



ESG Ratings as a Strategic Imperative: Unraveling Their Influence on Corporate Financial Performance in China

Wei Jiang¹ · Xin Wang¹ · Liping Liang² · Mingming Leng² · Xin Fang³

Received: 29 December 2023 / Accepted: 10 August 2024

© The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature 2024

Abstract

Recent years have witnessed a growing interest in understanding the impact of environmental, social, and governance (ESG) factors on corporate financial performance. However, the findings are mixed regarding the holistic impact of ESG in the context of Chinese companies. Using the ESG ratings data of SynTao Green Finance from 2010 to 2020, we investigate how a company's aggregate ESG score affects its financial performance, using a staggered difference-in-differences model. We find that (1) the overall ESG ratings of Chinese companies positively impact their financial performance; (2) the positive effects are achieved through alleviating agency problems, increasing R&D investment, and improving total factor productivity; (3) the effect is stronger in heavily polluting industries and state-owned enterprises; and (4) the larger a company, the more significant the influence of its ESG ratings on its financial performance. Our findings imply that companies should actively promote ESG practices through green production, active participation in social welfare-enhancing activities, and improved corporate governance systems. Moreover, the Chinese government should strongly support ESG practices, improve the ESG information disclosure system, and establish an incentive mechanism for companies' ESG practices.

Keywords ESG · Financial performance · Difference-in-differences · Agency problem · R&D investment · Total factor productivity

Introduction

Increasingly severe ecological and environmental problems, frequent natural disasters, and extreme climate risks have made green sustainable development a key contemporary theme. China's economic ascent in recent decades has transformed it into a global economic powerhouse. However, this rapid growth has not been without its

Xin Wang, Liping Liang, Mingming Leng, and Xin Fang contributed equally to this work.

Extended author information available on the last page of the article

Published online: 17 August 2024

challenges. The surge in industrialization and urbanization has taken a toll on the environment, leading to pollution, resource depletion, and ecological imbalances. As the largest manufacturing country in the world, China faces a particularly prominent conflict between environmental pollution and economic development in the global market. Concurrently, societal expectations and demands regarding corporate responsibility have evolved, with stakeholders increasingly scrutinizing companies' environmental impact, social engagement, and governance practices.

In response to these challenges, China has initiated ambitious green initiatives and policy frameworks aimed at fostering sustainable development. These include stringent environmental regulations, incentives for renewable energy adoption, and campaigns promoting corporate social responsibility (CSR). These efforts underscore the country's commitment to balancing economic prosperity with environmental stewardship and social well-being. With the strengthening of determination to promote green development, China has also put forward higher requirements for non-financial factors, including corporate environmental performance, social responsibility, and corporate governance. As companies are important creators of social wealth and are key to achieving green development, they should actively implement environmental regulations, take the initiative to assume social responsibilities, and optimize their corporate governance structure to promote the process of green development and realize their own long-term green, stable, and sustainable development.

Environmental, social, and governance (ESG) factors emphasize that companies should pay attention to protecting the ecological environment, fulfilling social responsibilities, and improving their governance level. ESG is a key indicator of the management ability and non-financial performance of companies (Galbreath, 2013) and is an important reference standard for the qualitative and quantitative measurement of CSR. Compared with the traditional financial rating system, ESG places a heightened focus on evaluating company risks across three crucial dimensions: environmental impact, social responsibility, and corporate governance. It has gradually become an important decision-making factor for market participants (Pedersen et al., 2021). Whereas the traditional view of maximizing shareholder value holds that companies' only social responsibility is to prioritize the interests of shareholders and use all available resources to seek profit growth (Friedman, 2007), ESG weighs the rights and interests of all stakeholders and pursues the maximization of social value (Peng, 2023).

ESG aligns with the requirements for sustainable social development and is garnering increasing attention from all sectors of society. ESG has increasingly become mainstream in society and is now an important factor in consumption, investment, and production decisions. Therefore, companies need to focus not only on economic performance but also on non-financial factors such as environment, social responsibility, and corporate governance to strike a harmonious equilibrium between advancing ESG initiatives and maintaining strong financial performance. It is crucial for government departments to foster the continuous advancement of ESG practices. In this context, it is important to examine the interplay between ESG and financial performance. Additionally, global investment in ESG is growing rapidly, and regulators and exchanges increasingly recognize the importance of ESG disclosure (Zhao

et al., 2018). Although China's ESG practices started late, many listed companies are gradually promoting ESG disclosure. However, the lack of awareness of enterprise managers and the lack of supervision by regulators have led to the slow development of ESG. Therefore, an in-depth analysis of the impact of ESG on the financial performance of Chinese companies can shed light on ESG practices.

The development of ESG practices has been accompanied by a wealth of academic research. Due to the late development of ESG practices in China, the ESG information disclosure framework and the mandatory disclosure system have not been fully established, and the ESG rating system lacks sufficient market influence. As a result, management in most companies remains skeptical about whether the benefits of improving ESG performance can compensate for the costs. If an enterprise is unable to gain added value through fulfilling its ESG responsibilities, it will lack motivation to do so. This can hinder the development of corporate ESG practices. Therefore, the government faces the problem of how to mitigate the concerns of companies, enable them to enjoy the benefits of ESG practices, and realize a win-win outcome for economic value and social value. Correspondingly, we are interested in the following questions: Does ESG help improve corporate financial performance in China? If so, what is the mechanism of this effect?

As ESG practices are still at the early development stage in China, the studies on ESG in China have only begun to appear in recent years, and most of them have primarily centered on the establishment of an ESG rating system, the improvement of ESG information disclosure, and the relationship between ESG and various risks. Moreover, most of the research has focused on the connection between individual ESG factors and financial performance, with limited research addressing the holistic relationship between overall ESG practices and corporate financial performance in China. This paper, from the perspective of environmental regulations, utilizes a staggered difference-in-differences (DID) model to study the relationship between ESG and the financial performance of Chinese listed companies. Our research aims to deepen the understanding of ESG and its economic benefits in China, promote high-quality and sustainable development of the Chinese economy, and contribute to the improvement of the ESG system in China.

This paper contributes to the literature on ESG in three respects. First, compared with studies focused on companies in specific regions or industries in China, this research encompasses a broader range of Chinese companies. Thus, it provides more general findings about ESG in China and could offer insights for similar developing nations (Lee et al., 2017; Dong and Xu, 2016; Liu et al., 2022). Second, this paper analyzes how ESG ratings affect corporate financial performance through the mechanisms of agency costs, R&D investment, and total factor productivity. The findings can aid Chinese companies in enhancing ESG practices, forming effective strategies, and fostering sustainable development, offering insights to both businesses and policymakers. Third, from the perspective of environmental regulation, this paper employs the DID method to explore the impact of overall ESG ratings on corporate financial performance. The results reveal the important implications of ESG ratings for the financial performance of companies and provide empirical evidence to help companies and relevant government departments further improve the ESG rating system.

The rest of this paper is organized as follows. The “Literature Review and Hypothesis Development” section reviews the relevant literature and develops the hypotheses. The “Research Design” section discusses the research method and data. The “Empirical Results” section presents the empirical analysis, including empirical findings, robustness tests, mechanism analysis, and further analysis. The “Conclusions” section concludes with a summary of the major findings and recommendations.

Literature Review and Hypothesis Development

ESG and Financial Performance

With the increasing global attention to ESG, scholars have made remarkable achievements in ESG research. However, the impact of ESG on corporate financial performance remains controversial. Shareholder primacy theory and sustainable development theory provide opposing views on the relationship between ESG and corporate financial performance.

Shareholder supremacy theory holds that the primary goal of a company is to maximize the interests of shareholders. From the company’s perspective, if funds are used to strengthen ESG efforts, this jeopardizes the interests of shareholders and violates the company’s core responsibilities, resulting in increased costs for the company and negative impacts on the company’s operation (Friede et al., 2015). Effective corporate governance can significantly improve the financial performance of a company, whereas board size is inversely related to financial performance (Malik & Makhdoom, 2016; Hu et al., 2023). Managers may seek personal gains under the pretext of social responsibility, and the conflict between over-investment practices and sustainable development commitments weakens the market value of companies (Nekhili et al., 2021). In addition, the disclosure of non-financial information regarding, for example, environmental and social responsibility increases the operating expenses of companies, which may lead to a decline in market value and financial performance (Garcia et al., 2017; Hassel et al., 2005; Kroes et al., 2012; Sarkis et al., 2010). CSR can negatively affect a company’s stock returns (Brammer et al., 2006). In addition, in the long run, managers’ strategic use of disclosure to conceal unethical behavior has a negative impact on companies (Shakil, 2021; Wong & Zhang, 2022).

Sustainable development theory refutes the viewpoint of shareholder supremacy theory. From the perspective of signal transmission, good ESG performance often conveys signals of sustainable development, and stakeholders can rely on these signals to judge business uncertainty and assess future profitability, cash flow, and risks (Clarkson et al., 2008). Improving ESG transparency can improve corporate profitability, and an increase in management power can strengthen the influence of ESG disclosure on corporate value (Li et al., 2018). ESG information helps mitigate information asymmetry. ESG ratings can reduce the information gap between companies and stakeholders, allowing companies to obtain more support from stakeholders and thus achieve better financial performance and higher market value (Deng et al.,

2013; Flammer, 2015a, 2015b). ESG ratings can also promote green innovation in companies (Li et al., 2023), improve their investment efficiency (Benlemlih & Bitar, 2018), and reduce the risks they face (Lins et al., 2017; Reber et al., 2022), which in turn reduces the cost of capital (Dhaliwal et al., 2011), cost of equity, and cost of debt (Goss & Roberts, 2011) and is economically beneficial to companies (Branco & Rodrigues, 2006; Zhou et al., 2022). Moreover, ESG ratings are correlated with corporate ratings in the bond market and with default risk. ESG enables companies to establish a brand image in society, win the trust of consumers (Hur et al., 2018), reduce the cost of violations, obtain more external resources, and become more competitive in the market, which is conducive to obtaining economic returns and enhancing companies' sustainable development.

According to stakeholder theory, companies actively undertake social responsibilities to meet the demands of stakeholders and earn their trust and support. This fosters long-term sustainable operations and enhances financial performance (Jones, 1995). Stakeholders include internal stakeholders such as shareholders, management, and employees, and external stakeholders such as consumers, suppliers, communities, and governments (Freeman, 2010). Stakeholder theory emphasizes business ethics and social ethics in company operation. In the face of market downturns and external uncertainties, ethical investments protect companies that are committed to environmental protection and social responsibility (Olofsson et al., 2021).

Based on the above discussions, we posit the following hypothesis:

H1: ESG ratings exert a positive influence on corporate financial performance.

Mechanism Analysis of ESG Ratings' Impact on Financial Performance

Agency Problem

The separation of company ownership and management rights leads to a series of principal–agent relationships, which involve information asymmetry and conflicting objectives between owners and managers. Therefore, for the sake of their own reputation and performance assessment, managers may make decisions to benefit their personal interests at the expense of companies; that is, agency problems may arise (Shleifer & Vishny, 1989; Stein, 1989). The costs resulting from agency problems are referred to as agency costs (Jensen & Meckling, 2019). At the same time, influenced by performance, public opinion, risks, and other factors, managers are likely to focus on the immediate performance of the company, opting for short-term investment projects while forgoing riskier, long-term ventures (Fang et al., 2014; He & Tian, 2013). Such short-sighted behavior by management usually leads to a reduction in investment efficiency, which can have adverse repercussions for the future performance of companies (Berger & Ofek, 1995; Zhu et al., 2017).

According to stakeholder theory, when undertaking social responsibilities, companies tend to be mainly concerned about the interests of shareholders. Thus, companies that fulfill ESG responsibilities may experience reduced agency costs between management and shareholders (Webb, 2005). This can be attributed to the

following causes. First, the fulfillment of ESG responsibilities and the disclosure of ESG information by companies help meet the interests of shareholders and alleviate agency problems between shareholders and management (Tang, 2022). Second, companies driven by ESG ratings pay more attention to long-term development and hold the management to higher moral standards than other companies. The use of ethical methods to solve agency problems can more effectively restrain the short-sighted behavior of the management (Jones, 1995). Third, the disclosure of ESG information can also help enhance the transparency of corporate information and limit management's ability to manipulate information. In summary, ESG ratings reduce information asymmetry, improve the transparency of companies, effectively guide the behaviors of management (e.g., by constraining their short-sighted behavior), reduce agency costs, and mitigate the negative impact of agency problems on corporate financial performance. Therefore, ESG ratings can reduce short-sighted behavior by management, which is conducive to improving corporate financial performance.

Therefore, we propose the following hypothesis:

H2a: ESG ratings exert a positive influence on corporate financial performance by alleviating agency problems.

R&D Investment

ESG practices can lead to an increase in R&D investments, which drive the advancement and implementation of environmentally friendly technology. However, the large expense, long cycle time, and high risk of R&D activities hamper R&D investment, and the extent of R&D expenditure is far below the optimal level (Arrow, 1972; Jones & Williams, 1998). R&D investment is an important basis for technological innovation by companies. Increasing R&D investment is conducive to the development of new technologies and the acquisition of more resources. It can also improve the production technology of companies, achieve product differentiation, and broaden market boundaries to enable companies to hone their core competitiveness and increase their market share, so as to gain a firm foothold in the market and promote the improvement of enterprise performance (Falk, 2012; Mansfield, 1962; Sharma, 2012).

ESG ratings can motivate companies to increase R&D investment and mitigate market failures through R&D activities. The release of ESG ratings improves the transparency of corporate information, helps the capital market evaluate companies' potential value, and provides incentives for companies to invest in innovation and increase R&D investment (Carrasco-Monteaudo and Buendia-Martinez, 2013). Moreover, higher ESG ratings often improve social image, which also gives companies an incentive to increase R&D investment to improve their own ESG ratings (Ho et al., 2016; Luo & Du, 2015; Wang & Sarkis, 2017).

Therefore, we propose the following hypothesis:

H2b: ESG ratings exert a positive influence on corporate financial performance by increasing R&D investment.

Total Factor Productivity

ESG practices have the potential to enhance the total factor productivity of companies (Deng et al., 2023). In response to environmental regulations, companies can adopt more advanced technologies to control pollution emissions, improve efficiency, and gain a competitive advantage (Hamamoto, 2006). Moreover, consumers with a sustainable development mindset are more inclined to purchase low-carbon and green products, which presents opportunities for companies offering such products to form purchase stickiness and attract potential consumers. This motivates companies to innovate green technologies, enhancing their total factor productivity (Gillan et al., 2021). In addition, based on the theory of information asymmetry, CSR can reduce the degree of information asymmetry and improve total factor productivity (Cheng et al., 2014; Liang et al., 2022). ESG practices can prompt companies to actively assume social responsibilities, and the information disclosed in the market is communicated to stakeholders in a timely, transparent, and efficient manner, so that stakeholders can provide companies with more resource support. Businesses that have access to the resources that they need will become more efficient, which effectively facilitates the expansion of the production size of companies, improves total factor productivity (Linthicum et al., 2010), and thus improves the financial performance of companies (Liang & Renneboog, 2017). In short, the disclosure of ESG ratings puts pressure on companies in terms of technological innovation and social responsibility and enables companies to improve their total factor productivity, thereby enhancing their financial performance.

Therefore, we propose the following hypothesis:

H2c: ESG ratings exert a positive influence on corporate financial performance by improving total factor productivity.

Research Design

Model Setting

ESG ratings are mainly published by third-party rating agencies and thus can be regarded as a governance mechanism exerted by the external market. Due to the varying timelines for ESG disclosure among Chinese companies, the standard DID method is not applicable. Similar to Wang and Chu (2024), we constructed a staggered DID model using the first-published ESG rating as an exogenous shock, which is shown below:

$$ROA_{i,t} = \alpha_0 + \alpha_1 ESG_{it} + \gamma X_{it} + \mu_i + \eta_t + \varepsilon_{it}, \quad (1)$$

where $ROA_{i,t}$ is the dependent variable, representing the financial performance of company i in year t ; ESG_{it} is the independent variable. If SynTao Green Finance released data on company i in year t , $ESG_{it} = 1$; otherwise, $ESG_{it} = 0$. X_{it} is a set of

control variables, μ_i denotes individual fixed effects, η_t denotes time fixed effects, and ε_{it} represents a random error.

To delve deeper into the dynamic effect of ESG ratings and conduct parallel trend tests, we constructed the following dynamic DID model:

$$ROA_{i,t} = \alpha + \beta_s^{precut} [D_i \times I(t - T_D < -3)] + \sum_{s=-3}^{-2} \beta_s^{pre} [D_i \times I(t - T_D = s)] + \sum_{s=0}^2 \beta_s^{post} [D_i \times I(t - T_D = s)] + \beta_s^{postcut} [D_i \times I(t - T_D > 2)] + \gamma X_{it} + \mu_i + \eta_t + \varepsilon_{it}. \quad (2)$$

If company i is in the treatment group, $D_i = 1$ and if company i is in the control group, $D_i = 0$. $I(\bullet)$ is the indicator function, T_D is the current ESG ratings period, and the relative time from the ESG ratings release time is the reference frame $t - T_D = s$, where $s = -1$ is the base period. The corresponding coefficient is β_s , and the fluctuation of its value reflects the evolving influence of ESG ratings on corporate financial performance. Specifically, before the introduction of ESG ratings, if the coefficients β_s^{precut} and β_s^{pre} before the release of ESG ratings are not statistically significantly different from zero, then $\beta_s^{postcut}$ and β_s^{post} after the release of ESG ratings are statistically significantly different from zero. This indicates that our DID model satisfies the parallel trend assumption.

Variables

Independent Variable

In practice, there is no unified standard for measuring ESG performance. One method is the use of index systems, but these are subjective to some extent. The other is to use the ratings data released by rating agencies, which are more credible. Referring to previous research (Wan & Dawod, 2022; Wang & Chu, 2024; Wang et al., 2023), this study used the more authoritative ESG ratings data of China's SynTao Green Finance. SynTao Green Finance holds the distinction of being the first agency in China to publish ESG ratings data. Furthermore, it was the first Chinese service agency to formally commit to the United Nations Principles for Responsible Investment, indicating its high authority. By 2020, SynTao Green Finance had expanded to cover 1043 listed companies, providing a useful basis for the construction of a staggered DID model. Therefore, the independent variable in this study was constructed based on the ESG data from SynTao Green Finance. If data on company i were released in year t , the company belongs to the treatment group, $ESG_{it} = 1$; otherwise, $ESG_{it} = 0$.

Dependent Variable

Two methods are commonly adopted in the literature to assess the financial performance of companies. One is to establish a comprehensive indicator system, and the other is to use individual indicators, which can be divided into accounting indicators and market indicators. Due to relatively large market fluctuations and the fact that market indicators are unstable, accounting performance indicators are more

commonly used in research. Hence, this study adopted accounting indicators. Compared with return on equity (ROE), return on assets (ROA) is more comprehensive and can reflect the income created by the overall assets of a company. Therefore, similar to Duque-Grisales and Aguilera-Caracuel (2021), this study adopted ROA to measure the financial performance of businesses. Moreover, ROE was used as an alternative independent variable in a robustness test.

Control Variables

We considered the following control variables that affect corporate financial performance: (1) equity concentration (*Top1*), indicating the concentration of corporate ownership, measured as the shares held by the largest shareholder; (2) proportion of independent directors (*Indep*), denoting the ratio of the number of independent directors to the total number of board members, which assesses board independence; (3) company age (*FirmAge*), calculated as the number of years a company has been in operation, reflecting its longevity; (4) business revenue growth rate (*Growth*), indicating the future growth opportunities of a company; (5) institutional investor ownership ratio (*INST*), measured as the percentage of shares held by institutional investors relative to the total number of shares; and (6) fixed assets per capita (*PFixA*), indicating capital density as the proportion of fixed assets to total assets.

Data

The ESG rating information provided by SynTao Green Finance has been released over time since 2015. Correspondingly, we selected A-share listed companies from 2010 to 2020 as the research sample. The companies' financial data were from the China Stock Market & Accounting Research database and the Wind database. We used the ESG ratings data from SynTao Green Finance to test our hypotheses and the ESG ratings data from the HuaZheng rating agency for a robustness test. We screened the initial sample by excluding companies with ST, ST*, and PT status, companies that had become public during the present year, and companies with significant missing financial data, and then applied winsorization at the 1st and 99th percentiles of the continuous variable. The resulting sample contained 25,654 observations.

Empirical Results

Descriptive Statistics

The descriptive statistics of the key regression variables are displayed in Table 1. The average ESG value of 0.128 means that companies with ESG ratings account for 12.8% of our sample. The mean ROA of 0.038 and the standard deviation of 0.066 suggest that the financial performance of the sample companies varies greatly.

Table 1 Descriptive statistics

Variable	Obs	Mean	Std. Dev	Min	Max
ESG	25,654	0.128	0.334	0	1
ROA	25,653	0.038	0.066	−0.415	0.244
Top1	25,654	0.344	0.148	0.084	0.758
Indep	25,654	0.375	0.054	0.300	0.600
FirmAge	25,654	2.863	0.347	1.099	3.555
Growth	25,654	0.174	0.447	−0.732	4.806
INST	25,654	0.398	0.232	0	0.889
PFixA	25,654	12.56	1.155	4.127	19.543

Benchmark Results

Table 2 presents the benchmark results for the effect of ESG ratings on corporate financial performance based on the estimation of model (1). To verify the robustness of the estimation results, control variables were introduced to control for individual fixed effects and time fixed effects. In all regression analyses, both firm-level and time-level fixed effects were incorporated, and firm-level clustering standard errors were adopted. As can be seen from Table 2, the coefficients of ESG ratings with control variables being gradually added are statistically significant and positive. This suggests that ESG ratings can significantly improve corporate financial performance. The result verifies Hypothesis 1, underscoring the positive influence of ESG ratings on corporate financial performance. This result may be attributable to the following factors. Although ESG ratings increase a company's costs, they can

Table 2 Benchmark regression

Variable	ROA	ROA	ROA
ESG	0.006*** (0.002)	0.006*** (0.002)	0.006*** (0.002)
Top1	0.069*** (0.010)	0.063*** (0.010)	0.061*** (0.010)
Growth	0.029*** (0.001)	0.029*** (0.001)	0.029*** (0.001)
Indep		−0.013 (0.015)	−0.011 (0.014)
FirmAge		−0.030*** (0.008)	−0.029*** (0.008)
INST			0.025*** (0.003)
PFixA			−0.003*** (0.001)
Constant	0.027*** (0.004)	0.109*** (0.022)	0.136*** (0.025)
Observations	25,653	25,653	25,653
Number of stkcd	3567	3567	3567
R-squared	0.112	0.114	0.118
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
r ² _a	0.112	0.113	0.118

Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

also affect the decisions of stakeholders. Thus, ESG ratings can bring more financing opportunities and resource advantages to improve a company's business environment, expand its market share, and significantly promote the improvement of its financial performance (Deng et al., 2013; Flammer, 2015a, 2015b). This is consistent with the findings of multiple studies on the relationship between ESG ratings and financial performance (Clark et al., 2015; Al Amosh et al., 2023; Fatemi et al., 2018; Hamdi et al., 2022; Aouadi and Marsat, 2018; Sandberg et al., 2023). This further underscores the importance of ESG ratings for businesses, especially in the context of today's increasing focus on sustainability.

Regarding the controlled factors, first, the coefficients of FirmAge and PFixA are both negative and significant, indicating that companies with longer listing times and more fixed assets per capita have lower financial performance. Second, the coefficients of Top1, Growth, and INST are all positive and significant in the regression, indicating that increases in the proportion held by the largest shareholder, the growth rate of operating income, and the proportion of institutional investors also improve corporate financial performance.

Robustness Tests

Parallel Trend Test

The premise of the DID method is the existence of parallel trends (Mascha & Sessler, 2019). To ensure that the findings are reliable, a regression analysis based on model (2) was conducted to test whether the parallel trend assumption was satisfied, and the findings are displayed in Fig. 1. It is apparent that prior to the introduction of ESG ratings, there was no notable divergence in ROA between the treatment and control groups, affirming the validity of the parallel trend assumption. Nevertheless, following the implementation of ESG ratings, the treatment group exhibited a significantly superior ROA compared with the control group. This reaffirms that ESG ratings positively influence the financial performance of companies.

Placebo Test

To verify that the influence of ESG ratings on corporate financial performance is not attributable to external factors, we conducted a placebo test to ensure that our results are robust and not driven by random chance. Following La Ferrara et al. (2012), 500 regressions were conducted using Eq. (1) to construct a pseudo-policy dummy variable and test whether it retained its significant impact on corporate financial performance. The result is shown in Fig. 2. As can be seen from the figure, the coefficients are around 0, and most of the *p*-values are above 0.10, indicating that the results are not statistically significant at the 10% level. This implies that the influence of ESG ratings on corporate financial performance is independent of other variables. This supports the reliability of our benchmark regression result that ESG ratings have a positive impact on corporate financial performance.

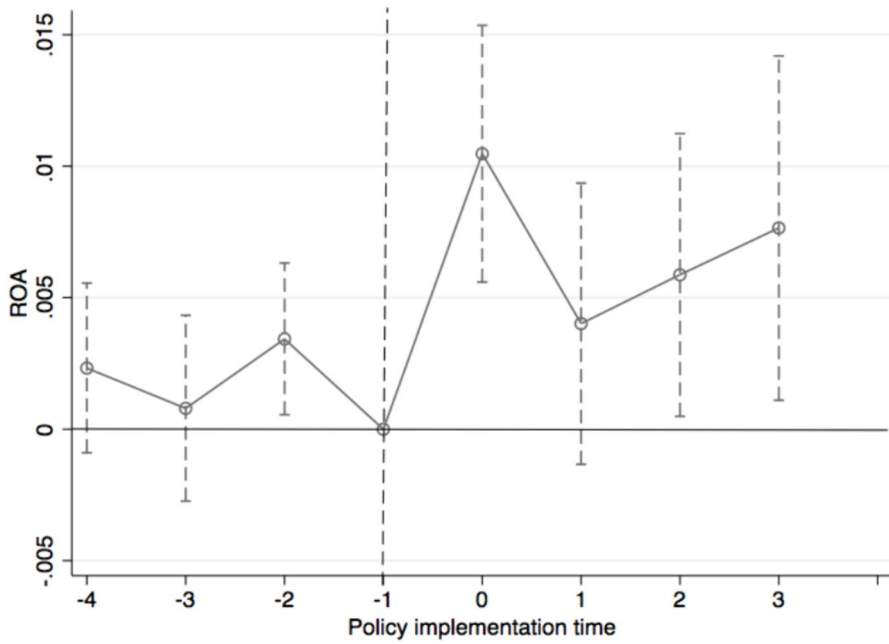


Fig. 1 Parallel trend test result

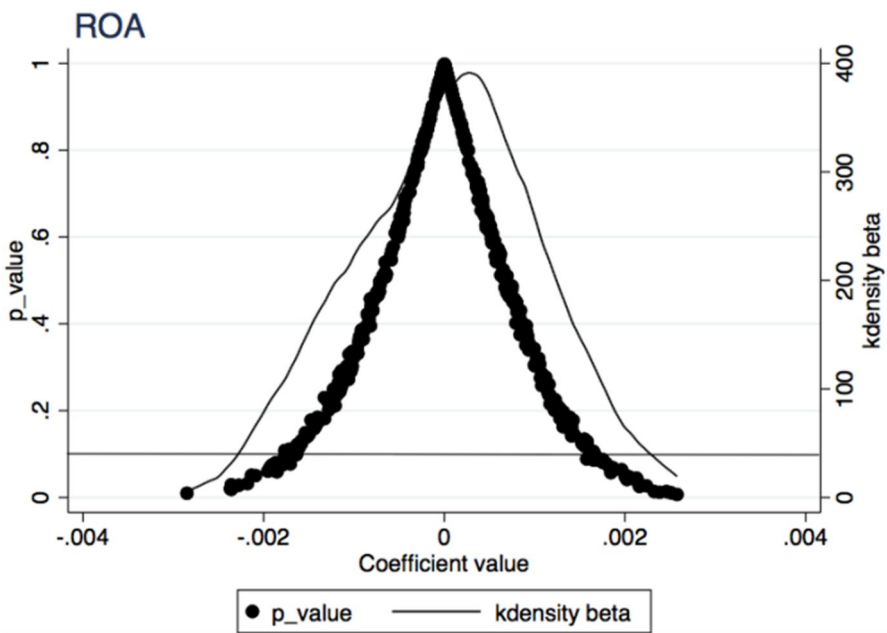


Fig. 2 Placebo test result

PSM-DID Test

The regional differences between samples have a great impact on individual differences. As the treatment and control groups may not possess identical individual characteristics, we employed the propensity score matching (PSM)-DID method to mitigate potential selection bias among variables.

Table 3 displays the results, which show that after performing the PSM-DID test, the positive and significant coefficient for the ESG ratings variable reaffirms its positive influence on corporate financial performance. This suggests that the original model does not have serious sample selection bias and the conclusion is reliable.

Independent Variable Based on Alternative Dataset

To further confirm the robustness of the finding that ESG ratings positively impact corporate financial performance, we replaced the independent variable with one based on HuaZheng's ESG ratings data. Besides SynTao Green Finance, HuaZheng also provides an ESG rating system that contains more information on companies than that provided by other sources. Therefore, we adopted its ratings data as an alternative independent variable to repeat our regression analysis. The results in Table 4 exhibit a positive and significant coefficient of HuaZheng's ESG ratings, affirming that ESG ratings indeed improve the financial performance of companies. This further validates the conclusion drawn in this paper.

Alternative Dependent Variable

To enhance the robustness of the findings of this paper, we replaced the dependent variable ROA in the original regression model in (1) with ROE. The new regression results are presented in Table 5. The results continue to highlight a notably positive

Table 3 PSM-DID test

Variable	ROA
ESG	0.008** (0.004)
Top1	0.013 (0.022)
Indep	0.007 (0.031)
FirmAge	−0.008 (0.022)
Growth	0.035*** (0.004)
INST	0.032*** (0.009)
PFixA	−0.006** (0.003)
Constant	0.130* (0.069)
Observations	5414
Number of stkcd	2069
R-squared	0.096
Firm FE	Yes
Year FE	Yes
r2_a	0.0927

Table 4 Independent variable based on HuaZheng' ESG ratings

Variable	ROA
HuaZheng ESG	0.008*** (0.001)
Top1	0.059*** (0.010)
Indep	−0.017 (0.014)
FirmAge	−0.024*** (0.008)
Growth	0.028*** (0.001)
INST	0.024*** (0.003)
PFixA	−0.003*** (0.001)
Constant	0.095*** (0.025)
Observations	25,634
Number of stkcd	3,565
R-squared	0.126
Firm FE	Yes
Year FE	Yes
r2_a	0.125

Table 5 Alternative dependent variable

Variable	ROE
ESG	0.010** (0.004)
Top1	0.131*** (0.020)
Indep	−0.047 (0.032)
FirmAge	−0.006 (0.017)
Growth	0.062*** (0.003)
INST	0.051*** (0.007)
PFixA	−0.005* (0.002)
Constant	0.118** (0.052)
Observations	25,624
Number of stkcd	3567
R-squared	0.102
Firm FE	Yes
Year FE	Yes
r2_a	0.102

coefficient of ESG ratings, which further supports our finding that ESG ratings have a positive and significant impact on the financial performance of companies, affirming the robustness of the benchmark regression results.

Sample with a Smaller Time Interval

Due to the outbreak of COVID-19 at the end of 2019, the global economy faced a substantial downturn, and businesses experienced a significant adverse shock. To avoid the possible interfering effect of the COVID-19 pandemic on corporate financial performance, we eliminated data from 2020 and conducted the regression again.

Table 6 summarizes the results. Evidently, after excluding the data from 2020, the coefficient of ESG ratings is still positive and significant, which again verifies the positive impact of ESG ratings on the financial performance of companies.

Mechanism Analysis

The benchmark regression yielded the conclusion that ESG ratings positively influence corporate financial performance. Following the discussion of the relevant theories in the “Literature Review and Hypothesis Development” section, in this section, we examine the effect of ESG ratings using three mechanisms: agency problems, R&D investment, and total factor productivity. We constructed the following model to test each of the mechanisms:

$$M_{it} = \omega_0 + \omega_1 ESG_{it} + \gamma X_{it} + \mu_i + \eta_t + \varepsilon_{it}, \quad (3)$$

where M_{it} is a mechanism variable, and the other variables have the same meaning as in model (1).

Analysis of Agency Problems

The extent of agency problems was measured by management myopia. We followed the method in Nan et al. (2021) to measure the degree of myopia in business management. Specifically, we first selected 43 terms indicating a short-term perspective, such as “within days,” “months,” as soon as “possible,” and then used the dictionary method to calculate the percentage frequency of these words in the management’s discussion and analysis (*Myopia*) as a measure of the degree of corporate management myopia. Considering that the decision-making of corporate management is affected by the behavior of investors in the securities market, we also introduced two

Table 6 Sample with a different time interval

Variable	ROA
ESG	0.004** (0.002)
Top1	0.055*** (0.010)
Indep	−0.018 (0.015)
FirmAge	−0.037*** (0.008)
Growth	0.025*** (0.001)
INST	0.025*** (0.003)
PFixA	−0.004*** (0.001)
Constant	0.161*** (0.028)
Observations	22,261
R-squared	0.502
Firm FE	Yes
Year FE	Yes
r2_a	0.416
F	80.49

indicators—the ratio of current short-term investment to the company’s total assets in the initial period (*Short*) and the average monthly excess turnover rate of company stocks (*DTurn*)—to measure the short-sighted behavior of corporate management. Table 7 presents the results. Columns (1) to (3) show that all the coefficients are negative and significant, indicating that ESG ratings can reduce the short-sighted behavior of managers. The results in column (4) demonstrate a markedly negative regression coefficient for management myopia in relation to corporate financial performance, indicating that management myopia hinders corporate financial performance. Therefore, it can be concluded that ESG ratings can alleviate agency problems and improve corporate financial performance by mitigating the shortsightedness of management. Hypothesis H2a is confirmed.

Analysis of R&D Investment

Our study measured R&D investment from two perspectives: total R&D expenditure (*RDExp*) and the proportion of R&D expenditure to operating income (*RDSales*) (see Huang et al., 2021). Table 8 shows the results of the R&D investment mechanism analysis. In columns (1) and (2), it is evident that the coefficients of both variables on ESG are positive and significant, indicating that ESG ratings can significantly increase companies’ R&D investment. Column (3) reports a positive coefficient for total R&D expenditure, which signifies that higher R&D investment leads to improved financial performance. Therefore, it can be inferred that ESG ratings positively influence corporate financial performance by increasing R&D investment, and hypothesis H2b is confirmed.

Table 7 Agency problem analysis

	(1)	(2)	(3)	(4)
Variable	Myopia	Short	DTurn	ROA
ESG	−0.008*** (0.002)	−0.006*** (0.002)	−0.091*** (0.009)	
Myopia				−0.047*** (0.006)
Top1	−0.031*** (0.011)	0.011 (0.011)	−0.370*** (0.042)	0.060*** (0.010)
Indep	0.030* (0.016)	0.017 (0.014)	0.071 (0.078)	−0.009 (0.014)
FirmAge	0.049*** (0.009)	0.025*** (0.010)	0.848*** (0.042)	−0.027*** (0.008)
Growth	−0.008*** (0.001)	−0.004*** (0.001)	0.028*** (0.006)	0.028*** (0.001)
INST	−0.007* (0.004)	−0.005 (0.004)	−0.106*** (0.025)	0.024*** (0.003)
PFixA	0.002* (0.001)	−0.004*** (0.001)	0.034*** (0.005)	−0.003** (0.001)
Constant	−0.073** (0.031)	0.007 (0.033)	−2.820*** (0.139)	0.122*** (0.027)
Observations	25,457	14,843	25,440	25,456
R-squared	0.426	0.627	0.386	0.489
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
r2_a	0.338	0.542	0.292	0.410
F	16.00	5.522	108.2	108.5

Table 8 R&D investment analysis

Variable	(1) RDExp	(2) RDSales	(3) ROA
ESG	0.331*** (0.037)	0.340*** (0.129)	
RDExp			0.004*** (0.001)
Top1	− 0.172 (0.220)	− 1.310** (0.598)	0.062*** (0.012)
Indep	− 0.386* (0.223)	− 0.772 (1.197)	− 0.005 (0.016)
FirmAge	− 0.343** (0.166)	− 2.766*** (0.793)	− 0.027*** (0.009)
Growth	0.143*** (0.018)	− 0.868*** (0.083)	0.034*** (0.001)
INST	0.136*** (0.060)	− 0.315 (0.215)	0.026*** (0.004)
PFixA	0.009 (0.024)	− 0.044 (0.094)	− 0.006*** (0.002)
Constant	18.719*** (0.567)	13.677*** (2.914)	0.084*** (0.036)
Observations	21,075	21,104	21,074
R-squared	0.859	0.764	0.511
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
r2_a	0.835	0.724	0.427
F	19.77	23.34	97.49

Total Factor Productivity Analysis

With reference to Xiao et al. (2021), this study employed the Lucas–Pigou method to assess companies' total factor productivity. Table 9 presents the findings of the mechanism analysis of total factor productivity. In column (1), it is evident that the

Table 9 Total factor productivity analysis

Variable	(1) TFP	(2) ROA
ESG	0.161*** (0.023)	
TFP_LP		0.020*** (0.002)
Top1	0.061 (0.123)	0.060*** (0.010)
Indep	− 0.186 (0.138)	− 0.007 (0.014)
FirmAge	0.605*** (0.092)	− 0.041*** (0.008)
Growth	0.308*** (0.009)	0.023*** (0.001)
INST	0.197*** (0.033)	0.021*** (0.003)
PFixA	− 0.128*** (0.015)	− 0.001 (0.001)
Constant	8.849*** (0.328)	− 0.047 (0.031)
Observations	25,457	25,456
R-squared	0.902	0.498
Firm FE	Yes	Yes
Year FE	Yes	Yes
r2_a	0.886	0.421

coefficient of total factor productivity in relation to ESG ratings is positive and significant. This suggests that ESG ratings significantly enhance the total factor productivity of companies. Column (2) shows the influence of total factor productivity on corporate financial performance. Here too, the regression coefficient is positive and significant, suggesting that higher total factor productivity corresponds to better financial performance. Consequently, it can be deduced that ESG ratings elevate corporate financial performance by augmenting total factor productivity, thereby confirming hypothesis H2c.

Further Analysis

The above analysis and verification demonstrate that ESG ratings can improve corporate financial performance. However, external factors such as industry attributes and forms of corporate ownership structure vary across companies, which may produce different effects. This section delves deeper into the influence of ESG ratings on the financial performance of companies from three perspectives: industry attributes, corporate ownership structure, and company size.

Industry Attributes

Over the past few years, the government has implemented a range of environmentally friendly policies to guide funds toward resource-efficient and eco-conscious companies. These policies have significantly increased financing costs for heavily polluting companies. Our study conducted heterogeneity analysis by dividing the samples into heavily polluting companies ($HPI=1$) and other companies ($HPI=0$) for testing. Column (1) in Table 10 presents the regression results with $ESG \times HPI$, an interaction term that includes ESG ratings and industry attributes. The positive and significant regression coefficient for this interaction term implies that the role of ESG ratings in boosting financial performance is more substantial for heavily polluting companies.

Corporate Ownership Structure

Non-state-owned enterprises and state-owned enterprises have different business goals and characteristics. Non-state-owned enterprises, whose goal is to maximize profits, are not under pressure to fulfill their ESG responsibilities and have greater autonomy in fulfilling their responsibilities. In contrast, state-owned enterprises have the dual mission of generating economic value and undertaking environmental and social commitments. Thus, they make greater efforts to conduct ESG activities under the pressure of various stakeholders. Given the differences in business purposes and characteristics of companies with different ownership rights, ESG ratings can have different influences on corporate financial performance. To analyze the heterogeneity in enterprise property rights, we used the variable SOE to divide the samples into state-owned enterprises (assigned a value of 1) and non-state-owned enterprises (assigned a value of 0). Column (2) in Table 10 shows the regression

Table 10 Further analysis

Variable	(1) ROA	(2) ROA	(3) ROA
ESG	0.006*** (0.002)	0.005 (0.003)	– 0.006 (0.005)
ESG×HPI	0.013*** (0.004)		
HPI	0.008* (0.004)		
ESG×SOE		0.010** (0.004)	
SOE		– 0.014*** (0.005)	
ESG×Size			0.006*** (0.002)
Size			0.007*** (0.002)
Control Variables	YES	YES	YES
Constant	0.125*** (0.027)	0.127*** (0.037)	– 0.010 (0.054)
Observations	25,456	25,456	25,456
R-squared	0.488	0.488	0.489
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
r2_a	0.410	0.410	0.411
F	80.73	53.13	65.06

results with $ESG \times SOE$, an interaction term that includes ESG ratings and the property rights attribute. The positive and statistically significant coefficient suggests that ESG ratings exert a more pronounced influence on the financial performance of state-owned than non-state-owned enterprises.

Company Size

The impact of ESG ratings may differ with the size of a company. The variable *Size* was introduced to conduct heterogeneity analysis of the effect of company size. Column (3) in Table 10 presents the regression results with $ESG \times Size$, the interaction term between ESG ratings and company size. The positive and statistically significant coefficient of the interaction term indicates that as the size of a company increases, the positive influence of ESG ratings on its financial performance becomes more substantial.

Conclusions

In this paper, we studied the impact and mechanism of ESG ratings on corporate financial performance in China. We adopted the aggregate ESG ratings of Chinese listed companies published between 2010 and 2020 by SynTao Green Finance and applied a staggered DID model to conduct a regression analysis. The main findings of the study are as follows: (1) The overall ESG ratings demonstrate a notably positive effect on corporate financial performance in China, a finding that remains robust even after undergoing a battery of rigorous tests, including a parallel trend

test, placebo test, and PSM-DID test, and the use of an independent variable based on an alternative dataset, an alternative dependent variable, and a sample with an alternative time interval. (2) An analysis of the influence mechanism reveals that ESG ratings improve the financial performance of companies by alleviating agency problems, increasing R&D investment, and improving total factor productivity. (3) A further analysis shows that the positive impact of ESG ratings on corporate financial performance becomes more evident in heavily polluting industries and state-owned enterprises. Moreover, as the size of a company increases, the influence of ESG ratings on its financial performance becomes more pronounced.

Practical Implications

Drawing from the above findings, we propose several suggestions. First, the government should take measures to enhance ESG practices in society. Second, the government should vigorously extol the benefits of ESG practices to the public, and progressively encourage companies to incorporate ESG practices into their operations processes and investment decisions. In addition, the government should establish a corresponding incentive mechanism, giving appropriate rewards and preferential policies to companies that carry out green technology innovation or have good ESG performance. In particular, given the lower impact of ESG ratings on the financial performance of non-state-owned enterprises compared with state-owned enterprises, the government may consider increasing subsidies to non-state-owned enterprises to promote their ESG investment and improve their financial performance.

Companies should create social benefits while pursuing profits. As ESG practices can enhance financial performance, companies should actively promote ESG practices. In the environmental dimension, companies should adopt green production, reduce environmental pollution, improve resource utilization, and increase investments in environmental protection and energy-saving technology. To fulfill social responsibility, companies should engage in activities to improve social welfare and address reasonable demands of various stakeholders. Regarding corporate governance, companies should improve their corporate governance mechanisms, reduce the short-sighted behavior of management, increase R&D investment, and improve their total factor productivity. Heavily polluting companies should actively carry out sustainable green transformation to improve their ESG performance and in turn their financial performance. In addition, companies should focus on ESG disclosure issues, improve the quality of ESG information disclosure by enriching its content, release signals of their sustainable development, win the trust of stakeholders, and pave the way for the realization of long-term value.

Limitations and Future Research

While our study provides valuable insights, it has some limitations that need to be further explored. Due to the lack of universal standards for measuring corporate ESG performance, this study selected the ESG ratings by SynTao Green Finance as a proxy variable for corporate ESG performance, as done in previous studies. While

these ratings carry high authority, there exist other proxy variables that may offer different interpretations. Therefore, if universal standards for measuring corporate ESG performance are established in the future, a further study can be conducted to gain a more comprehensive understanding of the impact of ESG ratings across different industries and regions. Additionally, due to the difficulty in obtaining data on non-listed companies, this paper's use of data from Chinese A-share listed companies may have introduced selection bias. To enhance the generality of research findings, future studies could expand the research scope to non-listed companies when the data system is robust and such data become available.

Acknowledgements The authors are grateful to the Editor-in-Chief (Professor Elias G. Carayannis) and two anonymous reviewers for their insightful comments that helped improve this paper.

Funding This work was supported by the National Social Science Fund of China (Number: 20BJL020) and the Major Project of National Social Science Fund (Number: 22&ZD117).

Data Availability The data used for this study are available upon request.

Declarations

Competing Interests The authors declare no competing interests.

References

- Al Amosh, H., Khatib, S. F., & Ananzeh, H. (2023). Environmental, social and governance impact on financial performance: Evidence from the Levant countries. *Corporate Governance: The International Journal of Business in Society*, 23(3), 493–513.
- Aouadi, A., & Marsat, S. (2018). Do ESG controversies matter for firm value? Evidence from international data. *Journal of Business Ethics*, 151, 1027–1047.
- Arrow, K. J. (1972). *Economic welfare and the allocation of resources for invention* (pp. 219–236). Macmillan Education UK.
- Atan, R., Alam, M. M., Said, J., & Zamri, M. (2018). The impacts of environmental, social, and governance factors on firm performance: Panel study of Malaysian companies. *Management of Environmental Quality: An International Journal*, 29(2), 182–194.
- Benlemlih, M., & Bitar, M. (2018). Corporate social responsibility and investment efficiency. *Journal of Business Ethics*, 148, 647–671.
- Berger, P. G., & Ofek, E. (1995). Diversification's effect on firm value. *Journal of Financial Economics*, 37(1), 39–65.
- Brammer, S., Brooks, C., & Pavelin, S. (2006). Corporate social performance and stock returns: UK evidence from dis-aggregate measures. *Financial Management*, 35(3), 97–116.
- Branco, M. C., & Rodrigues, L. L. (2006). Corporate social responsibility and resource-based perspectives. *Journal of Business Ethics*, 69, 111–132.
- Carrasco-Monteaquedo, I., & Buendía-Martínez, I. (2013). Corporate social responsibility: A crossroad between changing values, innovation and internationalisation. *European Journal of International Management* 2, 7(3), 295–314.
- Cheng, B., Ioannou, I., & Serafeim, G. (2014). Corporate social responsibility and access to finance. *Strategic Management Journal*, 35(1), 1–23.
- Clark, G. L., Feiner, A., & Viehs, M. (2015). From the stockholder to the stakeholder: How sustainability can drive financial outperformance. Available at SSRN 2508281.
- Clarkson, P. M., Li, Y., Richardson, G. D., & Vasvari, F. P. (2008). Revisiting the relation between environmental performance and environmental disclosure: An empirical analysis. *Accounting, Organizations and Society*, 33(4–5), 303–327.

- Deng, X., Kang, J. K., & Low, B. S. (2013). Corporate social responsibility and stakeholder value maximization: Evidence from mergers. *Journal of Financial Economics*, 110(1), 87–109.
- Deng, X., Li, W., & Ren, X. (2023). More sustainable, more productive: Evidence from ESG ratings and total factor productivity among listed Chinese firms. *Finance Research Letters*, 51, 103439.
- Dhaliwal, D. S., Li, O. Z., Tsang, A., & Yang, Y. G. (2011). Voluntary nonfinancial disclosure and the cost of equity capital: The initiation of corporate social responsibility reporting. *The Accounting Review*, 86(1), 59–100.
- Dong, S., & Xu, L. (2016). The impact of explicit CSR regulation: Evidence from China's mining firms. *Journal of Applied Accounting Research*, 17(2), 237–258.
- Duque-Grisales, E., & Aguilera-Caracuel, J. (2021). Environmental, social and governance (ESG) scores and financial performance of multilatinas: Moderating effects of geographic international diversification and financial slack. *Journal of Business Ethics*, 168(2), 315–334.
- Falk, M. (2012). Quantile estimates of the impact of R&D intensity on firm performance. *Small Business Economics*, 39, 19–37.
- Fang, V. W., Tian, X., & Tice, S. (2014). Does stock liquidity enhance or impede firm innovation? *The Journal of Finance*, 69(5), 2085–2125.
- Fatemi, A., Glaum, M., & Kaiser, S. (2018). ESG performance and firm value: The moderating role of disclosure. *Global Finance Journal*, 38, 45–64.
- Ferrara, E. L., Chong, A., & Duryea, S. (2012). Soap operas and fertility: Evidence from Brazil. *American Economic Journal: Applied Economics*, 4(4), 1–31.
- Flammer, C. (2015a). Does corporate social responsibility lead to superior financial performance? A Regression Discontinuity Approach. *Management Science*, 61(11), 2549–2568.
- Flammer, C. (2015b). Does product market competition foster corporate social responsibility? Evidence from trade liberalization. *Strategic Management Journal*, 36(10), 1469–1485.
- Freeman, R. E. (2010). Strategic management: A stakeholder approach. *Cambridge University Press*.
- Friede, G., Busch, T., & Bassen, A. (2015). ESG and financial performance: Aggregated evidence from more than 2000 empirical studies. *Journal of Sustainable Finance Investment*, 5(4), 210–233.
- Friedman, M. (2007). The social responsibility of business is to increase its profits. In *Corporate Ethics and Corporate Governance* (pp. 173–178). Berlin, Heidelberg: Springer Berlin Heidelberg.
- Galbreath, J. (2013). ESG in focus: The Australian evidence. *Journal of Business Ethics*, 118, 529–541.
- Garcia, A. S., Mendes-Da-Silva, W., & Orsato, R. J. (2017). Sensitive industries produce better ESG performance: Evidence from emerging markets. *Journal of Cleaner Production*, 150, 135–147.
- Gillan, S. L., Koch, A., & Starks, L. T. (2021). Firms and social responsibility: A review of ESG and CSR research in corporate finance. *Journal of Corporate Finance*, 66, 101889.
- Goss, A., & Roberts, G. S. (2011). The impact of corporate social responsibility on the cost of bank loans. *Journal of Banking Finance*, 35(7), 1794–1810.
- Hamamoto, M. (2006). Environmental regulation and the productivity of Japanese manufacturing industries. *Resource and Energy Economics*, 28(4), 299–312.
- Hamdi, K., Guenich, H., & Ben Saada, M. (2022). Does corporate financial performance promote ESG: Evidence from US firms. *Cogent Business Management*, 9(1), 2154053.
- Hassel, L., Nilsson, H., & Nyquist, S. (2005). The value relevance of environmental performance. *European Accounting Review*, 14(1), 41–61.
- He, J. J., & Tian, X. (2013). The dark side of analyst coverage: The case of innovation. *Journal of Financial Economics*, 109(3), 856–878.
- Ho, S. S., Li, A. Y., Tam, K., & Tong, J. Y. (2016). Ethical image, corporate social responsibility, and R&D valuation. *Pacific-Basin Finance Journal*, 40, 335–348.
- Huang, J., Zhao, J., & Cao, J. (2021). Environmental regulation and corporate R&D investment—evidence from a quasi-natural experiment. *International Review of Economics & Finance*, 72, 154–174.
- Hu, X., Lin, D., & Tosun, O. K. (2023). The effect of board independence on firm performance—new evidence from product market conditions. *The European Journal of Finance*, 29(4), 363–392.
- Hur, W. M., Kim, H., & Kim, H. K. (2018). Does customer engagement in corporate social responsibility initiatives lead to customer citizenship behaviour? The mediating roles of customer-company identification and affective commitment. *Corporate Social Responsibility and Environmental Management*, 25(6), 1258–1269.
- Jensen, M. C., & Meckling, W. H. (1919). Theory of the firm: Managerial behavior, agency costs and ownership structure. In *Corporate Governance* (pp. 77–132). Gower.
- Jones, C. I., & Williams, J. C. (1998). Measuring the social return to R&D. *The Quarterly Journal of Economics*, 113(4), 1119–1135.

- Jones, T. M. (1995). Instrumental stakeholder theory: A synthesis of ethics and economics. *Academy of Management Review*, 20(2), 404–437.
- Kroes, J., Subramanian, R., & Subramanyam, R. (2012). Operational compliance levers, environmental performance, and firm performance under cap and trade regulation. *Manufacturing & Service Operations Management*, 14(2), 186–201.
- Lee, E., Walker, M., & Zeng, C. C. (2017). Do Chinese state subsidies affect voluntary corporate social responsibility disclosure? *Journal of Accounting and Public Policy*, 36(3), 179–200.
- Li, Y., Gong, M., Zhang, X. Y., & Koh, L. (2018). The impact of environmental, social, and governance disclosure on firm value: The role of CEO power. *The British Accounting Review*, 50(1), 60–75.
- Liang, H., & Renneboog, L. (2017). On the foundations of corporate social responsibility. *The Journal of Finance*, 72(2), 853–910.
- Li, J., Lian, G., & Xu, A. (2023). How do ESG affect the spillover of green innovation among peer firms? Mechanism discussion and performance study. *Journal of Business Research*, 158, 113648.
- Liang, Y., Cai, C., & Huang, Y. (2022). The effect of corporate social responsibility on productivity: Firm-level evidence from Chinese listed companies. *Emerging Markets Finance and Trade*, 58(12), 3589–3607.
- Linthicum, C., Reitenga, A. L., & Sanchez, J. M. (2010). Social responsibility and corporate reputation: The case of the Arthur Andersen Enron audit failure. *Journal of Accounting and Public Policy*, 29(2), 160–176.
- Lins, K. V., Servaes, H., & Tamayo, A. (2017). Social capital, trust, and firm performance: The value of corporate social responsibility during the financial crisis. *The Journal of Finance*, 72(4), 1785–1824.
- Liu, P., Zhu, B., Yang, M., & Chu, X. (2022). ESG and financial performance: A qualitative comparative analysis in China's new energy companies. *Journal of Cleaner Production*, 379, 134721.
- Luo, X., & Du, S. (2015). Exploring the relationship between corporate social responsibility and firm innovation. *Marketing Letters*, 26, 703–714.
- Malik, M. S., & Makhdoom, D. D. (2016). Does corporate governance beget firm performance in fortune global 500 companies? *Corporate Governance*, 16(4), 747–764.
- Mansfield, E. (1962). Entry, Gibrat's law, innovation, and the growth of firms. *The American Economic Review*, 52(5), 1023–1051.
- Mascha, E. J., & Sessler, D. I. (2019). Segmented regression and difference-in-difference methods: Assessing the impact of systemic changes in health care. *Anesthesia & Analgesia*, 129(2), 618–633.
- Nan, H., Fujing, X., & Haonan, W. (2021). Does managerial myopia affect long-term investment? Based on text analysis and machine learning. *Management World*, 37(05), 139–156.
- Nekhili, M., Boukadhaba, A., Nagati, H., & Chtioui, T. (2021). ESG performance and market value: The moderating role of employee board representation. *The International Journal of Human Resource Management*, 32(14), 3061–3087.
- Nuber, C., Velte, P., & Hörisch, J. (2020). The curvilinear and time-lagging impact of sustainability performance on financial performance: Evidence from Germany. *Corporate Social Responsibility and Environmental Management*, 27(1), 232–243.
- Olofsson, P., Råholm, A., Uddin, G. S., Troster, V., & Kang, S. H. (2021). Ethical and unethical investments under extreme market conditions. *International Review of Financial Analysis*, 78, 101952.
- Pástor, L., Stambaugh, R. F., & Taylor, L. A. (2021). Sustainable investing in equilibrium. *Journal of Financial Economics*, 142(2), 550–571.
- Reber, B., Gold, A., & Gold, S. (2022). ESG disclosure and idiosyncratic risk in initial public offerings. *Journal of Business Ethics*, 179(3), 867–886.
- Pedersen, L. H., Fitzgibbons, S., & Pomorski, L. (2021). Responsible investing: The ESG-efficient frontier. *Journal of Financial Economics*, 142(2), 572–597.
- Peng, Q. (2023). ESG information disclosure of listed companies based on entropy weight algorithm under the background of double carbon. *International Journal of Information Technologies and Systems Approach (IJITSA)*, 16(3), 1–13.
- Sandberg, H., Alnoor, A., & Tiberius, V. (2023). Environmental, social, and governance ratings and financial performance: Evidence from the European food industry. *Business Strategy and the Environment*, 32(4), 2471–2489.
- Sarkis, J., Gonzalez-Torre, P., & Adenso-Diaz, B. (2010). Stakeholder pressure and the adoption of environmental practices: The mediating effect of training. *Journal of Operations Management*, 28(2), 163–176.

- Shakil, M. H. (2021). Environmental, social and governance performance and financial risk: Moderating role of ESG controversies and board gender diversity. *Resources Policy*, 72, 102144.
- Sharma, C. (2012). R&D and firm performance: Evidence from the Indian pharmaceutical industry. *Journal of the Asia Pacific Economy*, 17(2), 332–342.
- Shleifer, A., & Vishny, R. W. (1989). Management entrenchment: The case of manager-specific investments. *Journal of Financial Economics*, 25(1), 123–139.
- Stein, J. C. (1989). Efficient capital markets, inefficient firms: A model of myopic corporate behavior. *The Quarterly Journal of Economics*, 104(4), 655–669.
- Tang, H. (2022). The effect of ESG performance on corporate innovation in China: The mediating role of financial constraints and agency cost. *Sustainability*, 14(7), 3769.
- Wan, G., & Dawod, A. Y. (2022). ESG rating and northbound capital shareholding preferences: Evidence from China. *Sustainability*, 14(15), 9152.
- Wang, J., Ma, M., Dong, T., & Zhang, Z. (2023). Do ESG ratings promote corporate green innovation? A quasi-natural experiment based on SynTao Green Finance's ESG ratings. *International Review of Financial Analysis*, 87, 102623.
- Wang, Z., & Chu, E. (2024). Shifting focus from end-of-pipe treatment to source control: ESG ratings' impact on corporate green innovation. *Journal of Environmental Management*, 354, 120409.
- Wang, Z., & Sarkis, J. (2017). Corporate social responsibility governance, outcomes, and financial performance. *Journal of Cleaner Production*, 162, 1607–1616.
- Webb, E. (2005). Agency costs, leverage, and corporate social responsibility: A test of causality. *Financial Decisions*, 3(1), 1–19.
- Wong, J. B., & Zhang, Q. (2022). Stock market reactions to adverse ESG disclosure via media channels. *The British Accounting Review*, 54(1), 101045.
- Xiao, J., Li, G., Zhu, B., Xie, L., Hu, Y., & Huang, J. (2021). Evaluating the impact of carbon emissions trading scheme on Chinese firms' total factor productivity. *Journal of Cleaner Production*, 306, 127104.
- Zhao, C., Guo, Y., Yuan, J., Wu, M., Li, D., Zhou, Y., & Kang, J. (2018). ESG and corporate financial performance: Empirical evidence from China's listed power generation companies. *Sustainability*, 10(8), 2607.
- Zhou, G., Liu, L., & Luo, S. (2022). Sustainable development, ESG performance and company market value: Mediating effect of financial performance. *Business Strategy and the Environment*, 31(7), 3371–3387.
- Zhu, S., He, C., & Zhou, Y. (2017). How to jump further and catch up? Path-breaking in an uneven industry space. *Journal of Economic Geography*, 17(3), 521–545.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.

Authors and Affiliations

Wei Jiang¹  · Xin Wang¹ · Liping Liang² · Mingming Leng² · Xin Fang³

✉ Wei Jiang
xy072281@pku.edu.cn

Xin Wang
armo990424@163.com

Liping Liang
lipingliang@ln.edu.hk

Mingming Leng
mmleng@ln.edu.hk

Xin Fang
xfang@must.edu.mo

- ¹ School of Economics, Qingdao University, Qingdao No.62, Keda Branch Road, Qingdao 266100, China
- ² Department of Operations and Risk Management, Faculty of Business, Lingnan University, Tuen Mun, Hong Kong, China
- ³ School of Business, Macau University of Science and Technology, Macau 999078, China