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Really Want a Whole? Or Take It Apart? Evidence of ESG disclosure heterogeneity on Chinese Listed Firm

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ABSTRACT

Purpose: We examined how ESG disclosure and its sub-dimensions impact holding period returns, profitability, and company value.

Design/methodology/approach: Utilizing Bloomberg panel data, the research investigates the effects of ESG disclosures and their sub-dimensions on financial metrics within the Chinese stock market.

Findings: Results reveal a multifaceted impact of ESG disclosures: environmental aspects positively affect returns, governance has a negative impact, and social factors show no significant effect. Overall ESG disclosures enhance Tobin's q, particularly driven by environmental factors. The study also identifies industry specific ESG effects and confirms ESG disclosure as a precursor to firm value, addressing endogeneity concerns.

Research limitations/implications: The study offers vital insights for investors, guiding them on the differential impacts of ESG components on returns in China. It informs policymakers on crafting nuanced ESG disclosure regulations and encourages researchers to further explore ESG effects across industries and markets.

Originality/value: This research uniquely dissects the disparate impacts of ESG dimensions on firm performance, emphasizing environmental disclosures and industry heterogeneity, especially during the COVID-19 pandemic. It advances the literature by detailing how various ESG facets affect firm performance, aiding stakeholders in aligning sustainability strategies with market expectations.

Keywords: ESG disclosure, Emerging market, Environmental, Social, Governance, Chinese listed firm

I. Introduction

The academic field of corporate finance lacks consensus regarding the impact of corporate social performance (CSP) on corporate financial performance (CFP), market value, and investment decisions. Some scholars argue for a positive relationship between CSP and CFP, such as Aybars et al. (2019), while Friede et al. (2015) demonstrated that CSP could enhance CFP over time. Velte (2017) observed a significant positive effect of ESG performance on a firm's return on assets (ROA), highlighting governance as the most critical element among the ESG (Environmental, Social, Governance) dimensions. Similarly, Zhao et al. (2018), studying Chinese-listed firms in the power industry, noted a positive association between ESG and CFP. However, extensive research presents contradictory findings regarding corporate sustainability. Duque-Grisales et al. (2020 and 2019) found that ESG initiatives do

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not enhance financial success in developing countries' capital markets. Landi & Sciarelli (2019), using empirical evidence, suggested that a corporate sustainability portfolio does not generate market premiums. Yu and Jin (2021) identified debt policies as a primary reason for these inconsistent results, noting that financial performance may suffer in the short term when investing in ESG portfolios due to the debt impact on corporate financial structures.

Moreover, the discourse on ESG extends beyond

CFP. Researchers like Shanaev & Ghimire (2021) and Deng & Cheng (2019) consider ESG a valuable tool for boosting firms' share value and for hedging to enhance market predictability and reduce volatility, according to Patel et al. (2021). Nonetheless, during the COVID-19 pandemic, studies such as Demers et al. (2020) observed that ESG did not improve earnings returns, financial flexibility, or intangible assets, and even reduced corporate earnings in the second quarter of 2020, during the so-called "recovery

Table 1. The ambiguous relationship wi	rith CS and Firm's outcomes
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Issues	Variables	Method	Studies
	ESG performance, short-term and long-term investment decisions	Time-series analysis	Deng&Cheng, 2019
	ESG composite indices, cost of capital, investment returns	Fixed effects model	Duque-Grisales et al., 2020
CSP's negative/positive	ESG ratings, market value metrics (e.g., Tobin's Q)	Panel data analysis	Ruan&Liu, 2021
effect on FP.	CSP dimensions, firm profitability (e.g., net profit margin)	Cross-sectional regression analysis	Veenstra&Ellemers, 2020
	ESG disclosure score, financial performance indicators (e.g., ROA, ROE)	Regression analysis	Yu&Jin, 2021
	Social and environmental scores, investment inflows and outflows	Dynamic panel data analysis using system GMM	Benlemlih& Bitar, 2018
CSP's	CSR reporting, capital expenditure decisions	Fixed effects regression model	Bhandari& Javakhadze, 2017
positive/negative effect on investment	Governance disclosures, market reactions, investment timing	Logit regression analysis	Boerner, 2012
decision.	CSR activities, investor reactions post-crisis, market value adjustments	Event study and abnormal return analysis	Demers et al.,2020
	ESG performance, investment decisions, investor sentiment	Causal inference methods, including propensity score matching	Patel et al,2021
	ESG alignment with business strategy, market valuation	Path analysis with latent variables	Baboukardos,2018
	CSR disclosure, market capitalization, and stock liquidity	OLS regression with heteroskedasticity-robust standard errors	Capelle-Blancard&Petit, 2019
CSP positive/negative	ESG scores, short-term and long-term investment returns	Regression discontinuity design (RDD)	Kim et al, 2018
value in long term/short-term.	Environmental disclosure quality, cost of equity, market perception	Panel regression with random effects	Mervelskemper&Streit, 2017
	ESG score fluctuations, short- term vs. long-term market valuation	Multi-level mixed-effects linear regression	Pizzi, et al.,2020
	ESG integration, market value changes over time	Time-series cross-sectional (TSCS) regression models	Shanaev&Ghimire, 2021

period." Hawn (2020) suggests that firms should focus on reducing negative CSP impacts-termed corporate sustainable risk-rather than merely enhancing positive CSP. Conversely, Capelle-Blancard et al. (2017) found no significant link between CSP and firm market value, noting that negative CSP, resulting from an unfavorable corporate image, could reduce a public company's market value by 0.1%. Despite these challenges, corporate sustainability may still be a fundamental competitive advantage, enhancing market legitimacy (Luxmore et al., 2018), reputation, and effective corporate image management (Zhao et al., 2020), and the ability to mitigate systemic and idiosyncratic risks (Sassen et al., 2016). Table 1 summarizes the literature on the ambiguous relationship between CSP and firm outcomes.

Despite the unclear relationship between CSP and FP, market value, and investment decisions, the impact of different dimensions of ESG on a firm's performance has not been conclusively determined. Some research suggests that environmental performance may not increase-or could even diminish-business financial performance due to the substantial initial investments required for implementing green innovations, which can temporarily strain financial resources (Cek & Eyupoglu, 2020; Duque-Grisales & Aguilera-Caracuel, 2021; Yu & Jin, 2021). However, recent studies indicate that environmental performance significantly enhances a firm's financial outcomes (Baboukardos, 2016; Ciasullo et al., 2021; Farza et al., 2021; Koçak et al., 2021; Kuo et al., 2021; Monk & Perkins, 2021; Uddin et al., 2021; Zhao et al., 2020). Implementing environmental strategies can enhance stock returns and firm value (Baboukardos, 2016; Ekelenburg et al., 2016; Monk & Perkins, 2021), predict exogenous shocks, control risks (Sassen et al., 2016), improve market resilience (Seles et al., 2019), maintain a positive market reputation among stakeholders for image management (Uddin et al., 2021; Zhao et al., 2020), and increase the likelihood of securing external financing (Benlemlih & Cai, 2020; Zhang & Chen, 2017).

Addressing the social dimension, some researchers have shown that firms with higher social ratings may incur lower debt costs (Halbritter & Dorfleitner, 2015; La Rosa et al., 2018). However, other studies reveal that a high social portfolio can harm shareholder value and thus impair company performance (Surroca & Tribó, 2008). Conversely, some scholars have proven that only corporate social irresponsibility reduces firm value, while increasing positive CSR activities does not necessarily enhance firm value (Capelle-Blancard et al., 2017; Hawn, 2021).

Lastly, effective corporate governance management plays a crucial role in facilitating easier access to capital from investors and financial institutions (Abor & Biekpe, 2007; Cek & Eyupoglu, 2020). Yet, empirical data from specific research shows that the governance pillar does not influence financial performance (Shakil et al., 2019). Younas & Zafar (2019) suggest that restricted resources may shift stakeholder welfare to shareholder profit maximization, thus potentially reducing corporate performance. Table 2 summarizes the literature on these heterogeneous effects of each ESG dimension.

As a result of the complex and contradictory fundings discussed above, our research aims to provide a definitive conclusion on the impact of ESG on corporate value, focusing on the relationship between ESG disclosure and corporate outcomes. We are particularly interested in determining which pillar of ESG disclosure is most valued by investors, which is most beneficial for the firm's value, and how industry heterogeneity affects the relationship between a firm's ESG disclosure and its value. Despite previous research on the influence of ESG on corporate performance in the Chinese market (Zhao et al., 2018; Broadstock et al., 2021; Chang et al., 2021), our study contrasts the perspectives of firms and investors to illustrate the heterogeneity of ESG and its various dimensions, as well as the diversity of ESG consequences across industries.

The core argument here is that the heterogeneity of ESG in its various dimensions is complementary to the framework of appraising corporate legitimacy, particularly when assessing investor performance in terms of holding period return. Based on our findings, ESG has a positive and substantial effect on holding

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ESG Dimensions	v ariables	Ivietnoa	Iviain Evidence	Literature Keview
Environmental Pillar:				
	Environmental performance indicators, risk mitigation metrics	Structural equation modeling (SEM)	• Mitigate risk.	Sassen et al,2016
	Environmental innovation disclosures, core com- petence measures	Path analysis	• Improve the firm's core competence.	Kuo et al, 2021
	Social sustainability practices, market resiliency indicators	Multivariate regression analysis	• Mitigate the negative effect of crisis.	Seles et al, 2019
5 6 1	Governance structures, financial performance (e.g., ROE, ROA)	DID analysis	• Improve the firm's FP.	Farza et al, 2021
Beneficial to firm value.	ESG disclosure quality, firm market valuation	Event study	• Improve the firm's Market Valuation.	Baboukardos, 2016
	ESG integration into strategy, innovation outcomes	Longitudinal analysis with lagged variables	• Improve the firm's Innovation.	Ekelenburg et al., 2016
	Sustainability reporting quality, HR management effectiveness metrics	Fixed effects regression analysis	• Improve the firm's HR management effecti- veness.	Uddin et al, 2021
	Green product innovation, reputation indices	Multi-level regression analysis	• Improve the firm's Reputation.	Zhao et al,2020
	Environmental sustain- ability measures, market resiliency indicators	Time-series analysis	• Improve the firm's Market resilience.	Koçak et al, 2021
• No effect on firm value.	ESG scores, long-term firm value metrics	Cross-sectional regression analysis	• No effect	Yu & Jin, 2021
Social Pillar:				
No effect on investment decision.	Social responsibility scores, investment cost metrics	Panel regression with random effects	• No effect	Halbritter & Dorfleitner, 2015
• Panaficial to firm	CSR activities, risk mitigation outcomes	Path analysis	• Mitigate risk.	Sassen et al,2016
value.	Social performance indicators, core competency measures	Multi-variate regression analysis	• Improve the firm's core competence.	Hull and Rothenberg, 2008
Governance Pillar:				
	 Governance practices, investor returns Board structure, financial performance metrics 	 Tobit regression analysis Regression analysis controlling for firm size and industry 	• Decrease FP.	Boerner, 2012 Jung et al, 2018
• Negative effect on	Corporate governance score, market risk measures	Fixed-effects panel regression analysis	• Increase risk.	Sassen et al,2016
firm value.	Governance transparency, investor risk assessment	Vector autoregression (VAR) model	• Ambiguous criteria.	Veenstra et al., 2020
	Governance practices, cost of equity capital	Generalized method of moments (GMM) for dynamic panels	Increase Organizational Governance cost.	Mervelskemper et al., 2016
	performance reporting comprehensiveness, market reaction	Event study analysis focusing on disclosure events	Performance decoupled from report.	Tashman et al., 2019

Table 2. Literature on heterogeneity effect of each dimension of ESG

period returns. However, when evaluated independently, the E dimension has a positive and significant effect, S has a negligible effect, and G has a negative and significant effect on holding period returns. This provides shareholders with a theoretical basis for evaluating a firm's ESG disclosures, suggesting that shareholders might show bias in ESG evaluations. Overall, ESG disclosure provides positive and significant value to shareholders, but the disclosure of corporate governance information can diminish shareholding returns, consistent with shareholder theory.

In terms of company profitability and value, ESG also shows varied effects across each sub-dimension. We observed that while the overall ESG disclosure rating has a negative and significant impact on a firm's ROA, only G has a negative and significant impact on this sub-dimension. ESG as a whole has performed positively and significantly on Tobin's q of firms, with only E showing a positive and significant impact. The empirical findings support both shareholder theory and legislative theory.

Additionally, we conducted an event study using the Difference-in-Differences (DID) method regarding the ESG performance during COVID-19 and the heterogeneity of ESG in industry analysis. We found that industry heterogeneity influences the effectiveness of ESG disclosure, thereby contributing to the literature on corporate financial portfolios. ESG's strategic investment portfolio varies by industry.

According to our findings, E has a positive and significant effect in all industries except the service industry, S plays a significant role in the service industry, and G only has a significant role in the finance sector. In terms of shareholder income, E has a positive and significant impact on the manufacturing, mining, and construction industries, while G has a negative and significant impact in all industries except the service industry. Our findings have broad implications for research into the heterogeneity of industry effects on ESG. Exploring this divergence presents an intriguing theoretical and empirical research challenge for the future.

Lastly, we examined ESG endogeneity and validated the causal relationship between ESG and corporate outcomes by introducing an instrumental variable, namely whether the firm has passed ISO 14001 certification. It is proven that for stockholders, E is the dimension that increases the value of holding returns, while G reduces it. However, for firms, corporate governance truthfully improves the firm's value.

II. Theoretical Predictions on the Heterogeneous Effects of ESG

A. The Overall ESG Disclosure and Firm's Performance

First, we anticipate that overall ESG disclosure will positively affect holding period returns. According to institutional theory, robust ESG disclosure indicates that the firm has achieved regulatory isomorphism with stakeholders (Chan, 2023), resulting in societal legitimacy and trust (Oliver, 1997). This generates a reputation as a firm-specific advantage, sustaining long-term value for stockholders. Therefore, integrating ESG criteria into business operations positively influences investment decisions, as investors increasingly consider sustainable practices in their investment choices.

Furthermore, we contend that overall ESG disclosure improves the firm's Tobin's q. ESG disclosure can also reduce the cost of external debt financing (Halbritter & Dorfleitner, 2015; La Rosa et al., 2018), potentially increasing company value due to the tax benefits of debt. Additionally, according to social identity theory, a firm may enhance its reputation and manage its image positively through ESG disclosure, as it symbolizes the firm's commitment to social welfare, allowing it to be recognized as an in-group member of society (Cao, 2023; Zhao et al., 2020).

Lastly, we estimate that overall ESG disclosure will have a negative impact on ROA since additional expenditures are incurred to meet the regulatory threshold during the initial stages of the ESG portfolio (Duong, 2022; Yu & Jin, 2021). In other words, the implementation of ESG criteria initially negatively impacts a firm's short-term profitability due to the high costs associated with sustainable practice changes and compliance with environmental and social standards. Based on these, we predict:

- **Hypothesis 1:** The overall ESG disclosure positively influences investment decisions.
- Hypothesis 2: The overall ESG disclosure positively influences market value in the long term.
- **Hypothesis 3:** The overall ESG disclosure negatively influences short-term profitability.

B. ESG Sub-Dimension Disclosure and Firm's Outcomes

We also predict heterogeneity in the effect of each ESG disclosure pillar. Firstly, we propose that E disclosure will have a favorable effect on holding period returns. This is because environmental disclosure may boost stock returns and market value (Baboukardos, 2016; Ekelenburg et al., 2016; Farza et al., 2021; Monk & Perkins, 2021). Additionally, environmental performance can sustain a strong market reputation among stakeholders and project a positive company image (Benlemlih & Cai, 2020; Uddin et al., 2021; Zhang & Chen, 2017; Zhao et al., 2020), thereby increasing the possibility of external financing (Benlemlih & Cai, 2020; Zhang & Chen, 2017). Therefore, environmental criteria specifically contribute positively to investment decisions, as investors are increasingly aware of the financial and reputational risks associated with environmental negligence.

Secondly, S disclosure is not expected to influence holding period returns because investors may not view social performance as a criterion for investment decisions (Halbritter & Dorfleitner, 2015). Investors prioritize other factors, such as financial performance or environmental impact, over social issues. Social issues, including labor practices, community engagement, and diversity initiatives, are often harder to quantify and measure compared to environmental and governance criteria. This lack of clear, quantifiable metrics can make it challenging for investors to assess the direct impact of social criteria on a company's performance, leading them to undervalue these aspects in their investment decisions. Furthermore, the benefits of strong social practices, such as improved employee morale, better stakeholder relationships, and enhanced brand reputation, often manifest over the longer term. Investors looking for short- to medium-term gains may overlook these benefits due to their delayed impact on a company's financial performance.

Thirdly, G disclosure is predicted to negatively impact holding period returns. According to market efficiency theory, more governance disclosure implies greater transparency and information symmetry for public investors. Shareholders lack viable trading opportunities to incorporate this inside information into pricing for arbitrage, reducing the value of their ownership (Mervelskemper et al., 2016). As a result, governance transparency may reduce holding period returns due to concerns that stringent governance requirements limit managerial flexibility and decisionmaking, leading to reduced agility in strategic operations (Boerner, 2012; Jung et al., 2018). In hence, we predict that,

- **Hypothesis 4:** The Environmental disclosure positively influences investment decisions.
- **Hypothesis 5:** The Social disclosure neutrally influences investment decisions.
- Hypothesis 6: The Governance disclosure negatively influences investment decisions.

The following empirical analysis will examine which ESG pillar is most advantageous for firm profitability and MV. Additionally, we will explore the effects of ESG disclosure across different industries and address the issue of endogeneity and reverse causality in ESG disclosures.

III. Methods

A. Data

We began by collecting ESG rating data for Chinese-listed firms from the Bloomberg database, which offers a comprehensive range of firm-year data to evaluate China's capital market. Since ESG rating data in China is predominantly available from a few investment and finance firms, including SynTao Green Finance, the China Corporate Social Responsibility Research Institute, and MSCI, our selection was somewhat limited. SynTao Green Finance began providing the first ESG statistics in 2015. As a result, compared to prior studies that evaluated ESG disclosure in China's capital market (Broadstock et al., 2021; Chang et al., 2021; Liu & Luo, 2022; Ruan & Liu, 2021), our paper utilizes Bloomberg's ESG disclosure data. This dataset includes a total of 34,579 firm-year observations from 2010 to 2020, with a minimum of 2,166 in 2010 and a maximum of 4,877 in 2020. We excluded firms with missing ESG rating information and omitted samples, ultimately obtaining a total of 9,765 firm-year observations. We sourced the financial information from the China Stock Market and Accounting Research Database (CSMAR).

Moreover, to limit extreme values' impact on our

empirical results, all continuous variables are winsorized at 1 and 99 levels. Figure 1 and Table 3 demonstrate summary statistics of ESG disclosure data, and we found that since 2011, firms with public ESG disclosures have expanded by about 118.42 times and constantly risen. In 2015, the number of ESG-disclosed firms amounted by 37.5 percent of all listed companies. Because of the epidemic's influence, the ratio of ESG disclosed firms to total listed firms has been declining since 2019. In terms of ESG disclosure ratings, averages of E and S in 2020 have grown by 3.38 and 2 times, respectively, as compared to 2010. Furthermore, G has not changed all that much. It demonstrates that China's capital market has increased its attention to E and S.

B. Proxies

Because we are primarily interested in the influence of ESG disclosure on shareholder and firm value, we use holding period returns as our dependent variable to examine changes in value from the perspective of shareholders. Furthermore, we employ corporate profitability: *ROA (one year lagged net profit/average total assets)* and firm market value, *Tobin's q (total market value divided by total assets)* as our dependent variables to examine changes in



Figure 1. The trend of ESG disclosed firm during 2010 to 2020

value from the perspective of the firm.

The holding period returns are measured in two ways according to whether dividends are considered: 1) yretwd: the annual return on a single stock considering the reinvestment of cash dividends; 2) yretnd: the annual return on a single stock without considering the reinvestment of cash dividends.

In,
$$yretwd = r_{n,t} = \frac{P_{n,t}}{P_{n,t-1}} - 1$$

 $p_{n,t}$: Comparable price of stock n's closing price on the last trading day of year t considering cash dividend reinvestment.

 $p_{n, t-1}$: Comparable price of stock n's closing price on the last trading day of year t-1 considering cash dividend reinvestment.

Figure 2 shows the way to measure yretnd.

m: the number of ex-rights and ex-dividend events for stock n during the calculation period.

$$yretnd = r_{n,t} = \frac{P_{n,t} * \prod_{i=1}^{m} \left[(1 + F_{n,i} + S_{n,i}) * C_{n,i} \right] + \sum_{i=1}^{m} \left\{ \prod_{j=1}^{i} \left[(1 + F_{n,j-1} + S_{n,j-1}) * C_{n,j-1} \right] * D_{n,i} \right\}}{P_{n,t-1} + \sum_{i=1}^{m} \left\{ \prod_{j=1}^{i} \left[(1 + F_{n,j-1} + S_{n,j-1}) * C_{n,j-1} \right] * C_{n,i} * S_{n,i} * K_{n,i} \right\}} - 1$$

Figure 2. The measurement of yrtnd

Table 3. Descriptive statistics of the ESG disclosure ratings of Chinese listed firm

	N CE	No. of ESG	% of Obs. –		ES	SG			Ι	Ξ		
Year	No. of Firm.	disclosure	% of Obs.	Mean	SD	Min	Max	Mean	SD	Min	Max	
2010	2,166	7	0.3%	13.52	2.71	10.33	18.6	3.99	2.59	2.33	6.9	
2011	2,413	829	34.4%	17.96	6.48	7.85	40.9	9.63	5.33	1.55	41.8	
2012	2,575	885	34.4%	19.01	5.50	7.85	45.18	9.11	5.21	1.55	43.4	
2013	2,583	946	36.6%	19.31	5.54	6.61	45.18	9.27	5.38	1.55	47.9	
2014	2,702	945	35.0%	19.7	5.76	6.20	50.0	9.72	5.73	1.55	47.9	
2015	2,918	1,093	37.5%	20.0	6.06	1.24	51.24	9.74	6.36	1.55	50.0	
2016	3,181	1,163	36.6%	20.69	6.46	7.85	58.2	10.46	7.13	1.55	55.2	
2017	3,602	1,176	32.6%	21.59	7.25	7.85	59.5	11.46	8.46	1.55	55.2	
2018	3,680	1,189	32.3%	22.32	7.72	5.79	58.85	12.40	9.41	0.78	57.2	
2019	3,882	1,199	30.9%	22.83	8.16	7.8	61.72	13.0	10.14	0.78	60.4	
2020	4,877	1,279	26.2%	23.1	8.63	7.85	64.1	13.49	10.70	0.7	65.6	
Vear	No. of Firm	No. of ESG [.]	% of Obs	S					G			
1 cai	NO. OI PIIIII.			Mean	SD	Min	Max	Mean	SD	Min	Max	
2010	2,166	7	0.3%	12.91	8.97	6.67	28.07	44.64	2.73	39.29	48.2	
2011	2,413	829	34.4%	22.30	9.54	3.51	66.6	45.41	4.45	33.93	64.2	
2012	2,575	885	34.4%	21.44	9.08	3.51	63.16	44.11	4.93	28.57	64.2	
2013	2,583	946	36.6%	22.22	8.82	3.51	57.8	43.6	5.33	28.5	62.5	
2014	2,702	945	35.0%	22.8	9.05	3.51	61.40	43.3	5.56	26.7	62.5	
2015	2,918	1,093	37.5%	22.79	9.46	3.51	71.9	45.18	5.24	10.7	62.5	
2016	3,181	1,163	36.6%	23.54	9.58	3.5	77.19	45.4	5.25	10.7	62.5	
2017	3,602	1,176	32.6%	24.17	9.92	3.51	77.19	45.79	5.30	28.57	64.2	
2018	3,680	1,189	32.3%	24.73	10.21	3.51	77.19	45.94	5.32	28.57	64.2	
2019	3,882	1,199	30.9%	25.32	10.44	3.51	77.19	45.99	5.74	3.57	73.2	
2020	4,877	1,279	26.2%	25.70	10.91	3.51	77.19	46.06	5.65	3.57	67.8	

 $p_{n,t}$: Comparable price of stock n's closing price on the last trading day of year t considering cash dividend reinvestment.

 $p_{n, t-1}$: Comparable price of stock n's closing price on the last trading day of year t-1 considering cash dividend reinvestment.

 $D_{n,i}: \mbox{The cash dividend per share of stock n on the ith ex-dividends date.}$

 $F_{n,i}$: The number of bonus shares per share of stock n on the ith ex-dividends date, $F_{n,0}=0$.

 $S_{n,i}$: the number of allotments per share of stock n on the i_{th} ex-dividends date, $S_{n,0}$ =0.

 $K_{n,i}$: the allotment price per share of stock n when day i is the ex-dividends date.

 $C_{n,i}$: The number of subdivisions per share of stock n on the i_{th} ex-dividend date, $C_{n,0}$ =0.

Our independent variables are ESG disclosure score which following the weight assessed by Bloomberg (See Table 4). In addition, we controlled firm size by natural logarithm of total assets and numbers of employees; ROE (net profit/the average total equity), ROI (net profit divided by the average total investments), BM (Book value/Market value) and leverage (liability divided by total assets). We also introduced the dummy variable accessing if the firm passes ISO14001 as our instrumental variable (Wijethilake, 2017) for our further analysis on endogeneity issues.

Table 5 shows descriptive statistics and a correlation matrix for each variable. The correlation coefficient between the dependent and independent variables is less than 0.6, suggesting multicollinearity is not a big issue in our research design.

Ta	ble	4.	V	aria	bles	and	proxies
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Variables	Explanation	Data Source
Investor's persp	ective	
yretwd	Holding period returns: the annual return on a single stock considering the reinvestment of cash dividends	CSMAR
yretnd	Holding period returns: the annual return on a single stock without considering the reinvestment of cash dividends	CSMAR
Firm's perspect	ives	
ROA	Corporate profitability, one year lagged net profit/the average total assets	CSMAR
Tobin's Q	Total market value divided by total assets	CSMAR
ESG	Environmental, social and governance disclosure score collected by the Bloomberg database.	Bloomberg
E	Environmental disclosure score obtained from Bloomberg database. Pillar score measuring a company's impact on living and non-living natural systems, including the air quality, climate change, ecological & biodiversity impacts, energy, material & waste, supply chain and water disclosure score.	Bloomberg
S	Social disclosure score obtained from the Bloomberg database. Pillar score measuring a company's social impact on community & customers, workforce diversity, ethics & compliance, health& safety, human capital, and supply chain disclosure score.	Bloomberg
G	Governance disclosure score obtained from the Bloomberg database. Pillar score measuring a company's governance management on audit risk & oversight, board composition, diversity of board, nomination & governance oversight, independence, sustainability governance and tenure disclosure score.	Bloomberg
Ispassiso14001	Dummy Variable: if the firm pass ISO14001 (Instrumental Variable)	CSMAR
SIZE	Natural logarithm of total assets (firm size)	CSMAR
ROE	Net profit/the average total equity	CSMAR
ROI	Net profit/the average total investments	CSMAR
BM	Book value/Market value	CSMAR
Leverage	Liability divided by total assets	CSMAR

	1	2	3	4	5	6	7
1. yretwd	1						
2. yretnd	0.9937*	1					
3. ROA 0.1526*		0.1507*	1				
4. Tobin's Q	0.3453*	0.3432*	0.2422*	1			
5. E	0.0313*	0.0293*	0.0147	-0.0975*	1		
6. S	0.0146	0.014	0.0308*	-0.0946*	0.5901*	1	
7. G	-0.0355*	-0.0372*	-0.0490*	-0.1489*	0.3777*	0.3689*	1
8. ESG	0.0194	0.0176	0.0111	-0.1282*	0.9144*	0.8033*	0.5757*
9. BM	-0.3276*	-0.3263*	-0.2610*	-0.7292*	0.1707*	0.1564*	0.2445*
10. Leverage	-0.0327*	-0.0332*	-0.4035*	-0.3723*	0.1162*	0.1178*	0.2330*
11. SIZE -0.0131		-0.0153	-0.0584*	-0.3507*	0.3802*	0.3560*	0.4479*
12. ROI -0.0115		-0.0114	-0.018	0.0037	-0.0061	-0.0041	0.0059
13. ROE	0.0401*	0.0397*	0.3330*	0.0165	0.0009	0.0115	-0.0026
	8	9	10	11	12	13	
1. yretwd							
2. yretnd							
3. ROA							
4. Tobin's Q							
5. E							
6. S							
7. G							
8. ESG	1						
9. BM	0.2153*	1					
10. Leverage	0.1693*	0.4767*	1				
11. SIZE	0.4667*	0.5642*	0.5713*	1			
12. ROI	-0.0048	-0.0102	-0.0175	-0.0165	1		
13. ROE	0.0046	-0.0013	-0.0869*	0.0315*	-0.0013	1	

Table 5. Correlation matrix

** p<0.01, * p<0.05, + p<0.1

IV. Empirical Results

A. Main Results on ESG Heterogeneity Effects

The primary focus of our study is to assess the performance of ESG and its sub-dimensions⁻E, S, and G⁻in relation to holding period returns, ROA, and Tobin's q. To test our predictions, we employ a multi-level Fixed Effects (FE) Linear Model estimation, as outlined by Correia (2015). This approach is

particularly suited for handling the complexities of time-series cross-sectional (TSCS) data, which includes multiple data points across both time and different entities. Our model incorporates fixed effects at multiple levels to control for invariant characteristics across different firms and years. This method effectively isolates the impact of ESG disclosures by accounting for unobserved heterogeneity—traits that are unique to each firm and do not change over time or are common across all firms in a particular year. Table 6 shows the main results of hypothesis test for heterogeneity effect of ESG and its sub-dimension. First, model 1 and model 2 show the relationship between ESG sub-dimension disclosure and holding period returns. We predict that E, S, and G has positive, no, negative effect on holding period return, separately. Model 1 confirm our prediction when considering the dividend (β_E = 0.0037, p_E= 0.002; β_S = 0.0019, p_S= 0.102; β_G = -0.0104, p_G=0.000), which means one standard deviation increase in E, S, and G improve yretwd by 0.031 (0.0037×8.31); non, -0.056 (-0.0104×5.41). As the mean of *yretwd* is 0.12 in our sample, it reveals that E increase *yretwd* by 25.83% and G decrease *yretwd* by 46.67%. Thus, Model 1 confirms our prediction that E has a positive effect, S has no effect, and G has a negative effect on holding period returns, H4, H5, and H6 are supported. Model 2 shows S dimension with weak positive significance on holding period return without the dividend (β_E = 0.0037, p_E = 0.002; β_S = 0.0020, p_S = 0.095; β_G = -0.0100, p_G = 0.000). Ceteris paribus, when one standard deviation increases in each

Table 6. Multi-level fix effect estimation: the effect of ESG and its sub-dimension on holding period returns, ROA and Tobin's q.

VARIABLES	(1) yretwd	(2) yretnd	(3) yretwd	(4) yretnd	(5) ROA	(6) ROA	(7) Tobin's Q	(8) Tobin's Q	(9) Evebitdaev	(10) Evebitdaev
E	0.0037** [0.001] [0.002]	0.0037** [0.001] [0.002]			-0.0002 [0.000] [0.173]		0.0077** [0.002] [0.000]		0.0713 [0.344] [0.836]	
S	0.0019 [0.001] [0.102]	0.0020+ [0.001] [0.095]			-0.0000 [0.000] [0.994]		0.002 [0.002] [0.246]		-0.0872 [0.331] [0.792]	
G	-0.0104** [0.002] [0.000]	-0.0100** [0.002] [0.000]			-0.0005* [0.000] [0.013]		0.0022 [0.003] [0.459]		0.3075 [0.567] [0.588]	
ESG			0.0044** [0.001] [0.002]	0.0045** [0.001] [0.002]		-0.0007** [0.000] [0.000]		0.0134** [0.002] [0.000]		0.2940 [0.362] [0.417]
Leverage	0.1215+ [0.068] [0.072]	0.1311+ [0.068] [0.054]	0.1922** [0.064] [0.003]	0.1975** [0.064] [0.002]	-0.1810** [0.007] [0.000]	-0.1729** [0.006] [0.000]	-0.2524* [0.100] [0.012]	-0.0394 [0.098] [0.687]	44.5948* [19.519] [0.022]	49.7017** [16.835] [0.003]
Size	0.1624** [0.015] [0.000]	0.1577** [0.015] [0.000]	0.1027** [0.014] [0.000]	0.0993** [0.014] [0.000]	0.0085** [0.002] [0.000]	0.0088** [0.001] [0.000]	0.0252 [0.022] [0.255]	0.0068 [0.021] [0.743]	-1.0427 [4.225] [0.805]	-0.4875 [3.517] [0.890]
ROI	-0.0000 [0.000] [0.605]	-0.0000 [0.000] [0.613]	-0.0000 [0.000] [0.639]	-0.0000 [0.000] [0.645]	-0.0000** [0.000] [0.004]	-0.0000** [0.000] [0.007]	-0.0001+ [0.000] [0.060]	-0.0000 [0.000] [0.110]	-0.0060 [0.039] [0.878]	-0.0067 [0.038] [0.859]
ROE	0.0152** [0.005] [0.005]	0.0153** [0.005] [0.005]	0.0159** [0.005] [0.003]	0.0159** [0.005] [0.003]	0.0164** [0.001] [0.000]	0.0181** [0.001] [0.000]	0.0058 [0.008] [0.467]	0.0069 [0.008] [0.400]	-151.5870** [17.329] [0.000]	-176.7417** [16.179] [0.000]
B/M	-1.6906** [0.038] [0.000]	-1.6932** [0.039] [0.000]	-1.6719** [0.037] [0.000]	-1.6727** [0.038] [0.000]	-0.0506** [0.004] [0.000]	-0.0523** [0.004] [0.000]	-3.6415** [0.057] [0.000]	-3.8840** [0.057] [0.000]	-44.6591** [10.843] [0.000]	-41.3116** [9.600] [0.000]
Constant	-2.1655** [0.324] [0.000]	-2.0778** [0.326] [0.000]	-1.3054** [0.292] [0.000]	-1.2300** [0.293] [0.000]	-0.0079 [0.034] [0.816]	-0.0304 [0.029] [0.291]	3.6532** [0.478] [0.000]	4.1070** [0.444] [0.000]	65.6696 [91.105] [0.471]	57.9668 [74.834] [0.439]
Observations	8,495	8,495	9,903	9,903	8,532	9,969	8,532	9,969	7,763	9,111
R-squared	0.312	0.311	0.281	0.280						
F	222.9	221.2	295.6	294.4	210.0	348.3	512.4	748.3	9.931	19.24
Adjusted R ²	0.221	0.218	0.190	0.189	0.494	0.502	0.774	0.741	0.102	0.0525
R ²	0.321	0.319	0.288	0.287	0.559	0.562	0.803	0.772	0.227	0.176

** p<0.01, * p<0.05, + p<0.1

dimension of ESG, E and S increase yretnd by 25.83% and 16.6%, G decrease yretnd by 45.08%. It is consistent with legitimacy theory that E and S provide the value of reputation and legitimate isomorphism. Additionally, it is also in line with the efficient market theory that there are no opportunities for shareholders to make arbitrage for information asymmetry when G disclosure is higher.

However, when we take overall ESG disclosure, it shows the strong significant positive relationship with yretwd ($\beta_{ESG}=0.0044$, $p_{ESG}=0.002$) and yretnd ($\beta_{ESG}=0.0045$, $p_{ESG}=0.002$) in model 3 and model 4. Thus, one standard deviation increase in ESG will lead to a rise in yretwd and yretnd by 0.032 (0.0044×7.22 and 0.0045×7.22), indicating 26.67% boost in both yretwd and yretnd. These models assess the aggregate effect of overall ESG disclosure on investment decisions, showing a significant positive relationship. Thus, H1 is supported.

Moreover, we also found the heterogeneity of ESG in ROA and Tobin's q shown in model 5, 6, 7, and 8 at Table 4. Overall ESG disclosure has negative and significant relationship with ROA (β_{ESG} =-0.0007, p_{ESG}=0.000), The results indicate that disclosing overall ESG in one standard deviation leads to a drop in ROA by 12.63%, and only disclosing corporate governance in one standard deviation will decrease ROA by 6.76%. The findings highlight a significant negative relationship between overall ESG disclosure and ROA, indicating that while ESG enhances market valuations or returns, it simultaneously strains operational profitability in the short term. H2 is supported.

These confirm our prediction of the negative relationship between ESG and ROA. However, this negative relationship is not caused by the initial cost of ESG portfolio. Reaching corporate governance disclosure regulation will sacrifice the firm's profitability, leading to a decrease in shareholders' value. Additionally, when it comes to firm market value, Overall ESG disclosure has positive significance at 1% level on Tobin's q (β ESG=0.0134, pESG=0.000), but only environmental disclosure significantly strengthens Tobin's q (β E=0.0077, pE=0.000; β S=0.0020, pS=0.246; β G=0.0022, pG=0.459). It

Nam Kim

represents that increase in one standard deviation of overall ESG disclosure scores will raise Tobin's q by 0.097 (0.0134×7.22), and 35.28% increase in Tobin's q, and only environmental disclosure can improve Tobin's q at 5.95% when increasing one standard deviation in E dimension. It also aligns with our previous prediction of the positive relationship between ESG disclosure rating and market value. Intangible assets such as reputation and trust are formulated by disclosing ESG information which raise the firm value. Overall, H3 is supported.

B. ESG Disclosure and Covid-19 Pandemic

We utilized the DID approach to compare the performance of ESG disclosed and non-disclosed firms the before and post-Covid-19 to examine the performance of ESG disclosure. Furthermore, Table 7 describes the underlying statistics for the treatment and control groups. We found almost twice as many observations in the control group as in the treatment group. We discovered significant differences between the treatment and control groups in ROA, Tobin's q, BM, leverage, and firm size (pROA=0.0076; pTobin' q = 0.0001; pBM =0.0000; pliaat= 0.0000; pemp= 0.0000; plat= 0.0000). As a result, we may deduce that ESG disclosure is linked to a firm's profitability, market value, leverage, and size.

Table 8 shows the results of a univariate test that demonstrates the main impact of ESG disclosure on firm financial outcomes. We calculated the difference between the average value of the dependent variable during the Covid-19 period and the non-epidemic period. The results reveal a significant increase in shareholding returns in both the control and treatment groups, which was statistically significant at the 1% level. According to the results of univariate comparisons, ESG disclosed firms had a 6.4% greater shareholder return than non-disclosed firms during the pandemic. However, from the univariate DID method between ROA and Tobin's Q, we found that ESG had a significantly positive impact on ROA and a significantly negative impact on Tobin's Q

during the non-epidemic period. However, when the pandemic kicked in, this significance disappeared.

Then, using multivariate regression analysis, we estimated the effect of ESG disclosure rating in Covid-19 on holding period return (*yretwd*, *yretnd*), ROA, and Tobin's Q, respectively. We estimated the following OLS regression, where the coefficient of interest is β :

$yretwd_{i,t} = \alpha_t + \beta_2 Interaction(Treated_{i,t} \times Post_t)$
+ $\gamma X_{controls:i,t}$ + $\epsilon_{i,t}$
$yretnd_{i,t} = \alpha_t + \beta_2 Interaction(Treated_{i,t} \times Post_t)$
+ $\gamma X_{controls:i,t}$ + $\epsilon_{i,t}$
$ROA_{i,t} = \alpha_t + \beta_3 Interaction(Treated_{i,t} \times Post_t)$
+ $\gamma X_{controls:i,t}$ + $\epsilon_{i,t}$
Tobin's $Q_{i,t} = \alpha_t + \beta 4$ Interaction(Treated _{i,t} × Post _t)

$$+ \gamma X_{\text{controls:i,t}} + \varepsilon_{\text{i,t}}$$

In this case, i and t denote firms and years, respectively. Post is an indicator that predicts a value of one in 2019 and 2020 and a value of zero from 2010 to 2018. "Treated" is an indicator that takes a value of one for firms that possess ESG disclosure rating and zero for firms without ESG disclosure. Fixed effects absorb the coefficients for *Treated*_{i,t} and *Post*_{i,t} thus they are not presented. $X_{i,t}$ are control variables that describe company characteristics over time (Leverage, Size, Number of Employees, ROI, ROE, B/M). Annual fixed effects that absorb aggregate underlying economic shocks are represented by the *a*_t.

Table 9 depicts the multivariate analysis of the DID estimation on the changes in ESG disclosure around the Covid-19 Pandemic. Models 1, 2, 3, and 4 illustrate the changes in yrewtd, yrewnd, ROA, and Tobin's Q of the treated firm compared to the

Table 7. Summary Statistics of ESG disclosure in Covid-19 Pandemic

Variable	Total (Tr	Total (Treatment & Control)			Control			Treatment		
variable	Obs	Mean	S.D.	Obs	Mean	S.D.	Obs	Mean	S.D.	P-value
yretwd	31758	0.11	0.57	21147	0.11	0.58	10611	0.12	0.55	0.0253
yretnd	31758	0.11	0.57	21147	0.11	0.59	10611	0.12	0.55	0.0557
ROA	32317	0.03	0.75	21606	0.02	0.53	10711	0.05	1.06	0.0076
Tobin's q	32317	2.30	11.85	21606	2.49	14.39	10711	1.92	2.39	0.0001
ROE	32093	0.02	4.74	21408	0.02	5.72	10685	0.04	1.38	0.6208
ROI	26727	205.61	26991.14	16724	326.11	34120.58	10003	4.15	258.14	0.3453
BM	32317	0.62	0.25	21606	0.59	0.24	10711	0.68	0.27	0.0000
Leverage	32473	0.46	1.14	21762	0.44	1.38	10711	0.50	0.23	0.0000
Size	32473	22.20	1.54	21762	21.66	1.17	10711	23.29	1.61	0.0000

Table 8. Univariate test: Change in ESG disclosure around COVID-19 Pandemic

	yretwd		DD/DD/	yretnd	DD/DD/	ROA	DD/DD/	Tobin's Q	
	Control	Treatment	DDD	Treatment	DDD	Control	DDD	Control	Treatment
Non COVID-19	0.079	0.082	0.003 [0.008] [0.723]	0.082	0.001 [0.008] [0.914]	0.028	0.026** [0.010] [0.011]	2.634	1.934
COVID-19	0.189	0.257	0.067*** [0.014] [0.000]	0.255	0.064*** [0.014] [0.000]	0.006	0.012 [0.018] [0.503]	2.083	1.886
DD/DD/DDD	0.11	0.175	0.064*** [0.016] [0.000]	0.173	0.063*** [0.016] [0.000]	-0.022	-0.014 [0.021] [0.497]	0.11	0.175

*** p<0.01; ** p<0.05; * p<0.1

controlled firm. We discovered that following the epidemic, the treatment firm's Tobin's Q rose by 17.83% as compared to the control firm, which was statistically significant at the 1% level. In contrast, the treated firms' yrewtd, yrewnd, and ROA coefficients were insignificant.

Similarly, we marginalized this interaction effect and plotted Figure 3. We found that in Covid-19, the impact of ESG disclosure was not significantly different across *yrewtd*, *yrewnd*, and ROA, and that the control group was consistently higher on the outcome variables than the treatment group. Only in Tobin's Q, there is a huge difference between the treatment group and the control group, Tobin's Q in the treatment group is about 0.5 higher than that of the control group, and this difference showed an increasing trend in 2020. It is different from the results of the univariate analysis. When considering the control variables, ESG disclosure policies will increase the firm value under the external shock of the epidemic. The empirical results align with the theory that ESG can perform as a hedging instrument against exogenous shock.

Table •	9.	Multivariate	Test:	Interaction	of ESG	disclosure(treated)	and	Covid-19(Post)
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$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$					
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		(1)	(2)	(3)	(4)
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		yretwd	yretnd	ROA	Tobin's q
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		0.3139**	0.3123**	-0.0284**	0.1021**
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	Post	[0.011]	[0.011]	[0.003]	[0.022]
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		[0.000]	[0.000]	[0.000]	[0.000]
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		-0.1127**	-0.1113**	-0.0385**	0.2281**
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Treated	[0.026]	[0.027]	[0.006]	[0.053]
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		[0.000]	[0.000]	[0.000]	[0.000]
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		-0.0147	-0.0147	0.0019	0.1783**
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	Post×Treated	[0.016]	[0.016]	[0.004]	[0.033]
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		[0.358]	[0.364]	[0.623]	[0.000]
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	Controls:				
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		-0.0050	0.0037	-0.1962**	-0.2959**
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	Leverage	[0.036]	[0.036]	[0.009]	[0.073]
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	-	[0.891]	[0.919]	[0.000]	[0.000]
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		0.0452**	0.0444**	0.0280**	-0.1097**
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	Size	[0.008]	[0.009]	[0.002]	[0.017]
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		[0.000]	[0.000]	[0.000]	[0.000]
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		0.0000	0.0000	-0.0000	-0.0000
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	ROI	[0.000]	[0.000]	[0.000]	[0.000]
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		[0.457]	[0.461]	[0.777]	[0.210]
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		0.0091**	0.0092**	0.0126**	-0.0107**
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	ROE	[0.001]	[0.001]	[0.000]	[0.003]
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		[0.000]	[0.000]	[0.000]	[0.000]
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	B/M	-1.7498**	-1.7531**	-0.0315**	-4.4673**
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		[0.023]	[0.023]	[0.005]	[0.046]
0.1852 0.2017 -0.4668** 7.3155** Constant [0.176] [0.179] [0.042] [0.357] [0.294] [0.258] [0.000] [0.000] Observations 23,657 23,657 24,508 24,508 R-squared 0.343 0.341 0.305 0.712		[0.000]	[0.000]	[0.000]	[0.000]
Constant [0.176] [0.179] [0.042] [0.357] [0.294] [0.258] [0.000] [0.000] Observations 23,657 23,657 24,508 24,508 R-squared 0.343 0.341 0.305 0.712		0.1852	0.2017	-0.4668**	7.3155**
[0.294] [0.258] [0.000] [0.000] Observations 23,657 23,657 24,508 24,508 R-squared 0.343 0.341 0.305 0.712	Constant	[0.176]	[0.179]	[0.042]	[0.357]
Observations 23,657 23,657 24,508 24,508 R-squared 0.343 0.341 0.305 0.712		[0.294]	[0.258]	[0.000]	[0.000]
R-squared 0.343 0.341 0.305 0.712	Observations	23,657	23,657	24,508	24,508
	R-squared	0.343	0.341	0.305	0.712
F 743.2 727.6 278.9 1202	F	743.2	727.6	278.9	1202

*** p<0.01; ** p<0.05; * p<0.1



Figure 3. DID estimation: The difference of firm's performance between ESG disclosed firm(treatment) and non-disclosed firm(control)

C. ESG Disclosure and Industry Heterogeneity

This section examines how industry heterogeneity influences ESG effectiveness on the firms' and investors' value. We divide the industry into four major parts according to the commonalities between industries, 1) financial, insurance and real estate related to property, 2) services closely related to intangible assets, IT technology, entertainment, and retail, 3) Manufacturing, mining and construction related to traditional manufacturing industries, 4) Transportation and public utilities. We found that manufacturing occupies the most observations among the four major industries, accounting for 71.84% of the total.

Table 10 summarizes the role ESG plays across industries. First, for Tobin's Q (Model 1-4), except for the service industry, the environmental dimensions of other industries show a significant positive coefficient (β_{Finance} =0.0070, p_{Finance}=0.014; β_{Service} =

0.0061, p_{Service}=0.742; β_{Manu}.=0.0069, p_{Manu}.=0.001; β Trans.&Infra=0.0095, pTrans. &Infra=0.014). The social dimension only shows a weak positive significance in the service industry (B_{Service}=0.0230, p_{Service}=0.055), which indicates that the service industry relies on human capital to create intangible value. Aligning with the interests of employees and other stakeholders will create corporate value. Interestingly, the governance dimension showed a positive and significant influence on Tobin's Q in the financial industry ($\beta_{\text{Finance}}=0.0101$, pFinance=0.042). Second, for ROA (Model 5-8), ESG across all industries did not show a significant relationship. Only in the manufacturing industry does corporate governance shows a weak negative statistical significance (\(\beta_{Manu}\).=-0.0005, p_{Manu}\)=0.065). For holding period return (Model 9-12), the positive significance of the environmental dimension is only reflected in the manufacturing industry (β_{Manu} . = 0.0052, p_{Manu}=0.001). In addition to the service

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Tobin'sq	Tobin's q	Tobin's q	Tobin's q	ROA	ROA	ROA	ROA	yretwd	yretwd	yretwd	yretwd
Industry	Finance	Service	Manu. Mining	Trans. Infra	Finance	Service	Manu. Mining	Trans. Infra	Finance	Service	Manu. Mining	Trans. Infra
Е	0.0070^{*}	0.0061	0.0069 ^{**}	0.0095 [*]	0.0001	0.0017	-0.0002	0.0001	-0.0004	0.0040	0.0052 ^{**}	-0.0007
	[0.003]	[0.019]	[0.002]	[0.004]	[0.000]	[0.001]	[0.000]	[0.000]	[0.003]	[0.008]	[0.002]	[0.003]
	[0.014]	[0.742]	[0.001]	[0.014]	[0.886]	[0.208]	[0.169]	[0.444]	[0.902]	[0.612]	[0.001]	[0.803]
S	0.0013	0.0230+	0.0005	0.0019	0.0001	-0.0002	-0.0001	-0.0001	0.0044	0.0021	0.0003	0.0013
	[0.003]	[0.012]	[0.002]	[0.004]	[0.000]	[0.001]	[0.000]	[0.000]	[0.003]	[0.005]	[0.002]	[0.002]
	[0.623]	[0.055]	[0.826]	[0.587]	[0.842]	[0.787]	[0.360]	[0.378]	[0.106]	[0.674]	[0.824]	[0.595]
G	0.0101 [*]	0.0147	0.0012	-0.0082	0.0002	-0.0006	-0.0005 ⁺	-0.0001	-0.0157 ^{**}	-0.0109	-0.0085 ^{**}	-0.0165 ^{**}
	[0.005]	[0.020]	[0.004]	[0.007]	[0.001]	[0.001]	[0.000]	[0.000]	[0.005]	[0.009]	[0.003]	[0.005]
	[0.042]	[0.468]	[0.750]	[0.249]	[0.777]	[0.685]	[0.065]	[0.840]	[0.002]	[0.204]	[0.001]	[0.001]
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Leverage	0.0765	-0.2995	-0.3227 ^{**}	-0.6237*	0.1300 ^{**}	-0.2133**	-0.1875 ^{**}	-0.0721 ^{**}	-0.3019	0.0187	0.1393+	0.1515
	[0.226]	[0.654]	[0.119]	[0.243]	[0.038]	[0.046]	[0.009]	[0.011]	[0.228]	[0.276]	[0.085]	[0.167]
	[0.734]	[0.647]	[0.007]	[0.010]	[0.001]	[0.000]	[0.000]	[0.000]	[0.185]	[0.946]	[0.100]	[0.365]
Size	0.0090	-0.0788	0.0325	0.1143 ⁺	-0.0095	0.0014	0.0110*	-0.0051 ⁺	0.1876 ^{**}	0.0797	0.2070 ^{**}	0.1522 ^{**}
	[0.036]	[0.140]	[0.029]	[0.063]	[0.006]	[0.010]	[0.002]	[0.003]	[0.037]	[0.059]	[0.021]	[0.044]
	[0.805]	[0.573]	[0.258]	[0.069]	[0.116]	[0.884]	[0.000]	[0.074]	[0.000]	[0.176]	[0.000]	[0.001]
ROI	0.0013 [*]	-0.0084 ^{**}	-0.0000 ⁺	-0.0012	-0.0029 ^{**}	0.0003 ⁺	-0.0000 ^{**}	0.0002	-0.0005	0.0034 ^{**}	-0.0000	-0.0014
	[0.001]	[0.003]	[0.000]	[0.003]	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]	[0.000]	[0.002]
	[0.014]	[0.004]	[0.073]	[0.717]	[0.000]	[0.093]	[0.003]	[0.128]	[0.319]	[0.006]	[0.618]	[0.543]
ROE	0.1542 ^{**}	0.0209	0.0029	-0.0715	0.3459 ^{**}	0.0648 ^{**}	0.0141 ^{**}	0.2376 ^{**}	-0.0056	0.0696^+	0.0128 [*]	0.1350 [*]
	[0.051]	[0.094]	[0.008]	[0.086]	[0.009]	[0.007]	[0.001]	[0.004]	[0.051]	[0.040]	[0.006]	[0.059]
	[0.003]	[0.825]	[0.714]	[0.404]	[0.000]	[0.000]	[0.000]	[0.000]	[0.913]	[0.079]	[0.024]	[0.023]
BM	-2.7838 ^{**}	-4.8321 ^{**}	-3.8259**	-2.5010 ^{**}	0.0365 ⁺	-0.0340	-0.0551 ^{**}	-0.0158 ^{**}	-2.1439**	-1.7397 ^{**}	-1.7004 ^{**}	-1.3906 ^{**}
	[0.119]	[0.336]	[0.068]	[0.124]	[0.020]	[0.024]	[0.005]	[0.006]	[0.120]	[0.142]	[0.048]	[0.086]
	[0.000]	[0.000]	[0.000]	[0.000]	[0.065]	[0.152]	[0.000]	[0.005]	[0.000]	[0.000]	[0.000]	[0.000]
Constant	2.8092 ^{**}	5.7635 ⁺	3.6924 ^{**}	1.3439	0.0960	0.1355	-0.0579	0.1960 ^{**}	-1.9137 [*]	-0.2813	-3.2597 ^{**}	-1.7532 ⁺
	[0.762]	[3.072]	[0.621]	[1.350]	[0.127]	[0.216]	[0.045]	[0.061]	[0.771]	[1.293]	[0.444]	[0.935]
	[0.000]	[0.061]	[0.000]	[0.320]	[0.450]	[0.531]	[0.197]	[0.001]	[0.013]	[0.828]	[0.000]	[0.061]
Observatio ns	1,034	607	5,708	1,120	1,034	607	5,708	1,120	1,027	606	5,683	1,116
R-squared	0.730	0.820	0.797	0.836	0.980	0.492	0.593	0.886	0.322	0.354	0.334	0.313
F	76.92	29.75	388.1	49.78	3870	18.26	152.1	497.0	38.49	20.63	140.5	31.73

Table 10. ESG in Industry effect

** p<0.01, * p<0.05, + p<0.1

industry, G showed a strong negative significant effect ($\beta_{Finance}$ =-0.0157, $p_{Finance}$ =0.002; $\beta_{Service}$ =0.0109, $p_{Service}$ = 0.204; β_{Manu} =-0.0085, p_{Manu} =0.001; $\beta_{Trans.\&Infra}$ =-0.0165, $p_{Trans.\&Infra}$ =0.001). It matches our previous prediction. Moreover, our models' explanatory power for industry analysis is also very high; the range of R² is as high as 31.3%~98.0%.

D. Endogeneity Issues

Finally, we employed the Heckman two-stage model (2SLS) to examine the endogeneity issue of

ESG disclosure. We introduced a dummy variable measuring if a firm has passed ISO14001 certification as the instrumental variable for ESG disclosure (Wijethilake, 2017). Table 11 illustrates our empirical results. According to the Durbin score and Wu-Hausman test, we obtained mixed results regarding endogeneity:

Model 1 and Model 2 showed non-significant results for both the Durbin score (x2(1) = 3.15999, p = 0.0755; x2(1) = 3.17807, p = 0.0746) and the Wu-Hausman test (F (1,2722) = 3.1486, p = 0.0761; F(1,2722) = 3.16665, p = 0.0753), indicating no significant endogeneity. Model 3 reinforced this finding with a Durbin score of x2(1) = 0.234885, p = 0.6279, and a Wu-Hausman test of F (1,2722) = 0.233788, p = 0.6288. However, Model 4 revealed significant endogeneity, as indicated by a Durbin score of x2(1) = 7.98264, p = 0.0047, and a Wu-Hausman test of F (1,2722) = 7.96795, p = 0.0048.

These results suggest that, except for Model 4, there is no endogeneity problem between ESG disclosure and firm value. This confirms our hypothesis on the heterogeneity of each ESG dimension: The E dimension increases holding period returns ($\beta E = 0.0069$, pE = 0.062). The S dimension has no effect ($\beta S = 0.0039$, pS = 0.163). The G dimension reduces holding period returns ($\beta G =$ -0.0546, pG = 0.065).

For ESG sub-dimensions, there was no significant impact on ROA. Surprisingly, E and S showed a negative and significant effect on enterprise value, while G significantly increased Tobin's Q ($\beta E =$ -0.0202, pE = 0.067; $\beta S =$ -0.0186, pS = 0.026; $\beta G =$ 0.2078, pG = 0.019). This nuanced understanding highlights the complex relationships between

Table 11. 2SLS Estimation and endogeneity Issues

VARIABLES	(1)	(2)	(3)	(4)
VARIABLES	yretwd	yretnd	ROA	Tobin's Q
	0.0069+	0.0069 +	-0.0002	-0.0202+
Е	[0.004]	[0.004]	[0.000]	[0.011]
	[0.062]	[0.062]	[0.579]	[0.067]
	0.0039	0.0039	0.0006	-0.0186*
S	[0.003]	[0.003]	[0.000]	[0.008]
	[0.163]	[0.163]	[0.103]	[0.026]
	-0.0546+	-0.0543+	-0.0021	0.2078*
G	[0.030]	[0.029]	[0.004]	[0.089]
	[0.065]	[0.065]	[0.552]	[0.019]
	0.0286	0.0296	-0.1278**	-0.3847+
Leverage	[0.075]	[0.075]	[0.009]	[0.226]
	[0.705]	[0.692]	[0.000]	[0.088]
	0.1327**	0.1313**	0.0184**	-0.0655
Size	[0.028]	[0.028]	[0.003]	[0.085]
	[0.000]	[0.000]	[0.000]	[0.441]
	-0.0003	-0.0003	0.0002*	-0.0007
ROI	[0.001]	[0.001]	[0.000]	[0.002]
	[0.608]	[0.607]	[0.044]	[0.717]
	0.0111*	0.0111*	0.0127**	0.0092
ROE	[0.005]	[0.005]	[0.001]	[0.016]
	[0.041]	[0.040]	[0.000]	[0.574]
	-0.8280**	-0.8223**	-0.0667**	-4.0463**
BM	[0.041]	[0.041]	[0.005]	[0.123]
	[0.000]	[0.000]	[0.000]	[0.000]
	-0.3531	-0.3367	-0.2023**	-1.4768
Constant	[0.558]	[0.554]	[0.068]	[1.669]
	[0.527]	[0.544]	[0.003]	[0.376]
Durhin	3.15999+	3.17807+	0.234885	7.98264**
	[0.0755]	[0.0746]	[0.6279]	[0.0047]
Wu-Hausman	3.1486+	3.16665+	0.233788	7.96795**
F	12722	12722	12722	12722]
R ²	0.001	0.000	0.306	0.263
chi ²	426.1	426.0	1232	1835

Observations: 2375; ** p<0.01, * p<0.05, + p<0.1

different dimensions of ESG and various financial performance metrics.

V. Conclusion and Discussion

Our investigation into the differential impacts of ESG disclosure and its sub-dimensions on holding period returns, profitability, and company value, utilizing panel data from Bloomberg and CSMAR from 2010 to 2020, reveals nuanced relationships. The overall ESG score, and individual dimensions of E, S, and G demonstrate varied influences on firm value. Specifically, we observed a distinctly positive impact of the E dimension on holding period returns, a negligible effect from the S dimension, and a detrimental effect of G on these returns. This finding is in alignment with shareholder theory and legislative theory and underscores the complexities underlying the aggregated ESG score. It suggests that a composite ESG score might not only lead to potential misdirection in investment decisions but also create confusion about the efficacy of ESG portfolios.

Concerning ROA, our results indicate that while the combined ESG score detrimentally affects ROA, disaggregating the ESG components reveals that only G has a deleterious impact. Conversely, for Tobin's q, the overarching ESG score positively correlates, with E disclosures showing significant benefits, echoing legitimacy theory. The Environmental disclosures may diminish financing costs and enhance intangible assets such as corporate reputation and trust, which are crucial during times of crisis, such as the COVID-19 pandemic.

Our study extends the current understanding by dissecting the impact of ESG during the pandemic, where we found that ESG disclosures bolstered market value amid external shocks. This supports the notion that ESG serves as a hedge against market instability, reinforcing stakeholders' trust during tumultuous periods and augmenting a firm's competitive edge. Moreover, the heterogeneity of ESG impacts across industries is apparent in our data. In the financial sector, enhanced Governance disclosures increase firm value. However, this transparency may limit opportunities for shareholder gains through arbitrage due to information asymmetry, aligning with efficient market theory. This suggests that the benefits and disadvantages of ESG disclosures are industryspecific and vary between investor and corporate perspectives.

By addressing ESG endogeneity, we also clarify that it is the disclosure of ESG information that precedes and influences firm value, rather than corporate value driving ESG disclosures. This key finding refutes any reverse causality between ESG disclosures and both firm valuation and investor decision-making.

Comparatively, our study contributes to the discourse on ESG in several ways. It builds upon works such as those by Friede et al. (2015) and Busch et al. (2021) by providing granular insights into how ESG affects financial performance, particularly in the context of Chinese capital markets, which is less represented in literature. Unlike these earlier studies, we provide an extensive analysis over a decade and across different market conditions, including the unique circumstances of the COVID-19 pandemic, which adds depth to our understanding of ESG's role as a risk mitigation tool.

Our focus on the heterogeneity of corporate sustainability complements the findings of Khan et al. (2016), who highlighted ESG's value in crisis management. We further this by demonstrating that ESG's protective qualities extend beyond immediate crisis response to include overall market value stabilization.

Finally, by examining industry-specific effects, we build upon the sectorial analyses presented in the studies by Cheng et al. (2014) and offer practical guidance on the strategic application of ESG disclosures. We contribute a novel perspective on how firms in varying industries can tailor their ESG strategies to align with stakeholders' expectations and maximize their impact on firm value. From a practical standpoint, our findings suggest that investors and firms should not uniformly evaluate ESG impacts but rather consider each dimension's unique effects when making decisions. For policymakers, the insights could inform the development of targeted ESG disclosure regulations that recognize and address the complex effects of ESG information.

As for limitations, the specificity to Chinese listed firms may affect the generalizability of the results. The reliance on Bloomberg's panel data might also introduce selection bias, and the DID method may not capture all variables affecting firm performance during the pandemic. Future research could address these limitations by incorporating broader datasets and exploring other methodological approaches.

This expanded discussion offers a deeper comparative analysis with previous studies, highlighting both the theoretical and empirical contributions of our work, as well as practical implications and limitations for a holistic understanding of the study's context within the broader research landscape.

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