Spillover Effects of ESG Information Disclosure Mirrored in Earnings Forecasts

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Abstract

This paper examines the spillover effects of ESG information (from other firms held by the analyst) disclosure mirrored in earnings forecasts. The spillover effect associated with ESG information can be divided into two aspects: companies in the same industry and companies in different industries. It has been found that analysts do not only consider a company's ESG disclosures when predicting its earnings per share but also refer to disclosed ESG information of peer companies. As a result of this information spillover effect, analysts' forecast errors are reduced. Additionally, there is no robust evidence that non-peer firms' ESG information has a significant impact on analysts' forecast accuracy.

Keywords: ESG information disclosure, spillover effects, peers, earnings forecasts, analysts

1 Introduction

Analysts are often regarded as industry experts (Luo & Nagarajan, 2015), typically beginning their careers by writing industry reports. Although analysts tend to focus only on financial information and industry-related information when forecasting company performance, the commonality of information among companies in the same industry enables these analysts to extrapolate the earnings performance of the companies in their portfolios more effectively. This type of sector specialization is beneficial to analysts in terms of improving their access to information, productivity, and forecast performance (e.g., Kini et al., 2009). Conversely, analysts have begun taking serious risks in non-financial areas such as corporate ethics and the environment in an era where 'black swans' rippling through the capital markets are common occurrences. For example, the FASB published a staff educational paper on March 19, 2021. This paper provides a practical example for analysts to consider ESG matters under the existing accounting structure (Financial Accounting Standards Board, 2021). There is no doubt that a firm's ESG information is important for analysts to predict performance, but what about the ESG information of other firms? As industry experts, do analysts also consider the disclosure of environmental, social, and governance (ESG) information of their peers in the same manner that they consider financial information? Does the ESG disclosure of peer firms have a spillover effect on the analyst's prediction?

Previous research indeed finds that analysts often cover firms from multiple industries (e.g., Boni & Womack, 2006; Clement & Tse, 2005; Guan et al., 2015; Sonney, 2009). This is because analysts may benefit from the complementarity of information between firms from different industries (Guan et al., 2015). The question remains as to whether the complementarity of information between non-peer firms also applies to ESG information. In other words, when an analyst makes predictions performance of a

company, does the ESG disclosure of firms outside the company's peer group have a spillover effect on the analyst's prediction?

This paper attempts to address these issues using a database of ESG disclosure scores obtained from Bloomberg. The quality of financial disclosure is positively related to the accuracy of analysts' forecasts (Hope, 2003). Similar to financial data, a higher score indicates that a company discloses more ESG-related information (more transparent information). The above two information spillover effects are therefore separately measured using the average scores of ESG disclosures of peers and average scores of ESG disclosures outside peers which are covered by an analyst. The results suggest that ESG information spillovers from companies in the same industry exist and significantly improve analysts' forecast accuracy. However, no robust evidence shows that the effect of ESG information spillovers from non-peers significantly affects analysts' forecast accuracy. In short, the results support the assertion that those analysts can benefit from ESG information spillovers from companies in the same industry.

There are two contributions to this paper. Firstly, it extends the literature on analyst forecasting. Previous studies mainly focus on the relationship between financial disclosures and the accuracy of analysts' forecasts (Abarbanell & Bushee, 1997; Behn et al., 2008; Brown et al., 1987; Hope, 2003; Lang & Lundholm, 1996). More recently, several studies suggest that analysts should consider non-financial information (Nichols & Wieland, 2009), particularly ESG information, to improve forecasting accuracy (Dhaliwal et al., 2012; Muslu et al., 2019). However, the literature merely focuses on the relationship between the ESG disclosure predicted of firms and the accuracy of analysts' forecasts but fails to mention the ESG disclosure from other firms covered by the same analyst. This study complements the existing literature from the perspective of both peer and non-peer firms by examining their relationship with analysts'

forecasting accuracy.

Secondly, this paper contributes to the literature on ESG spillover effects. Some studies (e.g., Dai et al., 2020; Liang & Renneboog, 2020; Schiller, 2017) indicate that reports on ESG performance can affect other types of stakeholders, such as suppliers and competitors, because of the spillover effects of corporate social responsibility in these corporate networks. These studies, however, focus mainly on ESG performance. In contrast to the existing literature, this study merely focuses on the quality of ESG information disclosure (or transparency) and provides robust evidence supporting the spillover effects of ESG disclosure from peers in the same industry. This reveals a potential mechanism as to how the ESG disclosure transparency of peer firms can be incorporated into the stock price of the estimated company.

2 Literature Review

2.1 The commonality of financial information and spillover effects

There is some evidence that financial information spillover affects analysts' inferences about the earnings performance of the firms in their portfolios (e.g., Luo & Nagarajan, 2015). The information spillover effect is primarily caused by common information across firms. If a firm discloses its financial information in a more detailed and accurate manner, it will reduce the uncertainty of the firm to which it is linked. Analysts can use this method to better infer the earnings performance of related firms in their portfolios, which contributes to improved access to information and productivity, as well as more accurate forecasting (e.g., Kini et al., 2009; Luo & Nagarajan, 2015). Additionally, analysts serve as intermediaries in the transmission of spillover effects of information.

Previous studies have largely concentrated on the spillover effects of financial information disclosure among peer companies. Spillover effects are primarily caused

by several characteristics of financial information. In the first place, firms within the same industry often operate within the same external economic environment. Luo and Nagarajan (2015) assert that the economic events that drive a firm's performance are often linked to economic events experienced by other firms in the same industry.

Furthermore, firms in the same supply chain of industry are tightly linked to one another upstream or downstream. Moreover, there is a correlation between the market's reaction to similar companies. For example, when a firm announces higher earnings, the market response does not only increase for that firm but also for other firms in the same industry (Clinch and Sinclair 1987; Foster, 1981; Han & Wild, 1990).

Lastly, there is a 'peer effect' across firms, in which the business decisions of one firm are susceptible to those of other similar firms. Firms have been shown to refer to and imitate similar activities of their peer firms in making their investment decisions (e.g., Leary & Roberts, 2014; Roychowdhur et al., 2019). Beatty et al. (2013), for example, find that when an industry leader inflates its earnings during an incidence of fraud, its peers also increase investments.

For these reasons, the financial information of peer firms is relevant. Financial information disclosed by other firms needs to be of high quality so that analysts can verify the reliability of the analysed financial information from multiple perspectives. This reduces potential information uncertainty about the analysed firm's business activities and enhances the analysts' ability to acquire and interpret information. The integration of information across companies also enables analysts to analyse in greater depth and produce higher-quality forecasts (Kini et al., 2009).

According to previous studies, the quality of financial disclosure of peer companies tends to have a spillover effect on analyst forecasts. From this, three questions arise: 1)

Do analysts' forecasts consider ESG disclosures? 2) Does the spillover effect also apply to ESG information during forecasting? And 3) Does this spillover effect apply to industry-peer companies as well as non-peer firms? As far as I am aware, no study addresses all three questions simultaneously. In the following sections, a literature review will be conducted around these three questions.

2.2 ESG disclosure and analyst forecast accuracy

There is some evidence that third-party agency ratings of ESG disclosures (reflecting the transparency of ESG information) are positively associated with analysts' forecast accuracy, as ESG information is a valuable input to analysts' forecasting processes (e.g., Dhaliwal et al., 2012; Muslu et al., 2019). Analysts value the disclosure of environmental, social and governance (ESG) information primarily because ESG activities can affect financial performance (either positively or negatively) from multiple perspectives. The higher the level of disclosure of this type of information, the greater the transparency. Increased information transparency reduces uncertainty in the information available. Analysts can benefit from the disclosed ESG information and increase their forecast accuracy.

ESG disclosure has the potential to reduce information opacity for four main reasons. Firstly, ESG activities can influence financial performance via sales. Social responsibility performance can increase the brand value and reputation of a company in markets where consumer awareness of ESG is high, which in turn can enhance how the consumer evaluates a company's products (Brown & Dacin, 1997). Social responsibility performance can also lead to increased sales (Lev et al., 2010). Further, companies with better reputations and those that focus specifically on improving employee well-being through social responsibility performance initiatives are likely to attract better talent and motivate employees to be more productive (Edmans, 2011;

Roberts & Dowling, 2002; Waddock & Graves, 1997), while higher employee satisfaction can translate into better future financial performance (Banker & Mashruwala, 2007). Conversely, companies hesitating on the issues involved in ESG are more likely to adversely affect their sales and financial performance. As an example, in June 1995, Shell's sales decreased by 70% in some countries because Greenpeace boycotted the company due to its decision to abandon an oil platform in the Atlantic Ocean (Werther & Chandler, 2010).

Secondly, the literature points to various ways in which ESG activities can affect financial performance through the financing costs channel. For example, companies with superior ESG performance and/or disclosures have lower financing costs. Dhaliwal et al. (2012) find that companies which publish CSR reports and demonstrate improved CSR performance have a lower equity capital cost. At the same time, investors increasingly value ESG attributes. Growing awareness of ESG investments will result in corporations with poor records in this area being less attractive, thereby lowering stock prices and increasing the cost of capital for these corporations (Gillan et al., 2021). Conversely, Goss and Roberts (2011) find that firms with fewer ESG concerns pay lower interest rates on their bank loans—banks are more inclined to consider soft financing for companies with better CSR recorded by Goss and Roberts (2009). While Qiu et al. (2016) do not find any significant correlation between environmental or social disclosure scores and equity capital costs, Ng and Rezaee (2015) indicate a negative relationship between environmental and governance performance and the cost of equity capital, but not when looking at social performance. Breuer et al. (2018), analysing this issue from the perspective of where the firm is located, measure the relationship between ESG performance, and the cost of corporate capital based on the investor protection laws in the particular country where the firm is based. They note

that in countries with strong (weak) investor protection, higher ESG performance reduces (increases) the cost of capital.

Above are primarily positive effects of firms' ESG activities on their financing costs, but there are also a few ambiguous effects, such as bond costs. A study by Zerbib (2019) finds that green bonds are issued at a negative premium, which suggests that the issuance of bonds for environmental projects could lower the cost of capital for these projects. However, Flammer (2021) finds that the yield spread between a company's green bonds and other bonds is not different, suggesting that the cost of capital for green projects does not decrease.

Third, ESG activities can influence financial performance via the risk channel. ESG can influence a wide variety of risk factors including systemic risk (e.g., Albuquerque et al., 2019; Oikonomou et al., 2012); idiosyncratic risk (e.g., Benlemlih et al., 2018); litigation risk (e.g., Hong & Kacperczyk, 2009); regulatory risk, supply chain risk, product and technology risk, reputational risk, and physical risk (Starks, 2009).

For instance, companies with stronger ESG characteristics may be at risk for different systemic risks (Bénabou & Tirole, 2010), which makes them more resilient and better able to cope with crises (Lins et al., 2017). By contrast, Benlemlih et al. (2018) find a negative and significant correlation between a firm's E&S disclosures and its total and idiosyncratic risk rather than systematic risk. As far as litigation risk is concerned, ESG practices may also act as insurance against the specific legal risks faced by a given organization (Gillan et al., 2021), reducing their exposure to litigation (Hong & Kacperczyk, 2009). Hong and Liskovich (2015) provide evidence that companies with higher ESG ratings receive lenient settlements from prosecutors and have higher market valuations. Moreover, Schiller (2017) found that suppliers were less likely to face

environmental and social litigation when their corporate clients had better environmental and social policies.

Despite this, not all studies indicate an inverse relationship between ESG practices and different types of risk. As an example, Becchetti et al. (2015) claim that ESG increases firms' idiosyncratic risk. This is interpreted as a loss of flexibility for firms to respond to negative productivity shocks caused by ESG activities. As a result, stakeholder welfare is reduced. This relationship leads to higher ESG stock returns that are difficult to predict. Nevertheless, Humphrey et al. (2012) found no differences in idiosyncratic risk when comparing companies with high and low corporate social performance ratings.

Fourth, ESG activities can affect financial performance through management channels. On the one hand, some studies argue (e.g., Albuquerque et al., 2019; Baron, 2007; Bénabou & Tirole, 2010; Fatemi et al., 2015) that high ESG performance is likely to increase shareholder wealth (Gillan et al., 2021). Specifically, Ferrell et al. (2016) find a positive relationship between ESG scores and firm value and extend their analysis to show that having a better ESG performance can reduce the negative correlation between management entrenchment and firm value. In support of this finding, several studies determine that companies with higher ESG ratings have higher operating performance and Tobin's q (e.g., Gao & Zhang, 2015; Gillan et al., 2010). Further, Iliev and Roth (2020) estimate that an increase in ESG activities at director-driven firms leads to an improvement in ROA and other operating performance indicators.

On the other hand, some studies (e.g., Bénabou & Tirole, 2010) suggest that ESG activities could be indicative of or worsen managerial agency problems, with company managers engaging in these activities to increase their utility rather than the welfare of

shareholders. Di Giuli and Kostovetsky (2014) conclude that a firm's ESG score had a significant negative correlation with changes in ROA or stock returns over the three years of their study. In their view, the benefits to stakeholders associated with social responsibility result in a reduction of the value of the company. Buchanan et al. (2018) conclude—using Bloomberg ratings of the level of ESG disclosure—that agency conflicts increased during the financial crisis, and the ensuing costs of ESG overinvestment led to a significant decline in firm value for companies with higher ESG ratings.

Overall, the existing literature provides evidence that ESG information disclosure reduces opacity related to financial information. Analysts can infer useful information from disclosed ESG information that can be used to make forecasts. Dhaliwal et al. (2012) provide anecdotal empirical evidence that analysts use disclosed ESG information. In a 2003 survey conducted by Deloitte, CSR Europe and EuroNext of about 400 mainstream fund managers and financial analysts in nine European countries, about 80% of respondents state that ESG activities have a positive impact on the long-term value of their companies. And 50% of them have taken ESG information into account in their analysis (CSR Europe & Deloitte, 2003).

2.3 ESG disclosure, spillover effects, and forecast accuracy

Several studies (e.g., Dai et al., 2020; Liang & Renneboog, 2020; Schiller, 2017) examine the spillover effects of CSR information generated by the commonality of information in supply chain networks. This is manifested by the fact that high-performing companies with CSR influence the financial returns of their suppliers and competitors. In addition, these studies suggest that the spillover effect is a unilateral influence transmitted by customers to suppliers. Dai et al. (2020) find that a one standard deviation change in a customer's CSR rating leads to a total increase of

approximately 8% in a supplier's CSR performance through the customer's direct network, suggesting that customers have a positive influence on suppliers' CSR practices and that suppliers respond to their customers and act in a similarly responsible fashion. Another example is shown by Schiller (2017) who demonstrates that E&S policies can be shared between customers and suppliers, who then reduce toxic emissions, reduce litigation risk, and improve financial performance, demonstrating that proactive customers influence suppliers' E&S policies and actions.

Along with its transmission within the network of supply relationships, the disclosure of ESG also meets other conditions in contributing to the spillover effect (in section 6.1). Many of the companies covered by the same analyst operate in the same macroeconomic environment. This is because, in their effort to maximize productivity within a limited time and other analysing resources, analysts tend to focus on companies within the same market segment. ESG activities have macro aspects as well. As Cai et al. (2016) and Liang and Renneboog (2017) demonstrate, country characteristics appear to play a significant role in explaining firms' ESG activities. The research by Cai, Pan, and Statman suggests that differences in ESG attributes between countries are more closely related to country factors than to firm characteristics. Furthermore, the authors provide evidence that economic development, law, and culture all contribute to these differences. The latter study suggests that legal origins are the strongest predictors of corporate ESG adoption and performance, as they are more important than political institutions, regulations, social preferences, and the financial and operational performance of the firm compared to its peers.

Additionally, changes in market characteristics within states are important (Gillan et al., 2021). A company's KLD score is influenced by the political orientation of the state in which it is headquartered (Di Giuli & Kostovetsky, 2014). Furthermore, at the county

level in the United States, a company's KLD score is influenced by the social capital of the area in which it is headquartered (Jha & Cox, 2015). The results of these studies indicate that ESG activities are highly correlated with the local macroenvironment. As these macro-environments are correlated, analysts can take advantage of economies of scale in information acquisition and production (Clement, 1999).

Furthermore, the market reacts broadly to ESG activities or events. The Volkswagen emissions scandal is a prime example of this. In September 2015, the US Environmental Protection Agency claimed that Volkswagen had installed software designed to circumvent emissions tests to avoid official inspections. When driven at normal times, the cars emitted large amounts of pollutants, up to 40 times the legal limit for the United States (United States Environmental Protection Agency, 2021). Due to this ESG scandal, not only did the CEO resign but also the head of research and development at Audi as well as the head of engines at Porsche. One after another, the following countries launched investigations or lawsuits against Volkswagen in the following month: South Korea, Australia, France, Germany, Sweden, Italy, Norway, and India (Reuters, 2017). The VW case provides strong evidence of the wider impact of ESG activities. Aside from this, European regulators have tightened environmental regulations on cars in the wake of Volkswagen's 'Emissionsgate' scandal. By 2021, European car manufacturers must reduce the carbon emissions of new vehicles to less than 95 grams per kilometre (Reuters, 2021). The ESG incident may also have long-term implications for the company as a whole and the industry. Both broad and long-term implications contribute significant inputs for analysts' forecasts.

Lastly, there is frequently a peer effect for actions relating to ESG. Using a regression discontinuity design (RDD), Cao et al. (2019) conclude that when a firm adopts a low adoption rate for ESG proposals and then implements the proposals' recommendations,

its peers tend to then adopt similar practices. This peer effect can also be applied to institutions and firms. Dimson et al. (2021), for example, found that coordinated action among institutional investors participating in Principles for Responsible Investment (PRI) influences firms' ESG selections. In most cases, these investors employ a 'behind-the-scenes' engagement strategy (McCahery et al., 2016). Thus, ESG activities can have an effect not only on the initiating firm but also on other firms.

Overall, the literature suggests that the disclosure of ESG information satisfies the conditions for spillover effects to occur. In theory, this spillover effect of disclosure is not limited to companies in the same industry, as the association of ESG data has implications on a macro scale and often transcends industry boundaries. When analysts predict the performance of the companies they cover, ESG information disclosed by multiple companies not only reduces the analyst's uncertainty about the company, but also the commonality between ESG information affords analysts economies of scale in information acquisition and production. Additionally, if analysts can trace the original ESG disclosure documents, they will be able to perform a cross-check of the reliability of the information contained in each company's disclosure. Undoubtedly, multiple sources of information provide analysts with the opportunity to arrive at multiple understandings vis-à-vis ESG disclosure, thereby contributing to greater accuracy in the analysts' forecasts.

3 Hypotheses

Firms do not exist as separate entities, but rather are interconnected through multiple relationships. Some of these links are explicit and contractual, while others are implicit and less transparent (Cohen & Frazzini, 2008). Specifically, the former is an explicit economic tie, which is responsible for causing the spillover of financial information during the forecasting process. Therefore, the ESG information spillover effect assumes

that the information is valuable to the analyst and that there is some similarity in the information among the firms being analysed. The latter implicit links, although not contracted, should not be ignored by the market. These 'invisible' links may provide the key to unlocking Pandora's Box. The importance of invisible links can be seen in the scandals involving environmental, social, and governance (ESG) in recent years (e.g., Volkswagen). In addition to affecting the financial performance of the companies involved, these scandals have also negatively affected the long-term development of the industry.

In their role as market 'spotters', analysts have no reason to disregard ESG information and ESG links between companies. It has been seen that current literature highlights two important characteristics of the relationship between ESG disclosure and analyst accuracy. First, a firm that discloses a high level of environmental, social, and governance information reduces the level of information opacity and enables analysts to accurately predict the impact of ESG factors on the company's future performance. In other words, ESG information of the forecasted company is a useful input to analysts and is positively correlated with their forecast accuracy (e.g., Dhaliwal et al., 2012; Muslu et al., 2019).

Secondly, the same ESG activities/events have been shown to have a range of potential consequences for the future performance of a company, which may vary depending on its industry. Furthermore, the affecting channels are diverse and include primarily sales (e.g., Brown & Dacin, 1997; Lev et al., 2010), financing costs (e.g., Dhaliwal et al., 2012; Gillan et al., 2021; Goss & Roberts, 2011) and risk (e.g., Albuquerque et al., 2019; Bénabou & Tirole, 2010; Hong & Kacperczyk, 2009; Schiller, 2017) channels. By examining the ESG disclosures of the companies being analysed, analysts can reduce their analytical errors and improve the precision of their analysis. Consequently,

analysts' forecasts are increasingly more accurate. Based on these characteristics and projections, I derive the following H0 that ESG information of the forecasted firm can be useful to analysts:

Hypothesis 0 (H0): *ESG disclosure of a forecasted firm can provide analysts with valuable information. Consequently, a higher level of ESG disclosure by forecasted firms leads to a more accurate earnings forecast.*

Considering the commonality of information among firms in the same industry, analysts can more effectively infer the earnings performance of the firms in their portfolios (Luo & Nagarajan, 2015). Additionally, analytical portfolios may also include companies from other industries due to interfirm linkages (e.g., supply chain relationships). Luo and Nagarajan (2015) focus on companies with supply chain relationships in analysts' analytical portfolios. According to their sample, 64% of the suppliers and their main customers come from different industries. This indicates that the analysts cover companies spanning more than just one industry. Furthermore, due to the commonality of information between supplier chains, other companies covered by the same analyst also disclose their ESG information, which is often related to the estimated firm, thereby constituting an important source of information for the analyst (e.g., Kini et al., 2009; Luo & Nagarajan, 2015). With more efficient access to information, analysts can devote more time and attention to interpreting it. Also, if the origin of the ESG information disclosed by other firms can be traced back, the analyst can investigate the reliability of the ESG information disclosed by the company under analysis or supplement this with the disclosures from other companies.

The commonality of this information across industries can also be explained by how ESG information is disseminated. First of all, on a micro level, the stakeholders of ESG

information are also those disseminating the information, including customers, employees, suppliers, communities, and other stakeholders. A statement on the purpose of a corporation was issued by the Business Roundtable on August 19, 2019, signed by 181 CEOs who committed to leading their organizations for the benefit of all stakeholders–their customers, employees, suppliers, communities, and shareholders ("Business Roundtable Redefines the Purpose of a Corporation to Promote 'An Economy That Serves All Americans'", 2019). These stakeholders are involved in a wide range of social activities (due to community involvement), and the impact of ESG information can be transmitted to other sectors through their involvement in social activities. For example, more than 100,000 workers in the United States, including those on food production lines and machines, nurses in Massachusetts, and Hollywood employees, went on strike to demand better benefits in October of 2021 (Thomas, 2021). Secondly, ESG-related organizations often cross industry boundaries and possess a more macro-level character. The World Economic Forum, for example, is developing a growing set of sustainability indicators for companies to report on. Companies are being requested by investors and stakeholders to report on their ESG performance, and many are doing so voluntarily (Edmans, 2021). Moreover, some organizations that focus on ESG and related topics, such as International Labour Organization and the United Nations Global Compact[1], are examining the long-term value of ESG information from a more comprehensive perspective. It is possible for companies in different industries to share information if ESG information has a degree of macro characters, such as macroeconomic data.

In accordance with the existing literature, in this study, other companies covered by the

[1]These organizations are listed on the official website of The Library of Congress ("Research Guides: Corporate Social Responsibility (CSR): A Resource Guide: Organizations", n.d.). https://guides.loc.gov/corporate-social-responsibility/organizations

same analyst, in addition to the company being forecasted, could be divided into two groups: companies from the same industry as the estimated firm (henceforth, referred to as peer companies) and companies from a different industry than the estimated firm (henceforth, referred to as non-peer companies). Theoretically, the disclosure of ESG information of both peer and non-peer companies has a spillover effect on the prediction of the financial performance of the predicted firm. Thus, analysts can use the ESG disclosures of other companies as a complement or validation of the ESG information of the predicted company to improve the accuracy of their predictions. On this basis, the following two hypotheses are proposed:

Hypothesis (H1): *ESG information of peer firms is valuable for analysts forecasting the estimated firm. As a result, ESG information disclosures of peer firms have a significant impact on analysts' forecast precision.*

Hypothesis (H2): *The ESG information from non-peer companies is useful to analysts in predicting the performance of the company being valued. Therefore, analysts' forecasts are significantly influenced by the disclosure level of ESG information of non-peer companies.*

An important point to consider is that ESG disclosure by peer and non-peer firms varies in its impact on analysts' forecasts. It is well established in psychology that individuals can allocate their attention to various tasks. There is evidence to suggest that individuals have difficulty handling multiple tasks simultaneously (e.g., Cohen & Frazzini, 2008). Attention is a scarce cognitive resource and focusing on one task requires a substitution of cognitive resources from other tasks (Kahneman, 1973). Consequently, given the vast amount of information available and the limits to cognitive resources, analysts may need to assess the data, and then select and prioritize key information.

Firstly, the quality of ESG information that is disclosed by a firm itself has a direct impact on analysts' forecast accuracy. This was confirmed by Bernardi and Stark (2018) after studying the changes in South Africa's reporting regime between 2008 and 2012—the greater the level of ESG disclosure, the more useful these links are. Krueger et al. (2021) continue to lend credence to this argument, asserting that mandatory ESG reporting can contribute to a better financial reporting environment for companies. By requiring ESG disclosure, analysts' earnings forecasts become more accurate and less dispersed. I anticipate that the extent of ESG disclosure by the forecasted firm will have a greater impact on analyst accuracy than either of the spillover effects.

Secondly, I anticipate greater spillover effects from ESG disclosure from peer companies than from non-peer companies. Certainly, in predicting financial performance, analysts can more effectively infer the performance of their portfolio companies by using the commonality of information between companies in the same industry. If analysts consider ESG information disclosed by other companies, they may use the same analytical technique used for financial information—obtaining common information from peer companies. Thus, analysts may place greater emphasis on ESG information disclosed by peer companies than on information disclosed by non-peer companies. Based on these two points, I make the following predictions:

Hypothesis (H3): *A firm's own ESG disclosure quality has a greater impact on the accuracy of analysts' forecasts than that of its peers.*

Hypothesis (H4): *The degree of ESG disclosure of peer firms has a greater impact on analysts' forecast accuracy than that of non-peer companies.*

H3 and H4 would be valid only if H0 and H1 are valid at the same time, and if H1 and H2 are valid at the same time, respectively. Only if these information disclosures have

a significant impact will further comparisons be relevant.

4 Data and Research Design

4.1 Sample selection

Three datasets are analysed for testing these hypotheses: Compustat (which contains financial statements), Bloomberg (which contains CSR disclosure information), and I/B/E/S (which includes analyst forecasts). To begin, I select all American firms with no missing values from Bloomberg's CSR disclosure data for 2004-2020. The sample starts with 2004 because this is the earliest year for which CSR disclosure data is available. Financial institutions (SIC codes 6000-6999) and utilities (SIC codes 4900-4999) are regulated institutions and are excluded from the sample. Following that, I combine the Bloomberg sample with forecast errors calculated using I/B/E/S estimates and actual EPS values as well as Compustat financial data. Bloomberg comprises four ESG disclosure angles: environmental, social, and governance, as well as their combined scores. From 2004 to 2020, the final sample includes 380,426 annual-company-analyst observations, consisting of 162,532 observations from the one-year forecast window, 147,951 observations from the two-year forecast window, and 69,943 observations from the three-year forecast horizon.

[Insert Table 2 here]

Table 2 presents the sample composition by year and industry (based on the Fama-French 30 industry classification). For one-year and two-year forecasting periods, the year-by-year sample (panel A) shows a similar pattern. More specifically, in our analysis, there are fewer than 10,000 observations before 2010, stabilizing over 10,000 from 2010 to 2019 and peaking in 2013 with approximately 13,000 to 14,000 observations. For the three-year horizon, the sample peaks in 2015 (with 6,891

observations) before slowly declining. The small number in the first three years of the sample is since 2004 is the first year in which Bloomberg ESG disclosure scores are released, and the subsequent rapid growth is due to the increase in companies providing continuous Bloomberg ESG disclosures. There are fewer observations for 2020 over the one-year forecast period, mainly because many companies have not yet disclosed their actual earnings per share figures for 2020, making it difficult to calculate the number of analysts' forecast errors available for that year. The same reasoning applies to the sample of 2-year and 3-year forecasts for 2019. The distribution of industries in the sample is based on the Fama-French classification of 30 industries.

Panel B demonstrates that for all observation periods, the five industries with the largest sample distribution are as follows: business equipment (code 23), personal and business services (code 22), healthcare, medical devices, and pharmaceutical products (code 8), retail (code 27), and oil and gas (code 19). In both the one and two-year forecast periods, business equipment is the industry with the largest sample distribution. However, for the forecast period of three years, the most preferred sectors are health, medical devices, and pharmaceutical products. One possible explanation is that pharmaceutical products have long development cycles and thus attract the attention of analysts who make long-term forecasts.

4.2 Model and variables

Model

To investigate the spillover effects of peer and non-peer firms' ESG disclosure on the analyst forecast accuracy under the same analyst, I use multiple regression to regress individual analyst's forecast error (of which a detailed definition can be found in the dependent variables section) for a particular firm on the ESG disclosure score (both

individual and overall scores) as follows:

$$ERR\_ACT_{i,j,t} = \beta_0 + \beta_1 CSRG_{i,t} + \beta_2 CSRG\_P\_DIS_{i,j,t} + \beta_3 CSRG\_NP\_DIS_{i,j,t} + \sum \beta_n \, Controls_n + \sum \delta_n \, FE + \varepsilon \quad (1)$$

where *i, j*, and *t* denote the firm, analyst, and fiscal year, respectively.

The model is based on the ordinary least square (OLS) method with a robust standard error at the analyst level. The dependent variable, $ERR\_ACT_{i,j,t}$, represents the forecast error of analyst *j*'s EPS estimates for firm *i* for fiscal year *t*. $CSRG_{i,t}$, $CSRG\_P\_DIS_{i,j,t}$ and $CSRG\_NP\_DIS_{i,j,t}$ quantify, respectively, the impact on analyst forecasting errors of a firm's ESG disclosures, those of peer firms, and those of firms from other industries. More details on the specific definitions and calculations of the independent and dependent variables and control variables are given in the following sections. Further, I incorporate analyst fixed effects, which may affect the relationship between analysis accuracy and the various types of ESG disclosure scores. Dummy variables are defined based on broker and analyst codes. Also included are yearly dummy variables within the sample period to control the economic conditions that vary over time.

ESG disclosures

The initial sample is drawn from the Bloomberg ESG Disclosure Database, a database established in 2004 that evaluates the extent and quality of ESG disclosure information in terms of environmental factors, social factors, governance, and an aggregated score. The ratings are considered indicative of both the extent and quality of ESG disclosure, whilst the coverage of companies in the dataset is expanding over time. The database contains approximately 300 entities between 2004 and 2006, 1,800 between 2007 and 2009, and 4,000 between 2010 and 2019. The disclosure scores range from 0 to 100, with 0 representing no ESG disclosure and 100 representing the most comprehensive.

Bloomberg's ESG disclosure score is derived by combining three separate ESG disclosure scores (environmental, social, and corporate governance) to quantify the transparency of companies that disclose ESG information (Ioannou & Serafeim, 2019).

Based on the Bloomberg ESG database, three independent variables are set. The $CSRG_{i,t}$ represents the estimated firm's ESG score disclosure score in year t, which can be divided into five angles: including the environmental (E), social (S), governance (G), environmental and social (ES) angles combined, and the overall ESG scores. E, S, G, and the overall ESG are the original data from the Bloomberg ESG database. Data for E, S, G, as well as the overall ESG can be retrieved from the Bloomberg ESG database and ES is the average of E and S. To assess the effects of the ESG disclosure scores of other firms on the analyst's forecast error for firm *i* (forecasted firm), the other companies covered by the same analyst are divided into two groups: those in the same industry as firm *i* and those in a different industry. Next, I use the mean of peer firms' ESG (for each angle) disclosure scores as the value of $CSRG\_P\_DIS_{i,j,t}$ (*CSRG=E, S, G, ES or ESG*). Furthermore, the mean of non-peer firms' ESG (for each angle) disclosure scores is the value of $CSRG\_NP\_DIS_{i,j,t}$ (*CSRG=E, S, G, ES or ESG*).

[Insert Table 3 here]

Table 3 summarizes the descriptive statistics for ESG disclosures. The A, B, and C panels provide information about the forecasted firm's ESG disclosure score, the ESG disclosure score of peer companies, and the ESG disclosure score of non-peer companies, respectively. The disclosure scores of each panel are organized along five angles: E, S, G, ES, and ESG. The mean (median) values for the other angles, except governance and ES alone, are distributed between 20 and 25 (between 17 and 22). The mean values for ES are lower than the values for E and S taken alone. This is because

when calculating the ES, if a single angle is missing, it is recorded as zero, lowering the mean (i.e., ES) of the two items. Observing the maximum and minimum values, I find that there are larger distribution ranges for these four angles, but the scores tend to be scattered below 50. As opposed to the other four angles, the disclosure scores for G are generally higher, with a mean and median of approximately 55 and 51, respectively. These relatively higher scores can be interpreted from a practical regard: governance information is part of a company's operating information, is more closely related to the company's financial information, and is disclosed in the annual report. Thus, the level and quality of governance information disclosure are higher when compared with other angles.

Dependent variable

To measure the forecast accuracy, I use analyst forecast error as the dependent variable. The larger the error, the less accurate the forecast is. Following Bebchuk et al. (2011), Duru and Reeb (2002), Herrmann and Thomas (2005) and Loh and Mian (2006), the forecast error is defined as:

$$ERROR(H)_{f,i,j,t} = \frac{\left|EST^{H}_{f,i,j,t} - EPS^{H}_{i}\right|}{\left|EPS^{H}_{i}\right|} \quad (2)$$

where *f*, *i*, *j*, *t* indicate individual forecast, firm, analyst, and the year of making the forecast, respectively. *H* can be one of three values, 1, 2, or 3 to represent a forecast horizon of one year, two years, or three years. $EST^{H}_{f,i,j,t}$ is the estimated value of earnings per share for firm *i* in forecast *f*, which is made by analyst *j* in year *t* with an *H*-year forecast horizon. EPS^{H}_{i} is the actual corresponding EPS value of the forecasted firm *i* of the estimated year. Analysts typically issue multiple forecasts for a single company within a year. In this study, the error is calculated using only the first forecast of the year. Accordingly, for each analyst *j*, the forecast error for firm *i* in year *t*

$[ERR\_ACT(H)_{i,j,t}]$ is calculated as follows:

$$ERR\_ACT(H)_{i,j,t} = ERROR(H)_{first,i,j,t} \quad (3)$$

where first indicates the first forecast made by analyst *j* for firm *i* in year *t*. Other indicators are defined similarly to equation (2).

[Insert Table 4 here]

Panel A of Table 4 presents descriptive statistics for the dependent variable for each of the three forecast horizons. Accordingly, the means of forecast errors for 1, 2 and 3 years are 25%, 53% and 68%, respectively, indicating an increase in forecasting errors as the forecast period increases. An extended forecast window can result in a greater possibility of uncertainties affecting an organization's earnings per share, which may lead to an increase in analysts' forecast errors.

Control variables

To isolate the spillover effects of ESG disclosures on analysts' forecasting error, I apply several potential control variables that have been used in previous forecasting error studies, including:

The environmental, social, and governance performance of the estimated firm ($CSRG\_PFM$, where *CSRG=E, S, G, ES, or ESG*). Performance of firm *i*'s ESG in the one fiscal year preceding the forecast, including E, S, G, ES, and ESG. Data are derived from the Bloomberg ESG performance database, including environmental (E), social (S), and governance (G) three angles. The two composite scores, ES and ESG, are equally weighted averages. An ESG performance score ranges from 0 to 10, with 0 representing no performance score and 10 representing the highest level of performance.

The environmental, social, and governance performance of peer companies are from

the same analyst ($CSRG\_P\_PFM$, where *CSRG=E, S, G, ES, or ESG*). The ESG performance score of firm *i*'s peers in the one fiscal year preceding the forecast include E, S, G, ES, and ESG, respectively. Data are also derived from Bloomberg's ESG performance database. The two composite scores, ES and ESG, are derived following the last paragraph. I then select firm *i*'s peer companies covered by analyst *j*. The value of $CSRG\_P\_PFM$ is then determined by averaging these firms' ESG performance scores (including E, S, G, ES, and ESG five angles).

Environmental, social, and governance performance of firm *i*'s non-peer firms are covered by the same analyst ($CSRG\_NP\_PFM$, where *CSRG=E, S, G, ES, or ESG*). ESG performance scores for non-peer companies of company *i* in the one fiscal year preceding the forecast are for the five angles E, S, G, ES, and ESG. The process is the same as in *CSRG_P_PFM*, except that non-peer companies are selected in the first round instead of peer companies.

Firm size (*SIZE*) proxies for a firm's general information environment and various correlated factors (Atiase, 1985; Dhaliwal et al., 2012; Hope 2003; Muslu et al., 2019). The coefficient estimate for *SIZE* is expected to be negative since a better information environment makes forecasting easier.

Companies that have suffered accounting losses (*LOSS*) in the previous year have more uncertainty about their accounting performance in the following year, which makes forecasting more difficult for analysts (Hope, 2003; Dhaliwal et al., 2012) and may lead to higher forecast errors. As a result, the coefficient on *LOSS* is expected to be positive.

A leverage ratio (*LEV*) represents the information needs of debtors who are concerned with the downside risk of a company (Goss & Roberts 2011; Simnett et al., 2009). On the one hand, it would be reasonable to expect a positive coefficient estimate since

leverage increases the volatility of corporate earnings and increases the uncertainty of forecasts. On the other hand, some leverage, such as bank credit, comes with external regulatory effects. Companies must minimize uncertainty in their operations to meet credit criteria. At the same time, this is also advantageous for the analysts, and therefore *LEV* is expected to have a negative coefficient estimate.

The return on assets (*ROA*) measures the profitability of a firm. Analysts' forecasts are more likely to be accurate if the company maintains a positive trend in profitability. This is because positive earnings increases usually have a low 'ceiling', whereas losses are difficult to estimate, particularly unexpected losses. Therefore, analysts' forecasts are likely to be more accurate if earnings continue to rise. In other words, *ROA* is likely to be a negative factor in the forecast error.

The higher the earnings volatility (*ROAVOL*) for a company, the more difficult it is for analysts to forecast its performance (Dichev & Tang, 2009; Muslu et al., 2019). Therefore, *ROAVOL* is expected to have a positive coefficient.

I use accruals (*CC_ACC*) as an indicator of financial opaqueness. I adopt the absolute value of the accruals, averaged over the prior three years, following previous literature (e.g., Bhattacharya et al., 2003). According to Larson et al. (2018), accruals are conditionally conservative accruals derived from the statement of cash flows. A high proportion of accruals indicates an aggressive attitude toward earnings. Since earnings aggressiveness refers to the tendency to defer the recognition of losses while accelerating the recognition of gains, if cash flows are equally realized, then we would expect accruals to rise as earnings aggressiveness increases. Furthermore, earnings aggressiveness is a measure of the opacity of earnings. An accumulation of accruals implies significant earnings opacity, which prevents analysts from obtaining partial

earnings information, which is detrimental to forecast accuracy. Therefore, *CC_ACC* is expected to have a positive coefficient.

The number of analysts following (*FBA*) is also considered a control variable. When a firm is followed by a larger number of analysts, this stimulates or motivates competition among analysts. To survive the fierce competition, analysts must improve their accuracy (Lys & Soo, 1995; Muslu et al., 2019). Therefore, the *FBA* is estimated to have a negative coefficient.

The variables related to other peer firms as well as non-peer firms are calculated similarly to *CSRG_P_PFM* and *CSRG_NP_PFM*. The main difference is that the ESG performance variables are replaced with specific control variables, including *SIZE*, *LOSS*, *LEV*, *ROAVOL*, and *CC_ACC*.

In the robustness testing section, additional dependent variables and alternative control variables are used. The new dependent variables *ERR_PRICE*, *ERR_TA*, and *ERR_STD* are defined similarly to equation (2). The difference is, however, that the denominators in equation (2) are replaced by the absolute value of prices at the beginning of the forecast period, total assets, and the standard deviation of the analyst's forecast errors, respectively. There are two alternative accruals, including the composite accrual (*COMPACC*) and the absolute value of the company's accruals averaged over the past three years (*N_ACC*). The details of the calculation are presented in Table 1.

[Insert Table 1 here]

Various tables provide additional information on the above variables. For example, panels B to D in Table 4 show the descriptive statistics for all variables. In addition, detailed calculations of all variables are provided in Table 1. Further, the correlation coefficients between variables are shown in Table 5.

[Insert Table 5 here]

5 Empirical Evidence

In this section, I examine the impact of the ESG disclosure quality of other firms covered by analysts on the accuracy of analyst forecasts for the estimated firms, starting with two composite ESG disclosure scores. Furthermore, this section examines the impact of the disclosure of individual components of environmental, social, and governance of other companies on forecast accuracy. In addition, the last sub-section of this section expands the forecasting window to include two-year and three-year periods.

To test H3 and H4, I need to compare the standardised coefficients of those three independent variables, which reflect the relative effect of different independent variables on the dependent variable and can be used to measure the relative influence of each independent variable on the dependent variable. More specifically, the greater the absolute value of the standardised coefficient of a variable, the greater the influence of the variable on the dependent variable. However, unstandardized coefficients can only reveal absolute effects. Therefore, I report only the standardised coefficients for all variables in the following analysis. Lastly, the generic symbol "*CSRG*" is utilized to indicate the five different ESG disclosure scores for demonstration purposes. The labels for each column indicate the specific ESG disclosure scores for each model.

5.1 The overall ESG disclosure scores and forecast errors

Table 6 summarizes the results of estimating equation (1) using OLS when the forecast window is one year. The results have been corrected for heteroskedasticity and use clustered standard errors on the analyst level. Accordingly, the first and second columns represent the results when *CSRG* is ESG and ES, respectively, which means that the

main difference between the two is whether the governance disclosure is included. The estimated coefficient on *CSRG* in the first column (*CSRG = ESG*) is negative and statistically significant (at the one per cent level). Thus, the greater the level of consolidated ESG disclosure of the company itself, the lower the prediction error of the analyst, and the higher the prediction accuracy. This result is in line with the H0.

[Insert Table 6 here]

If we continue to focus on the first column, it is not difficult to find support for H1 and H3, respectively, when considering the results for the variables regarding spillover effects of ESG disclosure by other companies (*CSRG_P_DIS* and *CSRG_NP_DIS*). Continuing this theme, the negative and significant (at the 5% level) coefficient for *CSRG_P_DIS* suggests that a higher degree or quality of ESG disclosure by peers can reduce analysts' forecast errors, such that H1 is supported. In the case of non-peer firms, the coefficient on *CSRG_NP_DIS* is positive. Therefore, analysts' forecast error for the predicted firm is increased by high-quality ESG disclosure for non-peer firms.

There are two possible interpretations of this positive sign. The ESG information disclosed by non-peer firms may provide information relevant to the predicted firm, but the value of the information is limited. Analysts must spend more time and effort in collecting and analysing this information, which causes them to divert their attention and time away from the predicted firm. As a result, they are more likely to make errors in forecasts and thus offset the positive impact of ESG information on non-peer companies, thereby increasing forecast errors.

Another understanding is that non-peer companies' ESG information interferes with the extraction of useful information by analysts. When non-peer firms disclose qualified ESG information, analysts are faced with more information and their cognitive capacity

is limited, compelling them to select a limited number of sources of information they deem most important (Cohen & Frazzini, 2008). Some information that is useful for forecasting may be unintentionally discarded through this process, which may lead to a bias in analysts' forecasts. For either reason, this positive effect is statistically insignificant. Therefore, this result does not support H2.

Next, I compare the effects of the three disclosure scores on prediction error (i.e., H3 and H4). From the comparison, in column 1, the absolute values of the standardised coefficients of the three variables are *CSRG*, *CSRG_P_DIS*, and *CSRG_NP_DIS*, in decreasing order. The results indicate that the degree of ESG disclosure of the forecasted firm has the largest impact on the analyst's forecast error, followed by the quality of ESG disclosure of peer firms, while the quality of non-peer firm disclosure has the least impact. H4 could not be supported as the coefficient on *CSRG_NP_DIS* is not statistically significant.

By excluding the scores for governance, the disclosure quality in the second column considers the environmental and social disclosures. The H0, H1, and H3 are also confirmed. In particular, the *CSRG* is negative and significant at the 1% level, indicating that a better quality of ES disclosure by the predicted firm would reduce analysts' forecast errors. Accordingly, this is consistent with the results of Bernardi and Stark (2018) and supports the H0. Further, the coefficient of *CSRG_P_DIS* is negatively significant (at the 5% level) and its absolute value is smaller than that of the *CSRG* coefficient. This suggests that the disclosure of ES by peer firms can significantly influence the forecast accuracy of the analysed firms, although this effect is smaller than the level of overall environmental and social disclosure by the analysed firms. In accordance with the first column, this result supports H1 and H3. In addition, I do not find a significant coefficient for *CSRG_NP_DIS* in the second column, although this

coefficient is positive and smaller than the coefficient for *CSRG_P_DIS*. Accordingly, a higher level of ES disclosure by non-peer firms is associated with an error in the analyst's prediction, but this error is smaller than the level of ES disclosure by non-peer firms and is not statistically significant.

For the control variables, the results are largely consistent with our expectations, except for the positive coefficient on *FBA*. The discussion is omitted here since this coefficient is not statistically significant.

Together, the results in columns one and two support H0, H1, and H3. Furthermore, when the results in the first column are compared with those in the second column, it becomes apparent that the results do not change significantly if the score for the level of governance disclosure is excluded. In general, in ESG, companies' governance information is disclosed more, as indicated in Table 3 with a higher disclosure score. Also, the level of governance within a company has a direct effect on its operating performance. As a result, when reviewing the results in the first column, there is concern about whether the significant results for the level of ESG disclosure are primarily determined by the level of disclosure of governance information.

The results presented in the second column, however, dispel this concern, since the H0, H1 and H3, still hold even when only ES disclosures are considered. In addition, the similarity of the results in the second column with those in the first raises the question: if only the level of disclosure of governance is considered, is the impact on forecast error insignificant or is it like the combined effect of ES? To investigate this question further, the next subsection will examine the impact of the level of disclosure of environmental, social, and governance information separately on analysts' forecast accuracy for the predicted firm.

5.2 Individual components of ESG and forecast errors

To avoid masking the impact of individual ESG angles through the aggregation of ESG disclosure scores (Bouslah et al., 2013; Galema et al., 2008), I present three angles of the individual environmental (E), social (S), and governance (G) disclosure scores in this subsection and examine their relationship with prediction errors. As such, Table 7 replaces the overall ESG and ES scores in Table 6 with each angle of ESG, i.e., *CSRG* considers environmental (Model 1), society (Model 2), and governance (Model 3).

[Insert Table 7 here]

Results in Table 7 generally appear to support H0, H1 and H3. The analysis starts with the third column (i.e., CSRG = governance). The coefficients on CSRG, *CSRG_P_DIS*, and *CSRG_NP_DIS* are negative significant (on the 1% level), negative significant (on the 5% level), and positive insignificant, respectively. The absolute values of the standardised coefficients are *CSRG*, *CSRG_P_DIS*, and *CSRG_NP_DIS*, in descending order. These results are consistent with those found in Table 6. Moreover, these results also provide an answer to the question raised at the end of the previous subsection, namely whether the results of considering disclosures of governance information alone are consistent with, and not insignificantly different from, considering disclosures of ES information in concert.

When the CSRG includes only the environmental angle, the results in Table 7 are like those in Table 6. A negative and significant (at the 1% level) coefficient of *CSRG* indicates that forecasting the level of environmental disclosure of the predicted firm reduces the analyst's prediction error. Further, the results of the level of environmental disclosure of peer firms covered by the same analyst suggest that the forecast error of the forecasted firm can be reduced if the level of environmental disclosure of peer firms

is high, indicated by a negatively significant coefficient. Comparatively to Table 6, the significance level of the coefficient for this effect drops to 5%. Furthermore, regarding the level of environmental disclosure for non-peer firms, the results are consistent with those presented in Table 6, i.e., a negative, but insignificant coefficient on the forecast error. The absolute values of the coefficients of the three independent variables are also consistent with previous findings.

The significant results support the H0, H1, and H3 when only social is included in the *CSRG*, which will not be repeated here. It is noteworthy that the coefficient on *CSRG_NP_DIS* is negative in the second column, suggesting that the higher level of social information disclosure by firms that are not peers may have the effect of reducing analysts' prediction errors, as opposed to aggregating the overall ES disclosure. An explanation may be that social information has a broader reach, often crossing industry boundaries. As an example, over 100,000 people in the United States went on strike in October of 2021 to demand better benefits, including workers on machinery and food production lines, nurses in Massachusetts, and Hollywood employees (Thomas, 2021). Analysts can benefit from such cross-industry commonalities in information and reduce analytical error. Unfortunately, this effect does not appear to be statistically significant.

Overall, the results obtained when the ESG is broken down into environmental, social and governance angles are consistent with the results of the combined ESG scores, providing further evidence for H0, H1, and H3. Building on this, the next subsection examines the results for the longer forecast period window.

5.3 Longer forecast horizons

For extending previous conclusions, I increase the prediction horizon to two and three years, respectively. I then examine the impact of three independent variables that are

associated with ESG disclosure scores on the prediction accuracy based on the five angles of ESG disclosure using an OLS model.

[Insert Table 8 here]

In Table 8, the results are presented for a two-year forecasting period. Models 1 through 5 are presented along with the results for the total ESG disclosure score, the total ES disclosure score, the environmental disclosure score, the social disclosure score, and the governance disclosure score. Individual ESG disclosure scores (columns 3 to 5) are considered first. In the case where *CSRG* only includes disclosure scores for environmental (social) information, the results in column 3 (4) are generally consistent with the one-year window, i.e., they support H0, H1, and H3. There is a slight difference in that the significance level of the *CSRG_P_DIS* coefficient falls to 10%. However, the result differs significantly from the one-year forecast window when only governance disclosure scores are included in the *CSRG*. The spillover effect of peer company disclosure of governance information on analysts' forecast errors is no longer significant (despite remaining negatively correlated), indicated by an insignificant coefficient.

The score for governance information disclosure from non-peer firms is also inconsistent with the results in Table 7. Although *CSRG_NP_DIS* continues to be a positive coefficient, the effect becomes significant at the level of 5%. This suggests that higher levels of governance information disclosure of firms from other industries can significantly impact analysts' forecast errors. Two potential explanations are discussed in a previous section for this positive effect—diverting analysts' attention and information interference from non-peer companies. These two explanations still apply to the disclosure of governance disclosure during the two-year forecasting period. In

contrast to environmental and social information, the governance information disclosed by a company is typically limited to its operations and development issues and has a limited spillover effect on the rest of the industry. Therefore, the disclosure of governance information of non-peer companies is not only of limited value for analysts in making two-year forecasts, but can also distract and divert their attention, leading to an increase in forecast error.

Moreover, the results of the comparison of the absolute values of the coefficients of the three disclosure score variables are, in descending order, *CSRG*, *CSRG_NP_DIS*, and *CSRG_P_DIS*, which indicates that the level of governance information disclosed by non-peer firms has an impact on the forecast error and the effect is smaller than that by the forecasted firm but larger than that by peer firms. It is not consistent with the results in Table 7. The results in the fifth column are consistent with the H0 and H2, but not H4 since the coefficients on *CSRG_P_DIS* are not statistically significant. Simply put, when *CSRG* contains only one angle, the angles of E and S still provide evidence for H0, H1, and H3. Moreover, the results for the angle of governance disclosure support H0 and H2. Additionally, the spillover effect of non-peers governance disclosures on forecast error is smaller than that of the estimated firm.

The focus will next turn to the results for the two-year forecast window when *CSRG* is a composite angle (first and second columns). Combining the results of both columns, the negative and significant coefficients of *CSRG* and *CSRG_P_DIS* indicate that an increased level of ESG and ES disclosure by the analysed and peer companies results in reduced forecast errors. In contrast, the coefficient for the non-peer firm disclosure score variable remains insignificant. A comparison of the coefficients of the ESG and ES composite disclosure scores of the predicted, peer and non-peer firms covered by the same analyst continues to support H3. As a result, even when *CSRG* contains only

two composite angles, the results support H0, H1 and H3.

Summarizing the results in Table 8, H0, H1, and H3 are still supported by all the other disclosure angles except the governance angle. *CSRG* results that only consider the level of disclosure of governance support H0 and H2.

[Insert Table 9 here]

Table 9 extends the forecast horizon to three years. As shown in Table 8, results are presented in the order of models 1-5 when *CSRG* is an overall ESG, overall ES, and environmental, social, and governance disclosures accordingly. For the three disclosure quality variables, the results of the first three models are consistent: only the inclusion of consolidated ESG, ES and environmental information by forecasted companies is valuable for three-year forecasts, i.e., a high level of disclosure reduces forecast error. Conversely, disclosure by peer and non-peer firms does not seem to have a significant effect on forecast errors. Only H0 can be supported by these results.

Furthermore, when *CSRG* incorporates only the disclosure of social information, no variable of disclosure appears to be significant, suggesting that social information disclosed by these firms, whether they are predicted firms or not, does not have any relevance for long-term forecasting. It is surprising to see the results when *CSRG* incorporates solely the governance information angle. As shown in the fifth column, higher levels of governance disclosure by forecasted and peer companies still significantly reduce forecast errors (as indicated by a negative coefficient) (at 1% and 5%, respectively). Moreover, the *CSRG_P_DIS* coefficient is smaller, indicating that the effect of peer company management information disclosure is smaller than the effect of the predicted disclosure of the company. There are, however, no results showing that governance information disclosure by non-peer firms contributed to the

3-year forecast window. Overall, the results suggest that H0, H1 and H3, hold for the governance angle.

To summarize the results in Table 9, only the information provided by the forecasted firms themselves is valuable for long-term forecasting, both for the combined *CSRG* angles and the environmental angle. Therefore, there are no spillovers from the firms covered by the analysts. Consequently, these results only support H0, whereas no source of information about any firm from the social angle is worthwhile for long-term forecasting. This could be attributed to the fact that important social information (and more influential to the production and profitability of a firm) is usually determined by macro factors rather than individual firms, such as a national strike. An individual company cannot know or disclose this information in advance. Therefore, it is reasonable for analysts not to consider disclosures of such information in their long-term forecasts.

In the case of governance disclosure, both the estimated disclosure of the firm and those of its peers are important to analysts' long-term forecasts, i.e., they reduce forecasting errors. The positive impact of disclosure of governance of peer companies on forecast accuracy could be explained by the fact that the long-term development of a company needs to be in line with the development of the industry and the governance characteristics of the industry. By gathering governance information from peers, analysts can make more accurate long-term forecasts.

When combining the results for the 1-year, 2-year, and 3-year forecasting periods, it can be argued that spillover effects from ESG disclosure information from peer companies are present for short-term and middle-term forecasts. However, as the forecast window grows, the likelihood of such information spillovers (except for

spillovers from governance information) decreases. For long-term forecasts, only information disclosed by the forecasted company itself is useful and can significantly decrease period forecast errors. Nevertheless, for governance information, disclosure spillovers from peer firms are more useful to analysts for long-term forecasts (as opposed to mid-term forecasts) and can effectively improve the accuracy of their forecasts.

5.4 Robustness Tests

In this section, robustness tests are conducted on a sample with a one-year forecast period. To test the spillover effects of other firms' ESG disclosures on forecast errors, the first subsection employs alternative measurements of forecast errors and accruals. The last subsection also addresses the potential endogeneity issue. The results in this section support previous findings regarding H0, H1 and H3.

5.5.1 Alternative measures of forecast errors and accruals

In Table 10, I apply three measures of prediction error that have been used in existing studies and replicate the two models of ESG composite scores in Table 6 to determine whether firm conclusions can still be drawn. Based on Abarbanell and Bushee (1997), Bebchuk et al. (2011), Cohen and Lys (2003), Core et al. (2006) and Lim (2001), forecast errors are scaled by the absolute price at the beginning of the forecast period (*ERR_PRICE*) as the first alternative measure. In the second measure, forecast errors are scaled by total assets per share (*ERR_AT*), following Bebchuk et al. (2011), Core et al. (2006), and Giroud and Mueller (2011). Furthermore, in the third measurement, following Bartov et al. (2000) and Bebchuk et al. (2011), forecast errors are scaled by the standard deviation of analysts' forecasts (*ERR_STD*).

[Insert Table 10 here]

For all models in Table 10, H0, H1 and H3 are still valid. The coefficients on all variables *CSRG* and *CSRG_P_DIS* are negatively significant (at the 1% or 5% level) in columns 1 to 6. In this regard, ESG and ES information from the companies analysed is of value to analysts' forecasts. Further, the disclosure of ESG and ES information from peer companies is effective in reducing forecast errors. In addition, the magnitude of the coefficients of the three independent variables is consistent with H3. The results in the first two columns are also interesting. *CSRG_NP_DIS* is positive and significant (at the 5% or 1% levels) when the forecast error is scaled by the price at the beginning of the forecast period (*ERR_PRICE*); however, in Table 6 this coefficient is insignificant. These results suggest that the disclosure of consolidated ESG or ES information by non-peer companies also increases the incidence of analysts' prediction errors.

A potential reason can be put forward to explain the discrepancy between the ESG disclosure results for the first two columns of non-peer companies and the results in Table 6. In equation (1), forecast error is calculated as a percentage of the actual value of forecast error. This indicator has the advantage of being easily compared between companies in the form of a percentage. A disadvantage of the percentage form is that it does not remove the interference of other market information on the analyst's forecast error. However, if the error is scaled by the stock price, then the problem is mitigated. Accordingly, the impact of ESG and ESG disclosures of non-peer companies on forecasting errors is more pronounced after removing the interference of market information. This may account for the significance.

I use accruals to measure the degree of transparency of a firm's financial disclosures in the previous discussion. To put it simply, I expect analysts' forecast errors to be positively correlated with accruals. More specifically, higher accruals indicate less

transparent financial disclosure, which reduces the amount of reliable financial information analysts have about the firm being forecasted. This, in turn, makes it more difficult for analysts to forecast and is therefore likely to increase forecasting errors. In the previous discussion, conditional conservativeness accruals are used, and the results are aligned with my expectations.

[Insert Table 11 here]

To further verify the robustness of my results, I use two alternative measures of accruals in Table 11. Based on Larson et al. (2018), the accruals in the first five models are defined as comprehensive accruals (*COMPACC*), which are calculated as common share change in equity (*ΔCEQ*) minus change in cash and cash equivalents (*ΔCHE*). Intuitively, as the change in ordinary shareholders' equity equals the change in assets minus the change in liabilities, *COMPACC* represents the change in non-cash assets minus the change in liabilities. In the first five columns, the coefficient on *COMPACC* is positive and partially significant, which is in line with my expectations. Furthermore, both the *CSRG* and *CSRG_P_DIS* coefficients are negatively significant, and the *CSRG_P_DIS* coefficient is of a smaller absolute value than the *CSRG* coefficient. Conversely, the coefficients of *CSRG_NP_DIS* are both insignificant. The results demonstrate that H0, H1 and H3, continue to hold when comprehensive accruals are used. In the last five columns, accruals are defined according to the scaled accruals averaged over the last three years (Bhattacharya et al., 2003, Dhaliwal et al., 2012; Muslu et al., 2019), denoted by *N_ACC*. The definitions of specifically scaled accruals are provided in Table 1. The coefficients on the three independent variables in the last five columns remain the same as in the first five columns, which supports the proposition that a firm's ESG disclosure and a peer firm's ESG disclosure can reduce forecast errors. However, the spillover effect of peer firms is smaller when comparing

the two. It is also useful to note that although the coefficients on *N_ACC* in columns 6 to 9 do not match my expectation, they are not significant and therefore do not affect the results.

Overall, Tables 7.9 and 7.10 show that the results that have been obtained are not affected by the method of measuring forecast error or the measurement of accruals. Therefore, the results in this sub-section still support H0, H1 and H3.

5.5.2 Heckman's Two-stage Model

In this subsection, I provide further analysis of the robustness tests to illustrate potential endogeneity issues. When I select data to account for the company's ESG performance score, I find that only those companies with high ESG disclosure scores also have ESG performance scores. The sample selection bias could result in an endogeneity problem. To ensure that the impact of a company's ESG score disclosure and the ESG score disclosure of other companies covered by the same analyst on analysts are accurately estimated, I use the Heckman two-stage model to correct for this potential bias.

The principal objective of this analysis is to mitigate the sample selection bias caused by ESG performance scores. The regression analysis begins with a probit model (stage 1). On the left-hand side of the regression equation, the dependent variable is a dummy variable that has a value of 1 if the firm lacks data for one of the five angles; otherwise, its value is 0. On the right-hand side, there are control variables related to forecasted firms used in Tables 7.5 and 7.6. The right-hand side of the regression equation also includes an exclusion restriction variable (*INS_IND*), which is defined as the ratio of companies with ESG performance scores to companies with ESG disclosure scores within each industry on Bloomberg. As this industry-year variable is likely to be exogenous to the probability of having an ESG performance score over the same period,

it does not directly affect analyst forecast errors for firms. In the second stage of the regression, the dependent variable is the analyst's one-year forecast error, and the independent variable is the ESG disclosure score of the firm and other firms under the same analyst (based on the five ESG disclosure angles). In addition, the control variables are the same as those used in the main specification (Tables 7.6 and 7.7), and the inverse Mills ratio estimated in the first stage is included in the second.

[Insert Table 12 here]

In Table 12, I present the results of the first-stage regression (Model 1) and the second-stage regression (Models 2 through 6). The results of the first stage of the regression indicate that the exclusion restriction variable (*INS_IND*) has a positive and statistically significant effect on the likelihood of having an ESG performance score. In the second stage of the regression, I find that the following findings remain valid. First, a greater degree of ESG disclosure (five angles) will reduce analysts' prediction errors. Secondly, there is a significant spillover effect of peer companies' ESG disclosure on analysts' forecast errors (H1). Alternatively, a higher level of ESG disclosure by peer companies can improve forecast accuracy for the analysed companies. This enhancement effect is, however, smaller than that of ESG disclosure of the company being forecasted. The evidence for a spillover effect of ESG disclosure from non-peer companies on analysts' forecasts is insignificant. Table 12 provides further support for our H0, H1 and H3 in terms of robustness, demonstrating that sample selection bias does not affect the main findings.

6 Conclusions

The purpose of this study has been to explore whether the degree of disclosure of ESG information by other firms (covered by the same analyst) influences analysts' forecast

accuracy for the anticipated firm over the period 2004 to 2020. First, I observed that higher levels of ESG disclosure by forecasted firms can reduce analysts' forecast errors, which is consistent with existing research findings. Further, it has been found that the level of ESG disclosure by non-peer firms has no significant influence on analysts' forecast errors. However, the level of ESG disclosure by peers of the forecasted firm has been found to significantly reduce forecast errors, indicating that ESG disclosure by peers has a spillover effect on analysts' forecasts of the analysed firm. Furthermore, this spillover effect is smaller than the impact of the ESG disclosure of the analysed firm on forecast error. My research has indicated that the spillover effect is evident only for short and medium-term forecasts for environmental and social information disclosure. In long-term forecasts, it has been seen that only the forecasted firm's environmental and social information can impact forecast errors. In the case of governance information, the spillover effect from peers has proven to be more pronounced in the short- and long-term forecasts. A spillover effect of governance information from peer firms has not been found in the medium-term forecasts, but it has been unexpectedly found for information from non-peer firms.

My findings provide strong support for the spillover effect of company ESG disclosures in analysts' forecasts, indicating that referring to ESG information of peer companies can improve forecast accuracy. Furthermore, my findings reinforce previous research findings that a company's disclosure of non-financial information can reduce analysts' forecast errors and improve forecast accuracy. The study has also contributed to the discussion of integrated reports, the adoption of which can save a considerable amount of time and effort. These resources could then be devoted to forecasting expertise, which would increase the accuracy and productivity of analyst forecasts. Essentially, my results demonstrate that the disclosure of ESG information about other companies

may have an impact on analysts' forecasts of the estimated firm (i.e., information spillovers), although this effect is small compared with the disclosure of the forecasted company's ESG information.

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