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ESG Risk and Audit Firm Reputation

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ABSTRACT

Purpose:
The importance of ESG continues to grow day by day, and ESG risk management has become crucial for corporate sustainability. Understanding ESG risk management is an urgent and crucial issue that cannot be delayed any longer. This study aims to examine the relationship between ESG risk management and audit firms' reputation.

Design/methodology/approach:
This study investigates the correlation between the reputational effect of audit firms and ESG risk management, using companies listed on the TWSE and the TPEx in 2023 as the target population. We further develop two research models: first, a regression model (1) to examine whether the brand reputation effects of Big4 and non-Big4 audit firms are associated with corporate ESG risk management scores and set up an Ordered Probit model (2) to investigate how the reputation effect of Big4 and non-Big4 audit firms is related to corporate ESG risk ratings.

Finding:
The empirical results show that companies audited by the Big 4 audit firms have better ESG risk management performance than those audited by non-Big 4 audit firms, and that companies' ESG risk management performance varies depending on the specific Big 4 audit firm engaged. Furthermore, the association between ESG risk management performance and the reputation effect of audit firms depends on the firm's business model and corporate governance structure. The family-owned business model and strong corporate governance environment synergistically enhance the reputation effect of audit firms, thereby contributing to the improvement of ESG risk management performance. Finally, the choice of earnings management strategy affects the relationship between ESG risk management performance and the reputation effect of audit firms. Risk-averse companies that adopt conservative earnings management strategies benefit from the positive impact of the Big 4 audit firm reputation effect on ESG risk management performance.

Research limitations/implications:
The research limitations of this study stem from the difficulty in accessing ESG information, which constrains the sample size.

Originality/value:
First, this study provides a comprehensive examination of the ESG risk management performance of listed companies in Taiwan, contributing to a deeper understanding of the current status of ESG strategy development and implementation among Taiwanese companies. Second, by examining corporate ESG risk management, the study explores the impact of audit firms' reputation on corporate ESG risk management performance. Third, our findings contribute to academic research on ESG issues by incorporating the potential impact of audit firms' reputation into the analysis.

1. Introduction

The intensification of global warming and extreme weather events poses the greatest challenge to the survival of the world. The subsequent chain reactions triggered by the COVID-19 pandemic, international issues and financial crises further challenge human wisdom. This series of warnings not only makes countries around the world think about strategies related to environmental (E), social (S) and governance (G) issues, but also prompts the United Nations and

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ISO to actively formulate ESG-related standards. This is transforming sustainable development from mere rhetoric into a tangible force influencing the world. Faced with concerns about environmental protection, social responsibility and corporate governance, society recognizes that only by implementing ESG can we truly enter a sustainable era and have a bright future. As a result, public demands and expectations for sustainable development have shifted from consensus to concrete norms. Currently, specific regulations regarding ESG in Taiwan are primarily based on the "Corporation Rules Governing the Preparation and Filing of Sustainability Reports by TWSE Listed Companies" and "Rules Governing the Preparation and Filing of Sustainability Reports by TPEx Listed Companies". These regulations require companies with paid-in capital of over 2 billion NT dollars and specific industries to prepare and file sustainability reports. These reports must disclose operational decisions related to environmental impact, social responsibility, employee relations, supply chain management, corporate governance structure, and transparency to ensure accountability in their operations. Additionally, Taiwan will require all listed companies to prepare sustainability reports by 2025.

Sustainability reports are also encouraged to undergo third-party certification to ensure the reliability and transparency of ESG information (sustainability reports for the chemical and financial insurance industries must be certified by third parties). The escalating uncertainty and rapid changes in the global capital market have rendered economic activities in the business environment increasingly complex and risky. As a result, the role of auditors as guardians of the capital market has become more diverse. In the past, financial statements were the primary basis for assessing a company's future performance, with auditors providing reasonable assurance on the quality of financial reporting to ensure the normal functioning of the capital market. Today, ESG strategies are critical in determining a company's sustainability. Third-party assurance by auditors provides reasonable assurance on sustainability reports, highlighting the strategic development and implementation of sustainable practices (Bakarich et al., 2023; Asante-Appiah & Lambert, 2022; Cohn, 2021; Ho, 2021; Holger, 2021). Auditors play a crucial professional role in Taiwan's sustainability journey. Their expertise not only protects the interests of investors, but also assists companies in managing ESG risks and implementing ESG practices, with the ultimate goal of achieving sustainable operations. The importance of their role in the sustainability journey is undeniable.

This study aims to investigate the relationship between ESG risk management and audit firms' reputation, seeking to understand the role played by audit firms in corporate ESG risk management. ESG risk management scores and ratings are employed as proxy variables for corporate ESG risk management performance. This study examines whether the reputation of audit firms influences the ESG risk management scores and ratings of companies. This study focuses on companies listed on the Taiwan Stock Exchange (hereafter called TWSE) and the Taipei Exchange (hereafter called TPEx) in 2023. The ESG risk-related information utilized in this study was manually hand-collected from the Morningstar website and the ESG IR Platform (hereafter called ESGIR). Other relevant data were obtained from the Taiwan Economic Journal (hereafter called TEJ) database. A regression model was established to examine the association between the audit firms' reputation and the ESG risk management. The study analyzed the effect of the reputation of audit firms on the corporate ESG risk rating through an Ordered Probit model. Empirical results suggest that companies audited by the Big 4 audit firms (hereafter called Big4) perform better in terms of ESG risk management scores and ratings compared to those audited by non-Big 4 audit firms (hereafter called non-Big4). This implies that large audit firms possess not only accounting expertise but also knowledge of ESG risk management. They not only understand the financial status of their clients but also have the opportunity to comprehend their clients' ESG risk management practices. By providing non-audit services, the audit firm helps their clients improve their ESG risk management performance. Furthermore, the ESG risk management performance may also vary depending on the auditing conducted by different Big4, with only PwC having a positive impact on the ESG risk management performance of auditees. The relationship between ESG risk management performance and the reputation of audit firms is influenced by the company's operating model and governance structure. Empirical evidence suggests that, under the premise of strong corporate governance, the reputation of the Big4 enhances ESG risk management performance, regardless of whether the company is a family business. In family businesses with good governance, the Big4 has a significant positive impact on ESG risk management performance. Additionally, variations in earnings management strategies can lead to differences in ESG risk management performance. Conservative risk-averse companies audited by Big4 benefit from the reputation effect on ESG risk management. Only PwC clients that adopt conservative earnings management strategies clearly demonstrate the positive impact of audit firm reputation on ESG risk management performance.

This study contributes in the following ways: First, it provides a comprehensive examination of the ESG risk management performance of listed companies in Taiwan, contributing to a deeper understanding of the current status of ESG strategy development and implementation among Taiwanese companies. Second, by examining corporate ESG risk management, the study explores the impact of audit firms' reputation on corporate ESG risk management performance. The empirical results indicate that clients of Big4 outperform those of non-Big4 in terms of ESG risk management scores and ratings. In addition, there are differences in ESG risk management performance between clients of different Big4, with PwC having a particular impact on the ESG risk management performance of its audited clients. These findings contribute to supplementing the extant literature concerning the relationship between audit firms' reputation and ESG performance (Titman & Trueman, 1986; DeAngelo, 1981; Dopuch & Simunic, 1980). Finally, this study also found that the relationship between companies' ESG risk management and audit firms' reputation is influenced by the company's business model, governance structure and earnings management strategies, with governance structure having the greatest impact. These findings contribute to academic research on ESG issues by incorporating the potential impact of audit firms' reputation into the analysis. In addition, the results of this study may assist regulators in encouraging companies to establish dedicated ESG units to strengthen ESG risk management and implementation mechanisms.

2. Related literature

2.1 Importance of ESG risk management

The "Who Cares Wins" report released by the United Nations in 2004 clearly indicates that prioritizing ESG issues and implementing ESG policies can contribute to the environmental, social and governance value creation of companies, thereby facilitating their sustainable development in the future (Dechow, 2023; Asante-Appiah, 2020; Serafeim & Grewal, 2020). In recent years, the world has faced numerous high-risk situations, such as climate change, the COVID-19 pandemic, the Russia-Ukraine war, Israel-Palestine Conflict, energy crises, and inflation, which have raised public awareness of ESG-related issues and underlined the importance of companies' sustainable development strategies (Al Amosh & Khatib, 2023; Yahya, 2023; Serafeim & Yoon, 2022). ESG has become a critical criterion for investors to assess whether companies are ready to enter the sustainable era. Many large ESG rating agencies collect, review, and publicly provide information on ESG, scoring and ranking companies on various dimensions of environmental protection, social responsibility, and corporate governance, issuing ESG ratings and scores. Common ESG rating agencies include MSCI, FTSE Russell, ISS, S&P, Moody's, and Morningstar Sustainalytics. The availability of public ESG rating information enhances transparency and encourages companies to invest in ESG, aiming not only to showcase their commitment to ESG but also to create sustainable corporate value (Caskey et al., 2023; Chininga et al., 2023; Dechow, 2023; Li et al., 2022; Raghunandan & Rajgopal, 2022; Billio et al., 2020). However, the implementation and practice of ESG must be based on long-term strategic planning and blueprints of enterprises. ESG strategy considerations must encompass environmental, social, and governance dimensions, and each aspect of ESG action requires careful evaluation to avoid resource wastage and truly mitigate ESG strategy risks while creating economic value for companies and ESG benefits for society (Dathe et al., 2024; Dechow, 2023; Joe, 2023; Sharma, 2023; Gorley, 2022; Christensen et al., 2021; Asante-Appiah, 2020). Therefore, ESG risk management plays a crucial role not only in determining the success of corporate ESG practices but also in determining whether companies can enter the sustainable era, highlighting its undeniable importance.

2.2 Importance of audit firm reputation

Audit firms, as independent third-party professional organizations, not only provide reasonable assurance on financial statements, but also act as external independent oversight mechanisms for companies. Their role in safeguarding the interests of the investing public in the capital market can be likened to that of the gatekeepers of the capital market. Audit firms, with their independent third-party professional status, perform professional duties in economic activities in the capital market, safeguarding the interests of investors and shareholders. Therefore, their reputation as an independent asset in the accounting profession is crucial (Beck et al., 2022; Fan, 2021). There is a wealth of literature (Abbott et al., 2023; Gul et al., 2023; Choudhary et al., 2022; Mohapatra et al., 2022; Chakrabarty et al., 2020; Rothenberg, 2020; Wu & Ye, 2020; Xu & Kalelkar, 2020) on the brand reputation of audit firms, including studies on capital market reactions, economies of scale in audit firms, the relationship between audit firms and companies, audit fee pricing, audit quality/revenue quality, etc. However, the primary research direction is focused on exploring the relationship between audit firm size and audit quality. For example, previous literature (Hale & Truelson, 2023; Hall et al., 2023; Cowle & Rowe, 2022; Guo et al., 2022; Bacha et al., 2021; Zimmerman et al., 2021) has categorized audit firms into Big4 and non-Big4 and found that Big4 can provide better audit quality than non-Big4, and the capital market perceives Big4 to have better brand reputation. Brand reputation reflects not only the independence of auditors but also their professional competence. Therefore, if a company's financial statements are found to be inaccurate, it not only damages the reputation of the company's management, but also significantly damages the brand reputation of the audit firm. As a result, audit firms with a better brand reputation are more likely to emphasize professional competence, provide better audit quality and maintain their role as an independent third party, thus ensuring the normal functioning of economic activity in the capital market.

2.3 ESG risk management and audit firm reputation

ESG is the lifeblood of corporate sustainability and a fundamental aspect of national survival, so its importance is self-evident. As a result, there are a number of prominent ESG rating agencies around the world that annually assess the ESG performance of companies. In addition to disclosing ESG assessment information to market participants, their primary role is to help companies implement sustainable development through the rating mechanism (Economidou et al., 2023; Del Giudice & Rigamonti, 2020; Krueger et al., 2020; Capelle-Blancard & Petit, 2019). In addition to ESG rating agencies, audit firms play an indispensable role in helping companies implement sustainable development. Audit firms not only audit companies' ESG performance, but also assist in planning sustainable development strategies, implementing ESG-related systems and acting as intermediaries for evaluations. Previous literature (Joe, 2023; Asante-Appiah & Lambert, 2022; Asante-Appiah, 2020) has shown that accountants and related auditors are

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among the key factors influencing ESG risk management. Through the audit process, they gain extensive industry knowledge and experience in understanding business risks, and thus provide professional advice on how to manage these risks. According to the "Corporation Rules Governing the Preparation and Filing of Sustainability Reports by TWSE Listed Companies" and "Rules Governing the Preparation and Filing of Sustainability Reports by TPEx Listed Companies" issued by TWSE and TPEx, all listed companies in Taiwan will be required to prepare sustainability reports by 2025. Sustainability reports are encouraged to undergo third-party certification to ensure the reliability and transparency of ESG information (mandatory third-party certification for sustainability reports in the chemical and financial insurance industries). Audit firms are one of the impartial third-party certification organizations. Due to their understanding of various aspects of a company's operations during the audit process, most companies engage audit firms to provide assurance services on sustainability reports (Choudhary et al., 2022; Cimini et al., 2022; Ahn et al., 2021; Cook et al., 2020). As Taiwan's regulations on the preparation and filing of sustainability reports become more stringent, the role of audit firms in guiding companies into the sustainability era is becoming more prominent and important. Previous literature (Hale & Truelson, 2023; Hall et al., 2023; Cowle & Rowe, 2022; Guo et al., 2022; Bacha et al., 2021; Zimmerman et al., 2021) has found that audit firms have different brand reputation advantages, with Big4 being able to provide better audit quality than non-Big4. Therefore, when companies engage Big4 for assurance services on sustainability reports, the reflected performance in ESG risk management is expected to be better.

3. Sample distribution and research design

3.1 Sample and data

This study investigates the correlation between the reputational effect of audit firms and ESG risk management, using companies listed on the TWSE and the TPEx in 2023 as the target population. The ESG risk assessment information utilized in this study was manually collected from both the Morningstar website and the ESGIR. Taiwan's Corporate Governance Rating data were sourced from the ESGIR and TEJ Corporate Governance Module in the TEJ database, while other financial and auditing information was extracted from the TEJ database. Due to the unique nature of industries such as finance, insurance, and securities, their financial information differs from that of general companies and has therefore been excluded from this study. After the sample selection process, a total of 383 samples of listed companies in Taiwan were obtained. Table 1 presents the sample distribution for this study. Panel A displays the industry distribution of the sampled companies, with those audited by the Big4 constitute approximately 95% of the sample. Furthermore, the electronics industry represented the largest proportion of the overall sample distribution, accounting for approximately 53.26%. Panel B provides an overview of the distribution of ESG risk ratings for the sample firms. The results indicate that the medium of ESG risk rating has the highest proportion among the sample firms, with approximately 47%. PwC and KPMG have the largest proportion of ESG risk ratings below the medium, accounting for 85.1% (80/94) and 84.9% (73/86) of ESG risk ratings, respectively. This indicates that the clients of PwC and KPMG generally have better ESG risk ratings.

3.2 Research design

3.2.1 Model specification

This study investigates the relationship between the brand reputation of audit firms and corporate ESG risk management, seeking to determine the impact of the reputation effect of audit firms on corporate ESG risk management strategies. The classic literature (DeAngelo, 1981; Simunic, 1980) on auditing has identified differences in audit quality between Big N and Non-Big N auditors. Therefore, this study develops two research models: first, a regression model (1) to examine whether the brand reputation effects of Big4 and non-Big4 audit firms are associated with corporate ESG risk management scores and sets up an Ordered Probit model (2) to investigate how the reputation effect of Big4 and non-Big4 audit firms is related to corporate ESG risk ratings.

Table 1 Sample distribution

Panel A: Distribution by auditor and industry

Industry \ Auditor	Non-Big4 (n = 19)	Big4 (n = 364)				Total
		KPMG	EY	PwC	Deloitte	
Cement	0	0	0	0	4	4 (1.04%)
Foods	0	3	0	4	4	11 (2.87%)
Plastics	1	3	1	1	5	11 (2.87%)
Textiles	0	2	0	2	3	7 (1.83%)
Electric & Machinery	1	2	1	4	4	12 (3.13%)
Appliance & Cable	1	1	0	0	2	4 (1.04%)
Chemicals	2	6	1	4	12	25 (6.53%)
Glass Ceramics	0	1	1	0	0	2 (0.52%)
Paper	2	1	0	0	2	5 (1.31%)
Steel & Iron	3	2	2	0	8	15 (3.92%)
Rubber	1	1	0	2	2	6 (1.57%)
Automobile	0	2	0	2	4	8 (2.09%)
Electronics	5	51	23	56	69	204 (53.26%)
Constructions	2	6	2	4	4	18 (4.70%)
Transportations	0	4	0	4	7	15 (3.92%)
Tourism	0	0	1	1	1	3 (0.78%)
Wholesale & Retail	1	0	1	2	1	5 (1.31%)
Others	0	1	4	8	15	28 (7.31%)
Total	19 (4.96%)	86 (22.46%)	37 (9.66%)	94 (24.54%)	147 (38.38%)	383 (100%)

Panel B: Distribution by auditor and ESG risk category

ESG risk category \ Auditor	Non-Big4 (n = 19)	Big4 (n = 364)				Total
		KPMG	EY	PwC	Deloitte	
Negligible	0	0	0	1	1	2 (0.52%)
Low	1	29	9	38	40	117 (30.55%)
Medium	11	44	18	41	66	180 (47.00%)
High	3	11	10	11	34	69 (18.01%)
Severe	4	2	0	3	6	15 (3.92%)
Total	19 (4.96%)	86 (22.46%)	37 (9.66%)	94 (24.54%)	147 (38.38%)	383 (100%)

The research models are presented below:

$$ESGSC_{i,t+1} = \beta_1 BIGN_{i,t} + \sum Control\ Variables_{i,t} + \varepsilon_{i,t} \quad (1)$$
$$ESGRA_{i,t+1} = \beta_1 BIGN_{i,t} + \sum Control\ Variables_{i,t} + \varepsilon_{i,t} \quad (2)$$

where, for firm *i* and year *t*:

ESGSC = ESG risk management score, where a higher value of ESG risk score reflects a higher ESG risk;
ESGRA = ESG risk rating, where the ESG risk rating is divided into five degrees, with the highest degree representing the highest ESG risk;
BIGN = 1 if the firm's auditor is a Big 4 firm, else 0;
INDBOD = number of independent directors divided by total board size;
BDSIZE = number of directors on the board;
DEVIATION = the stock-control right minus the earnings-distribution right;
CONTROL = number of seat-control directors divided by the total board size;
ROA = net income divided by total assets;
DE = total debt divided by total assets;
OCF = cash flow from operations divided by total assets;
SIZE = dummy variables controlling for size based on total assets;

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AGE = the natural log of one plus the number of years elapsed since the year of incorporation;
IND = dummy variables controlling for industries;
ε = error term.

The seminal literature in auditing (Francis et al. 2005; Ferguson et al. 2003) has indicated potential differences in the brand reputation effects of the Big4. Thus, this study incorporates four dummy variables representing *KPMG*, *EY*, *Deloitte*, and *PwC* to examine whether the brand reputations of these Big4 are associated with corporate ESG risk management strategies. The research models are as follows:

$$ESGSC_{i,t+1} = \beta_1 KPMG_{i,t} + \beta_2 EY_{i,t} + \beta_3 Deloitte_{i,t} + \beta_4 PwC_{i,t} + \sum Control\ Variables_{i,t} + \varepsilon_{i,t} \quad (3)$$
$$ESGRA_{i,t+1} = \beta_1 KPMG_{i,t} + \beta_2 EY_{i,t} + \beta_3 Deloitte_{i,t} + \beta_4 PwC_{i,t} + \sum Control\ Variables_{i,t} + \varepsilon_{i,t} \quad (4)$$

where, for firm *i* and year *t*:
KPMG = 1 if the firm's auditor is KPMG audit firm, else 0;
EY = 1 if the firm's auditor is EY audit firm, else 0;
Deloitte = 1 if the firm's auditor is Deloitte audit firm, else 0;
PwC = 1 if the firm's auditor is PwC audit firm, else 0.

3.2.2 Variable definitions

The dependent variables used in this study are the ESG risk management score (ESGSC) and the ESG risk rating (ESGRA), with data hand-collected from the Morningstar website and the ESGIR. Both the Morningstar website and the ESGIR serve as public information platforms, utilizing diverse research methods and standards to assess the ESG risk management scores of various companies for investors' reference and selection. The ESG risk management information not only serves as a crucial reference for investment decisions but also aids investors in comprehensively evaluating companies' performance in environment, social, and governance. A higher ESGSC indicates a higher level of risk in a company's ESG management, while a higher ESGRA signifies a higher level of risk in a company's ESG management, based on a five-level ESG Risk Rating scale. To investigate whether the brand reputation effects of Big4 and non-Big4 are linked to corporate ESG risk management, this study creates a dummy variable for Big4 (BIGN). The independent variable, BIGN, assign a value of 1 if audited by a Big4 and 0 otherwise. Subsequently, four separate dummy variables are created for KPMG, EY, Deloitte, and PwC, respectively, to substitute BIGN, aiming to test whether the brand reputation of each Big4 is correlated with the ESG risk management strategies of corporations.

Drawing on relevant past research, this study identifies interfering factors that may affect the research outcomes as control variables. The study utilizes several control variables to measure corporate governance, including independent director proportion (INDBOD), board size (BDSIZE), deviation between share control and surplus distribution (DEVIATION), and board seat control ratio (CONTROL) (Cohen et al., 2023; Shi et al., 2021; Burke et al., 2020). It is expected that lower quality corporate governance mechanisms will result in poorer supervisory and managerial decisions, leading to an increase in ESG-related risks. This study also employs return on assets (ROA), debt ratio (DE), and operating cash flow ratio (OCF) as control variables for corporate financial performance, with the anticipation that worse financial performance will be associated with higher ESG-related risks (Chen et al., 2023; Darendeli et al., 2022; Christensen et al., 2021; Hettler et al., 2021; Feng & Malik, 2020). Finally, this study examines the impact of firm size (SIZE), firm age (AGE), and industry (IND) on the subject (Zhao et al., 2023; Burke et al., 2020).

4. Empirical results and analysis

4.1 Descriptive statistics

Table 2 presents the descriptive statistics of the sample companies. The results indicate that the mean ESG risk management Score (ESGSC) is 24.46 with a median of 23.42. Similarly, the mean ESG risk rating (ESGRA) is 2.943 and the median is 3. These findings suggest that the ESG risk level of the overall sample exhibits a moderate level, indicating satisfactory performance by most companies in controlling ESG risk. Within the entire sample, the ESG risk management score ranges from 8.37 (Negligible) to 53.35 (Severe), while the ESG risk rating performance ranges from 1 (Negligible) to 5 (Severe). The mean value of Independent Directors on the Board of Directors (INDBOD) is 0.376 and the median value is 0.364. This indicates that the majority of the companies comply with Article 14-2 of the Securities and Exchange Act, which requires the number of independent directors to be at least one-fifth of the total number of seats on the board of directors. However, the minimum value is 0.111, which means that a small number of companies in the sample do not comply with the Securities and Exchange Act. The board size (BDSIZE) value averages at 9.159, which is close to the median of 9. The minimum value is 5, meeting the requirement of Article 26-3 of the Securities and Exchange Act that the board must consist of no fewer than five members. With regards to the other control variables, the mean of return on assets (ROA) is 0.08, with a median of 0.069. The mean of firm size (SIZE) is 17.441, close to the median of 17.316, indicating no extreme large or small firms in the sample. The mean of firm age (AGE) is 3.14, which is similar to the median of 3.178, representing a relatively even distribution of the number of listed company ages in the sample.

4.2 Correlation analysis
The correlation between the variables was observed using the Pearson correlation coefficient matrix. From the matrix in Table 3, it can be observed that the correlation coefficient between BIGN and ESGSC is -0.171, and with ESGRA is -0.164, both of which are significant, indicating that clients audited by the Big4 generally exhibit better ESG risk management scores and ratings. Operating cash flow (OCF) shows a significant negative correlation with ESGSC and ESGRA, while firm size (SIZE) also exhibits a significant negative correlation with ESGSC and ESGRA. This suggests that companies with higher cash flow and larger size tend to have lower ESG-related risks. Moreover, although the Pearson correlation coefficients between board independence (INDBOD) and board size (BDSIZE) are relatively large, the subsequent empirical results in the attached tables show that the VIF values are all below 10, indicating that multicollinearity among the independent variables is within an acceptable range and should not pose a serious problem.

Table 2 Descriptive statistics

Variable[a]	Mean	SD	Min.	p25	p50	p75	Max.
ESGSC	24.460	7.814	8.370	18.980	23.420	29.200	53.350
ESGRA	2.943	0.813	1.000	2.000	3.000	3.000	5.000
INDBOD	0.376	0.094	0.111	0.333	0.364	0.429	0.667
BDSIZE	9.159	2.225	5.000	7.000	9.000	10.000	20.000
DEVIATION	0.078	0.127	0.000	0.002	0.013	0.093	0.603
CONTROL	0.475	0.152	0.111	0.364	0.444	0.571	0.769
ROA	0.080	0.085	-0.341	0.032	0.069	0.116	0.466
DE	0.453	0.186	0.007	0.318	0.459	0.585	0.979
OCF	0.103	0.117	-0.290	0.035	0.095	0.167	0.421
SIZE	17.441	1.307	13.695	16.530	17.316	18.138	22.326
AGE	3.140	0.507	1.099	2.996	3.178	3.401	4.127

[a] Please refer to Section 3.2 for the definition of the variables reported in this table.

4.3 Regression analysis results

4.3.1 ESG risk management and the reputation effect of audit firms
This study investigates the association between the reputation of audit firms and the effectiveness of corporate ESG risk management. This study observes the performance of corporate ESG risk management scores and ratings, and the empirical results are presented in Table 4. In Column (1), the estimated coefficient for audit firms (BIGN) is significantly negative, with a coefficient value of -4.136 (t=-2.40, p<0.01). Similarly, in Column (2), the estimated coefficient for audit firms (BIGN) is negative and significant, with a coefficient value of -4.136 (z=-2.48, p<0.01), indicating that companies audited by Big4 tend to exhibit better ESG risk management scores and ratings compared to those audited by non-Big4. The empirical results suggest that large audit firms possess not only accounting expertise but also ESG risk management expertise. This enables them to understand not only the financial status of their clients but also their ESG risk management status during the appointment process. This positions them to offer non-audit services, such as recommendations for enhancing ESG risk management strategies, thereby contributing to improved risk management performance. Regarding control variables, the empirical results indicate that companies with better governance practices (DEVIATION, CONTROL), larger firm size (SIZE), and longer incorporation years (AGE) are more likely to engage in activities related to ESG sustainability development. This, in turn, reduces the probability of ESG crises occurring in the future and enhances their ESG risk management performance. Additionally, investing more resources in the ESG risk management mechanism can improve its efficiency and lead to a better rating for ESG risk management. Additionally, companies with longer listing years possess more mature industry experience, providing them with a clearer understanding of how to develop their ESG risk management competitive advantage, hence receiving positive assessments in ESG risk management.

4.3.2 ESG risk management and Big 4 reputation
Based on the empirical results from Table 4, it is evident that the reputation effect of the Big4 has a significant positive impact on corporate ESG risk management performance. Therefore, this study further subdivides the Big4 sample into four subgroups: KPMG, EY, PwC, and Deloitte, to examine whether there are differences in the impact of the reputation effect of Big4 on corporate ESG risk management performance. The empirical results are presented in Table 5. The findings indicate that in the subgroups of KPMG and PwC, the estimated coefficients of the reputation effect (KPMG, PwC) are both negative and in line with expectations. However, only the PwC subgroup has a significant coefficient of 5%, using ESG risk management score (ESGSC) and ESG risk rating (ESGRA) as dependent

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variables, the estimated coefficient values are -1.904 (t=-2.29, p<0.05) and -0.269 (z=-1.92, p<0.05) respectively. In the subgroups of EY and Deloitte, the estimated coefficients of the reputation effect (EY, Deloitte) are both positive. Particularly, the estimated coefficient of the Deloitte subgroup reaches a significant level at 5%. Using ESG risk management score (ESGSC) and ESG risk rating (ESGRA) as dependent variables, the estimated coefficient values are 1.492 (t=1.99, p<0.05) and 0.231 (z=1.85, p<0.05) respectively. The information above suggests that the ESG risk management performance of companies may vary depending on the appointment of different Big4 for auditing. Only PwC among the Big4 has a positive impact on the ESG risk management performance of audited clients. The empirical results of the control variables are consistent with the previous discussion, indicating that good corporate governance (DEVIATION, CONTROL), larger firm size (SIZE), and older firms (AGE) exhibit better ESG risk management performance.

4.3.3 The impact of family firms on ESG risk management and the reputation of Big 4

Family businesses play a significant role in the economic growth of Asian economies, with the family ownership model being prevalent in many Asian countries. In Taiwan, for instance, over half of the listed companies are family businesses, exerting substantial influence on the overall market value (EY 2022). Previous studies (Ahmed et al., 2024; Maquieira et al., 2024; Indrajaya et al., 2023; Sun et al., 2023; Wu et al., 2022; Chen & Cheng, 2020) have found that family businesses tend to adopt a more conservative management approach, emphasizing sustainable development and long-term positioning, they are also more inclined to leverage ESG-related strategies to gain competitive advantages. Therefore, considering the characteristics of family business management models may contribute to the promotion of ESG risk management strategies and the enhancement of ESG risk management performance. This study further divides the research sample into two subgroups: family businesses (n=216) and non-family businesses (n=148), to examine whether there are differences in the impact of the reputation of the Big4 on corporate ESG risk management performance. The empirical results are presented in Table 6.

The empirical results in Panel A are similar to those in Table 5. In the subgroups of KPMG and PwC, the estimated coefficients of the reputation of the audit firms (KPMG, PwC) are negative and in line with expectations. Yet only the estimated coefficient in the PwC subgroup reaches the 5% significance level. Using ESG risk management scores (ESGSC) and ESG risk ratings (ESGRA) as dependent variables, the estimated coefficients are -2.495 (t=-2.11, p<0.05) and -0.356 (z=-1.82, p<0.05), respectively. In the subgroups of EY and Deloitte, the estimated coefficients for the reputation of the audit firms (EY, Deloitte) are positive, but weakly support that the reputation of the audit firms does not have a positive impact on corporate ESG risk management performance. As shown in the empirical results of Panel B, except for the Deloitte subgroup, the estimated coefficients for the reputation of the audit firms (KPMG, EY, PwC) are negative and in line with expectations, but they do not reach the significance level. The above information indicates that the ESG risk management performance of family businesses may differ depending on which of the Big4 they engage for auditing, with only PwC among the Big4 having a positive impact on the performance of its audited clients in ESG risk management. Additionally, there is no evidence supporting that the reputation of the audit firms contributes to the ESG risk management performance of non-family businesses.

4.3.4 The impact of corporate governance environment on ESG risk management and the reputation of Big 4

The core values of businesses should incorporate the implications of ESG risk management in tandem with the evolving times to underscore the commitment of enterprises to sustainable operations. How to implement ESG-related risk management activities and embed the concept into corporate operations to create new core values that integrate ESG sustainable operations relies on whether corporate governance mechanisms can exert influence to promote the governance practice of ESG risk management. Past literature has found that the quality of the corporate governance environment has a decisive impact on driving company ESG risk management strategies (Oyewo et al. 2024; Dyck et al. 2023; Huang et al. 2023; Sancha et al. 2023; Seow 2023; Chebbi and Ammer 2022; Fuadah et al. 2022). Therefore, this study incorporates evaluation indicators of the corporate governance environment for consideration, dividing the research sample into the top 20% of corporate governance ratings (n=169) and the non-top 20% of corporate governance ratings (n=195) to examine whether there are differences in the impact of the reputation of the Big4 on corporate ESG risk management performance. The empirical results are presented in Table 7.

The empirical results in Panel A indicate that when the corporate governance rating of the enterprise is in the top 20%, in both the KPMG and PwC subgroups, the estimated coefficients of the reputation effect of the audit firms (KPMG, PwC) are negative and in the expected direction. Specifically, in the KPMG subgroup, the estimated coefficient values for ESG risk management score (ESGSC) and ESG risk rating (ESGRA) as dependent variables are -1.57 (t=-1.42, p<0.1) and -0.376 (z=-1.75, p<0.05), respectively. In the PwC subgroup, the estimated coefficient value for ESGSC as the dependent variable is -1.986 (t=-1.71, p<0.05), while for ESGRA, the estimated coefficient value is negative but not significant. The empirical results in Panel B indicate that among companies with a corporate governance rating outside the top 20%, significant negative reputation effects of the audit firm (PwC) were found only in the PwC subgroup, reaching a 5% significance level. The estimated coefficient values for ESG risk management score (ESGSC) and ESG risk rating (ESGRA) as dependent variables were -2.241 (t=-1.79, p<0.05) and -0.336 (z=-1.76, p<0.05), respectively.

The above information suggests that the association between ESG risk management performance and audit firm reputation is influenced by the quality of corporate governance structure. A well-developed corporate governance

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environment complements the reputation effects of audit firms (KPMG, PwC), leading to a synergistic effect that enhances the ESG risk management performance of enterprises. When corporate governance is relatively weak, PwC as an audit firm acts as a gatekeeper for the capital market and an advisor for corporate governance. Its strong reputation serves as a moderating factor, contributing to the ESG risk management performance of enterprises.

Table 3 Pearson correlation matrix

Variable[a, b]	*ESGSC*	*ESGRA*	*BIGN*	*INDBOD*	*BDSIZE*	*DEVIATION*	*CONTROL*	*ROA*	*DE*	*OCF*	*SIZE*	*AGE*
ESGSC	1											
ESGRA	**0.934**	1										
BIGN	**-0.171**	**-0.164**	1									
INDBOD	-0.063	-0.026	-0.019	1								
BDSIZE	-0.033	-0.063	0.081	**-0.713**	1							
DEVIATION	0.058	0.059	**0.105**	-0.056	0.042	1						
CONTROL	0.073	0.076	-0.062	**-0.429**	**0.294**	**0.199**	1					
ROA	-0.078	-0.082	**0.104**	0.057	-0.082	-0.011	-0.072	1				
DE	-0.090	-0.078	**-0.125**	**-0.103**	0.049	**-0.110**	**0.144**	**-0.257**	1			
OCF	**-0.122**	**-0.111**	0.040	0.073	-0.059	0.006	-0.071	**0.717**	**-0.237**	1		
SIZE	**-0.213**	**-0.185**	0.042	**-0.155**	**0.302**	0.041	**0.279**	**-0.103**	**0.415**	-0.054	1	
AGE	-0.040	-0.061	**-0.130**	**-0.202**	**0.225**	-0.089	**0.238**	**-0.200**	**0.180**	**-0.206**	**0.322**	1

[a] Please refer to Section 3.2 for the definition of the variables reported in this table.
[b] In this Table, bold text indicates 5% statistical significance.

Table 4 ESG risk and audit firm reputation

		(1)		(2)	
		DV = ***ESGSC***		DV = ***ESGRA***	
Variable[a]	**Pred.**	**Coeff.**	***t*-value[b]**	**Coeff.**	***z*-value**
CONSTANT		51.567	8.20***		
BIGN	-	-4.136	-2.40***	-0.713	-2.48***
INDBOD	-	-5.838	-1.01	-0.756	-0.80
BDSIZE	-	-0.130	-0.53	-0.033	-0.83
DEVIATION	+	4.007	1.38*	0.613	1.29*
CONTROL	+	4.060	1.46*	0.820	1.79**
ROA	-	-3.302	-0.54	-0.830	-0.83
DE	+	-0.277	-0.12	-0.122	-0.32
OCF	-	-3.497	-0.78	-0.455	-0.62
SIZE	-	-0.956	-2.79***	-0.129	-2.25**
AGE	+/-	-2.466	-2.86***	-0.440	-3.10***
IND		Included		Included	
Adj. R^2 / Pseudo R^2		25.26%		12.63%	
Obs.		383		383	

[a] Please refer to Section 3.2 for the definition of the variables reported in this table.
[b] Asterisks *, **, *** indicate significance at the 0.10, 0.05, 0.01 levels, respectively. One-tailed for directional expectations, and two-tailed for others.

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4.3.5 The impact of family business and corporate governance environment on ESG risks and reputation of Big 4

The empirical results from Table 6 indicate that the ESG risk management performance of family firms varies depending on the appointment of different Big4 for audit purposes. The findings from Table 7 further suggest that the association between ESG risk management performance and the reputation effects of the Big4 is influenced by the quality of corporate governance structure. These pieces of information demonstrate that the relationship between ESG risk management performance and the reputation effects of the Big 4 audit firms is not only influenced by the operating model of family businesses but also varies with the quality of corporate governance environment. Hence, this study further divides the sample companies into groups based on whether they are family businesses and the level of corporate governance ratings to explore how different governance profiles affect the association between ESG risk management performance and the reputation effects of the Big4. The empirical results are presented in Table 8.

The research sample was divided into four subgroups: family businesses in the top 20% of corporate governance evaluation (n=84), family businesses in the non-top 20% of corporate governance evaluation (n=132), non-family businesses in the top 20% of corporate governance evaluation (n=85), and non-family businesses in the non-top 20% of corporate governance evaluation (n=63). However, this study found significant negative estimates for the reputation effects of audit firms only in the subgroups of family businesses in the top 20% of corporate governance evaluation (Panel A) and non-family businesses in the top 20% of corporate governance evaluation (Panel C). The empirical results in Panel A show that only the PwC subgroup exhibits a significant negative estimate for the reputation effects of audit firms (PwC), with the estimated coefficient for ESG risk management score (ESGSC) reaching the 1% significance level. In Panel C, the empirical results indicate that only the estimates for the reputation effects of audit firms (KPMG, EY) are significantly negative in the KPMG and EY subgroups. The empirical results indicate that regardless of whether the sample companies are family businesses, as long as the corporate governance structure is sound, it supports the idea that the reputation effects of the Big 4 audit firms contribute to improving ESG risk management performance. Additionally, the positive impact of the Big4 on enhancing ESG risk management performance is particularly evident for family businesses with a good corporate governance structure.

Table 5 ESG risk and Big 4 audit firm reputation

		(1)				(2)				(3)				(4)			
		KPMG				EY				PwC				Deloitte			
		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*	
Variable[a]	Pred.	Coeff.	*t*-value[b]	Coeff.	*z*-value	Coeff.	*t*-value	Coeff.	*z*-value	Coeff.	*t*-value	Coeff.	*z*-value	Coeff.	*t*-value	Coeff.	*z*-value
CONSTANT		47.487	7.68***			46.738	7.53***			47.962	7.80***			47.020	7.63***		
KPMG	-	-0.722	-0.84	-0.143	-1.01												
EY	-					1.581	1.30*	0.243	1.21								
PwC	-									-1.904	-2.29**	-0.269	-1.92**				
Deloitte	-													1.492	1.99**	0.231	1.85**
INDBOD	-	-6.052	-1.05	-0.784	-0.82	-4.850	-0.84	-0.577	-0.60	-5.846	-1.02	-0.734	-0.77	-7.256	-1.25	-0.968	-1.00
BDSIZE	-	-0.129	-0.52	-0.034	-0.82	-0.102	-0.42	-0.028	-0.70	-0.078	-0.32	-0.025	-0.62	-0.130	-0.53	-0.033	-0.81
DEVIATION	+	4.054	1.40*	0.633	1.33*	4.322	1.50*	0.677	1.42*	4.202	1.46*	0.656	1.37*	3.899	1.36*	0.610	1.28
CONTROL	+	3.588	1.28	0.827	1.78**	3.787	1.35*	0.859	1.84**	3.812	1.37*	0.869	1.86**	3.592	1.29*	0.834	1.79**
ROA	-	-1.418	-0.23	-0.612	-0.60	-1.766	-0.29	-0.684	-0.67	-3.102	-0.51	-0.882	-0.86	-2.242	-0.37	-0.754	-0.74
DE	+	-0.667	-0.28	-0.116	-0.30	-0.523	-0.22	-0.102	-0.26	-1.127	-0.48	-0.192	-0.49	-0.988	-0.42	-0.176	-0.45
OCF	-	-5.338	-1.19	-0.617	-0.83	-5.351	-1.19	-0.610	-0.82	-5.424	-1.21	-0.608	-0.82	-5.414	-1.21	-0.622	-0.83
SIZE	-	-0.934	-2.65***	-0.140	-2.37***	-0.941	-2.68***	-0.142	-2.40***	-0.925	-2.64***	-0.141	-2.38***	-0.912	-2.60***	-0.138	-2.33***
AGE	+/-	-2.436	-2.80***	-0.428	-2.98***	-2.505	-2.89***	-0.441	-3.06***	-2.563	-2.97***	-0.450	-3.12***	-2.451	-2.84***	-0.433	-3.01***
IND		Included		Included		Included		Included		Included		Included		Included		Included	
Adj. R^2 / Pseudo R^2		21.21%		11.20%		21.44%		11.25%		22.25%		11.51%		21.96%		11.48%	
Obs.		364		364		364		364		364		364		364		364	

[a] Please refer to Section 3.2 for the definition of the variables reported in this table.
[b] Asterisks *, **, *** indicate significance at the 0.10, 0.05, 0.01 levels, respectively. One-tailed for directional expectations, and two-tailed for others.

Table 6 ESG risk and Big 4 audit firm reputation - Considering ownership structure

Panel A: Family firm[a] (n = 216)

		(1)				(2)				(3)				(4)			
		KPMG				EY				PwC				Deloitte			
		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*	
Variable[b]	**Pred.**	**Coeff.**	***t*-value[c]**	**Coeff.**	***z*-value**	**Coeff.**	***t*-value**	**Coeff.**	***z*-value**	**Coeff.**	***t*-value**	**Coeff.**	***z*-value**	**Coeff.**	***t*-value**	**Coeff.**	***z*-value**
CONSTANT		42.322	4.65***			41.125	4.50***			42.628	4.73***			41.877	4.62***		
KPMG	-	-0.445	-0.38	-0.193	-1.03												
EY	-					2.026	1.17	0.385	1.39*								
PwC	-									-2.495	-2.11**	-0.356	-1.82**				
Deloitte	-													1.388	1.40*	0.257	1.60*
INDBOD	-	-1.309	-0.15	0.147	0.10	-0.051	-0.01	0.439	0.31	-1.192	-0.14	0.195	0.14	-2.449	-0.27	-0.044	-0.03
BDSIZE	-	0.088	0.22	-0.008	-0.12	0.071	0.18	-0.010	-0.15	0.013	0.03	-0.018	-0.28	0.052	0.13	-0.014	-0.23
DEVIATION	+	5.230	1.26	0.846	1.27	5.374	1.30*	0.888	1.33*	4.867	1.19	0.817	1.22	4.841	1.17	0.790	1.18
CONTROL	+	5.318	1.39*	1.053	1.70**	5.489	1.44*	1.079	1.74**	5.643	1.49*	1.100	1.77**	5.476	1.44*	1.076	1.74**
ROA	-	0.949	0.12	-0.337	-0.27	0.805	0.10	-0.421	-0.34	-0.849	-0.11	-0.672	-0.53	0.362	0.05	-0.493	-0.39
DE	+	4.752	1.46*	0.508	0.97	4.818	1.49*	0.501	0.96	3.666	1.13	0.336	0.63	4.239	1.30*	0.400	0.76
OCF	-	-7.829	-1.24	-1.006	-0.99	-7.978	-1.26	-1.045	-1.03	-8.398	-1.34*	-1.084	-1.06	-7.858	-1.225	-1.027	-1.01
SIZE	-	-0.943	-1.88**	-0.127	-1.56*	-0.912	-1.82**	-0.122	-1.50*	-0.849	-1.71**	-0.117	-1.42*	-0.91	-1.82**	-0.123	-1.50*
AGE	+/-	-3.260	-2.55**	-0.596	-2.88***	-3.298	-2.59***	-0.608	-2.93***	-3.317	-2.62***	-0.611	-2.94***	-3.242	-2.55**	-0.597	-2.88***
IND		Included		Included		Included		Included		Included		Included		Included		Included	
Adj.R^2/PseudoR^2		22.96%		14.25%		23.46%		14.42%		24.68%		14.69%		23.70%		14.53%	
Obs.		216		216		216		216		216		216		216		216	

Table 6 (Continued)

Panel B: Non-family firm[a] (n = 148)

		(1)				(2)				(3)				(4)			
		KPMG				EY				PwC				Deloitte			
		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*	
Variable[b]	**Pred.**	**Coeff.**	***t*-value[c]**	**Coeff.**	***z*-value**	**Coeff.**	***t*-value**	**Coeff.**	***z*-value**	**Coeff.**	***t*-value**	**Coeff.**	***z*-value**	**Coeff.**	***t*-value**	**Coeff.**	***z*-value**
CONSTANT		53.652	5.86***			53.543	5.81***			53.731	5.83***			53.520	5.84***		
KPMG	-	-1.371	-1.01	-0.069	-0.29												
EY	-					0.264	0.15	-0.006	-0.02								
PwC	-									-0.171	-0.13	-0.049	-0.21				
Deloitte	-													1.258	0.98	0.110	0.49
INDBOD	-	-11.598	-1.44*	-2.182	-1.50*	-10.799	-1.32*	-2.150	-1.46*	-11.064	-1.37*	-2.161	-1.49*	-13.007	-1.57*	-2.320	-1.55*
BDSIZE	-	-0.398	-1.07	-0.075	-1.11	-0.325	-0.88	-0.071	-1.07	-0.323	-0.86	-0.069	-1.02	-0.362	-0.98	-0.074	-1.11
DEVIATION	+	0.805	0.18	0.111	0.15	0.773	0.17	0.105	0.14	0.761	0.17	0.126	0.16	0.909	0.21	0.123	0.16
CONTROL	+	0.314	0.07	0.246	0.32	0.399	0.09	0.248	0.32	0.374	0.08	0.258	0.33	0.251	0.06	0.246	0.32
ROA	-	-9.307	-0.87	-1.440	-0.76	-8.639	-0.80	-1.410	-0.74	-8.707	-0.81	-1.434	-0.75	-9.815	-0.91	-1.508	-0.79
DE	+	-6.860	-1.87**	-1.035	-1.57*	-7.407	-2.01**	-1.069	-1.62*	-7.497	-2.07**	-1.065	-1.64*	-7.312	-2.02**	-1.052	-1.62*
OCF	-	-1.737	-0.25	-0.048	-0.04	-1.499	-0.22	-0.036	-0.03	-1.504	-0.22	-0.043	-0.04	-1.780	-0.26	-0.062	-0.05
SIZE	-	-0.848	-1.56*	-0.159	-1.60*	-0.878	-1.61*	-0.160	-1.61*	-0.875	-1.61*	-0.160	-1.61*	-0.835	-1.54*	-0.156	-1.57*
AGE	+/-	-1.297	-1.02	-0.258	-1.17	-1.372	-1.08	-0.261	-1.18	-1.375	-1.08	-0.266	-1.20	-1.348	-1.06	-0.262	-1.19
IND		Included		Included		Included		Included		Included		Included		Included		Included	
Adj.R^2/PseudoR^2		17.14%		11.81%		16.48%		11.78%		16.47%		11.80%		17.09%		11.86%	
Obs.		148		148		148		148		148		148		148		148	

[a] The information of family firm is as defined in TEJ database.
[b] Please refer to Section 3.2 for the definition of the variables reported in this table.
[c] Asterisks *, **, *** indicate significance at the 0.10, 0.05, 0.01 levels, respectively. One-tailed for directional expectations, and two-tailed for others.

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Table 7 ESG risk and Big 4 audit firm reputation - Considering corporate governance evaluation

Panel A: Top 20% of corporate governance evaluation[a] (n = 169)

		(1)				(2)				(3)				(4)			
		KPMG				EY				PwC				Deloitte			
		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*	
Variable[b]	**Pred.**	**Coeff.**	***t*-value[c]**	**Coeff.**	***z*-value**	**Coeff.**	***t*-value**	**Coeff.**	***z*-value**	**Coeff.**	***t*-value**	**Coeff.**	***z*-value**	**Coeff.**	***t*-value**	**Coeff.**	***z*-value**
CONSTANT		41.863	5.47***			40.849	5.33***			41.406	5.44***			40.549	5.36***		
KPMG	-	-1.570	-1.42*	-0.376	-1.75**												
EY	-					2.081	1.13	0.245	0.69								
PwC	-									-1.986	-1.71**	-0.260	-1.15				
Deloitte	-													2.197	2.19**	0.436	2.22**
INDBOD	-	-2.289	-0.32	-0.317	-0.22	-0.249	-0.03	0.089	0.06	-1.702	-0.24	-0.089	-0.06	-4.302	-0.59	-0.672	-0.47
BDSIZE	-	0.012	0.04	-0.018	-0.28	0.073	0.22	-0.005	-0.07	0.068	0.20	-0.005	-0.08	-0.012	-0.03	-0.021	-0.33
DEVIATION	+	1.931	0.53	0.790	1.14	1.605	0.44	0.715	1.03	1.660	0.46	0.717	1.04	2.073	0.58	0.809	1.17
CONTROL	+	5.720	1.31*	1.020	1.31*	6.049	1.48*	1.124	1.43*	4.867	1.21	0.986	1.26	3.947	0.98	0.775	0.98
ROA	-	6.229	0.72	1.982	1.17	6.625	0.76	2.165	1.29*	7.476	0.87	2.260	1.35*	6.509	0.76	2.101	1.25
DE	+	-2.886	-0.92	-0.265	-0.44	-3.218	-1.03	-0.375	-0.62	-4.187	-1.35*	-0.502	-0.83	-3.653	-1.19	-0.457	-0.76
OCF	-	-7.582	-1.26	-2.003	-1.71**	-7.890	-1.31*	-2.103	-1.80**	-9.372	-1.56*	-2.286	-1.96**	-8.807	-1.48*	-2.291	-1.96**
SIZE	-	-0.712	-1.71**	-0.107	-1.31*	-0.701	-1.68**	-0.102	-1.26	-0.576	-1.37*	-0.086	-1.05	-0.583	-1.40*	-0.080	-0.98
AGE	+/-	-2.726	-2.51**	-0.535	-2.56***	-2.949	-2.70***	-0.568	-2.71***	-2.933	-2.71***	-0.572	-2.73***	-2.685	-2.50**	-0.537	-2.57***
IND		Included		Included		Included		Included		Included		Included		Included		Included	
Adj. R^2/Pseudo R^2		20.82%		14.93%		20.41%		14.22%		21.32%		14.45%		22.31%		15.43%	
Obs.		169		169		169		169		169		169		169		169	

Table 7 (Continued)

Panel B: Non-top 20% of corporate governance evaluation[a] (n = 195)

		(1)				(2)				(3)				(4)			
		KPMG				EY				PwC				Deloitte			
		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*	
Variable[b]	**Pred.**	**Coeff.**	***t*-value[c]**	**Coeff.**	***z*-value**	**Coeff.**	***t*-value**	**Coeff.**	***z*-value**	**Coeff.**	***t*-value**	**Coeff.**	***z*-value**	**Coeff.**	***t*-value**	**Coeff.**	***z*-value**
CONSTANT		55.897	4.30***			53.980	4.14***			57.063	4.42***			54.990	4.24***		
KPMG	-	1.016	0.72	0.171	0.82												
EY	-					1.118	0.65	0.188	0.73								
PwC	-									-2.241	-1.79**	-0.336	-1.76**				
Deloitte	-													0.694	0.59	0.076	0.44
INDBOD	-	-8.303	-0.81	-0.120	-0.08	-7.574	-0.73	-0.009	-0.01	-8.761	-0.86	-0.181	-0.12	-9.181	-0.89	-0.240	-0.16
BDSIZE	-	-0.138	-0.34	0.005	-0.08	-0.147	-0.36	0.003	0.06	-0.122	-0.30	-0.008	0.13	-0.155	-0.38	0.002	0.03
DEVIATION	+	6.246	1.24	0.577	0.77	6.200	1.23	0.566	0.76	6.927	1.38*	0.671	0.89	5.715	1.14	0.486	0.65
CONTROL	+	3.953	0.93	1.050	1.65**	4.047	0.95	1.056	1.66**	4.826	1.14	1.195	1.86**	4.387	1.02	1.095	1.71**
ROA	-	-8.602	-0.94	-2.432	-1.78**	-7.547	-0.83	-2.257	-1.67**	-10.070	-1.11	-2.672	-1.95**	-7.854	-0.86	-2.291	-1.70**
DE	+	1.949	0.51	0.208	0.37	2.054	0.54	0.222	0.39	2.049	0.54	0.225	0.40	1.858	0.49	0.196	0.35
OCF	-	-2.653	-0.38	0.224	0.21	-3.570	-0.51	0.070	0.07	-2.572	-0.37	0.245	0.24	-3.299	-0.47	0.115	0.11
SIZE	-	-1.402	-1.91**	-0.167	-1.51*	-1.323	-1.82**	-0.153	-1.39*	-1.455	-2.01**	-0.176	-1.59*	-1.348	-1.85**	-0.156	-1.42*
AGE	+/-	-2.671	-1.77*	-0.496	-2.20**	-2.625	-1.73*	-0.489	-2.17**	-2.737	-1.82*	-0.509	-2.25**	-2.672	-1.76*	-0.495	-2.19**
IND		Included		Included		Included		Included		Included		Included		Included		Included	
Adj. R^2/Pseudo R^2		17.95%		12.15%		17.90%		12.12%		19.24%		12.67%		17.87%		12.05%	
Obs.		195		195		195		195		195		195		195		195	

[a] The information of corporate governance evaluation is as defined in TEJ database.
[b] Please refer to Section 3.2 for the definition of the variables reported in this table.
[c] Asterisks *, **, *** indicate significance at the 0.10, 0.05, 0.01 levels, respectively. One-tailed for directional expectations, and two-tailed for others.

Table 8 ESG risk and Big 4 audit firm reputation - Considering ownership structure and corporate governance evaluation

Panel A: Family firm in the top 20% of corporate governance evaluation[a] (n = 84)

		(1)				(2)				(3)				(4)			
		KPMG				EY				PwC				Deloitte			
		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*	
Variable[b]	Pred.	Coeff.	*t*-value[c]	Coeff.	*z*-value	Coeff.	*t*-value	Coeff.	*z*-value	Coeff.	*t*-value	Coeff.	*z*-value	Coeff.	*t*-value	Coeff.	*z*-value
CONSTANT		24.785	1.90*			20.121	1.71*			21.834	1.77*			24.325	1.90*		
KPMG	-	-0.464	-0.29	-0.338	-1.08												
EY	-					11.963	3.56***	9.879	0.04								
PwC	-									-4.422	-2.40***	-0.819	-2.11**				
Deloitte	-													1.230	0.79	0.357	1.16
INDBOD	-	9.574	0.71	3.611	1.35*	10.391	0.86	4.353	1.58*	8.622	0.68	3.835	1.43*	8.032	0.59	3.415	1.26
BDSIZE	-	0.354	0.62	0.067	0.59	-0.100	-0.19	-0.067	-0.55	0.026	0.05	0.014	0.12	0.293	0.51	0.053	0.46
DEVIATION	+	2.953	0.49	1.202	1.04	0.792	0.14	0.726	0.59	2.819	0.49	1.210	1.04	3.042	0.51	1.259	1.09
CONTROL	+	12.531	1.96**	2.980	2.25**	14.519	2.49***	3.960	2.80***	10.969	1.79**	2.811	2.11**	11.783	1.83**	2.784	2.09**
ROA	-	18.165	1.42*	4.572	1.80**	16.489	1.42*	4.238	1.62*	19.261	1.58*	4.955	1.94**	18.256	1.44*	4.676	1.84**
DE	+	5.360	1.06	1.528	1.50*	5.239	1.15	1.776	1.62*	1.606	0.32	0.834	0.79	4.459	0.87	1.248	1.21
OCF	-	-11.870	-1.15	-2.685	-1.34*	-8.412	-0.90	-1.868	-0.89	-14.458	-1.47*	-3.257	-1.60*	-12.652	-1.23	-2.963	-1.47*
SIZE	-	-0.807	-1.21	-0.109	-0.83	-0.412	-0.67	0.005	0.03	-0.216	-0.32	0.009	0.06	-0.719	-1.08	-0.074	-0.56
AGE	+/-	-3.426	-2.05**	-0.789	-2.34**	-3.382	-2.24**	-0.963	-2.71***	-3.287	-2.07**	-0.822	-2.40**	-3.339	-2.01**	-0.785	-2.32**
IND		Included		Included		Included		Included		Included		Included		Included		Included	
Adj.R^2/Pseudo R^2		14.49%		23.56%		29.72%		34.51%		22.12%		25.43%		15.27%		23.66%	
Obs.		84		84		84		84		84		84		84		84	

Table 8 (Continued)

Panel B: Family firm in the non-top 20% of corporate governance evaluation[a] (n = 132)

		(1)				(2)				(3)				(4)			
		KPMG				EY				PwC				Deloitte			
		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*	
Variable[b]	Pred.	Coeff.	*t*-value[c]	Coeff.	*z*-value	Coeff.	*t*-value	Coeff.	*z*-value	Coeff.	*t*-value	Coeff.	*z*-value	Coeff.	*t*-value	Coeff.	*z*-value
CONSTANT		56.790	3.36***			56.293	3.35***			58.514	3.48***			55.996	3.35***		
KPMG	-	0.525	0.28	0.013	0.05												
EY	-					-0.129	-0.06	-0.024	-0.07								
PwC	-									-1.783	-1.03	-0.303	-1.18				
Deloitte	-													0.993	0.68	0.214	1.00
INDBOD	-	-4.748	-0.33	-0.041	-0.02	-4.713	-0.32	-0.055	-0.03	-5.059	-0.35	-0.096	-0.05	-5.296	-0.37	-0.196	-0.09
BDSIZE	-	-0.015	-0.02	-0.016	-0.17	-0.010	-0.01	-0.016	-0.17	-0.071	-0.11	-0.026	-0.27	-0.027	-0.04	-0.021	-0.21
DEVIATION	+	2.798	0.42	0.195	0.20	2.654	0.40	0.185	0.19	2.656	0.40	0.198	0.20	2.240	0.34	0.083	0.08
CONTROL	+	4.440	0.80	1.177	1.44*	4.557	0.82	1.180	1.45*	5.386	0.96	1.338	1.62*	5.220	0.93	1.328	1.60*
ROA	-	-8.600	-0.81	-2.359	-1.54*	-8.350	-0.79	-2.351	-1.54*	-10.557	-0.98	-2.777	-1.76**	-9.073	-0.85	-2.528	-1.64*
DE	+	5.835	1.22	0.659	0.95	5.859	1.23	0.660	0.95	5.634	1.18	0.631	0.91	5.775	1.21	0.652	0.94
OCF	-	-6.796	-0.77	-0.616	-0.48	-6.818	-0.77	-0.615	-0.48	-6.428	-0.73	-0.517	-0.40	-6.546	-0.74	-0.558	-0.44
SIZE	-	-1.522	-1.74**	-0.199	-1.53*	-1.493	-1.71**	-0.198	-1.54*	-1.555	-1.79**	-0.212	-1.63*	-1.481	-1.70**	-0.196	-1.52*
AGE	+/-	-3.328	-1.60	-0.654	-2.13**	-3.356	-1.61	-0.655	-2.14**	-3.467	-1.67*	-0.675	-2.20**	-3.465	-1.66*	-0.684	-2.22**
IND		Included		Included		Included		Included		Included		Included		Included		Included	
Adj.R^2/Pseudo R^2		21.13%		16.82%		21.07%		16.82%		21.87%		17.25%		21.42%		17.12%	
Obs.		132		132		132		132		132		132		132		132	

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Table 8 (Continued)

Panel C: Non-family firm in the top 20% of corporate governance evaluation[a] (n = 85)

		(1)				(2)				(3)				(4)			
		KPMG				EY				PwC				Deloitte			
		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*	
Variable[b]	Pred.	Coeff.	*t*-value[c]	Coeff.	*z*-value	Coeff.	*t*-value	Coeff.	*z*-value	Coeff.	*t*-value	Coeff.	*z*-value	Coeff.	*t*-value	Coeff.	*z*-value
CONSTANT		51.832	4.69***			51.957	4.66***			51.673	4.55***			52.327	4.78***		
KPMG	-	-2.254	-1.30*	-0.292	-0.84												
EY	-					-2.007	-0.81	-0.918	-1.70**								
PwC	-									0.096	0.05	0.118	0.34				
Deloitte	-													2.718	1.71**	0.497	1.55*
INDBOD	-	-4.549	-0.51	-1.781	-0.96	-4.533	-0.50	-2.073	-1.11	-3.425	-0.38	-1.592	-0.86	-6.947	-0.77	-2.240	-1.18
BDSIZE	-	-0.299	-0.60	-0.132	-1.29*	-0.222	-0.45	-0.147	-1.43*	-0.148	-0.30	-0.116	-1.16	-0.352	-0.71	-0.151	-1.47*
DEVIATION	+	-0.896	-0.17	0.292	0.27	-1.352	-0.25	0.178	0.17	-1.120	-0.20	0.269	0.25	-1.264	-0.24	0.226	0.21
CONTROL	+	3.697	0.62	0.301	0.25	2.127	0.35	-0.208	-0.17	3.359	0.56	0.261	0.22	2.046	0.35	0.059	0.05
ROA	-	-2.256	-0.17	0.471	0.17	3.858	0.28	1.838	0.68	1.902	0.14	0.999	0.38	-1.233	-0.09	0.437	0.16
DE	+	-6.188	-1.32*	-1.229	-1.30*	-8.243	-1.79**	-1.672	-1.78**	-7.705	-1.68**	-1.386	-1.50*	-6.982	-1.55*	-1.320	-1.43*
OCF	-	-5.943	-0.73	-1.829	-1.11	-8.400	-1.01	-2.546	-1.52*	-7.252	-0.88	-1.966	-1.20	-7.620	-0.95	-2.081	-1.26
SIZE	-	-0.827	-1.36*	-0.142	-1.12	-0.805	-1.31*	-0.119	-0.93	-0.865	-1.40*	-0.148	-1.16	-0.716	-1.18	-0.118	-0.92
AGE	+/-	-1.344	-0.83	-0.278	-0.86	-1.190	-0.71	-0.198	-0.61	-1.449	-0.86	-0.273	-0.83	-1.501	-0.94	-0.308	-0.96
IND		Included		Included		Included		Included		Included		Included		Included		Included	
Adj.R^2/Pseudo R^2		26.11%		21.24%		24.93%		22.51%		24.16%		20.91%		27.47%		22.16%	
Obs.		85		85		85		85		85		85		85		85	

Table 8 (Continued)

Panel D: Non-family firm in the non-top 20% of corporate governance evaluation[a] (n = 63)

		(1)				(2)				(3)				(4)			
		KPMG				EY				PwC				Deloitte			
		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*	
Variable[b]	Pred.	Coeff.	*t*-value[c]	Coeff.	*z*-value	Coeff.	*t*-value	Coeff.	*z*-value	Coeff.	*t*-value	Coeff.	*z*-value	Coeff.	*t*-value	Coeff.	*z*-value
CONSTANT		48.480	1.97*			47.375	1.91*			49.470	2.02**			48.887	1.99*		
KPMG	-	0.370	0.15	0.430	1.06												
EY	-					0.734	0.26	0.243	0.53								
PwC	-									-1.800	0.77	-0.451	-1.17				
Deloitte	-													1.153	0.45	-0.121	-0.29
INDBOD	-	-29.183	-1.63*	-4.549	-1.53*	-28.350	-1.55*	-4.384	-1.45*	-31.567	-1.75**	-5.299	-1.76**	-33.006	-1.69**	-4.346	-1.35*
BDSIZE	-	-0.500	-0.75	0.002	0.02	-0.498	-0.76	-0.008	-0.07	-0.472	-0.72	-0.004	-0.03	-0.556	-0.84	-0.009	-0.08
DEVIATION	+	6.247	0.66	0.326	0.21	6.398	0.68	0.160	0.11	8.545	0.87	0.660	0.41	6.148	0.66	0.001	0.00
CONTROL	+	-3.422	-0.45	-0.270	-0.22	-3.436	-0.45	-0.265	-0.22	-3.381	-0.45	-0.221	-0.18	-3.335	-0.44	-0.278	-0.23
ROA	-	-18.144	-0.86	-3.825	-1.10	-16.922	-0.80	-2.983	-0.86	-16.702	-0.80	-2.943	-0.86	-16.716	-0.80	-3.353	-0.97
DE	+	-9.256	-1.24	-1.882	-1.53*	-9.040	-1.20	-1.825	-1.47*	-7.904	-1.03	-1.571	-1.24	-9.052	-1.21	-1.958	-1.58*
OCF	-	9.402	0.68	3.131	1.36*	8.316	0.61	2.342	1.03	8.454	0.64	2.383	1.07	7.925	0.59	2.650	1.17
SIZE	-	-0.671	-0.42	0.210	0.08	-0.633	-0.40	0.046	0.18	-0.711	-0.45	0.028	0.11	-0.652	-0.41	0.042	0.16
AGE	+/-	-0.782	-0.30	-0.207	-0.49	-0.724	-0.28	-0.152	-0.36	-0.743	-0.28	-0.169	-0.40	-0.643	-0.24	-0.165	-0.39
IND		Included		Included		Included		Included		Included		Included		Included		Included	
Adj.R^2/Pseudo R^2		8.27%		16.36%		8.37%		15.75%		9.51%		16.56%		8.67%		15.60%	
Obs.		63		63		63		63		63		63		63		63	

[a] The information of family firm and corporate governance evaluation is as defined in TEJ database.
[b] Please refer to Section 3.2 for the definition of the variables reported in this table.
[c] Asterisks *, **, *** indicate significance at the 0.10, 0.05, 0.01 levels, respectively. One-tailed for directional expectations, and two-tailed for others.

4.3.6 Additional tests- Impact of surplus management strategies on ESG risks and reputation of audit firms

Recent literature suggests a mutual interdependence between a company's financial condition and its efficiency in executing ESG initiatives, with the costs of ESG-related activities also constrained by the company's earnings management strategies (Tohang et al., 2024; Adeneye et al., 2023; Aljughaiman et al., 2023; Ali et al., 2022; Liu & Sun, 2022; Shi et al., 2022; Gonçalves et al., 2021). Different earnings management strategies reflect the company's attitude towards risk management (Agusta & Adhi, 2022; Gajdosikova et al., 2022; Hartam & Kresnawati, 2021; García Lara et al., 2020), thus ESG risk management performance may also vary with different earnings management strategies. Earnings management strategies can be categorized into reducing income-decreasing accruals or increasing income-increasing accruals depending on different purposes (Nguyen et al., 2024; Hernawati et al., 2021; Lassoued & Khanchel, 2021; Darmawan et al., 2019). In this study, we employ the cross-sectional modified Jones model (1995) to calculate abnormal accruals and utilize the direction of abnormal accruals to classify the sample, aiming to re-examine the association between auditor reputation and corporate ESG risk management performance. Empirical results are presented in Table 9. The empirical results indicate that the auditor reputation effect (BIGN) is statistically significant only in the subsample with negative abnormal accruals, with estimated coefficients of -3.722 ($t=-1.72$, $p<0.05$) for ESG risk management score (ESGSC) and -0.807 ($z=-2.06$, $p<0.05$) for ESG risk rating (ESGRA), both in line with expectations and reaching the 5% significance level. This information suggests that risk-averse companies with conservative earnings management strategies, when audited by the Big4, experience a significant positive impact of auditor reputation on ESG risk management scores and ratings.

Table 9 ESG risk and audit firm reputation - Considering earnings management strategy

		(1)				(2)			
		Positive abnormal accruals[a]				Negative abnormal accruals			
		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*	
Variable[b]	Pred.	Coeff.	*t*-value[c]	Coeff.	*z*-value	Coeff.	*t*-value	Coeff.	*z*-value
CONSTANT		28.691	2.96***			71.735	8.22***		
BIGN	-	-3.374	-1.19	-0.409	-0.90	-3.722	-1.72**	-0.807	-2.06**
INDBOD	-	6.235	0.76	0.184	0.14	-22.864	-2.76***	-3.081	-2.09**
BDSIZE	-	0.273	0.64	0.012	0.17	-0.649	-2.01**	-0.100	-1.74**
DEVIATION	+	1.733	0.43	0.421	0.65	3.724	0.85	0.419	0.54
CONTROL	+	6.436	1.52*	0.786	1.15	1.693	0.44	0.836	1.24
ROA	-	3.071	0.29	-0.053	-0.03	-11.160	-1.29*	-1.903	-1.25
DE	+	1.270	0.31	0.485	0.74	-0.707	-0.23	-0.472	-0.88
OCF	-	-11.839	-1.64*	-1.299	-1.12	4.593	0.77	0.503	0.48
SIZE	-	-0.354	-0.66	-0.031	-0.35	-1.188	-2.52***	-0.204	-2.41***
AGE	+/-	-2.495	-1.80*	-0.436	-1.94*	-2.750	-2.40**	-0.546	-2.69***
IND		Included		Included		Included		Included	
Adj. R^2 / Pseudo R^2		21.94%		12.26%		32.15%		20.95%	
Obs.		180		180		201		201	

[a] Abnormal discretionary accruals is obtained from the cross-sectional modified Jones model (1995).
[b] Please refer to Section 3.2 for the definition of the variables reported in this table.
[c] Asterisks *, **, *** indicate significance at the 0.10, 0.05, 0.01 levels, respectively. One-tailed for directional expectations, and two-tailed for others.

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4.3.7 Additional tests- Impact of surplus management strategies on ESG risks and reputation of Big 4

Based on the empirical results in Table 10, it is evident that the impact of the Big4's reputation effect on company ESG risk management performance varies depending on the company's earnings management strategy. Therefore, this study further divides the research sample of the Big4 into four subgroups: KPMG, EY, PwC, and Deloitte, to examine whether the effect of the Big4's reputation on corporate ESG risk management performance differs based on the company's adoption of aggressive or conservative earnings management strategies. The empirical results are presented in Table 10. The results indicate that only in the subsample with negative abnormal accruals (Panel B), the estimated coefficient of the PwC audit firm's reputation effect (PwC) is significantly negative. The estimated coefficient is -2.413 ($t=-2.04$, $p<0.05$) for ESG risk management score (ESGSC), reaching the 5% significance level, and -0.351 ($z=-1.63$, $p<0.1$) for ESG risk rating (ESGRA), reaching the 10% significance level. This information suggests that the choice of earnings management strategy by companies does not have a clear impact on the association between the reputation effect of different Big4 and company ESG risk management performance, except for PwC's clients adopting a conservative earnings management strategy, where the positive influence of the auditor reputation effect on ESG risk management performance is noticeable.

Table 10 ESG risk and Big 4 audit firm reputation - Considering earnings management strategy

Panel A: Positive abnormal accruals[a] (n = 173)

		(1)				(2)				(3)				(4)			
		KPMG				EY				PwC				Deloitte			
		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*	
Variable[b]	Pred.	Coeff.	*t*-value[c]	Coeff.	*z*-value	Coeff.	*t*-value	Coeff.	*z*-value	Coeff.	*t*-value	Coeff.	*z*-value	Coeff.	*t*-value	Coeff.	*z*-value
CONSTANT		26.577	2.92***			25.099	2.79***			26.348	2.88***			25.823	2.83***		
KPMG	-	-1.475	-1.11	-0.163	-0.74												
EY	-					3.146	2.02**	0.411	1.58*								
PwC	-									-0.833	-0.64	-0.171	-0.79				
Deloitte	-													0.082	0.07	0.034	0.19
INDBOD	-	5.232	0.65	0.069	0.05	7.770	0.97	0.397	0.29	5.452	0.67	0.060	0.04	5.754	0.69	0.093	0.07
BDSIZE	-	0.299	0.71	0.011	0.16	0.334	0.80	0.0161	0.23	0.271	0.64	0.006	0.09	0.293	0.69	0.010	0.14
DEVIATION	+	1.102	0.28	0.352	0.54	1.822	0.47	0.446	0.68	1.343	0.34	0.391	0.60	1.127	0.29	0.352	0.54
CONTROL	+	5.747	1.38*	0.777	1.12	5.951	1.44*	0.810	1.17	5.853	1.40*	0.800	1.16	5.772	1.38*	0.782	1.13
ROA	-	1.147	0.11	-0.232	-0.14	2.480	0.25	-0.092	-0.05	2.417	0.24	-0.121	-0.07	2.405	0.23	-0.133	-0.08
DE	+	-0.320	-0.08	0.354	0.54	0.816	0.20	0.498	0.75	-0.367	-0.09	0.342	0.52	-0.448	-0.11	0.328	0.50
OCF	-	-10.896	-1.54*	-1.199	-1.03	-11.843	-1.70**	-1.314	-1.13	-11.882	-1.68**	-1.308	-1.12	-11.659	-1.65*	-1.259	-1.08
SIZE	-	-0.308	-0.58	-0.025	-0.28	-0.372	-0.71	-0.033	-0.37	-0.297	-0.56	-0.025	-0.28	-0.285	-0.54	-0.023	-0.26
AGE	+/-	-2.692	-1.98**	-0.465	-2.06**	-2.735	-2.03**	-0.478	-2.11**	-2.592	-1.89*	-0.450	-1.99**	-2.656	-1.94*	-0.459	-2.03**
IND		Included		Included		Included		Included		Included		Included		Included		Included	
Adj.R^2/PseudoR^2		20.75%		11.73%		22.24%		12.21%		20.32%		11.75%		20.09%		11.61%	
Obs.		173		173		173		173		173		173		173		173	

Table 10 (Continued)

Panel B: Negative abnormal accruals[a] (n = 189)

		(1)				(2)				(3)				(4)			
		KPMG				EY				PwC				Deloitte			
		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*		DV = *ESGSC*		DV = *ESGRA*	
Variable	Pred.	Coeff.	*t*-value	Coeff.	*z*-value	Coeff.	*t*-value	Coeff.	*z*-value	Coeff.	*t*-value	Coeff.	*z*-value	Coeff.	*t*-value	Coeff.	*z*-value
CONSTANT		69.120	7.76***			69.394	7.74***			68.140	7.78***			66.540	7.48***		
KPMG	-	0.625	0.52	-0.014	-0.07												
EY	-					-1.058	-0.54	-0.060	-0.18								
PwC	-									-2.413	-2.04**	-0.351	-1.63*				
Deloitte	-													1.695	1.62*	0.297	1.59*
INDBOD	-	-22.472	-2.68***	2.971	-1.99**	-23.030	-2.72***	-3.003	-1.99**	-21.777	-2.62***	-2.893	-1.93**	-22.839	-2.74***	-3.082	-2.06**
BDSIZE	-	-0.584	-1.77**	-0.090	-1.52*	-0.609	-1.86**	-0.089	-1.53*	-0.483	-1.46*	-0.072	-1.21	-0.583	-1.79**	-0.086	-1.48*
DEVIATION	+	4.224	0.95	0.563	0.72	4.022	0.91	0.558	0.72	4.586	1.05	0.637	0.82	4.058	0.92	0.545	0.70
CONTROL	+	1.319	0.33	0.924	1.32*	1.278	0.32	0.908	1.29*	1.500	0.38	0.944	1.34*	1.647	0.42	0.955	1.36*
ROA	-	-10.710	-1.21	-1.868	-1.19	-9.797	-1.12	-1.884	-1.22	-13.283	-1.51*	-2.413	-1.53*	-9.865	-1.14	-1.906	-1.23
DE	+	-1.254	-0.40	-0.469	-0.85	-1.182	-0.38	-0.476	-0.86	-1.343	-0.43	-0.505	-0.91	-0.987	-0.32	-0.457	-0.83
OCF	-	2.204	0.36	0.168	0.15	1.881	0.31	0.169	0.16	2.057	0.34	0.220	0.20	1.260	0.21	0.063	0.06
SIZE	-	-1.259	-2.49***	-0.252	-2.76***	-1.269	-2.51***	-0.254	-2.78***	-1.158	-2.32**	-0.245	-2.68***	-1.181	-2.35***	-0.243	-2.66***
AGE	+/-	-2.770	-2.36**	-0.518	-2.49**	-2.653	-2.26**	-0.517	-2.49**	-3.167	-2.69***	-0.591	-2.79***	-2.779	-2.39**	-0.539	-2.60***
IND		Included		Included		Included		Included		Included		Included		Included		Included	
Adj.R^2/PseudoR^2		27.14%		19.50%		27.15%		19.51%		28.85%		20.12%		28.18%		20.08%	
Obs.		189		189		189		189		189		189		189		189	

[a] Abnormal discretionary accruals is obtained from the cross-sectional modified Jones model (1995).
[b] Please refer to Section 3.2 for the definition of the variables reported in this table.
[c] Asterisks *, **, *** indicate significance at the 0.10, 0.05, 0.01 levels, respectively. One-tailed for directional expectations, and two-tailed for others.

5. Conclusion

The aim of this study is to explore the correlation between corporate ESG risk management and the impact on audit firms' brand reputation. Additionally, it seeks to investigate whether the reputation of audit firms affects the ESG risk management scores and ratings of companies, using ESG risk management scores and ESG risk ratings as proxy variables for corporate ESG risk management performance. This study first analyses the impact of audit firm reputation on ESG risk management scores and ratings and then examines the respective reputation effects of the Big4 on ESG risk control management performance. Furthermore, this study incorporates the characteristics of corporate governance structures and the level of corporate governance ratings in the analysis to investigate the impact on the relationship between the Big4 and ESG risk management performance. Finally, considering the broad spectrum of cost-benefit considerations associated with engaging in ESG activities, companies may adopt different earnings management strategies, which could influence their perceptions of risk management. Therefore, this study further examines how corporate earnings management strategies affect the association between auditor reputation effects and the control and management of ESG risks.

The empirical findings of this study indicate that companies audited by Big4 tend to exhibit better ESG risk management performance compared to those audited by non-Big4. Additionally, the ESG risk management performance of companies varies depending on which of the Big4 they engage for audit services. Moreover, the association between ESG risk management performance and auditor reputation effects is influenced by corporate business models and governance structures. Family businesses and robust corporate governance environments synergistically enhance the impact of auditor reputation effects, thereby contributing to the improvement of ESG risk management performance. Lastly, the choice of corporate earnings management strategies affects the relationship between ESG risk management performance and auditor reputation effects. Risk-averse companies employing conservative earnings management strategies tend to benefit from the positive influence of auditor reputation effects on ESG risk management performance.

The research limitations of this study stem from the difficulty in accessing ESG information, which constrains the sample size. The voluntary nature of ESG disclosures by companies hampers data accessibility, requiring extensive time and manpower for manual data collection and organization. Moreover, the lack of standardized international norms and measurement mechanisms for ESG risks complicates the evaluation process. Variability in scoring criteria, scope, and publication timelines among different rating agencies means that the same company may receive different ratings from various institutions. Establishing a comprehensive and consistent global system for ESG evaluation in the future could facilitate the proactive creation and dissemination of sustainable value by companies. It would also enhance the research value in academia concerning ESG-related issues.

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