0.379, $p < 0.01$) and *GOV disclosure score* (0.052, $p < 0.01$). Finally, the results also show that governance controversies are related to higher *ENV disclosure score* (0.334, $p < 0.01$), *SOC disclosure score* (0.235, $p < 0.01$) and *GOV disclosure score* (0.029, $p < 0.05$). Overall, the strongest disclosure-controversy relations are found for environmental controversies. Moreover, it seems that governance disclosure does not respond to controversies as strongly as environmental or social disclosure.

Our results support the findings of Gómez-Carrasco et al. (2020), who state that firms tend to communicate more effectively about ESG in response to legitimacy-damaging events. In their analysis, they separated core ESG communications from supplementary ESG communications through a textual analysis. They find that firms heavily focus on increasing the disclosure of core ESG issues after damaging events, but also to a lesser extent increase supplementary ESG information. We identify similar patterns to the findings of Gómez-Carrasco et al. (2020). By focusing on the dependent variable *SOC disclosure,* we find the largest coefficient for *ENV controversies* (0.560, $p < 0.01$), but not for *SOC controversies* (0.379, $p < 0.01$). This implies that firms who experience controversies in a certain dimension not only react by increasing information in the same dimension but also increase disclosure in other dimensions.

Table 8
Regression models: the relation between environmental, social and governance controversies and environmental, social and governance disclosure.

Panel A: regression of environmental and social controversies on environmental, social and governance disclosure

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	*ENV disclosure score*	*SOC disclosure score*	*GOV disclosure score*	*ENV disclosure score*	*SOC disclosure score*	*GOV disclosure score*
ENV controversies	0.514***	0.560***	0.139***			
	(0.081)	(0.073)	(0.028)			
SOC controversies				0.408***	0.379***	0.052***
				(0.056)	(0.048)	(0.017)
size	3.892***	3.383***	1.070***	3.723***	3.304***	1.120***
	(0.246)	(0.230)	(0.076)	(0.249)	(0.229)	(0.079)
earnings loss	1.290	0.043	0.350	1.003	−0.251	0.288
	(0.921)	(0.957)	(0.405)	(0.909)	(0.953)	(0.408)
propcosts	24.802	−14.343	70.663***	47.637	5.598	72.464***
	(41.339)	(41.608)	(24.937)	(39.686)	(42.225)	(25.192)
Financial transparency	−2.132***	−1.129**	−0.403	−2.323***	−1.309***	−0.430*
	(0.553)	(0.485)	(0.252)	(0.550)	(0.497)	(0.253)
lev	1.293	2.741	0.233	−0.596	0.881	−0.105
	(2.733)	(2.685)	(0.812)	(2.703)	(2.689)	(0.814)
ROA	0.022	0.047	0.032*	−0.000	0.025	0.029
	(0.056)	(0.056)	(0.018)	(0.055)	(0.055)	(0.018)
ROA volatility	−0.254**	−0.164	−0.072**	−0.251**	−0.161	−0.071**
	(0.102)	(0.100)	(0.030)	(0.102)	(0.100)	(0.030)
Constant	−55.929***	−48.072***	−20.171***	−50.802***	−44.475***	−20.561***
	(4.907)	(4.595)	(2.125)	(4.911)	(4.579)	(2.165)
Observations	8,369	8,369	8,369	8,369	8,369	8,369
R-squared	0.397	0.377	0.891	0.401	0.376	0.891
Country FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Notes
This table reports the results of regression models with *ENV disclosure, SOC disclosure and GOV disclosure* as dependent variables. Columns (1)–(3) summarise results for the regression model, and the regression analysis with the environmental controversies variable (*ENV controviersies*) on the dependent variables. Columns (1)–(3) summarise results for the regression model, and the regression analysis with the social controversies variable (*SOC controversies*) on the dependent variables.
This table reports the coefficients of the respective regression models. Standard errors are clustered by firm to account for heteroscedasticity, and are reported in parenthesis below the coefficient values.
All of the continuous variables are winsorized at the 1% and 99% levels to mitigate the influence of outliers. The sample consists of 8,369 observations.
Significance levels at $p < 10\%$, 5% and 1%, one-tailed, are indicated by *, ** and ***, respectively.

Panel B: regression of governance controversies on environmental, social and governance disclosure

	(1)	(2)	(3)
VARIABLES	*ENV disclosure score*	*SOC disclosure score*	*GOV disclosure score*
GOV controversies	0.334***	0.235***	0.029**
	(0.044)	(0.038)	(0.014)
size	3.895***	3.582***	1.163***
	(0.239)	(0.225)	(0.077)
earnings loss	0.865	−0.325	0.280
	(0.917)	(0.962)	(0.409)
propcosts	8.895	−28.607	67.826***
	(39.967)	(39.783)	(25.403)
Financial transparency	−2.216***	−1.195**	−0.414
	(0.552)	(0.491)	(0.253)
lev	−0.891	0.939	−0.083
	(2.730)	(2.688)	(0.817)
ROA	0.026	0.047	0.032*
	(0.057)	(0.056)	(0.019)
ROA volatility	−0.287***	−0.187*	−0.075**
	(0.102)	(0.101)	(0.030)
Constant	−53.407***	−49.197***	−21.311***
	(4.797)	(4.490)	(2.123)
Observations	8,369	8,369	8,369
R-squared	0.398	0.369	0.890
Country FE	YES	YES	YES
Industry FE	YES	YES	YES
Year FE	YES	YES	YES

Notes
This table reports the results of regression models with *ENV disclosure, SOC disclosure and GOV disclosure* as dependent variables. Columns (1)–(3) summarise results for the regression model with the governmental controversies variable (*GOV controversies*) on the dependent variables.
This table reports the coefficients of the respective regression models. Standard errors are clustered by firm to account for heteroscedasticity, and are reported in parenthesis below the coefficient values.

All of the continuous variables are winsorized at the 1% and 99% levels to mitigate the influence of outliers. The sample consists of 8,369 observations. Significance levels at p < 10%, 5% and 1%, one-tailed, are indicated by *, ** and ***, respectively.

5.3. Robustness of the results

We carried out a range of robustness tests to analyse the potential impacts of our research design decisions on the results. First, we account for the possibility that the ESG controversies are influenced by the ESG disclosure of a firm. Consequently, we exclude controversies that are linked to firm disclosures. Additionally, we apply a test based on Hummel and Schlick (2016) and review the RepRisk based on search terms for "misleading communication" because these controversies could be caused by ESG disclosure. In our sample, we find 620 firm-year observations where the RepRisk score also contains controversies linked to misleading communication. When dropping these observations and running our main analysis, the results remain directionally robust.

Second, Kölbel et al. (2017) argue that analysts have limited capacities to monitor firms regarding their ESG controversies. Therefore, it could be possible that the main source for information for analysts regarding *ESG controversies* is *ESG disclosure*. In this case, we expect a mediating effect instead of a moderating effect of *ESG disclosure*. To test this possibility, we follow the suggestions of Hayes (2009) and Zhao, Lynch, and Chen (2010) and subsequently carry out three steps to investigate the mediation. The first step is to investigate whether *ESG disclosure* increases when *ESG controversies* does. We test this relation through a regression analysis with *ESG disclosure* as the dependent variable, and *ESG controversies* alongside firm-level and disclosure-related controls as independent variables. In our unreported results, we find that firms with higher *ESG controversies* also show higher *ESG disclosure* (i.e., positive and significant coefficients). These results are in line with legitimacy theory (Suchman, 1995) and also with previous empirical research (Cho et al., 2015; Hummel et al., 2019). In the second step, we analyse the relation between *ESG controversies* and *forecast error*. However, this was already conducted in regression model (1), as shown in our tests on H1 (see Table 5, columns 1–3). We report a positive significant coefficient of *ESG controversies*. In the third step, we add *ESG disclosure* as a further independent variable to regression model (1). The regression shows an insignificant coefficient for *ESG disclosure*, and therefore does not add any statistical explanation to the relation between *ESG controversies* and *forecast error*. In addition, the coefficient for *ESG controversies* does not show any significant change in comparison with regression model (1). Based on these results, we conclude that *ESG disclosure* does not mediate the relation between *ESG controversies* and *forecast error*. These results suggest that analysts do pay attention to ESG controversies published by the media (and therefore expressed in the RepRisk score) and do not merely focus on a firm's ESG disclosure.

Third, we run regression models with different subsamples of our dataset. To test robustness in light of the different countries involved, we apply our regression models to subsamples on individual continents with sufficient firm-year observations (i.e., America, Europe and Asia). The results stay directionally similar for all continents.

Fourth, we consider the fact that we have dichotomised the disclosure variable for the sake of easier presentation and interpretation, especially regarding the interaction effects. To analyse whether this measurement approach impacted our results, we run an analysis with the initial categorical Bloomberg ESG disclosure score. The results remain robust. In particular, the interaction term (*Bloomberg ESG disclosure* x *ESG controversies*) is negative and significant. Additionally, we analyse the impact of our research design choice for *ESG disclosure* to take a value of 1 for the highest 67% of Bloomberg ESG disclosure scores. We vary this cut-off value for the 10th percentile. All of the interactions remain directionally robust.

Fifth, it is critical to note that we run our analyses with an unbalanced panel, as is typically done in empirical accounting research (Bernardi & Stark, 2018; Dhaliwal et al., 2012; Hummel et al., 2019). This approach is appropriate as long as no missing data is correlated with the idiosyncratic errors $\varepsilon_{i,t}$. Nonetheless, we run the analysis with a balanced sample to test whether the effect stays the same. The results stay robust in an analysis with a balanced sample.

Sixth, we follow Wooldridge (2013) and run our equation with a random effects model, assuming that our effect is uncorrelated with the explanatory variable. We derive a generalized least square transformation, which aims to eliminate serial correlation. The results stay robust for all of the analyses, which allows us to assume that we are not leaving a larger fraction of the unobserved effect in the error term.

Our sample contains firms from 51 countries, which means the ESG disclosure levels might be subject to differences in countries' ESG disclosure requirements. Therefore, we follow Christensen, Serafeim and Anywhere (2022) and create a mandatory disclosure variable based on a summary of laws and regulations in these countries.[3] The variable *mandatory disclosure* captures whether a firm is subject to environmental, social and/or governmental disclosure regulation (we add one for each area, meaning the variable has a maximum value of three) in its home country during each year of our sample time window and equals zero if not. The variable can increase during our sample period, if and when new legislation is introduced. In unreported results, the variable *mandatory disclosure* does not show a significant coefficient if added to our regression models. Moreover, our main analyses remain entirely robust. Therefore, we conclude that mandatory ESG disclosure regulation does not seem to relate to the interaction between ESG controversies and ESG disclosure on analyst forecast accuracy.

Eighth, although our main analysis captures ESG disclosure and ESG controversies, the relation might be influenced by the ESG performance of the respective firm. Firms with higher ESG performance are more likely to engage in higher ESG disclosure (Gao et al., 2016) and, therefore, adding the ESG performance to our main analysis may induce multicollinearity. Nonetheless, it is important to acknowledge that firms with higher ESG performance might face lower risk from ESG controversies, which reduces analyst forecast errors. Hence, we run an additional analysis, with a subsample of 1,231 firms (4,266 firm-year observations), which we obtain after merging our sample to the Morgan Stanley Capital International Intangible Value Assessment (MSCI IVA). We did not include the MSCI IVA Score in our main analysis because it might dilute the ESG disclosure and performance effect. We find a partly significant trend that higher ESG performance is associated with lower analyst forecast errors. While significance levels are lower compared to the main analysis, our main variables of interest (*ESG controversies* and *ESG disclosure x ESG controversies*) remain directionally similar.

Ninth, we acknowledge that our sample period has been subject to the effects of the financial crisis in 2007. Therefore, we decided to run several robustness tests with two different approaches. First, since the financial crisis spanned from (the end of) 2007 to 2009, we decided to create a dummy variable to capture the effects of the financial crisis in 2008 and 2009 (i.e., the first two years in our sample). In unreported results, the dummy variable for the financial crisis is significant and confirms that the forecast errors in the sample after the financial crisis are significantly lower than during the financial crisis. This is in line with the expectation that shortly before and during the financial crisis, the earnings per share were more difficult to forecast due to increased risk (Kölbel et al., 2017). More importantly, our results for the independent variables of interest remain robust. Second, we rerun our analysis with a reduced sample, starting after the financial crisis (i.e., 2009, and alternatively 2010). Again, our results for the independent variables are qualitatively and directionally similar to our main

[3] For further details on these disclosure requirements, see https://www.carrotsandsticks.net. Note that we make use of the classifications of environmental, social and governance provided by the Carrot & Sticks website.

analyses. Thus, we conclude that the financial crisis did not impact our main results.

Tenth, we include firm-clustered standard errors to account for the problem that residuals are very likely correlated across firms. There are different strategies in how to address this issue (Petersen, 2009), which raises the question of whether the results are robust to other strategies. We used firm fixed effects models as an alternative approach, and results stay directionally similar for all analyses and provide robust significance levels.

6. Conclusion

We show that ESG disclosure moderates the relation between ESG controversies and analyst forecast accuracy. First, our results emphasise that higher levels of ESG controversies increase the difficulty of forecasting a firm's future financial performance. This finding contributes to the research of how ESG controversies translate into capital market effects (Hummel et al., 2019; Kölbel et al., 2017). Second, we empirically show that higher ESG disclosure moderates and mitigates the effect of ESG controversies on analyst forecast errors. This adds to empirical research by showing that the mere decision to publish a stand-alone sustainability report increases analyst forecast accuracy (Dhaliwal et al., 2012). We complement this research by showing that the level of a firm's overall ESG disclosure, through its moderating role, is a relevant determinant of analyst forecast accuracy. Third, we find that higher levels of ESG controversies are associated with higher ESG disclosure. This finding is in line with the literature investigating how legitimacy pressures are related to ESG disclosure (Cho et al., 2015; Patten, 1991).

Kölbel et al. (2017) assume that firms might reduce the severity of the consequences of ESG controversies in the media through increased ESG disclosure. Our results confirm this assumption. Furthermore, in an additional analysis, we disentangle the ESG pillars and reveal that the moderating effect is particularly pronounced in the social pillar. This contributes to Bernardi and Stark (2018) and Muslu et al. (2019) by showing that social disclosure helps to mitigate uncertainty, especially for companies experiencing more serious social controversies. Moreover, we contribute to Gao et al. (2016) and show that the availability of higher ESG disclosure supports analysts in the assessment of firms within the capital market. Our results also contribute to de Oliveira et al. (2020) because we not only show that ESG coverage indeed reduces uncertainty, but we also show that ESG disclosure is helpful in mitigating the uncertainty-increasing effect of ESG controversies.

Our results also have practical implications. Using interviews, Amel-Zadeh and Serafeim (2018) report that investors claim to mainly use ESG information for risk-screening purposes. By showing that ESG information is especially useful after the occurrence of ESG controversies, we confirm that ESG information can support the better evaluation of the risks after uncertainty increasing events. Furthermore, our results show that better ESG disclosure can act as an insurance-like protection if controversies occur (Zhang et al., 2020). Consequently, firms should proactively work on enhancing their ESG disclosure to be better prepared and protected against the effects of ESG controversies.

Our empirical study has observed several limitations, which should be considered when interpreting results but which also open avenues for future research. First, we measured our constructs based on data provided by third party research. In particular, the ESG controversies score by RepRisk is based on a proprietary algorithm. Although the measure has previously been tested in empirical research (Hummel et al., 2019; Kölbel et al., 2017), we are not able to directly assess the validity and reliability of this score. Therefore, future research might test alternative approaches, such as the textual analysis of news articles. Second, our analysis does not attempt to capture the analyst's valuation process. While we have contributed to Amel-Zadeh and Serafeim (2018) to illustrate how ESG disclosure materialises in the ESG disclosure research, it is recommended that future research should use interviews, surveys or experiments to analyse how the analysts perceive and process information about ESG controversies and ESG disclosure.

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