

國立臺灣大學管理學院會計學系暨研究所



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MD&A 中的 ESG 揭露與盈餘持續性：基於 FinBERT-
ESG 之實證結果

ESG Disclosures in MD&A and Earnings Persistence:
Empirical Evidence by FinBERT-ESG

劉孟頡

Liu, Meng-Chieh

指導教授：謝昇峯 博士

Advisor: Hsieh, Sheng-Feng, Ph.D.

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摘要

本研究探討財務報表管理層討論與分析中 ESG 揭露數的決定因素，以及這些揭露與財務績效和盈餘持續性之間的關聯，基於 1999 年至 2020 年間美國市場上的 52,064 家公司的年度觀察樣本，並使用 FinBERT-ESG 模型來萃取 ESG 相關訊息。實證結果顯示，ESG 揭露數與股利、市值與帳面價值比率、資本支出和公司員工人數呈正相關，而與槓桿比率、業務波動性和特別損益呈負相關。有趣的是，無論是盈利公司還是虧損公司，都更傾向於揭露更多 ESG 訊息，但後者可能出於轉移注意力之策略，此外，研究亦發現 ESG 揭露數與盈餘持續性呈負相關，而與 ESG 揭露和獲利能力之交乘項呈現正相關，這表明 ESG 揭露為獲利能力較強的公司帶來更高的盈餘持續性。

關鍵字: ESG 揭露、決定因素、財務表現、盈餘持續性、FinBERT-ESG

Abstract



This paper presents an empirical analysis examining the determinants of ESG disclosures and their relationship with financial performance and earnings persistence. The study utilizes a dataset of 52,064 firm-year observations from the US market spanning 1999 to 2020, employing FinBERT-ESG to extract ESG sentences and quantify ESG disclosures. The results reveal positive associations between ESG disclosures and dividends, market-to-book ratio, capital expenditure, and number of employees, while negative relationships are observed with leverage, business volatility, and special events. Notably, both profitable firms and loss-making firms disclose more ESG information, with the latter potentially using ESG disclosures as a diversionary tactic. Additionally, a negative correlation is observed between ESG disclosures and earnings persistence, while a positive connection is identified in the interaction of ESG disclosures and profitability, suggesting that firms with more ESG disclosures exhibit higher earnings persistence, particularly if they are profitable.

Keywords: ESG Disclosures, Determinants, Financial Performance, Earnings Persistence, FinBERT-ESG



1. Introduction

U.S. Securities and Exchange Commission (SEC) is planning to enhance and standardize climate-related disclosures for investors as part of a ESG growing awareness of the importance of issues among public firms, but right now, there is no regulation forcing firms to disclose their ESG information in their financial reports.¹ Nevertheless, numerous firms proactively disclose their ESG information in their financial reports to the public even before regulatory requirements are established. In contrast to various materials, such as ESG reports and firms' websites, the obligation to disclose ESG information in the MD&A section of 10-K filings demands considerably higher levels of accountability from companies. This heightened responsibility arises due to the fact that 10-K submissions are subject to stringent regulatory scrutiny and legal liabilities, rendering them more legally binding and enforceable. Consequently, firms must exercise greater diligence and transparency when divulging ESG-related data within this official document.

The examination of firms exhibiting a higher inclination towards disclosing ESG information is a pertinent subject of discussion. Previous research on the effects of sustainable management disclosures has been constrained by limited variables and small sample sizes., I conduct a determinants analysis on 10 different aspects, in order to find

¹ SEC fact sheet: enhancement and standardization of climate-related disclosures

the key factors that influence on firms' ESG disclosures tendency, using firm-year data of US market from 1999 to 2020, which is 52,064 sample data in total.



Besides, prior studies have a conflict regarding the relationship between firms' ESG disclosures and firms' financial performance: Sharma et al. (2020) discovered a positive association between sustainable management disclosures and firms' profitability, whereas Chandok and Singh (2017) identified a negative relationship. It is worth investigation that what do the ESG Disclosures within 10-Ks' MD&A section tell us about firms' financial performance, so I also conduct an analysis to investigate the relationship between ESG disclosures and firms' financial performance, aiming to examine the true connection between ESG disclosures and firms' financial performance.

Additionally, firms' ESG disclosures are highly associated with both firms' sustainable management activities and the disclosure quality of financial report. In both aspects, the engagement of sustainable management activities and the quality of firms' disclosure, have association with firms' earnings quality according to prior studies: Ma and Yoo (2022) used ESG ratings to examine the association between sustainable management and firms' earnings persistence in Korean markets and found a positive relationship between firms' ESG scores and earnings persistence; Li (2008) found that firms having more reader-friendly annual reports tend to exhibit higher levels of persistent positive earnings. Further determination on the association between firms' ESG

disclosures with MD&A section and firms' earnings persistence are hence conducted.

My study offers four main contributions: Firstly, I apply a deep-learning- model-based approach: FinBERT-ESG to extract the ESG sentences from the MD&A section (Huang et al. 2023), and convert the textual content into numerical data according to the proportion of ESG information, which is not yet be used before in prior studies regarding firms' sustainable management disclosure.

Secondly, I perform determinants analysis on ESG disclosures within firms' financial reports, finding that dividends, market-to-book ratio, capital expenditure and number of employees are positively associated with the quantity of ESG disclosures, while leverage, volatility of business, special events have negative relationship. Firms' profitability is also negatively related to the ESG disclosures at the first glance; however, it turns out to be a positive connection between the absolute magnitude of firms' profitability, which extends to the third contribution.

My third contribution pertains to conducting the analysis on ESG disclosures and firms' financial performance and explain the inconsistency between prior studies. By identifying the inverse association for firms with different profitability, it is revealed that firms with higher profitability tend to provide a greater volume of ESG disclosures, suggesting that they may participate in more ESG activities. Conversely, firms experiencing financial losses tend to disclose more non-financial information as a means

to divert attention away from their poor financial performance.

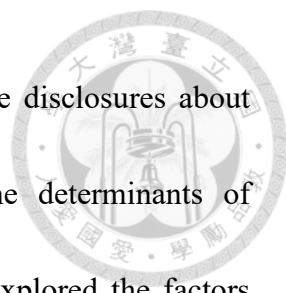
Last but not least, this study delves into the association between ESG disclosures and firms' earnings persistence, revealing that ESG disclosures demonstrate a cost concept, displaying an inverse correlation with earnings persistence. However, when examining the interaction term with earnings, a positive relationship emerges, indicating that ESG disclosures are indicative of heightened earnings persistence, particularly as firms' profitability increases.



2. Literature Review and Assumptions

2.1 Literature Review on Sustainable Management Activities and Disclosures

Prior studies indicated that firms' sustainable management is positive related to firms' performance and firms' value: Waddock and Graves (1997) found that firms' corporate social responsibility (CSR) performance is positively associated with not only prior but also future financial performance. Lev et al. (2010) found that firm's charitable contributions are significantly associated with future revenue. Ma and Yoo (2022) used ESG ratings as the proxy of sustainable management to examine the association with firms' earnings persistence based on the evidence of Korean markets, finding that firms' ESG scores is positively associated with firms' earnings persistence while firms have higher earnings.




One stream of sustainable management research focuses on the disclosures about firms' sustainable management. Some studies investigate on the determinants of sustainable management disclosures: Chandok and Singh (2017) explored the factors influencing the degree of environmental disclosures made by firms based on information gathered from the firms' websites and annual reports, Sharma et al. (2020) examined the connection of various financial determinants with ESG disclosure on Indian firms' annual and sustainability reports. However, a conflict existed in prior studies that Chandok and Singh (2017) found a negative relationship between sustainable management disclosures and firms' profitability while Sharma et al. (2020) observed a positive relationship.

Other studies do not focus on sustainable management disclosures themselves, but trying to find the relationship between sustainable management disclosures and other variables: Plumlee et al. (2015) assessed the correlation between firms' environmental disclosures quality and firms' value with a disclosure index composed, Cannon et al. (2020) provided evidence that firms' CSR disclosure inside 10-Ks gives information about firms' competitive advantages with a textual method aggregating CSR keywords within 10-Ks. In both studies, it was found that the sustainable management disclosures are positively associated with firms' value.

2.2 Literature Review on Earnings Persistence

The concept of earnings persistence serves as a commonly employed measure for



assessing the quality of earnings. Dechow et al. (2010) indicated that research on earnings persistence can be broadly categorized into two streams. The first stream focuses on examining whether earnings are decision useful by investigating their impact on equity valuation outcomes. The second stream operates under the assumption that earnings with higher persistence provide better inputs for equity valuation models, suggesting that higher persistence signifies higher quality earnings compared to those with lower persistence.

Studies of the second stream aim to identify financial characteristics that associated with persistent earnings, for example, Sloan (1996) documented a negative relation between the absolute value of accruals and earnings persistence; Skinner and Soltes (2011) found a positive association between dividend and earnings persistence. Few investigated in the relation between earnings persistence and non-financial characteristics: Li (2008) found readability of financial statement is significantly related to earnings persistence, which broaden the scope of studies that non-financial characteristics can be also useful evaluating firms' earnings persistence.

2.3 Extension of Prior Studies


In previous studies, the examination of sustainable management disclosures was restricted to a narrow range of variables and a limited sample size. To address this limitation, I conduct a multivariate regression analysis on 10 distinct factors to identify

the key determinants that influence firms' tendency to disclose their ESG information.

The analysis was based on a comprehensive dataset comprising firm-year information from the US market spanning the period from 1999 to 2020, with a total of 52,064 samples.

This study aims to contribute to the ongoing debates concerning the correlation between sustainable management disclosures and firms' earnings performance. It achieves this by focusing on ESG disclosures within the MD&A section of 10-K reports—a category of strictly regulated documents that hold greater accountability compared to other sources, such as standalone ESG reports and firms' websites.

Prior studies that examining on the relationship between sustainable management disclosures and firms' earnings' performance do not consider the essential difference between firm with different profitability. Firms with better profitability volunteer to disclose more ESG information as a result of their actual or expected involvement in sustainable management practices, however, firms suffering from loss also have the chance to disclose more ESG information due to the “management obfuscation hypothesis”. The management obfuscation hypothesis asserts that the manager employs impression management techniques to obfuscate the intended message, causing readers to become bewildered or confused, which is achieved through the use of jargon, irrelevant information, complexity, and excessive length, which serve to distract or perplex the audience (Courtis 2004). For loss-incurring firms, their unfavorable financial



performances can be considered undesirable news, as a result, managers may resort to obfuscating their financial reports by avoiding discussions about the firms' financial performance and instead focusing on information that is less financially relevant, such as ESG information.

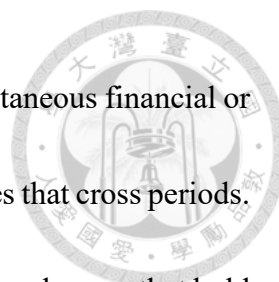
Given the assumption that both profitable firms and loss-making firms are likely to increase their ESG disclosures as their absolute magnitude of profitability grow, I put forward the initial proposition of hypothesis:

- H1: Firms' absolute level of profitability is positively related to the quantity of ESG disclosures.

In the determinants' analysis, hypothesis 1 is tested through taking the quantity of ESG disclosures as dependent variable and the absolute level of profitability as independent variable. It is anticipated that a positive coefficient will be observed for the absolute level of profitability if hypothesis 1 is supported.

A robustness test is performed to examine the enduring correlation between firms' financial performance and their ESG disclosures by interchanging the roles of the dependent and independent variables. It is anticipated that a higher quantity of firms' ESG disclosures will correspond to a greater absolute magnitude of firms' profitability.

Another goal of this study is trying to make an extension on the topic regarding ESG disclosures' forecasting ability on firms' future-related attributes. Many studies regarding



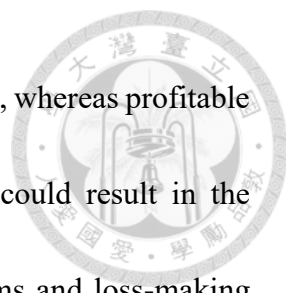
sustainable management disclosures confirms its association with coetaneous financial or non-financial variables, but few examines its association with variables that cross periods.

It is remaining a question that sustainable management disclosures a good proxy that hold the same ability to capture firms' future performance as other sustainable measures. This study trying to explain the characteristic by examining the relationship between ESG disclosures and firms' earnings persistence.

Firms taking sustainable management aim to enhance their long-term performance and stability; however, sustainable management activities implicitly contain the concept of cost which will depreciate firms' earnings persistence. While with firms' probability grow, the positive effect of sustainable management on firms' earnings persistence is more likely to fulfilled, for profitable firms are better equipped to withstand challenges, adapt to changing market conditions, and achieve the goal of sustainable management. Building on the assumption that ESG disclosures share similar characteristics with sustainable management, I present the following hypothesizes:

- H2a: The quantity of ESG disclosures is negatively related to firms' earnings persistence.
- H2b: The synergy of the quantity ESG disclosures and profitability is positively related to firms' earnings persistence.

Also, given the management obfuscation hypothesis, it is proposed that loss-making



firms may disclose ESG information with the intention of obfuscation, whereas profitable firms disclose without such intention. This disparity in behavior could result in the variations of credibility of ESG information between profitable firms and loss-making firms, which might bring different influences on firms' earnings persistence. In light of these arguments, a robustness test is conducted to assess the impacts on firms with varying levels of profitability.

3. Data and Empirical Measures

3.1 Sample

The sample includes US listed firms from 1994 to 2020, which consist of the following component: (1) The sample starts with the firm-year text content of 10-Ks' MD&A section from EDGAR dataset to calculate ESG proportion and fog index, for firm-years that sentence count of 10-Ks' MD&A section is less than 100 is eliminated. (2) I then collect firm-year data needed for determinants from COMPUSTAT and CRSP, merging all the firm-year data through CUSIP or CIK.

Only firm-years with complete data fields will be retained. There are 52,064 firm-years available for the determinants' analysis and the analysis on firms' financial performance. For the analysis on earnings persistence, the data size is reduced to 38,910 firm-years when the gap year is 1, and 34,942 firm-years when the gap year is 2, as data



needs to be shifted for future earnings.

There are 52,064 firm-years for the determinants analysis. The data size reduced to 38,910 firm-years for earnings persistence analysis when gap year is 1, and 34,942 firm-years when gap year is 2, due to the need of shifting data for future earnings.

After data merging and processing, I implement winsorization on the upper 1% and lower 1% of observed values for each variable, aiming to mitigate the influence of extreme sample values.

3.2 The Sustainable Management Measurement

I use the quantity of ESG information within MD&A text section as the measure of firm's sustainable management, for firms' care or have done more about sustainable management are more likely to convey their concern or state their activity regarding ESG voluntarily.

I extract the ESG information within the MD&A section into a quantitative value by calculating the proportion of ESG disclosures within MD&A. The key of the transformation is how to determine the nature of sentences. For there is no strict standard to differentiate that which sentences are regraded ESG and which sentences are non-ESG, I apply FinBERT-ESG model to do the classification task.

BERT, which stands for Bidirectional Encoder Representations from Transformers, is a large language model built on the attention mechanism. With the inclusion of only a few

additional output layers, the pre-trained BERT model can achieve exceptional performance across a wide range of NLP (Natural Language Processing) tasks (Vaswani et al. 2017; Devlin et al. 2018).



FinBERT is a pre-trained BERT model finetuned with financial text for several financial NLP tasks, which out-perform other traditional dictionary method and machine learning algorithm in sentiment classification task (Huang et al. 2023). FinBERT-ESG shares the same structure with FinBERT but is finetuned with ESG related contents; for each text content input it can be classified into one of the four labels: Environmental, Social, Governance or None of the above. It is anticipated that FinBERT-ESG will deliver classification results of superior quality akin to those achieved by FinBERT. Furthermore, the outputs generated by FinBERT-ESG have been found to be both reasonable and satisfactory following human verification. Table 1 illustrates actual classification outcomes derived from the sample data.

In detail, I calculate the proportion of ESG disclosures within MD&A section through the following method: For each MD&A section, the non-textual data (e.g., table, graph) are pre-processed and hence mostly textual content left. I then sentencize the MD&A section through NLTK's `sent_tokenize` function, put each sentence into FinBERT-ESG model pipeline and make classification, summing the sentence counts labeled as Environmental, Social or Governance, which compose the total ESG sentence counts for

Sample Sentences (Firm-Year)	ESG Labels
Coal is used to generate approximately 39% of the electricity in the U.S., but is also used for coke production and for certain industrial applications, such as cement making. (TX Holdings Inc. - 2014)	Environmental
Ethanol is a renewable, environmentally clean fuel source that is produced at numerous facilities in the United States, mostly in the Midwest. (Advanced BioEnergy LLC - 2017)	Environmental
Prior to the change of control, the Firm's long-term goal was focus on solving some of the major challenges in China, such as pollution and food safety issues for the general public, as well as raising funds to grow the business. (Velt International Group Inc. - 2016)	Social
COVID-19 has since spread rapidly throughout many countries, and, on March 12, 2020, the World Health Organization declared COVID-19 to be a pandemic. (Remedent Inc. - 2019)	Social
The Audit Committee of the Board of Directors, composed solely of outside directors, meets periodically with the independent auditors, management, and the internal auditors to assure that each is carrying out its responsibilities. (Hormel Foods Corp. - 2015)	Governance
On October 3, 2017, a Subcommittee of FINRA's Uniform Practice Code Committee decided to remand the case to the Department for further review. (CX Network Group Inc. - 2018)	Governance


Table 1. Sample Sentences for FinBERT-ESG

one MD&A section. In the last step, I divide ESG sentence counts by the number of all sentence and get the proportion, which serves as the quantity of ESG disclosures within MD&A.

3.3 Variables Definition

Table 2 provides the definitions of the variables used in the study. Except for ESG and FOG, all other variables are computed using data obtained from COMPUSTAT or CRSP.

FOG is calculated using Gunning Fog tool provided by py-readability-metrics 1.4.5 library.



Variable	Definition
ESG	The proportion of ESG sentences selected by FinBERT-ESG within 10-k's MD&A section
Earnings	Operating Income After Depreciation / Total Assets
ROA	Net Income / Total Assets
DIV	Dummy variable for Dividends
SIZE	Log value of Total Assets
MTB	Log value of (Common Shares Outstanding * Price Close + Total Liabilities) / Total Assets
CAPX	Capital Expenditure / Total Assets
LEV	(Debt in Current Liabilities + Long-Term Debt) / Total Assets
EMP	Log value of the number of employees
BETA	Beta value calculated by CRSP Portfolio Statistics and Assignment
VOL	Standard deviation value calculated by CRSP Portfolio Statistics and Assignment
SPI	Dummy variables for Special Items
AQC	Dummy variables for Acquisition
FOG	(Words per sentence + percent of complex words) * 0.4

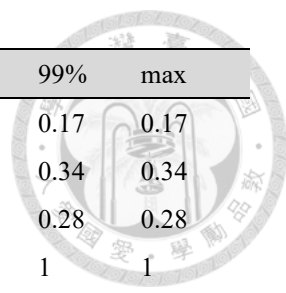
Table 2. Variables Definition

3.4 Summary Statistics

Table 3 presents the summary statistics of the variables after winsorization. The mean value of ESG disclosures proportion is 0.02, with the maximum value observed at 0.17. Notably, the first quartile value for ESG remains at 0, indicating that a significant number of firm-years refrain from disclosing any ESG-related information within their 10-Ks' MD&A section.

In Table 4, the distribution of sample data across the years is presented. The lowest recorded value for a single year is 1,341 in 1999, while the highest recorded value for a single year is 2,685 in 2008.

Table 5 displays the distribution of sample data across various industries, categorized according to the divisions. The Agriculture, Forestry, & Fishing industry has the lowest



	count	Mean	std	min	1%	25%	50%	75%	99%	max
ESG	52,064	0.02	0.03	0	0	0	0.01	0.03	0.17	0.17
Earnings	52,064	-0.04	0.94	-1.38	-1.38	-0.01	0.04	0.09	0.34	0.34
ROA	52,064	-0.09	1.47	-1.69	-1.69	-0.04	0.01	0.05	0.28	0.28
DIV	52,064	0.41	0.49	0	0	0	0	1	1	1
SIZE	52,064	6.59	2.13	2.01	2.01	5.10	6.61	7.99	11.78	11.78
MTB	52,064	0.46	0.61	-0.55	-0.55	0.03	0.29	0.75	2.34	2.34
CAPX	52,064	0.04	0.06	0	0	0	0.02	0.05	0.30	0.30
LEV	52,064	0.26	0.54	0	0	0.04	0.18	0.38	1.11	1.11
EMP	52,064	-0.06	2.10	-4.83	-4.83	-1.55	-0.12	1.40	4.62	4.62
BETA	52,064	0.97	0.71	-0.35	-0.35	0.50	0.90	1.35	3.13	3.13
VOL	52,064	0.03	0.02	0	0	0.02	0.03	0.04	0.12	0.12
SPI	52,064	0.66	0.48	0	0	0	1	1	1	1
AQC	52,064	0.36	0.48	0	0	0	0	1	1	1
FOG	52,064	19.46	4.57	15.97	15.97	18.37	19.34	20.36	23.39	23.39

Table 3. Summary Statistics

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Count	1,341	1,414	1,571	2,323	2,161	2,569	2,630	2,633	2,617	2,685	2,563
Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Count	2,514	2,470	2,422	2,408	2,534	2,588	2,542	2,519	2,475	2,522	2,563

Table 4. Year Distribution

Industry	Range of SIC Codes	Count
Agriculture, Forestry, & Fishing	0100-0999	106
Construction	1000-1499	625
Finance, Insurance, & Real Estate	1500-1799	13,689
Manufacturing	2000-3999	19,054
Mining	4000-4999	2,318
Nonclassifiable Establishments	5000-5199	274
Retail Trade	5200-5999	1,640
Services	6000-6799	8,721
Transportation & Public Utilities	7000-8999	4,455
Wholesale Trade	9100-9729	1,182

Table 5. Industry Distribution



	ESG	Earnings	ROA	DIV	SIZE	MTB	CAPX	LEV	EMP	BETA	VOL	SPI	AQC	FOG
ESG														
Earnings	-0.07													
ROA	-0.06	0.91												
DIV	-0.01	0.29	0.29											
SIZE	0.03	0.44	0.43	0.51										
MTB	0.09	-0.19	-0.19	-0.19	-0.26									
CAPX	0.04	0.04	0.01	-0.12	-0.05	0.08								
LEV	0.00	0.03	-0.05	0.05	0.19	-0.05	0.10							
EMP	0.08	0.45	0.38	0.24	0.67	-0.07	0.10	0.13						
BETA	0.05	-0.05	-0.05	-0.09	0.17	0.11	0.09	0.09	0.17					
VOL	0.05	-0.41	-0.42	-0.40	-0.43	0.01	0.05	-0.01	-0.30	0.23				
SPI	0.03	0.06	0.00	-0.01	0.19	-0.06	0.00	0.15	0.28	0.16	0.00			
AQC	0.00	0.19	0.16	0.05	0.24	-0.01	-0.03	0.02	0.39	0.06	-0.14	0.25		
FOG	0.12	-0.12	-0.09	0.01	0.23	0.08	-0.15	0.09	0.04	0.20	-0.03	0.12	0.02	

Table 6. Pearson Correlation Matrix

recorded value of 106, while the Manufacturing industry has the highest recorded value of 19,054.

Table 6 presents the Pearson correlation matrix for all variables. The ESG variable shows a positive association with SIZE, MTB, CAPX, LEV, EMP, BETA, VOL, SPI, AQC, and FOG. However, it exhibits a negative association with Earnings, ROA, and DIV. SIZE and EMP share the largest correlation value, which is 0.67.

Figure 1 depicts the fluctuation in the average proportion of ESG within the MD&A section of 10-Ks. It clearly demonstrates a consistent upward trend over time, providing evidence of the increasing awareness and attention towards ESG issues. Notably, the sharp increase in 2020 can be attributed largely to the influence of the COVID-19, as many firms mentioned the impacts it had on their businesses.

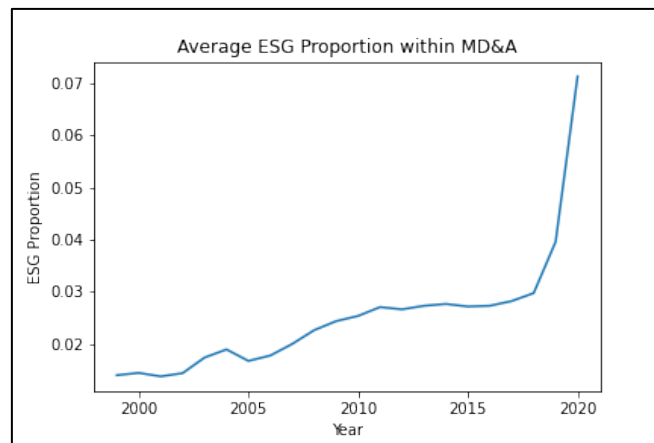


Figure 1. Average ESG proportion within MD&A

3.5 Determinants of ESG Disclosures

Before we discuss the relationship between ESG disclosures and earnings and earnings persistence, it is important to have an insight on the characteristics of ESG disclosures itself, for which determinants are significantly related to the ESG disclosures.

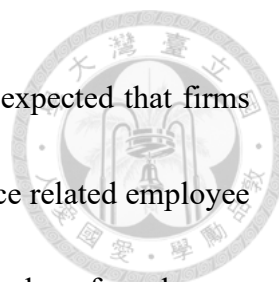
I undertake multivariate regression analysis to examine the factors using following variables:

- **Profitability (Earnings, ROA):** A firm Prior studies find that firms' profitability has significant association with firms' sustainable management disclosures. I follow the design of Li (2008), take operating income after depreciation (Earnings) and net income (ROA) as the proxy of firms' profitability, both are scaled by firms' total assets.
- **Dividends (DIV):** Payout of dividends can reflect firms' financial stability, transparency, long-term value creation, stakeholder engagement, and risk management. It is expected that firms that able to pay dividends are more likely to



disclose more ESG information. The variable DIV is defined as followed: Firms who declare dividends are labeled as one and who do not are labeled as zero.

- **Firm Size (SIZE):** Size of a firm theoretically assumed to affect the level of disclosure of a firm. Also, the previous studies showed that there is a significant relationship between the size of a firm and its disclosure characteristics. In this study, I follow the design of Sharma et al. (2020), measured firm size (SIZE) as the log value of total assets.
- **Market-to-Book Ratio (MTB):** Market-to-book ratio measure the level that the firm operation performance in comparison to market expectation. With the growing awareness of ESG issues, firms with higher market-to-book ratio are expected to disclose more ESG information in response to the market reaction.
- **Capital Expenditure (CAPX):** Firms' capital expenditure often involved with firm's commitment to environmental sustainability, social responsibility, good governance practices, and long-term value creation. It is expected that firms with higher capital expenditure will disclose more ESG-related capital expenditure information.
- **Leverage (LEV):** Sharma et al. (2020) finds that firm's level of leverage is significantly negatively related to firms' ESG disclosures scores. The leverage is measured as total debts scaled by total assets.
- **Employees (EMP):** Firms are expected to take more social responsibility on



employees and receive governance on employees' welfare. It is expected that firms hiring more employees might disclose more social and governance related employee information. The variable EMP is measured as the log value the number of employees.

- **Systematic Risk (BETA):** Higher systematic risk levels can signal the need for greater transparency and accountability regarding a firm's ESG practices, so it is expected that firms' systematic risk will output a negative association with ESG disclosures.
- **Volatility on Business (VOL):** Firms with higher volatility on their business is expected to have a negative relationship with firms' ESG disclosures, for firms engage in sustainable managements more usually contribute to a higher stability on business. I take the standard deviation on firms' daily stock return in the prior year as the proxy of firms' volatility on business.
- **Firm events (SPI, AQC):** Extra and more detailed disclosures may be necessary in the case of uncommon or exceptional events within a firm, and these extra disclosures take up space in MD&A sections and hence might cause a compression on length or reduction on relatively proportion of ESG disclosures. It is expected that firm events will show a negative association with firms' ESG disclosures. I take special items (SPI) and acquisition (AQC) as the proxy of firm events, and both are defined as dummy variables: it is labeled as one if the amount of item is not zero and is labeled

zero if the amount of item is zero.

- **Readability of MD&A section (FOG):** The readability of firms' financial reports is closely associated with their choices concerning the topics they address. Particularly, the inclusion of ESG issues tends to introduce ESG-specific terminology, thereby potentially leading to higher text complexity as the proportion of ESG information increases. Consequently, a negative relationship is anticipated between the readability of firms' financial reports and the extent of ESG disclosures. I followed the structure of Ma and Yoo (2022), use fog index (FOG) as the proxy of the readability of reports.

4. Empirical Results

4.1 Determinant's Analysis

To examine the association of firms' profitability with ESG disclosures, I conduct a multivariate determinant analysis, taking firms' profitability and other determinants as independent variable. I use two variables, Earnings and ROA, to represent firms' profitability separately.

Table 7 shows the result of determinant's analysis on ESG disclosures. There are significant negative relationships between firms' profitability and firms' ESG disclosures within 10-K's MD&A section under both model using Earnings and ROA as profitability, and the result consistent with the study of Chandok and Singh (2017).

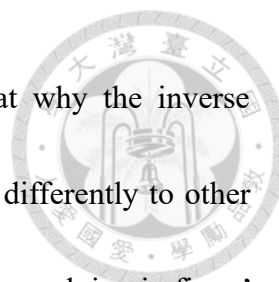
Dependent variable		ESG disclosures	
Independent variable	Predicted sign		
Earnings	△	-0.011[-17.97]***	
ROA	△		-0.008[-15.76]***
DIV	+	0.002[4.84]***	0.001[4.56]***
SIZE	+	0.000[1.26]	0.000[1.64]
MTB	+	0.001[5.34]***	0.001[5.37]***
CAPX	+	0.005[1.93]*	0.005[1.73]*
LEV	-	-0.005[-10.55]***	-0.006[-11.76]***
EMP	+	0.002[14.35]***	0.001[13.11]***
BETA	-	-0.002[-9.59]***	-0.002[-9.49]***
VOL	-	0.027[3.32]***	0.030[3.60]***
SPI	-	-0.002[-6.92]***	-0.002[-7.52]***
AQC	-	-0.002[-5.84]***	-0.002[-6.09]***
FOG	+	0.000[0.80]	0.000[1.48]
Constant variable		Yes	Yes
Year dummies		Yes	Yes
Industry dummies		Yes	Yes
Observations		52,064	52,064
Adjusted R squared		0.2	0.198

***/**/* means significance at 0.01, 0.05, and 0.10 level, respectively.

Table 7. Result of Determinants' Analysis (1)

Most of other results are consistent with prior predictions. Dividend, market-to-book ratio, capital expenditure, employees are found significantly positively related to the ESG disclosures under both models; Leverage, systematic risk and firm events are found to have inverse association with the ESG disclosures. The only exceptions are that SIZE are found to have no significant association with the ESG disclosures, and firms' volatility is found to have a positive association with the ESG disclosures.

Although the results that firms' profitability is inversely associated with the ESG



disclosures is consistent with prior study, it is still confusing that why the inverse relationship exist, in other words, why the ESG disclosures behave differently to other proxy variable of sustainable management? Is there any special tendency lying in firms' ESG disclosures decision?

To explain the inverse relationship, I divide the data into two group according to firms' probability: firms with positive probability and firms with negative probability, Group 1 and group 2 of Table 8 shows the results of determinant's analysis on ESG disclosures of two groups.

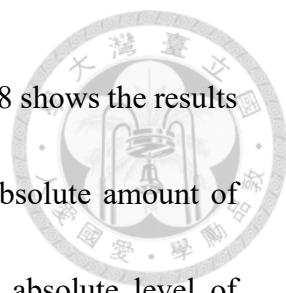
The regression results report significant positive and negative associations between profitability and ESG disclosures for two groups, which indicates that the relationship is not linear, the tendencies toward ESG disclosures are different for firms with different profitability state. The result of first group shows that firms tend to disclose more ESG information while firms' profitability increase if the firms having positive profitability, however, the result of second group shows that firms' negative relationship between firms' profitability and the ESG disclosures, which can be regarded as that firms tend to disclose more ESG information while firms' losing amount increase. Based in the results, the conflict on prior studies can be explained for that the positive relationship and negative relationship exist at the same time.

Based on the results, it is assumed that the absolute amount of firms' profitability is

Dependent variable		ESG disclosures					
Independent variable	Predicted sign	[1] Positive profitability	[2] Negative profitability		[3] Absolute profitability		
Earnings	△	0.018[6.58]***		-0.005[-5.03]***		0.013[18.85]***	
ROA	△		0.014[4.37]***		-0.004[-6.46]***	0.009[15.95]***	
DIV	+	0.001[3.98]***	0.002[4.47]***	0.001[1.27]	0.000[0.34]	0.001[3.13]***	0.001[3.78]***
SIZE	+	0.001[4.37]***	0.000[2.61]***	-0.001[-2.35]**	-0.000[-1.09]	0.000[2.57]***	0.000[2.13]**
MTB	+	-0.001[-2.57]***	-0.000[-0.81]	0.001[1.20]	0.001[1.69]*	0.000[0.11]	0.001[2.51]**
CAPX	+	0.010[3.06]***	0.007[1.80]*	0.004[0.79]	0.005[1.22]	0.003[1.13]	0.004[1.34]
LEV	-	-0.007[-11.97]***	-0.005[-6.85]***	-0.001[-0.51]	-0.005[-6.06]***	-0.006[-11.16]***	-0.006[-11.33]***
EMP	+	0.002[15.31]***	0.002[16.75]***	-0.000[-0.84]	0.000[0.23]	0.001[12.51]***	0.001[12.52]***
BETA	-	-0.002[-8.86]***	-0.002[-7.82]***	-0.001[-2.61]***	-0.001[-4.17]***	-0.002[-9.64]***	-0.002[-9.46]***
VOL	-	0.030[2.39]**	0.050[3.41]***	0.016[1.32]	0.016[1.53]	0.034[4.21]***	0.032[3.93]***
SPI	-	-0.002[-5.23]***	-0.002[-4.85]***	-0.001[-2.00]**	-0.002[-2.97]***	-0.002[-6.45]***	-0.002[-7.36]***
AQC	-	-0.002[-6.51]***	-0.002[-6.49]***	0.000[0.16]	-0.001[-1.14]	-0.002[-5.95]***	-0.002[-6.01]***
FOG	+	0.000[2.50]**	0.000[1.72]*	-0.001[-4.46]***	-0.000[-2.38]**	0.000[1.60]	0.000[1.82]*
Constant variable		Yes	Yes	Yes	Yes	Yes	Yes
Year dummies		Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies		Yes	Yes	Yes	Yes	Yes	Yes
Observations		38,209	33,866	13,855	18,198	52,064	52,064
Adjusted R squared		0.208	0.205	0.204	0.213	0.2	0.199

***/**/* means significance at 0.01, 0.05, and 0.10 level, respectively.

Table 8. Result of Determinants' Analysis (2)

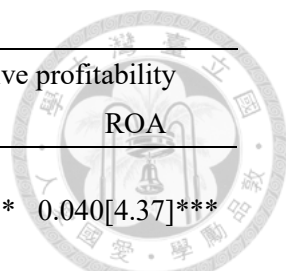


positively associated with firms' ESG disclosures, Group 3 of Table 8 shows the results of determinant's analysis on ESG disclosures, replaced with the absolute amount of firms' profitability. The results support our hypothesis 1: Firms' absolute level of profitability is positively related to the quantity of ESG disclosures, which indicates that firms have better profitability are more likely to engage in more sustainable management activity and hence will tend to disclose more ESG disclosures; firms suffering from loss may tend to disclose more financial-irrelevant information in order to distract the attention from firm's poor financial performance.

4.2 ESG Disclosures and Financial Performance

In this section, I put firms' profitability (Earnings and ROA) as dependent variables and ESG disclosures as independent variable to examine the association of ESG disclosures toward firms' financial performance. All other determinant used in the determinant's analysis are setting as control variables (DIV, SIZE, MTB, CAPX, LEV, EMP, BETA, VOL, SPI, AQC and FOG).

Table 9 shows the regression results of ESG disclosures toward firms' financial performance, which is in line with the results of determinant's analysis: Group 1 use directly use firms' profitability as dependent variable and find a negative relationship with ESG disclosures; Group 2 and Group 3 using firms with positive and negative profitability as sub-samples. For firms with positive profitability, the higher the ESG



Dependent variable	[1] Profitability		[2] Positive profitability	
	Earnings	ROA	Earnings	ROA
ESG disclosures	-0.586[-17.97]***	-0.595[-15.76]***	0.064[6.58]***	0.040[4.37]***
Constant variable	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	52,064	52,064	38,209	33,866
Adjusted R squared	0.362	0.342	0.488	0.419
Dependent variable	[3] Negative profitability		[4] Absolute profitability	
	Earnings	ROA	Earnings	ROA
ESG disclosures	-0.390[-5.03]***	-0.516[-6.46]***	0.509[18.85]***	0.533[15.95]***
Constant variable	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Observations	13,855	18,198	52,064	52,064
Adjusted R squared	0.441	0.414	0.381	0.37

***/**/* means significance at 0.01, 0.05, and 0.10 level, respectively.

Table 9. Result of Analysis on Financial Performance

disclosures proportion the better the firms' financial performance, and for firms with negative profitability, the higher the ESG disclosures proportion the worse the firms' financial performance; Group 4 takes firms absolute amount of profitability as dependent variables, finding a positive relationship between firms ESG disclosures proportion and firms' financial performance magnitude.

The observed outcome also supports the hypothesis 1, which tells us that the higher the ESG disclosures proportion, the more likely that a firm have an enormous financial

performance magnitude, which is in line with previous finding that an opposite tendency on the ESG disclosures exist between profitable firms and firms facing financial losses.

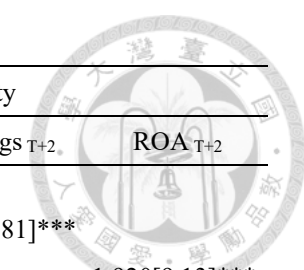


4.3 ESG Disclosures and Earnings Persistence

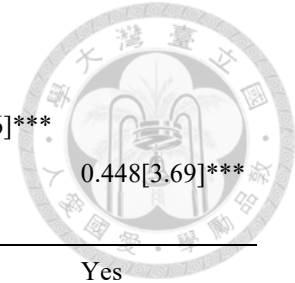
In this part, I examine the implication of ESG disclosures for earnings persistence. Following the design of Li (2008), the regression analysis examines the relationship between earnings, ESG disclosures and their interaction in the current year and earnings projections for both one and two years ahead. The interaction term measures the impact of changes in the proportion of ESG disclosures on the level of earnings persistence. In all regression analyses, control variables (DIV, MTB, SIZE, CAPX, LEV, EMP, BETA, VOL, SPI, AQC and FOG) are incorporated to account for potential determinants of ESG disclosures, as well as their interactions with earnings.

In Table 10, Group 1 models investigate the impact of ESG disclosures on earnings persistence, using Earnings and ROA as proxies for profitability. Irrespective of whether Earnings or ROA is utilized and whether the forecast period is one year or two years ahead, the findings consistently convey analogous information across all models.

It is found that there is a significant negative relationship between ESG disclosures and firms' future probability, while there is a significant positive association between the interaction term and firms' future financial performance, which supports the



Dependent variable	[1] Profitability				[2] Positive profitability			
	Earnings _{T+1}	ROA _{T+1}	Earnings _{T+2}	ROA _{T+2}	Earnings _{T+1}	ROA _{T+1}	Earnings _{T+2}	ROA _{T+2}
Earnings	1.023[25.09]***		0.564[11.42]***		1.504[16.16]***		1.583[12.81]***	
ROA		0.702[13.58]***		0.318[5.49]***		1.646[9.90]***		1.920[9.13]***
ESG	-0.097[-3.51]***	-0.136[-3.40]***	-0.138[-4.18]***	-0.203[-4.60]***	-0.034[-1.35]	-0.067[-1.92]*	-0.075[-2.27]**	-0.070[-1.58]
Earnings*ESG	0.151[1.81]*		0.432[4.34]***		0.468[2.23]**		0.818[2.97]***	
ROA*ESG		0.322[2.95]***		0.545[4.54]***		1.156[2.99]***		1.076[2.22]**
Constant variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	38,910	38,910	34,942	34,942	27,081	23,729	24,297	21,339
Adjusted R squared	0.687	0.528	0.581	0.439	0.411	0.192	0.279	0.156
Dependent variable	[3] Negative profitability				[4] Absolute profitability			
	Earnings _{T+1}	ROA _{T+1}	Earnings _{T+2}	ROA _{T+2}	Earnings _{T+1}	ROA _{T+1}	Earnings _{T+2}	ROA _{T+2}
Earnings	1.112[11.69]***		0.584[5.17]***		0.934[20.29]***		0.412[7.48]***	
ROA		0.617[6.48]***		0.192[1.84]*		0.620[11.49]***		0.203[3.43]***
ESG	-0.186[-1.79]*	-0.168[-1.47]	-0.301[-2.48]**	-0.391[-3.16]***	0.082[2.73]***	0.129[3.15]***	0.087[2.49]**	0.152[3.45]***



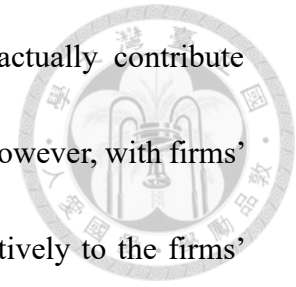
(continued)

Earnings*ESG	0.059[0.31]		0.139[0.62]		0.115[1.25]		0.340[3.16]***
ROA*ESG		0.314[1.56]		0.284[1.31]		0.229[2.03]**	0.448[3.69]***
Constant variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,829	15,181	10,645	13,603	38,910	38,910	34,942
Adjusted R squared	0.550	0.440	0.450	0.375	0.613	0.494	0.497

***/**/* means significance at 0.01, 0.05, and 0.10 level, respectively.

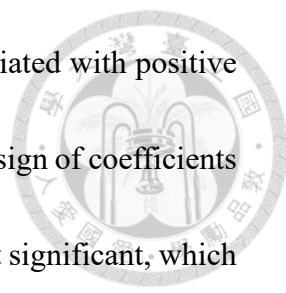
Table 10. Result of Analysis on Earnings Persistence

hypothesis 2a and 2b, indicating that the ESG disclosures actually contribute negatively to the future, resulting in negative earnings persistence, however, with firms' current profitability growing, the ESG disclosures contribute positively to the firms' future financial performance, leading to positive earnings persistence.



The results also explained that the level of earnings persistence that ESG disclosures provided are very different for firms with different profitability. The negative coefficient of ESG disclosures can be represented as the cost of engaging sustainable management, if the firms do not make profit enough or even suffering from financial losses, then the proportion of ESG disclosures cannot guarantee the stability on firms' future financial performance, however, as firms' profitability increasing, the ESG disclosures show its value in enhancing firms' earnings persistence.

I conducted further examinations to ascertain the implications of ESG disclosures on firms with varying profitability. The outcomes of this investigation are presented in group 2 and group 3 of Table 10, where models are applied to sub-samples of both profitable and non-profitable firms. It can be found that for models in group 2, the relationships remain the same as group 1, supporting that for profitable firms, firms' ESG disclosures is negatively related to firms' earnings persistence, and the interaction of ESG disclosures and profitability is positively related to firms' earnings persistence, which also consolidating the argument that the ESG disclosures implicitly contain a



concept of cost, at the same time, and the ESG disclosures do associated with positive earnings persistence for profitable firms; For models in group 3, the sign of coefficients also remain the same as group 1, however, the interaction term is not significant, which represents that the effect on earnings persistence do not change significant while the firms' losing amount increase or decrease, supporting that for losing firms, firms' ESG disclosures is negatively related to firms' earnings persistence, and the interaction of ESG disclosures and profitability have no significant relationship with firms' earnings persistence, which in other way confirm that the ESG disclosures only bring better implication for earnings persistence on firms with better profitability.

Group 4 of Table 10 shows the results applying the regression model with absolute amount of firms' profitability, to be noticed that the results show a difference relationship between ESG disclosures and earnings persistence, it is reasonable for that the implications of ESG disclosures have different patterns for firms with different profitability.

5. Conclusions

This study make extension on prior research regarding sustainable management disclosures, investigating on the determinants of ESG disclosures and the association of ESG disclosures toward financial performance and earnings persistence.

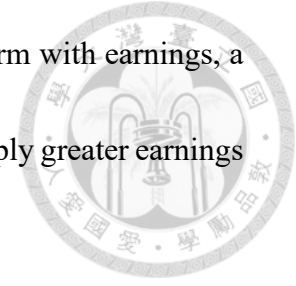
My study makes four significant contributions. Firstly, I introduce a novel approach using FinBERT-ESG to extract ESG information from the MD&A section of financial reports. This approach has not been utilized in prior studies on sustainable management disclosure.

Secondly, I conduct determinants analysis on ESG disclosures within financial reports. The findings reveal positive associations between ESG disclosures and factors such as dividends, market-to-book ratio, capture expenditure, and number of employees, and negative associations between ESG disclosures and factors like leverage, volatility of business, and special events. Besides, it is observed that there is a positive relationship between firms' absolute amount of profitability and ESG disclosures.

The third contribution involves analyzing the relationship between ESG disclosures, firms' financial performance, and addressing inconsistencies in prior studies. The study uncovers an inverse association based on firms' profitability: firms with higher profitability are more inclined to engage in sustainable management practices, leading to greater ESG disclosures. On the other hand, firms experiencing financial losses also tend to disclose more ESG information, which is possibly caused by distracting disclosures taken by firms' management.

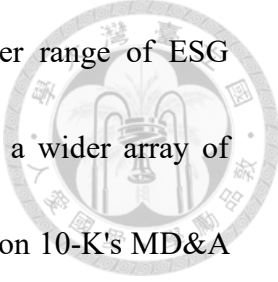
Lastly, I explore the relationship between ESG disclosures and firms' earnings persistence. The study reveals a negative relationship between ESG disclosures and

earnings persistence. However, when considering the interaction term with earnings, a positive association emerges. This suggests that ESG disclosures imply greater earnings persistence as firms' profitability increase.



Several limitations exist in this study. Firstly, as the regression result report positive relationship in both 4.1 and 4.2, which draw forth the potential issue of endogeneity between the quantity of ESG disclosures and earnings persistence. In this study, the primary aim is to examine the relationship between the quantity of ESG disclosures and firms' earnings performance, consequently, the issue of endogeneity has not been subjected to testing within the scope of this research. Secondly, it is imperative to acknowledge that the results heavily rely on the labels generated by FinBERT-ESG, without further finetuning, the vanilla version does not guarantee high precision. Thirdly, a significant number of firm-years are devoid of any identified ESG sentences in their 10-Ks' MD&A section, resulting in a zero measurement of their ESG disclosure. This could potentially have an impact on the regression results.

To advance future studies, several research directions are recommended. Firstly, the utilization of two-stage least squares regression analysis can furnish more robust empirical outcomes. This approach allows for addressing endogeneity concerns and may significantly enhance the reliability and validity of the findings. Secondly, an improvement in the accuracy of ESG information identification can be attained through



additional finetuning of the FinBERT-ESG model using a broader range of ESG sentences, thus yielding more precise results. Thirdly, considering a wider array of information channels would be beneficial. While this study focused on 10-K's MD&A sections, incorporating other channels such as ESG reports, websites, and newsletters could provide additional insights. Lastly, conducting market reaction analysis would help assess the informational value of ESG disclosures within financial reports, which can shed light on the extent to which such disclosures influence investor perceptions and subsequent market outcomes.

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