Heliyon 11 (2025) e41996

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon

Research article

Does integration of ESG disclosure and green financing improve firm performance: Practical applications of stakeholders theory

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ARTICLE INFO

Keywords:
Chinese firms
Competitive advantage
ESG
Firm performance
Green finance

ABSTRACT

Drawing on the lens of stakeholder theory, this paper explores the association between ESG disclosure, green finance, and the performance of Chinese firms, while considering the moderating role of competitive edge in terms of financing costs. By integrating ESG disclosure and green finance, firms can efficiently manage their financial resources and operate in an environmentally friendly manner. Besides, to gain stakeholder legitimacy, firms can exploit green finance to balance the triple bottom-line principle of People-Planet-Profit. For empirical investigation, the Two-stage Least-squares Cluster (2SLS-cluster) Regression method and the two-step dynamic System Generalised Method of Moments (Sys-GMM) method are used. The study uses data from a sample of Chinese firms over the period of 2014–2022. We find a positive and significant link between green finance and ESG disclosure. Our results further reveal that the competitive edge of firms in terms of financing costs moderates the relationship between green finance, ESG disclosures, and firm performance. These insights contribute to the extant literature on sustainable finance and have important implications for policymakers.

1. Introduction

The efforts of the United Nations to combat climate change are opening new avenues for corporate finance and investment. At the 2014 Paris Summit, developed nations emphasized the importance of sustainable business practices that prioritize environmental protection and resource efficiency [1]. In response, socially responsible companies are taking proactive measures such as issuing green bonds to tackle the urgent issue of reducing harmful carbon emissions. These bonds provide funding for the installation of eco-friendly technologies, thereby promoting sustainability and safeguarding the environment [2].

According to Ref. [3] green finance firms are being urged to incorporate ESG practices in order to gain a competitive edge. The ESG concept stems from the stakeholder theory, which holds that firms are responsible for their governance structure and stakeholders [4]. In the view of [5], firms that embrace ESG disclosures exhibit features such as an efficient governance structure, eco-friendly practices, and consistent cash flow over a period of time. Such firms are able to secure external financing with lower equity capital and adopt

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https://doi.org/10.1016/j.heliyon.2025.e41996
Received 10 May 2024; Received in revised form 9 January 2025; Accepted 15 January 2025
Available online 21 January 2025

sustainable business policies [6]. However, the [7] argue that ESG disclosures must be aligned with corporate sustainability and market acceptance.

Incorporating green finance with ESG strategies can lead to a variety of benefits for firms, such as enhancing their non-financial attributes like market reputation, consumer satisfaction, and social values [5]. Furthermore, the [8] argue that aligning green finance with ESG disclosures can improve a firm's long-term sustainable policy and investment decisions. Hence, integrating green finance with ESG strategies can lead to numerous advantages for firms seeking to priorities sustainability and gain a sustainable competitive advantage. Additionally, the [9] suggest that by integrating green finance with ESG strategies, firms can adopt sustainable business practices that lead to reduced cash flow volatility, an efficient governance structure, and significant investments in social and environmental values. However, it remains unclear whether firms only declare the integration of green finance and ESG practices to meet statutory requirements and improve their reputation [10]. Moreover, the [11] argue that such integration promotes sustainable business practices and goodwill among stakeholders, while [12] contend that the implementation of ESG disclosures supported by green finance is primarily an administrative tool for managing a firm's investment portfolio in accordance with statutory requirements.

There is an ongoing debate about whether the integration of green finance and ESG disclosures into a firm's valuation model leads to an increase in firm performance through stakeholder's wealth, or firms use it as a tool for market acceptance and reputation. Motivated by this stream of research, this study contributes to the debate by examining the impact of green finance integration with ESG disclosures on a firm's market performance, while considering the moderating role of competitive advantage in terms of financing costs. We adopt [5] model of competitive advantage, which emphasizes the importance of a firm's pool of resources and competencies.

For firms to outperform in their respective industries, competitive advantage can play a crucial role in prioritizing sustainable policies related to environmental, social, and governance structures and communicating these efforts through ESG corporate disclosures as a signal to stakeholders. The [13] suggested that integrating green finance with ESG disclosure activities could be linked to a firm's resources, potentially offering a competitive edge and mitigating agency conflicts, ultimately resulting in more objective decisions regarding future investments. Since integration of green finance and ESG disclosures is an environment-oriented approach of firms to product/process quality development that supports firms in developing new products and processes in a structured way based on further ecological protection and assessment of stakeholders' needs and expectations, it could be argued that this integration could not have a direct effect on firm performance but is moderated by competitive advantage.

For empirical investigation, this study examines Chinese firms by combining the stakeholder theory and the robust econometric methods, the Two-stage Least-squares Cluster (2SLS-cluster) Regression and the two-step dynamic System Generalised Method of Moments (Sys-GMM) method. Moreover, clustering of the observations is based on year and industry. Our main findings show that competitive advantage, in terms of financing costs, significantly moderates the relationship between the integration of green finance and ESG disclosures and the market performance of firms.

The rest of the paper is structure as follows. The next section provides the brief overview of ESG disclosure policy in China. Section 3 presents literature review and the development of research hypotheses. Section 4 provides the data description, measurement of variables, and estimation method. Section 5 discusses the empirical results. Section 6 provides the concluding remarks, and policy implications, and future research directions are presented in section 7.

2. Brief overview of ESG disclosure policy in China

Chinese regulatory authorities play a crucial part in advancing corporate sustainability. Back in 2006, the Shenzhen Stock Exchange (SZSE) encouraged publicly listed firms to willingly disclose their Corporate Social Responsibility (CSR) reports. From 2008 onwards, it became mandatory for firms listed on the SZSE 100 Index and the Shanghai Stock Exchange (SSE) to disclose their CSR reports. According to Ref. [14], Chinese firms prioritize creating value for shareholders while also ensuring employees satisfaction. The Chinese government has recognized the importance of CSR and has therefore mandated its integration into the National Development Plan, demonstrating its commitment to promoting and ensuring the success of CSR initiatives. Compliance with CSR regulations is a legal requirement for companies operating in China, and this has resulted in higher CSR scores being recorded by Chinese firms [15].

The Chinese government has made ESG disclosures an important part of their 2015–2030 sustainable development agenda. This demonstrates their commitment to reducing agency problems and promoting transparency in businesses. By issuing non-financial compliance standards for investment prospects, China hope to encourage firms to integrate ESG considerations into their policies [16]. Besides, China has been leading the way in reporting CSR globally, with 92 percent of the top 150 firms reporting their CSR performance, compared to 72 percent of firms worldwide. In 2008, China introduced a CSR code for institutional investors, making them one of the few countries to address sustainability issues in their long-term investment portfolio analysis. According to Refs. [14, 17] Chinese boards of directors are increasingly focusing on integrating ESG disclosures into their investment decisions to serve the long-term interests of various stakeholders.

3. Literature review and development of hypotheses

According to Ref. [18] firms in advanced markets that integrate green finance with ESG disclosures are exposed to lower business and idiosyncratic risks due to a reduce likelihood of legal action or negative market reactions. Likewise, the [19] suggested that such integration enhances a firm's competitive position by enabling the introduction of sustainable business solutions that address social and environmental issues [11]. Moreover, the integration of green finance with ESG activities enables firms to develop a new range of products that meet customer demand for environmentally friendly and quality-of-life-improving products [20]. Similarly, the [21] noted that integrating green finance with ESG compliance in the context of United States enhances firm performance, while

environmental disclosure reduces it. Likewise, a study conducted in developed markets has found that the integration of green finance with ESG disclosures can have a positive impact on firm performance [22]. This is because higher ESG disclosures are associated with lower information risk. Furthermore, a study by Ref. [7] analyzed European Union countries and found that financial institutions tend to value a firm's efforts in reporting ESG and offer lower financing costs.

Similarly, in the context of OECD countries [23], noted that when there is a high level of green finance integration with ESG compliance, financing costs tend to be lower. This can give firms a competitive advantage in terms of lower yield spread and lower risk, as financing costs are directly related to bond issuance [24]. The [25,26] also noted that environmental disclosure is positively related with the returns of stock and lowers risk. In developed markets, ESG disclosures help to maintain trust of stakeholders and enhance the firm's ability to outperform its competitors, which incentivises firms to invest in green finance ESG integration to meet stakeholder's expectations [19]. Likewise, integrating green finance ESG practices supports the generation of higher returns by facilitating negotiations for favorable borrowing terms and promoting lower financing costs [27].

The [28] investigated that incorporating a green finance ESG strategy can mitigate agency conflict and boost investor confidence in a firm's market acceptance and future investment prospects. Likewise, the [29,30] concluded that ESG disclosures can positively impact firm value through direct or indirect effects on performance. Other studies link firm environmental performance and CSR with tax avoidance, executive compensation on implicit cost of equity, working capital management and short term performance, and intellectual capital [31,32]. In the context of China, the [33] argued that integrating a green finance ESG strategy into a firm's corporate strategy, along with a clear mission, can promote core competencies, attract potential customers through reliable governance structures, and enhance shareholder value. However, the implementation of ESG strategy in China remains voluntary, resulting in poor ESG disclosures, and this may explain inconsistent findings in research studies that rely on limited information (Shen et al., 2020).

The [34,35] found that government ownership and recognition of governance standards have a positive impact on the ESG disclosures related to green finance and firm performance. For firms in China, government support in establishing corporate standards, investment policies, and providing resources is necessary for the implementation of green finance ESG strategies to enhance their value. Government and institutional investor initiatives increase investor confidence and provide a competitive advantage to firms by lowering their cost of financing [36]. Stakeholder recognition of green finance ESG disclosures also creates awareness and encourages firms to participate in ESG activities, positioning them as leaders and prominent firms in the market [37]. A study in Australian market demonstrated that green finance ESG disclosure reduces firm's cost of capital as financial institutions recognise the benefits of improving sustainability [38]. However, in Malaysian context, ESG disclosure is positively associated with the cost of capital as noted by Ref. [39] because of financial institutions inability to recognise the engagement of firm in implementing ESG disclosures, or the firm's inefficiency in resources allocation to maintain sustainability in the future.

In a study conducted by Ref. [40] suggested that green finance coupled with ESG disclosures have a negative impact on firm performance in both developed and developing markets. Likewise, the [41] found that in developing markets, CSR had a significant negative effect on market performance. However, the [42] study on MENA firms showed a positive association between ESG and firm performance. The [43] examined the association between ESG disclosure and the performance of banks in developing and developed economies and reported the mixed results. The findings indicated that while green finance ESG disclosure positively affects firm performance, CSR disclosure is negatively associated with firm performance. Due to the inconsistent findings regarding the integration of green finance ESG and firm performance, this study conjectures as follows:

H1. There is a simultaneous relationship between green finance and ESG disclosures.

H2. The integration of green finance with ESG disclosures has a significant influence on firm performance.

Integrating green finance with ESG practices has been shown to increase institutional investor's returns and reduce uncertainty regarding future cash flows, as noted by Ref. [44]. In addition, the [45] found that firms implementing CSR policies have better access to external finance, as stakeholders can more easily manage and maintain transparency. This, in turn, allows firms to invest in projects that promote efficient resource management [46]. Therefore, firms that implement ESG strategies may gain a competitive advantage by reducing the cost of financing, as higher ESG scores not only optimize organizational resources but also promote long-term sustainability.

The [13] argued that the integration of green finance with ESG disclosures activities can be associated with the firm's resources, which, in turn, may provide a competitive advantage and reduce agency conflicts, leading to less prejudiced decisions about future investments. However, simply introducing ESG disclosures with the goal of reducing financing costs may not be sufficient to maintain sustainability. It is crucial for firms to recognise the value created for their stakeholders through the integration of green finance with ESG engagement. Moreover, the [47] observed that firms operating in environmentally sensitive sectors in the group of industrial countries (BRICS) Brazil, Russia, India, China, and South Africa performed better in terms of environmental sustainability than those in less-sensitive industries. Interestingly, the market responded more positively to firms operating in environment-sensitive sectors. Therefore, it is crucial for firms to efficiently communicate their green finance ESG strategy to reduce agency conflict and prevent prejudiced investment decisions. The [45] investigated the impact of CSR on the cost of financing for US firms. Their findings revealed that CSR investments in socially sensitive firms, such as tobacco, were associated with higher financing costs.

The [48] explained that shareholders have a negative impact on the voluntary disclosure of firms operating in Environment Sensitive Industries (ESI), and the capital market response to ESI firms is more challenging when it comes to acknowledging environmental disclosures compared to non-ESI firms. According to Ref. [49], firms operating in sensitive sectors are encouraged to maintain ESG reports due to legal requirements on the implementation of ESG practices. The [50] found that firms with higher

financing costs in the previous year are more likely to disclose their CSR initiatives in the current year to reduce their financing costs in the future.

H3. The competitive edge of firms in terms of financing costs moderates the relationship between green finance, ESG disclosures, and firm performance, such that when firm's competitive advantage is high, the integration effect of green finance with ESG disclosures on firm performance will be stronger.

4. Data and research methodology

4.1. Data description

The data regarding empirical analysis were obtained from different sources. The data on ESG scores were gathered from the Refinitiv database. The data regarding Environmental, Social, and Governance (ESG) Score, Tobin's Q (the measure of firm performance) and other firm-specific variables were collected from the Refinitiv database, Datastream and Worldscope terminals. The final dataset consisted of 891 firms over the period of 2014–2022. These firms are selected from the most environmentally sensitive industries, including oil and gas extraction, mining (excluding oil and gas), automobiles, energy, plastics, chemicals, furniture, food manufacturing, textile, wood product manufacturing, and tobacco.

4.2. Empirical model and measurement of variables

The empirical strategy of this paper has three steps. In the first step, we employ the baseline model to test our first hypothesis regarding the simultaneous relationship between green finance and ESG disclosure using Two-Stage Least Squares (2SLS) cluster regression approach. 2SLS approach has been widely used in prior literature to address the endogeneity problem arises due to reverse-causality and simultaneous relationship between variables [51,52]. Specifically, 2SLS regression specification for the reverse-causality relationship between ESG disclosures and green finance is as follows:

$$ESG_{it} = \beta_0 + \beta_1 GF_{it} + \beta_2 X_{it} + \eta_i + \mu_{it} + \varepsilon_{it} \quad (1)$$

$$GF_{it} = \beta_0 + \beta_1 ESG_{it} + \beta_2 X_{it} + \mu_{it} + \eta_i + \varepsilon_{it} \quad (2)$$

where ESG_{it} represents the disclosure score for Environment, Social, and Governance for firm "i" at time "t". The firms are categorized on the scale of ESG scores from 0 to 100, with the highest score being the most favorable [53]. GF_{it} represents the green finance of firm "i" at time "t". We follow prior literature, and use green bonds as a proxy for green finance issued by Chinese firms during the sample period [54,55]. Importantly, we follow [56], and use the lagged values of ESG (in equation (1)) and lagged values of GF (in equation (2)) serving as the instruments in the 2SLS regression.

X_{it} is the vector of control variables including firm size (SIZ), leverage (LEV), profitability (Return on Assets, ROA), cashflows (CF), liquidity (LIQ), sales growth (GROWTH), and independent directors (INDEP). All control variables emerged from the prior literature on ESG and green finance. For instance, based on the stakeholder theory assumption, The [57,58] argue that big firms face higher public pressure, and they use the sustainability initiatives as a form of justification to stakeholders to enhance their performance. In the case of leverage, under the stakeholder theory assumption, companies are more inclined to prioritize the interests of debtholders, who represent a more influential stakeholder group, over those of less influential groups like the community. As a result, highly indebted companies are anticipated to focus less on sustainability initiatives [59,60], which in turn impact performance. In addition, from the perspective of legitimacy theory, the [61] suggest that profitable companies are more likely to engage in sustainability efforts to demonstrate their positive impact on societal well-being and to legitimize their existence. Likewise, the free cash flow can positively impact ESG performance because free cash flow is a factor that can reduce the indebtedness of companies [47,62]. Also, independent directors play a crucial role in good governance and to protect stakeholders' interests. Thus, independent directors promote sustainability initiatives in firm, which, in turn, improves firm performance [63,64].

In the second step, we examine the impact of the integration of green finance with ESG disclosures on firm performance using the two-step dynamic System- Generalised Method of Moments (Sys-GMM) method in order to control the endogeneity in estimating the following model in equation. (3).

$$Tobin's\ Q_{it} = \gamma_0 + \gamma_1 ESG_{it} + \gamma_2\ GF_{it} + \gamma_3 ESG_{it} \times GF_{it} + \gamma_4 X_{it} + \theta_i + \vartheta_t + \varepsilon_{it} \quad (3)$$

Where Tobin's Q is the measure of firm performance, and calculated as the ratio of the market value of assets to the book value of assets [5,28]. Tobin's Q is used to measure a firm's financial position in terms of its ability to meet its obligations. The [65] explained that traditional accounting measures do not effectively account for systematic risk, while Tobin's Q provides a more accurate and market-based measure of firm performance. The interaction effect ($ESG_{it} \times GF_{it}$) captures impact of the integration of green finance with ESG disclosures on firm performance. θ_i and ϑ_t capture the industry and time effects.

Finally, in the third step, we examine the moderating role of firm's competitive advantage in terms of financing costs on the relationship between integration of green finance with ESG disclosures and firm performance. Specifically, using the three-way interaction ($ESG_{it} \times GF_{it} \times COMPADV_{it}$) in equation (4), we test the moderation effect of firm's competitive advantage on integration of green finance with ESG disclosures and firm performance, such that when firm's competitive advantage is high, the integration

effect of green finance with ESG disclosures will be stronger. The econometric specification for two-step Sys-GMM is as follows:

$$Tobin's\ Q_{it} = \beta_0 + \beta_1 ESG_{it} + \beta_2\ GF_{it} + \beta_3 COMPADV_{it} + \beta_4 ESG_{it} \times GF_{it} \times COMPADV_{it} + \beta_5 X_{it} + \theta_i + \vartheta_t + \varepsilon_{it} \quad (4)$$

Where COMPADV is competitive advantage in terms of financing costs, as described by Ref. [66], and calculated as the excess return on invested capital minus the weighted average cost of capital divided by total assets. A firm is considered to gain competitive edge if its return on capital is higher than the cost of capital [67]. The [68] explained that this measure considers both financial and non-financial aspects, including the cost of capital. Furthermore [69], argued that a firm's value increases when it earns an return higher than the cost of employed capital, and its value decreases when the excess return is less than the cost of capital. Finally, by following [70], observations are clustered based on industry and year. The description of variables used in this study can be found in Table 1.

5. Results and discussion

5.1. Descriptive statistics

Table 2 reports the descriptive statistics for the variables under investigation. The mean value of Tobin's Q is (1.183), with a median of (0.483), a minimum of (0.751), and a maximum of (2.439). The mean of the ESG Score is (1.343), with a maximum score of (1.892). This suggests that most firms in China are implementing ESG disclosures to comply with legal and social requirements. The mean value of Green Finance is 0.034, with a maximum value of (0.064), indicating that only a small percentage of total investment is financed through green bonds. The mean of COMPADV is (0.11), with a maximum of (0.21), indicating that a large number of firms have a competitive advantage due to lower financing costs. Additionally, the mean value of INDEP (5.231) indicates that most firms have appointed a satisfactory number of independent directors to protect the rights of various stakeholders.

Similarly, the mean values of the control variables Growth (0.096), ROA (0.13), and CF (0.19) suggest that a large number of firms are committed to implementing sustainable business practices. On the other hand, the mean value of LEV (0.55) suggests that firms disclosing ESG information have lower equity capital and higher debt financing. The summary statistics indicate that firms in China are increasingly adopting sustainable business policies and practices, although there is still room for improvement in areas such as green finance and equity capital.

5.2. Multicollinearity checks

Multicollinearity checks, namely correlation matrix and Variance Inflation Factor (VIF) were applied to investigate the issue of multicollinearity among explanatory variables. Table 3 presents the correlation matrix for variables use in this study. The independent variables exhibit correlations below 70 %, indicating the absence of multicollinearity in our model, as noted by Ref. [71]. The correlation analysis reveals that ESG Score (0.374), INDEP (0.281), and COMPADV (0.245) are significantly and positively correlated with the dependent variable, Tobin's Q. The control variables, namely Growth (0.367), ROA (0.132), CF (0.342), and Size (0.028), are also significantly and positively correlated with firm performance. On the other hand, LIQ (−0.291) and LEV (−0.024) demonstrate a significant negative correlation with Tobin's Q. These findings suggest that the appropriate variables were selected to investigate the impact of ESG disclosures on firm performance. Moreover, multicollinearity was assessed using the Variance Inflation Factor (VIF) in each regression analysis, and the VIF values were less than 10 in each analysis, indicating the absence of multicollinearity in our analysis, as reported by Refs. [72,73].

5.3. 2SLS cluster regression analysis

Table 4 presents the results obtained from the 2SLS cluster regression analysis aimed at predicting the causal relationship between ESG Score and Green Finance. By following [56], we use the lagged values of ESG (in model 1) and lagged values of GF (in model 2) as

Table 1
Description of variables used in this study.

Variable	Acronym	Description
Tobin's Q	Tobin's Q	The ratio of the market value of assets to the book value of assets.
Environmental, Social, and Governance Score	ESG	ESG Disclosure Score.
Green Finance	GF	Green bonds issued by firms over the sample period by total assets.
Firms competitive advantage	COMPADV	Firm's competitive advantage (Return on Invested Capital - Weighted Average Cost of Capital/total assets.
Independent Directors	INDEP	Percentage of independent non-executive directors on the board.
Firm Growth	Growth	Percentage growth in total assets.
Profitability	ROA	computed by dividing earnings before interest and tax (EBIT) on assets.
Liquidity	LIQ	Current assets/current liabilities.
Cash Flows	CF	Cash flow before depreciation amortization and extraordinary items/total assets.
Leverage	LEV	Long-term interest-bearing debt/total assets.
Size	SIZ	Log of total assets.

Table 2
Descriptive statistics.

Variables	Mean	Median	Maximum	Minimum
Tobin's Q	1.183	0.483	2.439	0.751
ESG Score	1.343	0.349	1.892	0.553
Green Finance	0.034	0.001	0.064	0.000
COMPADV	0.11	0.071	0.21	0.001
INDEP	5.231	2.554	8.942	1.163
Growth	0.096	0.034	0.239	0.003
ROA	0.139	0.071	0.34	0.001
LIQ	1.486	0.581	1.944	0.610
CF	0.19	0.084	0.37	0.002
LEV	0.55	0.211	0.77	0.081

Table 3
Correlations matrix.

	Tobin's Q	ESG Score	COMPADV	INDEP	Growth	ROA	LIQ	CF	LEV	SIZ
Tobin's Q	1.00									
ESG Score	0.374	1								
	(0.000)									
COMPADV	0.245	−0.008	1							
	(0.000)	(0.000)								
INDEP	0.281	0.564	−0.121	1						
	(0.001)	(0.000)	(0.000)							
Growth	0.367	0.451	−0.084	0.573	1					
	(0.000)	(0.002)	(0.000)	(0.003)						
ROA	0.132	0.054	0.057	0.056	0.153	1				
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)					
LIQ	−0.291	−0.273	0.043	−0.232	−0.611	−0.022	1			
	(0.000)	(0.000)	(0.000)	(0.021)	(0.000)	(0.002)				
CF	0.342	0.115	0.140	0.101	0.243	0.273	−0.201	1		
	(0.000)	(0.000)	(0.000)	(0.000)	(0.022)	(0.000)	(0.000)			
LEV	−0.024	0.253	−0.136	0.233	0.431	0.024	−0.370	−0.047	1	
	(0.002)	(0.000)	(0.000)	(0.003)	(0.000)	(0.030)	(0.000)	(0.000)		
SIZ	0.028	0.381	−0.185	0.452	0.759	0.091	−0.459	0.035	0.385	1
	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	

the instruments in the 2SLS regression. The results of both the under-identification test and the test for weak identification rejects the null hypothesis that the instrumental variables are irrelevant or weakly relevant to ESG and GF variables, while the over-identification test accepted the null hypothesis that the instrumental variables are irrelevant to the error term. Thus, the instrumental variables met the underlying assumptions for valid instrumental variables.

The findings reveal that ESG Score significantly and positively explains GF in both year and industry effects with $\beta = 0.003$ and $\beta = 0.003$, respectively at 5 % significance level, as shown in Panel C and Panel D. Likewise, GF significantly and positively explains ESG score in both year and industry effects with $\beta = 0.001$ and $\beta = 0.002$, respectively at 5 % significance level, as demonstrated in Panel A and Panel B. Therefore, from both an econometric and economic perspective, the results indicate that a significant reciprocal relationship exists between firm ESG disclosures and GF, supporting Hypothesis 1.

These findings are in-line with the existing studies and suggest that firms should integrate green finance with ESG disclosures in order to meet the needs of various stakeholders and ensure long-term sustainability [18]. This can be further encouraged by the stakeholders who prioritize a firm's long-term sustainability [20]. Furthermore, the integration of green finance with ESG disclosures helps to uphold societal values and promote environmentally-friendly projects through the issuance of green bonds [11]. These findings are supported by Ref. [37] investigation into the reciprocal relationship between ESG disclosures and green finance.

Table 5 presents the results estimated from the two-step Sys-GMM analysis. For the validity of the instrument (lagged value of performance), the over identification test and test for autocorrelation suggest that AR (1) is significant, while AR (2) is insignificant, indicating that second-order autocorrelation has no effect on the results. Furthermore, the insignificant results of the Hansen test confirm validity of instrument for the models.

In the first part of the specification without moderation under Panel A and Panel B, the ESG Score in both year and industry effects with $\beta = 0.032$ and $\beta = 0.042$, respectively at 5 % significance level are significant and positively explain the dependent variable, firm performance proxied by Tobin's Q. The results suggest that firms with strong ESG practices are in a better position to improve their performance and maintain sustainability and are consistent with the prior work [21]. Moreover, the use of green financing (GF) has a significant positive effect on Tobin's Q, both in terms of the year and industry effects with $\beta = 0.025$ and $\beta = 0.023$, respectively at 5 % significance level.

This indicates that financing through green bonds can communicate a firm's policy to address environmental and societal concerns to various stakeholders, which may positively impact the firm's value [27]. Likewise, competitive advantage (COMPADV), as shown in

Table 4
Reverse-causality between ESG Score and GF: 2SLS cluster regression analysis.

	ESG Score (Model-1)						Green Finance (Model-2)					
	Panel A (Yearly Effect)			Panel B (Industry Effect)			Panel C (Yearly Effect)			Panel D (Industry Effect)		
	Coff.	t-value	VIF	Coff.	t-value	VIF	Coff.	t-value	VIF	Coff.	t-value	VIF
L.ESG	0.0015***	3.135	2.67	0.003***	3.165	2.805						
L.GF							0.0045***	3.42	2.925	0.0045***	3.435	2.85
GF	0.001**	2.09	1.78	0.002**	2.11	1.87						
ESG Score							0.003**	2.28	1.95	0.003**	2.29	1.90
COMPADV	0.001***	3.48	1.119	0.001***	3.47	1.17	0.001***	3.22	2.56	0.001***	3.29	2.44
INDEP	0.002	0.52	2.37	0.002**	0.51	2.22	0.002**	1.78	2.24	0.002**	1.77	2.17
Growth	0.023***	3.12	4.72	0.024***	3.11	4.67	0.022***	3.23	4.15	0.023***	3.33	4.47
ROA	0.003***	2.70	2.78	0.003**	2.48	2.75	0.001**	2.08	2.55	0.001**	2.01	3.16
LIQ	0.002	0.85	2.09	0.002	0.87	2.08	0.001	1.54	2.03	0.002	1.54	2.07
CF	0.001***	2.86	1.48	0.002***	2.77	1.46	0.002***	3.81	2.56	0.002***	3.56	2.52
LEV	−0.002	−1.44	1.57	−0.002	−1.38	1.57	−0.001***	−3.05	2.08	−0.001***	−3.02	1.89
SIZ	0.032***	3.88	5.56	0.033***	3.53	4.63	0.024***	3.87	4.99	0.025***	4.78	3.78
IND	0.013	1.62	1.09	0.0133*	1.65	1.09	0.012***	3.66	1.09	0.013***	3.36	1.18
Year	0.014	1.26	1.09	0.013	1.29	1.22	0.012***	2.81	3.44	0.012***	2.76	3.33
R-Square	0.281			0.283			0.290			0.292		
Under-identification test *(p-value)*					0.000		Under-identification test *(p-value)*				0.000	
Weak-identification test *(p-value)*					0.015		Weak-identification test *(p-value)*				0.010	
Over identification test *(p-value)*					0.420		Over identification test *(p-value)*				0.309	
Hausman endogeneity test *(p-value)*					0.01		Hausman endogeneity test *(p-value)*				0.03	

Note: *** significant at 1 %, ** significant at 5 %, * significant at 10 %.

Table 5
Impacts of ESG, GF, and COMPADV on firm performance: Two-step Sys-GMM.

Variables	without moderating effect				with moderating effect			
	Coff.	t-value	Coff.	t-value	Coff.	t-value	Coff.	t-value
L.Tobin's Q	1.304***	5.696	1.313***	5.688	1.248***	5.784	1.162***	5.064
ESG Score	0.032**	2.12	0.042**	2.14	0.034**	2.27	0.034**	2.27
GF	0.025**	2.03	0.023**	2.05	0.024**	2.03	0.024**	2.03
COMPADV	0.002 ***	3.44	0.002***	3.42	0.001***	3.23	0.001***	3.21
ESG Score × GF					0.0366**	2.28	0.0366**	2.26
ESG Score × GF × COMPAD					0.0511***	3.45	0.0511***	3.41
INDEP	0.003	0.56	0.003	0.59	0.003*	1.76	0.002*	1.74
Growth	1.631***	7.12	1.642***	7.11	1.561***	7.23	1.453***	6.33
ROA	0.277***	6.70	0.243***	6.48	0.231***	3.08	0.221***	3.03
LIQ	−0.001	−0.81	−0.001	−0.88	−0.003	−1.54	−0.003	−1.54
CF	0.001***	2.83	0.002***	2.76	0.004***	3.87	0.003***	3.86
LEV	−0.002	−1.48	−0.001	−1.34	−0.000***	−3.07	−0.001***	−3.04
SIZ	0.642***	5.88	0.741***	5.53	0.521***	9.87	0.451***	7.78
IND	−0.014	−1.62	−0.0143	−1.64	−0.014***	3.67	−0.013***	3.33
Year	0.024	1.22	0.015	1.23	0.015***	3.81	0.014***	3.76
AR (1) *(p-value)*	0.000				0.000			
AR (2) *(p-value)*	0.437				0.501			
Hansen test (overidentification) *(p-value)*	0.742				0.648			

Note: *** significant at 1 %, ** significant at 5 %, * significant at 10 %.

Panel A and Panel B, has a significant positive influence on firm performance, both in terms of the year and industry effects with $\beta = 0.002$ and $\beta = 0.002$, respectively at 1 % significance level. This suggests that firms that adopt ESG disclosures are better positioned to finance their operations and improve their performance [5].

It is important to note that the effect of ESG on firm performance is greater than the effect of GF and COMPADV. However, GF has a more positive impact on firm performance than competitive advantage. These three variables, namely ESG, GF, and COMPADV are individually significant and have an impact on firm performance.

After including interaction variables in the two-step Sys-GMM analysis, such as ESG × GF and ESG × GF × COMPADV, the results in Table 5 show that the integration of green finance with ESG disclosures (ESG × GF) appears to have a more significant positive effect on firm performance, as evidenced by the coefficients ($\beta = 0.0366$; significant at 5 % confidence interval) under industry and year effect. This suggests that green finance may be enabling firms to engage in ESG disclosure activities more effectively. For example, firms that disclose their ESG practices may issue green bonds to meet their social responsibility and environmental protection goals [33,50].

The study suggests that the three-way interaction (ESG × GF × COMPADV) further strengthen the positive effect on firm performance. The results show that the moderating variable enhances the influence of ESG and green finance integration on firm performance, as indicated by the significant beta coefficients of 0.0511 and p-values of 1 % under both year and industry effects. The significant positive interaction effect explains that firms with a competitive advantage can issue low-cost green finance instruments for

Table 6
Two-step Sys-GMM analysis controlling for both year and industry.

Variables	Panel A without moderating effect		Panel B with moderating effect	
	Coff.	t-value	Coff.	t-value
L.Tobin's Q	0.0481***	3.01	0.050***	3.53
ESG Score	0.0391***	3.26	0.041***	2.72
GF	0.0254***	2.76		
COMPADV	0.002***	3.84	−0.001***	−3.20
ESG Score × GF			0.0374***	2.66
ESG Score × GF × COMPADV			0.0461***	4.59
INDEP	0.006***	3.43	0.004***	3.83
Growth	1.574***	5.33	1.540***	7.88
ROA	0.283***	3.49	0.254***	5.67
LIQ	−0.001***	−3.75	−0.000***	−4.087
CF	0.001***	2.96	0.000***	2.94
LEV	−0.003**	2.23	−0.0001*	1.87
SIZ	0.632***	7.03	0.625***	6.88
IND	−0.015**	2.15	−0.014***	2.89
Year	0.032*	−1.95	0.021***	2.59
AR (1) *(p-value)*	0.000		0.000	
AR (2) *(p-value)*	0.321		0.362	
Hansen test (overidentification) *(p-value)*	0.452		0.461	

Note: *** significant at 1 %, ** significant at 5 %, * significant at 10 %.

long-term environmental sustainability and social development. Alternatively speaking, firms implementing ESG disclosures have a lower cost competitive advantage, and such firms can issue green bonds to meet environmental and social disclosures, as explained in hypothesis 3. Thus, firms that possess a competitive advantage are in a favorable position to implement ESG disclosures for improving their performance. This finding is consistent with previous research by Refs. [7,18].

The findings are also consistent with a study conducted by Ref. [20], which investigates how firms that implement ESG disclosures can manage their resources efficiently and improve their value. ESG firms are able to effectively manage their businesses and recommend optimal solutions for societal issues [74]. The results suggest that firms those follow ESG disclosure activities are better positioned to manage their businesses efficiently and maintain long-term sustainability. Previous research studies also suggest that the introduction of CSR disclosures, adoption of corporate standards, and incorporation of stakeholder approaches positively influence firm value [7,13,20,27,38,39]. Furthermore, the [22] argue that firms improve their ESG performance due to stakeholder pressures or market acceptance. However, our results indicate that ESG disclosures positively interact with competitive advantages on firm performance, thereby creating value for stakeholders rather than only reacting to market sentiments to generate value for shareholders.

5.4. Robustness check

For robustness test, two-step Sys-GMM is used by controlling for both year and industry. Table 6 presents the effects of ESG scores and its moderators on firm performance.

In the case of Panel A of Table 6, without moderators, ESG with $\beta = 0.0391$ at 1 % significance level, GF with $\beta = 0.0254$ at 1 % significance level, and COMPADV with $\beta = 0.002$ at 1 % significance level are significant and positively explain the dependent variable, firm performance measured by Tobin's Q [49]. Likewise, in Panel B with moderating variables, ESG $\times$ GF ($\beta = 0.0374$ at 1 % significance level), ESG Score $\times$ GF $\times$ COMPADV ($\beta = 0.0461$; at 1 % significance level) are significantly and positively influencing firm performance (Tobin's Q). Ceteris paribus, overall, these findings confirm the main results.

6. Conclusion

Overall, the findings of this research study suggest that a firm's engagement in green finance ESG activities may support managers in managing resources more efficiently and running the business effectively while addressing environmental and social issues. In contrast to prior research studies, it has been found that green finance integration with ESG disclosures in China provides better value to stakeholders in terms of market performance, rather than just market acceptance. Concerning stakeholder theory, the findings suggest that the integration of green finance and ESG depends on a firm's competitive position in terms of financing costs as a signal to stakeholders. Hence, running a business with ethical and social behavior in protecting societal values leads to improved firm performance [29]. The findings also in-line with existing research studies that suggest that government should support firms with lower competitive advantage and increase their ESG engagement to improve their performance [5].

The study also supports the notion that running business operations in a more responsible manner leads to better performance, as firms that earn higher ESG disclosures tend to perform better. However, in some countries, firms are not required to follow ESG disclosures. The findings of this study may encourage such firms to consider implementing environmental and social disclosures for future sustainability. Because when firms view ESG disclosures as integral factors in improving their performance, the ultimate reward is a higher return for shareholders.

At present, firms operating in China are not subject to strict regulations regarding the disclosure of ESG information. Conversely, firms operating in advanced countries such as the European Union (EU) countries and the U.S. are required to disclose their ESG information [7]. Recently, there has been increased shareholder activism, which has brought attention to the dissemination of ESG activities in a firm's annual report to better understand how ESG drives value for firms. Similarly, the European Commission stresses that firms report their ESG disclosures in their annual reports to promote sustainable business performance [53]. However, ESG disclosure is a new concept in China, and more research can be conducted on various industries to better understand the impact of ESG disclosures on a firm's performance [50].

7. Policy implication and future research directions

The findings of this study suggest that integrating green finance with ESG disclosures is important for improving firm's financial performance and competitive advantage by providing lower-cost financing options. This can be very beneficial for different stakeholders in emerging markets, such as China, as firms start considering the environment and its impact on society. Additionally, the integration of green finance with ESG disclosures in China has inspired firms to engage in ESG initiatives thereby increased competitive edge and lower financing costs due to market reputation and investor acceptance. Therefore, this study complements with the strategic vision of China ESG disclosure according to sustainable development agenda 2015–2030. Importantly, statutory bodies should assist firms with a weak competitive position by providing tax rebates or financial support to actively engaging in ESG initiatives that benefit their business operations and value chain.

Future research could explore how various ways of ESG disclosures like those related to social and cultural change, protecting human rights, and improving the welfare and health of employees, can improve firm performance. Additionally, the ESG roadmap for SMEs is also still in its infancy. Given that SMEs represent the largest percentage of firms operating in China, future research studies could be conducted to address issues related to the resources and expertise required for SMEs to incorporate ESG disclosures.

CRediT authorship contribution statement

Ashfaq Habib: Writing – original draft. **Judit Oláh:** Investigation, Funding acquisition. **Mushtaq Hussain Khan:** Data curation. **Smutka Luboš:** Supervision, Investigation.

Data availability statement

The data can be provided on the request of other researchers. For requesting the data please contact with the corresponding author.

Research funding

This research study has been financed by the Project No. TKP2021-NKTA-32 implemented with the support provided by the Ministry of Culture and Innovation of Hungary from the National Research, Development and by the University of Debrecen Program for Scientific Publication.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:Judit Olah reports financial support was provided by University of Debrecen. Judit Olah reports a relationship with University of Debrecen that includes: employment and funding grants. There is no conflict of interest among the authors If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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