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## Article

# An analysis on the relationship between ESG information disclosure and enterprise value: A case of listed companies in the energy industry in China

Cogent Business & Management

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*Suggested Citation:* Siwei, Dong; Chalermkiat, Wongvanichtawee (2023) : An analysis on the relationship between ESG information disclosure and enterprise value: A case of listed companies in the energy industry in China, Cogent Business & Management, ISSN 2331-1975, Taylor & Francis, Abingdon, Vol. 10, Iss. 3, pp. 1-21, <https://doi.org/10.1080/23311975.2023.2207685>

This Version is available at:

<https://hdl.handle.net/10419/294404>

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To cite this article: Dong Siwei & Wongvanichtawee Chalermkiat (2023) An analysis on the relationship between ESG information disclosure and enterprise value: A case of listed companies in the energy industry in China, *Cogent Business & Management*, 10:3, 2207685, DOI: [10.1080/23311975.2023.2207685](https://doi.org/10.1080/23311975.2023.2207685)

To link to this article: <https://doi.org/10.1080/23311975.2023.2207685>



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Published online: 17 Nov 2023.



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Received: 14 March 2023  
Accepted: 24 October 2023

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## ACCOUNTING, CORPORATE GOVERNANCE & BUSINESS ETHICS | RESEARCH ARTICLE

# An analysis on the relationship between ESG information disclosure and enterprise value: A case of listed companies in the energy industry in China

Dong Siwei<sup>1,2\*</sup> and Wongvanichtawee Chalermkiat<sup>1</sup>

**Abstract:** This study examines the relationship between environment, social responsibility, and governance (ESG) information disclosure and firms' value. It also investigates how debt cost is the mediate variable between the ESG and firms' value. The content analysis supported sustainability development theory, stakeholder theory, and the double carbon target in China. The multiple linear regression is used to examine the relationships for a sample of 94 firm 4-year observations listed in the GICS energy industry during 2018–2021 in China. The results show that ESG is significantly positively associated with firms' value. Nevertheless, debt cost is negatively and significantly related to ESG. More importantly, the results show that debt cost mediates ESG firms' value relationship. Further, when the sample is split into state-owned and non-state-owned firms, the ESG- firms' value significant positive relationship is evident only in the latter, corroborating the mediate role of the debt cost in China. This study contributes to the literature on ESG, debt cost, and firms' value by offering evidence for the mediating role of debt cost on the ESG firms' value relationship, supporting the view that non-state-owned firms are more sensitive. Regulators and stakeholders should be aware of the potential effect of engagement in ESG reporting and the benefits of having a low cost of debt on firms' value.

**Subjects:** Agriculture & Environmental Sciences; Environmental Studies; Accounting;

**Keywords:** sustainability; ESG information performance; corporate value; cost of debt; stakeholders

### ABOUT THE AUTHOR

Dong Siwei is a Ph.D.Candidate of the Doctor of Philosophy Program in Management, Siam University. She ever studies risk management major in Monash University in Australia, and Accounting major in Liaoning University in China. Thus, she is very interested in Accounting areas about the non-financial statement of public companies' ESG performance effect on the firm's value. She also works at Shandong Technology and Business University in China, as a lecturer of financial management and capital operation management. She is good at statistical software including Stata, SPSS, and AMOS.

### 1. Introduction

In the Sustainable Development Goals proposed by the United Nations, issues related to environmental protection, social responsibility, and corporate governance emerge endlessly and are highly related to ESGs. Therefore, the disclosure of non-financial information ESGs of enterprises is very important. By testing the relationship between ESG information disclosure performance and enterprise value, this paper puts forward the significance of ESG performance for enterprises and stakeholders.

According to the theory of sustainable development, the fundamental requirement of development is to meet the needs of the present without compromising the ability of future generations to meet their own needs (Borowy, 2013).

Under the Sustainable Development Goals (SDGs), the United Nations 2015 called on countries, organizations, and businesses to take action to protect property, and the planet and ensure a vision of peace and good for all by 2030. 17 The Sustainable Development Goals (SDGs) in figure 1 were proposed, each of which is interrelated, contributes to, and influences each other.

With increasing public concern for sustainability (Barman, 2018; Schoenmaker & Schramade, 2019), it is becoming increasingly important to link non-financial issues such as social and environmental issues to the creation of long-term financial value. The MSCI World SRI index has outperformed the regular MSCI World index for the past 3 years, showing that sustainable investing can deliver higher returns (Liddell, 2021).

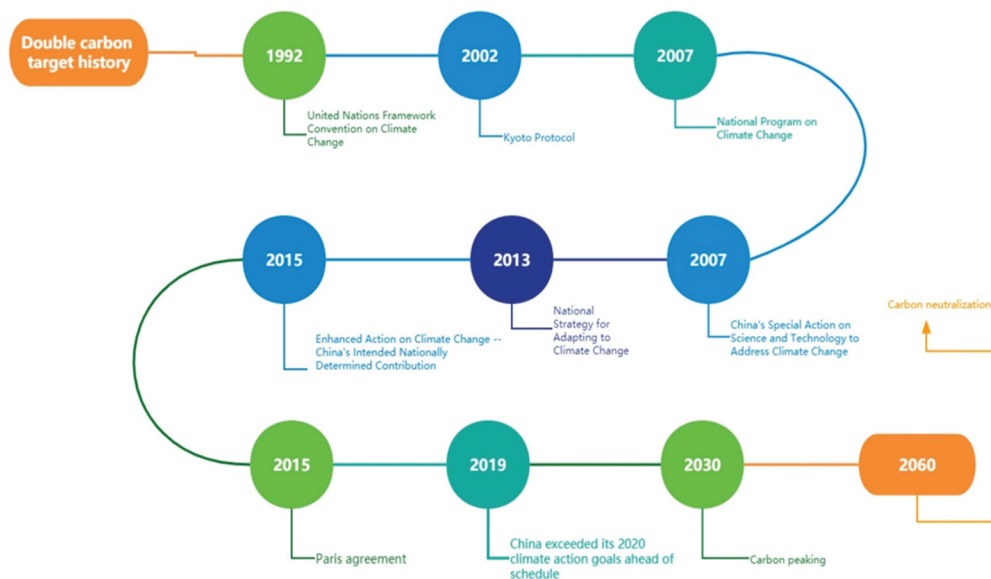
The major strategic goal of “achieving carbon peak by 2030 and carbon neutrality by 2060” bears on the sustainable development of the Chinese nation, the building of a community with a shared future for mankind, and a community of life between man and nature. It is an inherent requirement of the great cause of national rejuvenation and an objective need for the sustainable development of mankind.

Persisting on promoting the green and low-carbon development of enterprises is becoming the main theme of sustainable development worldwide. ESG (Environmental, Social, and Governance) is the pursuit of economic, environmental, and social comprehensive development concepts, to maximize the value can effectively guide the major players to create economic value of the capital market, under the big wave of “double carbon” strategy, it has become an important concept of

Figure 1. Sustainable development Goals.



**Figure 2. Double carbon target History.**



global consensus to pay attention to the development of ESG. Environmental protection enterprises should make use of unique advantages to strengthen information disclosure and carbon inspection, reduce pollution and reduce carbon, clean energy, and resource utilization, and truly become the pioneers, advocates, and practitioners of ESG high-quality development paradigm to help China achieve the goal of “carbon peak, carbon neutral”, and promote social sustainable development. In addition, Ntim et al. (2021) suggested that board structure variables (i.e., the board size, independence, gender diversity, and meeting frequency) could explain, to a certain extent, differences in environmental management practices among Chinese companies from heavily polluting industries.

The status of ESG society: The global community is increasingly concerned about ESG. In recent years, ESG issues such as climate change, public health, environmental pollution, product quality, and business ethics have frequently become hot social issues. A 2021 Price Water house coopers survey shows that the global community is very worried about ESG issues such as climate change and environmental damage, excessive regulation, epidemics, and other health crises. As the economic and social crisis caused by COVID-19 intensifies, the global community is paying increasing attention to the development of ESG. The input of ESG has a significant impact on enterprise value.

Given the important role of environmental, social, and governance factors in financial performance, some previous literature has demonstrated the relationship between ESG rating and financial performance from different indicators and industry perspectives. For example, the impact of environmental, social, and governance activities on financial performance was examined in 11 industries including industry, materials, energy, health, finance, and telecommunication services in the United States, Japan, and European countries. So far, however, China’s energy sector has not been targeted.

In addition, the impact of ESG on enterprise efficiency is revealed. According to Minutolo et al. (2019), ESG scores are considered to reflect strategic choices of transparency. To do so, 467 companies in the S&P 500 were surveyed. In this study, the impact of ESG on Tobin’s Q in large companies is measured by sales volume, while the impact of ESG on return on assets and Tobin’s Q in small companies is measured by market capitalization. Still, legitimacy requirements and levels of disclosure vary from industry to industry.

Further, previous literature has opened the door to examining the relationship between ESG ratings and financial performance in other industries such as the food industry. The industry trend toward a circular economy and sustainable development has led to an increase in the investigation of ESG activities on the financial performance of Chinese listed companies (Zhou et al., 2022). In addition, the impact of ESG activities on the financial risk of 500 large American companies is also studied. Finally, based on the systematic review and meta-analysis of the literature related to ESG and financial performance; There is no research on the relationship between ESG rating and enterprise value in China's energy industry.

This paper aims to solve the problem of “Does ESG information disclosure improve enterprise value?” And “What are the suggestions about ESG performance for energy enterprises?”

After the study of this paper, achieve the objectives include:

- (1) To study the ESG information disclosure of energy enterprises in China.
- (2) To analyze the relationship between Environment, Social responsibility, Corporate Governance, and enterprise values.
- (3) To get suggestions about ESG performance and use the suggestions in energy enterprises.

To date, the literature on ESGs has become saturated in advanced economies with a strong institutional element base in corporate social responsibility and ESG practices (Ioannou & Serafeim, 2010; Kalaiganam et al., 2007). However, in developing economies, due to the instability of political and institutional systems, regulations and norms related to carbon emissions and environmental hazards, pollution, and various social issues related to wages and other aspects (Odell & Ali, 2016; Odera et al., 2016), evidence may vary significantly.

It is worth noting that India faces challenges in integrating ESG into its strategic practice due to limited resources, a large population, high population density, limited material and social infrastructure, and political instability. Therefore, in India, research in this area is crucial. By better integrating ESG standards, companies may be able to take advantage of growth and value creation, because there are significant differences between ESG scores and corporate performance in different economies (Odell & Ali, 2016; Odera et al., 2016).

This paper theoretically analyzes the relationship between ESG performance, corporate reputation, debt cost, and corporate market value, and selects panel data of some A-share listed companies to conduct an empirical study using the intermediary effect model. Consequently, the current paper seeks to make the following contributions to the existing literature. Firstly, policy and regulation makers should pay more attention to the performance of enterprise ESG and encourage enterprises to participate in the investment of ESG. Secondly, for enterprises, the excellent performance of ESG can bring benefits to their operation and improve market value. Furthermore, from the perspective of investors, ESG-related products should be selected for investment, such as green bonds. Finally, corporate consumers, choose green quality products to promote corporate ESG investment.

## 2. Background

Figure 2 shows the history of Double carbon target. In 1992, China became one of the first signatories of the United Nations Framework Convention on Climate Change (hereinafter referred to as the Convention). Since then, China has not only set up a national coordination body on climate change but also adopted a series of policies and measures related to climate change following the requirements of the national sustainable development strategy, making positive contributions to the mitigation and adaptation of climate change. The Chinese government ratified the Kyoto Protocol in 2002. In 2007, the Chinese government formulated the National Program on Climate Change, which sets out the specific goals, basic principles, key areas, policies, and measures to address climate change by 2010, and calls for a 20% reduction in energy consumption per unit of GDP by 2010

compared with that of 2005. In 2007, the Ministry of Science and Technology, the National Development and Reform Commission, and 14 other government departments jointly formulated and issued China's Special Action on Science and Technology to Address Climate Change, which set out the goals, key tasks and safeguard measures for improving science and technology development and independent innovation capability in addressing climate change by 2020. It also announced that China will increase its intended nationally determined contributions, adopt stronger policies and measures, strive to achieve carbon neutrality by 2060, and strive to reach the peak of carbon dioxide emissions by 2030.

Climate change is a global problem facing mankind. With the emission of carbon dioxide by all countries, greenhouse gases have soared, posing a threat to living systems. Using a panel data set of 8,408 observations from 35 countries between 2002 and 2019, the study found a negative correlation between higher actual greenhouse gas (GHG) emissions and market value. (Ntim & Malagila, 2022) Against this background, the countries in the world reduce greenhouse gases through a global agreement and put forward the carbon peak and carbon neutralization goals. As the world's factory, China's industrial chain is improving, its domestic manufacturing and processing capacity is increasing, and its carbon emissions are accelerating. However, oil and gas resources are relatively short, and it is of great security significance to develop a low-carbon economy and rebuild the energy system.

As the economic and social crisis caused by the pandemic intensifies, the global community continues to pay more attention to ESG, especially the issue of climate change will become a top priority, and the pandemic will catalyze society to refocus its attention on social and governance issues. Persisting on promoting the green and low-carbon development of enterprises is becoming the main theme of sustainable development worldwide. ESG (Environmental, Social, and Governance) is the pursuit of economic, environmental, and social comprehensive development concepts, to maximize the value can effectively guide the major players to create economic value of the capital market, under the big wave of "double carbon" strategy, it has become an important concept of global consensus to pay attention to the development of ESG. From the perspective of corporate sustainability strategies, corporate boards, and executive management teams should recognize the catastrophic consequences of climate change risks and the enormous economic potential of placing the corporate sustainability agenda at the heart of long-term organizational strategies and action plans. (Ntim & Malagila, 2022)

### 3. Theoretical literature review

The term ESG was formally introduced in 2004 with the publication of the UN Global Compact Initiative report "Who Cares Who Wins" (Ge et al., 2022). It has set an ambitious goal of restructuring the three pillars of ethical finance: environmental, social, and governance. They all contain different questions and present specific goals for evaluation.

At present, theories studying the relationship between environmental, social, corporate governance, and corporate performance mainly include the following three categories:

First, according to Sustainable development Theory, the fundamental requirement of development is to meet the needs of the present without jeopardizing the ability of future generations to meet their own needs. Economic sustainability is the premise of social sustainability. As a micro-unit of economic development, enterprises can achieve long-term sustainable development of themselves and the whole economy and society only by balancing their benefits, environmental benefits, and social benefits.

In 1987, the United Nations Commission on World and Environmental Development, chaired by Norwegian Prime Minister Gro Harlem Brundtland, issued a report "Our Common Future", which formally put forward the concept of sustainable development and comprehensively discussed the environment and development issues of common concern to mankind on this theme. In 1992, the

United Nations Conference on Environment and Development accepted the consensus and recognition of the key points of sustainable development. The general aim of (Ziolo et al., 2019) is to investigate which ESG criteria are incorporated into the decision-making process of financial institutions and to verify the level of sustainability of financial systems in selected OECD (Organization for Economic Cooperation and Development) countries.

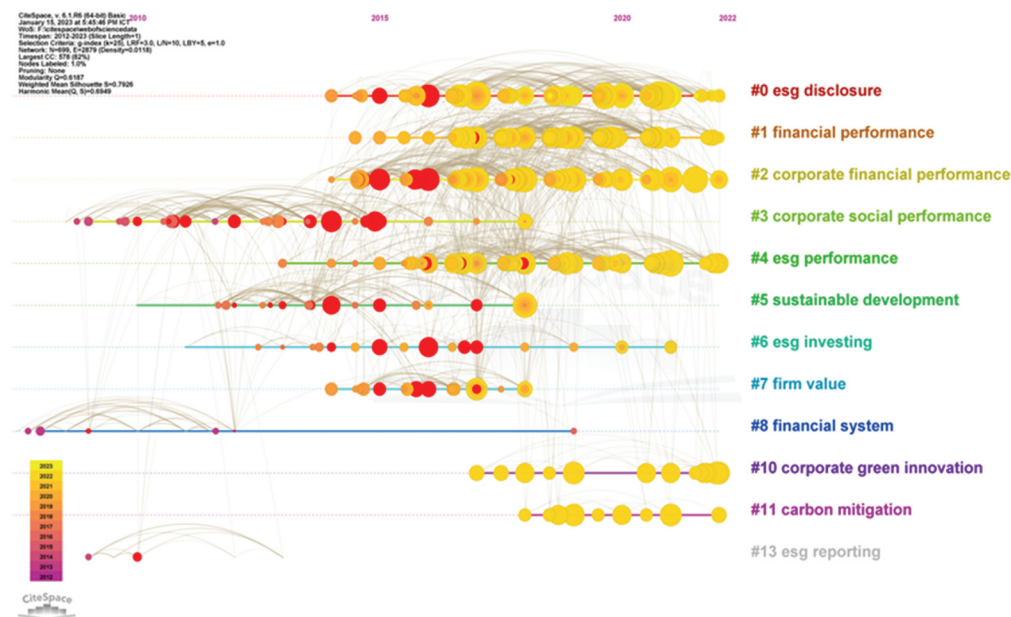
The second is stakeholder theory (Freeman, 2010). According to this theory, factors affecting enterprise operation and management not only include shareholders and creditors, but also include employees, upstream and downstream customers, and the natural environment. Environmental pollution, lack of social responsibility, and imperfect corporate governance will harm the interests of employees, their communities, and even the whole society, thus affecting their performance and lowering their valuation. Based on stakeholder and upper echelons theory (Velte, 2019) aim to analyze whether the link between environmental, social, and governance (ESG) performance and financial performance is moderated by chief executive officer (CEO) power.

Theoretical studies show that the performance of enterprises is not only related to the realization of profit targets and shareholder value but more importantly depends on whether they can coordinate with the society and environment, to realize their development without damaging the sustainable development of the economy and society.

Figure 3 was formed using Citespace. It is the keywords related to the topic of this paper made by Citespace. From ESG to financial performance, and from light yellow to red are the important time nodes of the research. Here, it indicates that the research of ESG information disclosure and enterprise value in this paper is the hot topic of current research.

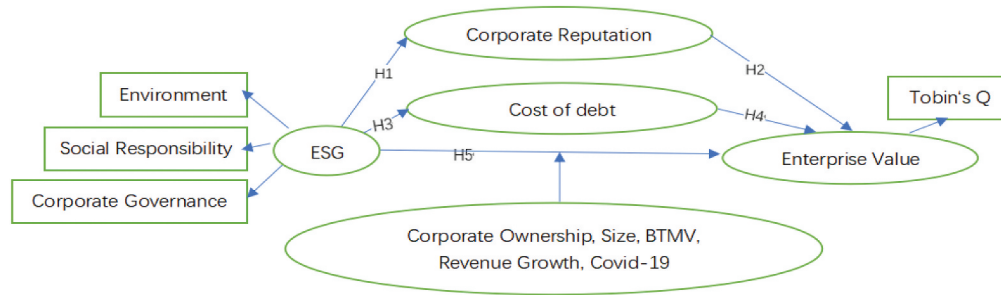
Li et al. (2021) uses Citespace to conclude that cooperation between Europe and the United States appears to be close in the field of ESG research. Taking the top three countries as an example, the United States has cooperated in ESG 386 times since 2004, with a centrality of 0.91. Canada has a cooperation frequency of 85 and a centrality of 0.21. In the UK, the cooperation frequency is 75 and the centrality is 0.33. As mentioned earlier, cooperation among developed countries such as the United States, Canada, and the United Kingdom shows a high degree of concentration and a high level of practice. In terms of cooperative institutions, academic institutions represented by Harvard

Figure 3. ESG research hotspot.





**Figure 4. An analytical Model.**



University, the University of Pennsylvania, the University of Minnesota, and Boston University have strong cooperative links in ESG research, with cooperation frequency of 16, 16, 15, and 14 times respectively, and centrality of 0.02, 0.04, 0.01 and 0.03 times respectively. Compared with developed countries such as Europe and the United States, developing countries represented by China have a relatively low level of research cooperation in the field of ESG.

Accepting financial penalties is harmful to a bank's reputation, so banks must improve their reputation by adopting ESG practices. Reputation building seems to be a plausible reason for the increase in overall ESG scores (Pina Murè, 2021). When examining the relationship between corporate reputational risk (CRR) and stock performance, Wong and Zhang, (2022) found that media coverage of ESG-related bad news had a significant negative impact on corporate valuation. According to further industry data, the stock performance of companies in the gaming, cigarette, and alcohol sectors is not vulnerable to adverse ESG reports.

Clark and Viehs (2014) review the most important academic studies on CSR and ESG to show where the current research on this topic is standing (Porumb et al., 2017), analyze if the non-financial performance of real estate firms is associated with a decreased cost of capital. Using legitimacy and institutional theories (Eliwa et al., 2021) investigate whether lending institutions reward firms in 15 EU countries for their environmental, social, and governance (ESG) performance and disclosure in terms of lowering their cost of debt capital.

Enterprise value is often used to measure the expected profitability and sustainable development ability of enterprises (Ohlson, 1995). Value is also the basis for the enterprise to make decisions, Tobin's Q value is the most frequently used method. Tobin's Q = market value/replace-ment cost, which is often used by scholars to measure the market value of enterprises.

#### 4. Empirical literature review and hypotheses development

Reputation building seems to be a plausible reason for the increase in overall ESG scores (Pina Murè, 2021). When examining the relationship between corporate reputational risk (CRR) and stock performance, Wong and Zhang, (2022) found that media coverage of ESG-related bad news had a significant negative impact on corporate valuation. According to further industry data, the stock performance of companies in the gaming, cigarette, and alcohol sectors is not vulnerable to adverse ESG reports (Wong and Zhang, 2022). examine the value relevance of corporate reputation risks (CRR) from adverse media coverage of environmental, social, and governance (ESG) issues on stock performance at the firm level. (Lambert et. al., 2021) explore whether auditors effectively help companies manage heightened ESG risk in times of reputation crisis, using abnormal negative ESG-related media coverage as a measure of "tainted reputation". Figure 4 shows the analytical model of this paper.

**H1:** ESG information disclosure has a positive effect on enterprises' reputations.

**H2:** Corporate reputation can increase the enterprises' value.

Using legitimacy and institutional theories (Eliwa et al., 2019) investigate whether lending institutions reward firms in 15 EU countries for their environmental, social, and governance (ESG) performance and disclosure in terms of lowering their cost of debt capital. The subject of (Hamrouni et al., 2019) is to test whether or not CSR disclosure (i.e. aggregate as well as its three sub-indicators) reduces the cost of debt for French corporations listed in the SBF 120 index between 2010 and 2015 (Feng & Wu, 2021) find that REITs with higher levels of ESG disclosure have lower costs of debt, higher credit ratings, and higher unsecured debt to total debt ratio, controlling for key firm characteristics. These findings suggest that improving ESG disclosure can help REITs to gain better access to the capital markets and enhance corporate financial flexibility, as lenders have paid close attention to a firm's ESG disclosure and integrated evaluation of ESG factors into their lending decisions (Feng & Wu, 2021). The purpose of (Ratajczak & Mikolajewicz, 2021) is to examine the impact of environmental, social, and corporate governance (ESG) responsibility on the short- and long-term cost of debt.

**H3:** ESG information disclosure has a negative effect on the cost of debt.

**H4:** Cost of debt can decrease the enterprises' value.

(Fatemi et al., 2018) investigate the effect of environmental, social, and governance (ESG) activities and their disclosure on firm value. Using a large cross-sectional data set comprising FTSE 350 listed firms (Li et al., 2018). investigate whether superior environmental, social, and corporate governance (ESG) disclosure affects firm value (Lokuwaduge & Heenetigala, 2017). explore the extent of ESG reporting of metal and mining sector companies listed in the Australian Securities Exchange to determine the nature of ESG indicators in use in the sector. The empirical analyses suggest that the benefits of ESG disclosure outweigh their costs for the average listed firm (Yu et al., 2018).

**H5:** ESG information disclosure can improve enterprises' value.

## 5. Research design

### 5.1. Sample selection and data sources

As my research object, China's energy industry uses GICS industry classification in Flush software, including the oil and gas supply chain, equipment, and services of the entire energy industry. The Global Industry Classifications Standard (GICS)SM system, jointly developed by Standard & Poor's and Morgan Stanley Capital International (MSCI), is popular among financial practitioners, whereas the Fama and French [1997] algorithm is used primarily by academics. The study found that in most research applications encountered by finance scholars, the GICS classification system provides a better technique for identifying industry peers. Given that GICS information increases availability at a relatively low cost and is widely accepted by finance practitioners, we believe our results provide a strong case for the wider adoption of GICS by academic researchers in projects involving industry classifications. (Bhojraj et al., 2003)According to the Global Industry Classification Standard (hereinafter GICS), the energy industry consists of firms that are in the business of oil and gas, coal, and other consumable fuels' exploration, production, refining, marketing, storage, and transportation (Andriuškevičius & Štreimikienė, 2021).

This paper selects the data of listed energy companies in GICS categories in Shanghai and Shenzhen A-share markets from 2018–2021 four years as samples. These public companies normally released their financial and non-financial information during the annual period, ESG data collected from the Wind ESG database. To make the research result clearer and more accurate, the data was clear through Removing missing data, such as missing ESG ratings and missing companies or years with ROA and T-values, which were eliminated, leaving 296 subjects.

## 5.2. Variables and measurements

### 5.3. Model construction

To test the objective hypothesis, we first model the impact of ESG performance and firm value. Then, according to the three-step approach of Baron and Kenny (1986), the mediating effect, corporate reputation, and the cost of debt are tested. The corporate value of this study is mainly reflected by the value of Tobin's Q. Therefore, three groups of related models are divided into empirical tests.

### 5.4. ESG score, reputation and firm's value

- (1) Tobin's  $Q_{it} = \alpha_{10} + \alpha_{11}ESG_{it} + \alpha_{12}SIZE_{it} + \alpha_{13}REVENUEGROWTH_{it} + \alpha_{14}BTM_{it} + \alpha_{15}OWNERSHIP_{it} + \alpha_{16}COVID-19_{it} + \alpha_{17}cost\ of\ debt_{it} + \epsilon_{1it}$
- (2) Reputation  $it = \alpha_{20} + \alpha_{21}ESG_{it} + \alpha_{22}SIZE_{it} + \alpha_{23}REVENUEGROWTH_{it} + \alpha_{24}BTM_{it} + \alpha_{25}OWNERSHIP_{it} + \alpha_{26}COVID-19_{it} + \alpha_{27}cost\ of\ debt_{it} + \epsilon_{2it}$
- (3) Tobin's  $Q_{it} = \alpha_{30} + \alpha_{31}ESG_{it} + \alpha_{32}Reputation_{it} + \alpha_{33}SIZE_{it} + \alpha_{34}REVENUEGROWTH_{it} + \alpha_{35}BTM_{it} + \alpha_{36}OWNERSHIP_{it} + \alpha_{37}COVID-19_{it} + \alpha_{38}cost\ of\ debt_{it} + \epsilon_{3it}$

In the formula, Tobin's  $Q_{it}$  is Tobin's Q of the company  $i$  in year  $t$ . The cost of debt is the debt cost of the company  $i$  in year  $t$ , and  $\alpha_{10}$ ,  $\alpha_{20}$ , and  $\alpha_{30}$  are constant terms.  $\epsilon_{1it}$ ,  $\epsilon_{2it}$  and  $\epsilon_{3it}$  are residual terms,  $\alpha_{11}$  is the influence coefficient of ESG performance on the company's market value,  $\alpha_{21}$  is the influence coefficient of ESG performance on the company's reputation,  $\alpha_{12}$ - $\alpha_{38}$  is the influence coefficient of each control variable on the company's market value. If  $\alpha_{11}$  is significantly positive, hypothesis H5 is verified; That is, the improvement of ESG performance is conducive to the improvement of the company's market value. If  $\alpha_{21}$  is significantly positive, hypothesis H1 that ESG performance improvement is beneficial to corporate reputation improvement is verified. The check steps are the same as in the previous section.

### 5.5. ESG score, cost of debt and firm's value

- (4) Tobin's  $Q_{it} = \alpha_{40} + \alpha_{41}ESG_{it} + \alpha_{42}SIZE_{it} + \alpha_{43}REVENUEGROWTH_{it} + \alpha_{44}BTM_{it} + \alpha_{45}OWNERSHIP_{it} + \alpha_{46}COVID-19_{it} + \alpha_{47}Reputation_{it} + \epsilon_{1it}$
- (5) cost of debt  $it = \alpha_{50} + \alpha_{51}ESG_{it} + \alpha_{52}SIZE_{it} + \alpha_{53}REVENUEGROWTH_{it} + \alpha_{54}BTM_{it} + \alpha_{55}OWNERSHIP_{it} + \alpha_{56}COVID-19_{it} + \alpha_{57}Reputation_{it} + \epsilon_{2it}$
- (6) Tobin's  $Q_{it} = \alpha_{60} + \alpha_{61}cost\ of\ debt_{it} + \alpha_{62}ESG_{it} + \alpha_{63}SIZE_{it} + \alpha_{64}REVENUEGROWTH_{it} + \alpha_{65}BTM_{it} + \alpha_{66}OWNERSHIP_{it} + \alpha_{67}COVID-19_{it} + \alpha_{68}Reputation_{it} + \epsilon_{3it}$

Where Tobin's Q is the TBQ value of company  $i$  in period  $t$ , cost of debt is the debt cost of company  $i$  in period  $t$ ,  $\alpha_{40}$ ,  $\alpha_{50}$ , and  $\alpha_{60}$  are the constant terms  $\epsilon_{1it}$ ,  $\epsilon_{2it}$  and  $\epsilon_{3it}$  are residual terms,  $\alpha_{41}$  is the ESG performance coefficient on firm's value Tobin's  $Q_{it}$ .  $\alpha_{42}$  is the influence coefficient of ESG performance on cost of debt, and  $\beta_{42}$ - $\alpha_{38}$  is the influence coefficient of control variable on company market value. If the  $\alpha_{41}$  coefficient is significantly positive, hypothesis H5 is verified; That is, the improvement of ESG performance is conducive to the improvement of the company's market value. If the coefficient  $\alpha_{51}$  is significantly positive, hypothesis H3, that is, the improvement of ESG performance is conducive to reducing the cost of corporate debt, is verified. The check steps are the same as in the previous section.

## 6. Empirical results and discussion

### 6.1. Descriptive statistic

Table 1 shows the variables and measurements mentioned in this paper. Descriptive statistics in Table 2 show all the variables covered in this paper. In the sample, Tobin's value ranges from 0.765 to 8.246, with an average value of 1.459; The value of ROA varies from -112.8 to 27.35, with an average value of 3.235. The range is wide, which is also reflected in the high values of skewness and kurtosis. The ESG rating varies from 2.900 to 8.510, with an average value of 6.061, indicating that the ESG rating of the energy industry is generally good, but there are

**Table 1. Variables and measurements**

Variables	Expected sign	Description
Tobin'sQ	+	Tobin's Q = market value/replacement cost, which is often used by scholars to measure the market value of enterprises. Due to the lag of this correlation, Tobin's Q value can effectively combine financial and market data more easily than accounting indicators, and can more accurately reflect the long-term performance of enterprises, which not only reflects the previous achievements of enterprises but also reflects the long-term performance of enterprises.
ESG	+	Actual ESG scores provided by Wind ESG database
Environment	+	Actual E scores provided by Wind ESG database
Social responsibility	+	Actual S scores provided by Wind ESG database
Corporate governance	+	Actual G scores provided by Wind ESG database
Reputation	+	A firm's reputation refers to the beliefs of various stakeholders regarding the likelihood that the firm will deliver value along key dimensions of performance chiefly product quality and financial performance. (Rindova et al., 2006) Corporate reputation is the collective assessment that all stakeholders make about the trustworthiness of an organization, and its character, which influences their decision to trust and support.(van der Merwe & Puth, 2014)
Cost of debt	-	The cost of debt is the effective interest rate that the company pays on its debts, such as bonds and loans.
Size	+	The proxy for the size of a firm is obtained by taking the natural logarithm of its total assets (Demsetz & Lehn, 1985; Hackston & Milne, 1996; McWilliams & Siegel, 2001; Black et al., 2006).
Revenue growth	+	The revenue growth of a firm is measured by the percentage of changes in the sales level from year t-1 to year t (Wasiuzzaman, 2019).
BTMV	+	The BTMV is used to control firms' growth, which is measured as the company's book value over its market value (Li et al. , 2014; Kumar & Firoz, 2018).
Ownership	+	Whether it is state-owned or not
Covid-19	-	Suppose companies are hit by COVID-19 in 2020

also low scores. From the single score of E, S, and G: First, E represents the environmental score, which ranges from 0 to 8 points. More than 25% of enterprises get 0 points for the environment, indicating that there is significant environmental pollution. The highest score was 8, with an average of 1.782; In the context of China's double carbon goal, the management of enterprises with low environmental scores should reflect more, analyze the main reasons for the low environmental scores of enterprises, and improve the behaviors of enterprises that damage the environment in modern times when environmental protection is so important. The average score of environments in 50 percent of the companies was only 1.100, and that in 75 percent of the companies was only 2.930, indicating that environment played a role in lowering the score in the ESG rating. The second is S, representing social responsibility, which ranges from 0 to 8.640. The highest score is better than the environmental score, from 2.870 to 5.460, with a median of 4.410 and an average of 4.232. At present, there is still huge room for improvement in the contribution of energy enterprises to social responsibility. In addition, G is the score, G represents corporate governance, and the average score of corporate governance is as high as 7.059, are E, S, and G are three of the highest score of the role, and is also a relatively successful part of energy enterprises; The standard deviation (0.891) is lower than

**Table 2. Descriptive statistics**

variable	N	mean	sd	min	p25	p50	p75	max
E	325	1.782	2.078	0	0	1.100	2.930	8
S	325	4.232	1.893	0	2.870	4.410	5.460	8.640
G	325	7.059	0.891	2.860	6.610	7	7.450	9.700
ESG	326	6.061	0.905	2.900	5.460	5.920	6.540	8.510
Reputation	326	19.80	2.421	11.12	17.85	19.70	21.37	25.50
Cost of debt	326	0.0170	0.0300	-0.177	0.0100	0.0210	0.0310	0.104
Size	326	23.03	1.802	19.27	21.73	22.93	24.08	28.64
Revenue growth	357	16.57	48.64	-96.20	-5.630	9.693	28.27	457.5
BTMV	326	0	0	0	0	0	0	0
Ownership	310	0.600	0.491	0	0	1	1	1
Covid19	376	0.250	0.434	0	0	0	0.500	1
T	326	1.459	0.935	0.765	0.980	1.158	1.553	8.246
ROA	326	3.235	11.01	-112.8	2.060	4.574	7.226	27.35

that of the environment (2.078) and social responsibility (1.893), indicating a small gap between enterprises. The minimum value of social governance is 2.860, the maximum is 9.700, close to the full score, 75% of enterprises score more than 5.460 points, indicating that the execution of corporate governance is strong, and most enterprises pay more attention to corporate governance activities.

In descriptive statistics, the intermediary variable “reputation”, measured using the natural logarithm of assets, has an average of 19.80, a minimum of 11.12, and a maximum of 25.50; The intermediate variable “cost of liabilities”, measured by the ratio of interest on liabilities to liabilities, varied from -0.177 to 0.104, with an average of 0.0170; The size of enterprises is represented by assets. The size of selected samples ranges from 19.29 to 28.64, with a median of 23.03.

In descriptive statistics, control variables include firm size, profit growth, firm attributes, and factors affecting the COVID-19 pandemic in 2020. Growth of the current year’s sales revenue/total sales revenue of last year was used to measure the profit growth rate of the enterprise. Due to the different enterprise sizes of the 357 samples, therefore, the standard deviation is larger, reaching 48.64. The profit growth rate varies from -5.630 to 457.5, with an average of 16.57, indicating that most enterprises can achieve profitable growth. The median is 9.693, indicating that the growth rate of more than half of enterprises is higher than 9.693, and that of 75% of enterprises is higher than 28.27. The highest was 457.5, indicating that the amount of profit growth in that year was four times that of last year’s revenue, which was a considerable growth rate. If the enterprise is a state-owned holding, it is expressed by 1, and if it is not, it is expressed by 0. According to the data, there are general enterprises above that are state-owned holding enterprises; Meanwhile, a quarter of the sample companies have been affected by the COVID-19 pandemic.

**6.2. Correlation analysis**

Pearson correlation analysis involves estimating the correlation matrix to avoid bias in the model. Table 3 shows the correlation coefficients of all variables to check the statistical relationship between dependent and independent variables and determine whether there is a col-linearity problem.

ROA is significantly positively correlated with E, S, G, ESG, reputation, size, and revenue growth. ROA was significantly negatively correlated with the cost of debt, BTMV, and covid-19. This

Table 3. Pearson correlation analysis

	E	S	G	ESG	reputation	cost of debt	size	revenue growth	BTMV	ownership	covid19	ROA	T
E	1												
S	0.6088*	1											
G	0.5442*	0.5537*	1										
ESG	0.8484*	0.8264*	0.7385*	1									
reputation	0.6398*	0.4201*	0.3537*	0.5582*	1								
cost of debt	0.00810	0.0366	-0.1102*	-0.0293	0.1300*	1							
size	0.885	0.511	0.0472	0.598	0.0188	0.1470*	1						
revenue growth	-0.0505	-0.0248	0.0559	-0.00670	-0.105	-0.1880*	-0.0703	1					
BTMV	0.375	0.663	0.326	0.906	0.0631	0.000800	0.216	-0.0797	1				
ownership	-0.4669*	-0.3579*	-0.3520*	-0.4543*	-0.5235*	-0.0609	-0.6670*	0.160	-0.4176*	1			
covid19	0	0	0	0	0	0.273	0	0.175	0	-0.0150	1		
ROA	0.3790*	0.1424*	0.1827*	0.2746*	0.4553*	-0.0488	0.4678*	-0.0790	0.0963	0.792	-0.0662	1	
T	-0.2362*	-0.1985*	-0.0843	-0.2257*	-0.5985*	-0.2080*	-0.5622*	0.2351*	0.0496	0	0.233	-0.2375*	1
	0	0.000300	0.130	0	0	0.000200	0	0	0.372	0	0.371	0	0

indicates that the COVID-19 pandemic and debt costs have negatively impacted corporate value. To avoid col-linearity problems, highly correlated variables are excluded.

When the independent variables in the model produce very serious col-linearity, it will affect the reliability of the mediation results in the model. In statistical analysis methods, col-linearity can be detected using the Pearson correlation test and variance wave number test. The variables in the Pearson correlation test model are applied in the doctoral thesis, and the test results are shown in the table.

As can be seen from the table, except for the relationship between ESG and E, S, and G, the maximum correlation coefficient between enterprise size and reputation is 0.8630, with col-linearity risk, and the rest are all less than 0.8. Therefore, there is no serious col-linearity problem among the selected variables. This paper can continue to study the next step and draw conclusions through a regression analysis model.

### 6.3. Regression analysis of the relationship between ESG performance, reputation, cost of debt, and company market value

First, in Panel data analysis, the Hausman test is sometimes described as a test for model misspecification, this test can help this paper choose between fixed effects model or a random effects model. The null hypothesis is that the preferred model is random effects. Essentially, the tests look to see if there is a correlation between the unique errors and the regressors in the model. The null hypothesis is that there is no correlation between the two. If the p-value is small (less than 0.1), reject the null hypothesis.

The regression results can be seen in the Table 4, when reputation is not used as a mediating variable, ESG performance has a clear correlation with the value of the firm. When reputation is used as the mediating variable, this significant effect is slightly increased, indicating that the positive correlation between reputation and ESG performance and enterprise value becomes more significant, which confirms the original hypothesis. As can be seen from Model (2), there is a positive correlation between ESG performance and corporate reputation, but not significant, thus rejecting hypothesis H1. However, in Model (3), reputation is negatively correlated with

**Table 4. Regression results of ESG performance, reputation, and the company's market value**

	<b>Model1</b>	<b>Model2</b>	<b>Model3</b>
<b>Variables</b>	<b>TBQ</b>	<b>Reputation</b>	<b>TBQ</b>
ESG	0.145***(0.052)	0.0429 (0.0936)	0.153***(0.0498)
Reputation	---	---	-0.166***(0.0313)
Size	-0.475***(0.0332)	1.212***(0.0597)	-0.274***(0.0495)
Revenue growth	0.00168**(0.00075)	-0.00036(0.00135)	0.00162**(0.000717)
BTMV	-4860E+09***(4.750E+8)	2.60E+09***(8.54E+08)	-4.43E+09***(4.610E+08)
Covid-19	0.0835(0.074)	0.0709(0.133)	0.0498
Ownership	-0.304***(0.0882)	0.43***(0.159)	-0.233***(0.0854)
Cost of debt	-2.779**(1.351)	2.985(2.431)	-2.285*(1.295)
Constant term	12.2(0.689)	-8.958(1.24)	10.72***(0.716)
Sample size	296	296	296
Fix effect	YES	YES	YES

Note: The values in parentheses are standard errors.

\*Significant at the level of 10%,

\*\*Significant at the level of 5%.

\*\*\*Significant at the level of 1%.

enterprise value, which rejects hypothesis H2. Therefore, the influence of ESG performance on enterprise value cannot depend on the intermediary variable reputation.

Note that the Wind ESG Rating releases a company's ESG performance rating for the previous year in the middle of each year, so all other variables in models (1)-(3) are essentially one stage behind the ESG variable. This eliminates the possibility of two-way causality when the ESG variable is the key explanatory variable. On the other hand, the TBQ value we selected is the sum of the current market ending net liabilities and ending net liabilities divided by the ending net assets, which is defined as the point representing the ending value of the enterprise, while the variable of financial performance indicator reflects the average capacity of the whole year, so there can be no two-way causal relationship between them. Therefore, the regression results in Table 4 do not have endogeneity problems caused by causal inversion. On the other hand, the fixed effect model is used in the regression of the model, which can partially solve the endogeneity problem caused by missing variables. To sum up, the regression results in Table 4 are valid.

Same to the test procedure in the previous section, the Hausman test is first used to select the fixed effect model or random effect, model. See Table 5 for the results, as can be seen from the regression results in Model 4, the ESG performance of the company is significantly positively correlated with the market value of the company, thus verifying the theoretical hypothesis H5. In addition, there is a significant negative correlation between ESG performance and the cost of debt, which verifies the theoretical hypothesis H3. When the two variables of ESG performance and the cost of the debt of the company are put into the same model (Model 6), the regression coefficients of ESG performance and cost of debt are significant. This means that the impact of the company's improvement of ESG performance on market value is partly caused by the cost of debt. The regression results verify the theoretical hypothesis that the cost of debt is an important channel for the company's ESG performance to affect market value.

In the previous subsections, we find empirical evidence that generally supports the hypotheses H2, H3, and H4 presented in our study. In this subsection, we retest the robustness of the conclusions derived from the main regressions above using several methods, including substituting dependent variables, substituting independent variables, controlling for endogeneity due to possible reverse causality, instrumental variable (IV) estimates, and Heckman's two-stage estimates.

**Table 5. Regression results of ESG performance, cost of debt, and the company's market value**

	<b>Model4</b>	<b>Model5</b>	<b>Model6</b>
<b>Variables</b>	<b>TBQ</b>	<b>cost of debt</b>	<b>TBQ</b>
ESG	0.164***(0.0495)	-0.00509**(0.00224)	0.153***(0.0498)
Cost of debt			-2.285*(1.295)
Size	-0.278***(0.0496)	0.00158(0.00225)	-0.274***(0.0495)
Revenue growth	0.00186***(0.000707)	-0.000103***(0.000032)	0.00162***(0.000717)
BTMV	-4.42E+09***(4.63E+08)	-5.302E+06(21000000)	-4.43E+09***(4.610E+8)
Covid-19	0.0919(0.0711)	0.00145(0.00322)	0.0952(0.0708)
Ownership	-0.209**(0.0846)	-0.0106***(0.00383)	-0.233***(0.0854)
Reputation	-0.17****(0.0314)	0.00175(0.00142)	-0.166****(0.0313)
Constant term	10.75****(0.719)	-0.0135(0.0326)	10.72****(0.716)
Sample size	296	296	296
Fix effect	YES	YES	YES

Note: The values in parentheses are standard errors.

\*Significant at the level of 10%,

\*\*Significant at the level of 5%.

\*\*\*Significant at the level of 1%.



#### 6.4. Robustness test

Alternative Dependent Variable. It can use an alternative proxy variable, firm value, to perform additional robustness checks. According to the Robustness test, Step 3 Develops models that change the assumptions of the baseline model one at a time. These alternatives are known as robustness testing models (Neumayer & Plümper, 2017). These alternatives are known as robustness testing models. Instead of using Tobin Q, this paper uses price-to-book ratio (PB) as the proxy variable of corporate value, which is calculated by the ratio of the market value of the stock to the book value of net assets, similar to the reference (Aouadi & Marsat, 2018). Using alternative dependent variables, this paper re-estimated the regressions specified with PB valuation (data from the Flush financial database), and regression of models (7) - (9) was conducted again. The regression results are shown in Table 6, the mediating effect of the cost of debt still exists, so the index selection of operating capacity in this paper is robust.

#### 6.5. Further study

Generally speaking, the drivers of ESG improvement are different for listed companies with different equity rights. As a relatively pure market participant, the main motive of non-state-owned enterprises is to improve ESG to obtain economic returns and pursue profit maximization. In contrast, ESG practices of state-owned enterprises(soes') pay more attention to the system, policy factors, and social influences. In addition, soes' performance of social responsibility is often regarded as their "duty", and they face high public pressure and social expectations in terms of ESG performance, leading to a low market response to social responsibility's improvement of ESG performance. Considering the different property rights, the samples are divided into state-owned enterprises and non-state-owned enterprises according to the nature of the actual controller. A total of 41 non-state-owned enterprises and 53 state-owned enterprises were obtained, which were respectively substituted into models (10)-(15). The test results are shown in Tables 7 and 8. It can be seen from Table 7 that, first of all, different from the results in Table 5, for the samples of listed companies with state-owned backgrounds, when both the ESG index and debt cost are controlled, the impact of the ESG index on debt cost is no longer significant. It can be seen that, for the samples of listed companies with non-state assets, the impact of the ESG index on company value is realized through debt cost, which is a typical complete intermediary effect.

**Table 6. Robustness test: replace the explained variable**

	<b>Model7</b>	<b>Model8</b>	<b>Model9</b>
<b>VARIABLES</b>	<b>PB</b>	<b>Cost of debt</b>	<b>PB</b>
Cost of debt	.	.	-7.009*(-1.87)
ESG	0.112***(2.64)	-0.001**(-2.07)	0.102**(2.41)
size	-0.239***(-5.63)	-0.000(-0.64)	-0.242***(-5.72)
Revenue growth	0.001(1.17)	-0.000***(-2.75)	0.001(0.86)
BTMV	-2.316e+09***(-5.81)	-9223138.000(-1.48)	-2.381e+09***(-5.98)
ownership	-0.142*(-1.96)	-0.002**(-2.10)	-0.158**(-2.19)
covid19	0.051(0.73)	-0.001(-0.61)	0.046(0.66)
reputation	-0.063**(-2.34)	0.001(1.65)	-0.058**(-2.16)
Constant	8.237***(13.43)	0.028***(2.94)	8.435***(13.61)
Observations	296	296	296
R-squared	0.424	0.059	0.431
Pseudo R2	0.410	0.0360	0.415
t-statistics in parentheses			
* p<0.1			
** p<0.05			
*** p<0.01			

**Table 7. Regression results of the mediating effect of different enterprises' cost of debt for state-owned energy companies**

	<b>Model 10</b>	<b>Model 11</b>	<b>Model12</b>
<b>VARIABLES</b>	<b>T</b>	<b>Cost of debt</b>	<b>T</b>
			(.)
Cost of debt	.	.	-5.866***
	(.)	(.)	(-5.19)
ESG	0.108***	-0.002	0.095***
	(4.35)	(-1.44)	(4.07)
Size	-0.141***	0.000	-0.141***
	(-5.31)	(0.09)	(-5.65)
Revenue Growth	0.000	-0.000	0.000
	(0.42)	(-0.50)	(0.25)
BTMV	-1.353e+09***	-3854402.250	-1.376e+09***
	(-3.19)	(-0.15)	(-3.47)
Covid19	-0.013	-0.001	-0.021
	(-0.31)	(-0.52)	(-0.53)
Reputation	-0.066***	0.001	-0.060***
	(-4.00)	(0.97)	(-3.90)
Constant	5.338***	0.010	5.395***
	(12.58)	(0.36)	(13.62)
Observations	181	181	181
R-squared	0.563	0.025	0.622
Pseudo R2	0.548	-0.00837	0.606
t-statistics in parentheses			
* $p < 0.1$			
** $p < 0.05$ ,			
*** $p < 0.01$			

Secondly, for enterprises with state-owned assets, ESG has a significant impact on enterprise value. This may be due to the increase in the value of the ESG index to state-owned asset enterprises, which first received more attention from analysts and the media. Second, the degree of government intervention is high. Maintaining a good relationship with the government can bring political resources, on the contrary, it will reduce the government's support for debt, resulting in lower debt costs, but it will not be significantly affected by ESG. Finally, it is more convenient for state-owned enterprises to obtain support from the government and state-owned banks, and the marginal effect of ESG on obtaining related resources from the government and state-owned banks is relatively low.

Specific industries, such as energy and related industries, the chemical industry, and other industries that pose a greater threat to the environment and have more responsibilities to stakeholders, are operating (Blacconiere & Northcutt, 1997; Blacconiere & Patten, 1994) requires strategic ESG management. The relationship between CSR and firm value also varies by ownership and depends on economic conditions. During the 2008 global financial crisis, CSR overinvestment did not have a positive impact on firm value (Buchanan et al., 2018). Therefore, the input of ESGs is not only dependent on the industry but also influenced by different circumstances.

In addition to intangible resources such as culture, expertise, and market reputation (Grant, 1991), firms also create tangible resources through better ESG integration practices, namely technological advances to avoid environmental hazards and high cash reserves (Groenewegen &

**Table 8. Regression results of the mediating effect of different enterprises' cost of debt for non-state-owned energy companies**

	<b>Model 13</b>	<b>Model14</b>	<b>Model15</b>
<b>VARIABLES</b>	<b>T</b>	<b>Cost of debt</b>	<b>T</b>
			(.)
Cost of debt	.	.	-3.280**
	(.)	(.)	(-2.27)
ESG	0.102***	-0.007***	0.079**
	(2.66)	(-2.77)	(2.04)
size	-0.341***	0.001	-0.339***
	(-8.60)	(0.30)	(-8.70)
Revenue growth	-0.000	-0.000***	-0.000
	(-0.51)	(-3.36)	(-1.20)
BTMV	-2.421e+09***	-1.695e+07	-2.477e+09***
	(-9.70)	(-1.04)	(-10.06)
Covid19	0.048	0.003	0.059
	(0.81)	(0.87)	(1.01)
Reputation	0.005	0.002	0.011
	(0.21)	(1.18)	(0.47)
Constant	8.719***	0.016	8.770***
	(14.50)	(0.40)	(14.85)
Observations	115	115	115
R-squared	0.659	0.198	0.674
Pseudo R2	0.640	0.154	0.653
t-statistics in parentheses			
* $p < 0.1$			
** $p < 0.05$ ,			
*** $p < 0.01$			

Vergagat, 1991; Hart, 1995; Kemp, 1994). These tangible and intangible capabilities are required for industries primarily responsible for greenhouse gas emissions, air pollution, and waste management, such as energy and related industries. Specifically for the global energy industry, Shahbaz et al. (2020) found that higher CSR performance in ESG scores does not guarantee higher financial performance—represented by market and accounting performance.

### 7. Summary and conclusion

This paper theoretically analyzes the relationship between ESG performance, corporate reputation, debt cost, and corporate market value, and selects panel data of some A-share listed companies to conduct an empirical study using the intermediary effect model. The results show that:

- (1) The improvement of listed companies' ESG performance is conducive to reducing debt costs but has no significant impact on improving corporate reputation.
- (2) The improvement of listed companies' ESG performance is conducive to improving the company's market value, and debt cost are one of the important mediating ways that ESG performance affects the company's market value.
- (3) Further research shows that the listed companies with actual controllers of non-state capital have the complete intermediary effect, while the listed companies with actual controllers of state capital have no obvious intermediary effect.

These research outcomes contribute to the stakeholder theory. First of all, it is a necessary policy goal for policymakers and regulators to pay more attention to ESG performance rating and enhance enterprises' willingness to actively manage ESGs. In December 2016, the European Commission established a High-Level Group of Experts (HLEG) to develop a comprehensive and detailed EU sustainable financial strategy. On 31 January 2018, HLEG published its final report. This report presents a holistic view of sustainable finance in Europe and establishes two financial system imperatives. The first is to increase finance's commitment to long-term inclusive development. The second objective is to improve financial stability by fostering awareness of environmental, social, and governance (ESG) issues when making investment decisions. That shaped policymakers around the world.

Secondly, for enterprises, ESG performance management can bring benefits to their operation and maintenance of market value. Therefore, enterprises should correct the previous wrong views and actively maintain and improve their ESG performance. Companies need to respond to changing consumer preferences to stay viable. Volvo, for example, is now switching to becoming an all-electric vehicle manufacturer by 2030 "to take advantage of the growing demand for electric vehicles", in response to government policies restricting the sale of new fossil fuel-powered vehicles (BBC News, 2021). Therefore, it is necessary to study how government policies change consumer preferences to drive the improvement of ESG performance to understand how it affects future climate change-related policies.

Finally, from the perspective of investors, institutional investors, mainly asset management institutions, should continue to explore the feasibility of investment strategies based on ESG performance and strengthen research and analysis.

For example, BlackRock, the world's largest investment fund, is shifting its investment strategy to focus on sustainability for the reason that investors now recognize that "climate risk is investment risk". This risk translates into stranded assets and resources, as the low-carbon economy renders certain assets worthless or even turns them into liabilities (Bos & Gupta, 2019). As investors now need to better understand the relationship between climate change and investment risk, the demand for investment-grade climate change and other ESG performance information is growing exponentially.

In addition, ESG investment practice is carried out at the buying end, and the development of related products is strengthened at the end of the sales based on the ESG investment concept. As for individual investors, with the improvement of the capital market information disclosure system of China, we can incorporate the disclosed ESG information and ESG rating into our investment strategy, and make full use of the ESG rating in choosing an excellent company, to improve the ability of their assets to resist the risk and stabilize return.

In the long run, the positive impact of ESG score on firm value supports the stakeholder theory. However, in developing economies like China, it takes longer to create intangible resources such as corporate culture and reputation in the market due to instability in political and institutional systems, regulations, norms on carbon emissions and environmental hazards, pollution, and various social issues related to wages and other aspects. Customers in the initial years may not be prepared to pay more for sustainable or green products, so we observe a lag time to reap the benefits of ESG investments in enterprise value. In a developing economy like China, this lagging gain is due to the cost of environmentally and socially responsible investments in the early years. Executives may be reluctant to invest in such initial returns unless they are legitimate.

Specifically, concerning companies in the energy and related sectors, the market punishes companies for irresponsible environmental management and attracts penalties and legal fees for companies that do not disclose their carbon emission activities. In the case of greenhouse gas emissions or environmental pollution from the energy and related sectors, ESGs and

“environmental” disclosures lead to higher company values in the long run (Matsumura et al., 2014). In the long run, ESG investment reduces corporate risk because it improves reputation in the long run, which may manifest as a cost in the short run, but it does so through the creation of intangible resources and smaller fluctuations in stock prices and corporate values (Godfrey et al., 2009; Jo & Na, 2012) to reduce operational risks, to gain benefits in the long run.

The limitation of this study is that first of all, only the energy industry is selected, so the new energy industry can be studied in the future. Secondly, since ESG’s rating agencies have just emerged in China, more years of data can be selected as samples in the future. Furthermore, for model selection, the Evans model can be used as a dynamic model to predict future data (He et al., 2021).

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#### Disclosure statement

No potential conflict of interest was reported by the author(s).

#### Citation information

Cite this article as: An analysis on the relationship between ESG information disclosure and enterprise value: A case of listed companies in the energy industry in China, Dong Siwei & Wongvanichtawee Chalermkiat, *Cogent Business & Management* (2023), 10: 2207685.

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