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Corporate management, green finance, and sustainability

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This study aimed to assess the impact of green finance and corporate management on China's sustainable development index from 1990 to 2020 using time series analysis. The findings reveal that a 1% increase in the green financial market corresponds to a 0.31% and 0.69% enhancement in China's sustainable development index in the short and long-term, respectively. Similarly, a 1% improvement in the corporate governance index is associated with a 0.16% and 0.29% increase in the short- and long-term. Interestingly, the green tax policy, acting as a proxy for green fiscal policy, negatively influences the sustainable development index. Additionally, the poverty rate emerges as a concerning factor hindering sustainable development in China. The policy implications include advocating for the digitalization of green finance, expanding poverty alleviation efforts, reforming the green taxation system, and implementing corporate sustainable management education programs.

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Introduction

During the eighteenth century and the early stages of the British revolution, the focus of nations was not on the depletion of natural resources or climate change. Instead, they were immersed in the rapid waves of industrialization and the migration of people from rural areas to urban centers. Industrialization and urbanization became the defining socio-economic identity, with countries aligning their political and economic interests accordingly (Antoci et al., 2018; Usman and Balsalobr-Lorente, 2022; Ren et al., 2023). It's crucial to acknowledge that the progress of industrialization and modern urbanization over the past three centuries relied heavily on the consumption of natural resources. As time passed, particularly from the late nineteenth century onward, concerns regarding environmental pollution and the disruption of the planet's ecosystem grew. In 1992, the concept of sustainable development was introduced during the Earth Summit held in Brazil (Soykan and Atasoy, 2012). Sustainable development, as defined, is the pursuit of social satisfaction and economic growth within the framework of environmental conservation and responsible use of natural resources.

Sustainable development seeks to redefine economic progress beyond the realms of mere economic growth and social well-being. It encompasses broader considerations such as energy, urbanization, poverty alleviation, hunger, and the promotion of environmentally friendly economic prosperity (Bonnedahl et al., 2022; Filho et al., 2023). The essence of sustainable development lies in ensuring the safeguarding of the environment and natural resources. It charts a course where the social and economic development of nations continues unabated, yet economic activities evolve responsibly, preserving the delicate balance of the planet's ecosystem. Numerous experts, including Rasoulinezhad (2020), Vuuren et al. (2022), Zakari et al. (2022), and Sun et al. (2023), emphasize that the well-being of future human life hinges on the adoption of sustainable development practices. They argue that any alternative to sustainable development not only jeopardizes economic prosperity but also leads to the depletion of natural resources, escalating the threats of global warming and climate change. This imperative has become even more apparent in the aftermath of the COVID-19 pandemic, with carbon dioxide emissions rebounding to precarious levels (Min et al., 2022). Consequently, the demand for green economic revitalization and sustainable development by nations has surged.

The pursuit of sustainable development goals is far from being a straightforward and swift endeavor. Various obstacles, each with its distinct characteristics, pose challenges along the path to achieving these goals. Among these hurdles, the issue of insufficient capital for environmentally friendly investments stands out significantly, particularly in developing countries (Yoshino et al., 2021; Rasoulinezhad and Taghizadeh-Hesary, 2022; Li et al., 2023). Capital accumulation in developing countries is not in an advantageous position, limiting the government's capacity to invest in all economic projects. Consequently, the focus is often on prioritizing projects with rapid returns. The private sector, too, faces financial constraints, with major economic enterprises hesitating to engage in green projects due to perceived investment risks and lower returns (Xu et al., 2022). Green projects, despite their environmental benefits that hold significance for countries, often lack the allure of efficiency and financial profitability. In the private sector, environmental considerations take a back seat to the primary priority of financial and economic profitability in companies' decision-making processes.

Addressing the capital shortage in green projects finds a significant remedy in the development of green finance. Green finance encompasses a diverse set of tools designed to offer financial services aimed at boosting investments in environmentally friendly initiatives. The creation of green financial instruments, such as green bonds, green loans, or green credit, not only establishes a transparent market based on supply and demand but also ensures the return of capital and favorable investment yields for the private sector. Scholars, including Li et al. (2021) and Tong et al. (2022), posit that the evolution of green finance will empower the private sector to increase its involvement in sustainable investments. The market size of green finance has experienced substantial growth over the past decade. According to Forrester (2021), the green finance market reached nearly 720 billion US dollars in 2021, with over 522.7 billion US dollars attributed to issued green bonds. Projections indicate a continued expansion, with the green finance market expected to reach a staggering 22,485 billion US dollars by 2031. This trajectory underscores the recognition that countries are placing on green financial policies as a pivotal solution in achieving sustainable development goals.

Another important issue is the method of resource management in economic enterprises. As we know, companies are important consumers of fossil fuels due to their productive role in the economy. At the same time, due to market competition, they are looking for innovation and new technologies. The concept of corporate management includes the use of tools and strategies to maximize the use of available resources in order to achieve the company's economic goals and in terms of social and environmental responsibilities. Corporate management has a comprehensive view of the company's responsibilities towards shareholders, society, and the environment and can use new technologies such as big data to find appropriate solutions to optimize the use of resources available to the company. Baumgartner and Rauter (2017) emphasize that corporate sustainability management would bring the best solutions for an enterprise to become eco-friendly and support environmental restoration and conservation.

This article delves into the research progress by examining the correlation between green finance and corporate management in influencing China's sustainable development index. The choice of China as the focal point holds significance for various reasons. Firstly, China plays a pivotal role in global environmental pollution and fossil fuel consumption. It claims the top spot in carbon dioxide emissions globally and stands as one of the largest consumers of fossil fuels, including coal and crude oil. The annual combustion of millions of tons of fossil fuel in Chinese manufacturing factories and power plants contributes significantly to carbon dioxide emissions. Secondly, studying China is crucial due to its demonstrated commitment to implementing sustainable development goals. The country has instilled hope for a better environmental future by unveiling two noteworthy initiatives: aiming for a carbon peak by 2030 and achieving carbon neutrality by 2060. Moreover, China boasts one of the world's largest green finance markets, securing the second position in the global market for issued green bonds in 2021. Anticipations indicate that the Chinese green finance market is poised to reach a staggering 7.8 trillion US dollars by 2030.

This research makes noteworthy contributions to advancing the current literature in several ways. Firstly, it focuses on examining the composite sustainable development index of China, which incorporates economic, social, and environmental indicators. Additionally, the corporate management index for China is measured using the approach outlined by Aliabadi et al. (2017), rooted in the concept of good governance.

The structure of the paper is organized into six sections. The upcoming section provides a comprehensive review of prior literature, setting the stage for the research. Section "Theoretical mainstreams" delves into the theoretical underpinnings that

guide the study. The data description and the estimation process are expounded upon in the section "Data and estimation identification". Section "Empirical outputs" presents the empirical model's outputs. The final section serves as a conclusion, summarizing the research findings and offering policy implications, along with recommendations for future research expansion.

Literature review

Sustainable development emerged as the central focus of countries' economic activities in the post-corona era. In this critical period, it becomes imperative for nations to navigate towards social cohesion through a blend of diverse monetary and green financial policies, ultimately striving for sustainable goals. The commitment to supporting the environment and preserving natural resources, with the overarching aim of enhancing living conditions on our planet, echoes the sentiments expressed in prior studies within the realms of sustainable development and green growth.

The research aligns with the overarching purpose by categorizing the existing literature into two distinct groups: "studies on green finance and sustainable development" and "studies on corporate management and sustainable development." This classification provides a framework for exploring the interconnected dynamics of financial policies, corporate practices, and sustainable development goals in the evolving landscape of the post-corona era.

Green finance and sustainability. A cohort of scholars has underscored the efficacy of green finance in advancing sustainable development goals. In their research, Cui et al. (2020) posited that green finance serves as a catalyst, motivating enterprises and investors to actively engage in green finance markets, whether by borrowing loans, securing credit, or acquiring bonds, as part of a green policy initiative to foster sustainability. Ronaldo and Suryanto (2022) highlighted the role of green finance in enhancing financial inclusion, thereby increasing the purchasing power of vulnerable households. The improved income quality of less affluent individuals, in turn, has a positive impact on investment flows into environmentally friendly projects.

Yu et al. (2022) and Huang et al. (2022) conveyed that green finance contributes to the amplification of sustainable innovation progress, particularly in developing countries. This is evident in the expansion of green research and development (R&D) facilitated by enhanced access of enterprises to green funds and services. Ma et al. (2023) asserted that the growth of the green finance market results in increased capital accumulation by private investors, fostering a boost in sustainable projects. They concluded that green finance has the potential to create a transparent market with more extensive green financial services. Mirza et al. (2023) demonstrated the efficiency of IT-based green finance markets in expanding enterprise access to a broader array of cheaper green financial instruments. In a separate paper, Umar and Safi (2023) underscored the imperative of the green finance market in promoting technological advancement and increasing the number of green-registered patents. They emphasized the role of green finance as a mediator connecting enterprises to sustainable targets.

Corporate management and sustainable prosperity. Another group of former studies has explored the vital role of corporate management in activating sustainable engines in countries. For example, Stacchezzini et al. (2016) determined the influential factors to have successful corporate green management in an enterprise. The paper highlighted the vital role of financial reporting, technological progress, and resource efficiency in enterprises. Dutta et al. (2016) expressed that sustainable corporate management leads enterprises to find green funds to invest in sustainable projects and also make plans to mitigate environmental adverse impacts. Baumgartner and Rauter (2017) made a discussion about corporate sustainability management as a pillar guaranteeing the implementation of sustainable development goals in enterprises. Corporate management will extract sustainable development trends and developments according to the company's performance and adjust and modify production, consumption, and distribution processes according to its sustainable development roadmap. Xia et al. (2020) revealed that through sustainable corporate management, the rate of innovation, social inclusion, and environmental quality are boosted. The corporate management finds the best eco-solutions for the challenges faced by the enterprises. Maia et al. (2022) stated that corporate management is the art of using resources (capital, labor force, natural resources) with the aim of financial prosperity and environmental quality improvements. Sanoran (2023) summarized that corporate management accelerates the greening of enterprises through innovation expansion, digitalization, and promotion of ESG (environment, social, and governance) investing. Park (2023) expressed that corporate sustainability management is an appropriate motivation for enterprise performance. The corporate management creates a green comparative advantage and circulation of materials in the production process.

Literature review. Green finance and corporate management stand out as crucial components in the pursuit of sustainable development goals. However, existing studies have overlooked the impact of these variables on China's sustainable development index. In this research endeavor, we aim to fill this gap by constructing a time series model that incorporates the calculation of both the corporate management index and the composite index of sustainable development. Additionally, we will introduce a green tax control variable to assess China's sustainable development's sensitivity to both green fiscal policy (using the green tax as a proxy) and green monetary policy (utilizing the green financial market size as a proxy). This comprehensive approach allows us to delve into the intricate dynamics between corporate practices, financial policies, and the overarching goal of sustainable development in the Chinese context.

Theoretical mainstreams

In this section, we delve into a theoretical discussion of the influences exerted by green finance and corporate management on sustainability.

Firstly, the symbiotic development of green finance and corporate management is poised to enhance companies' access to financial resources. Limited access to financial means has been a hindrance to the sustainable development of economic enterprises. Yet, the interplay between corporate management structures and the green financial market opens up avenues for companies to utilize a broader spectrum of green financial instruments, including green loans, green credits, green bonds, and green guarantees.

Furthermore, the evolution of the green financial market and robust corporate governance has the potential to elevate societal awareness and understanding of environmental threats, emphasizing the imperative to foster clean energy initiatives. Augmenting sustainable literacy within society enables more widespread participation in environmentally friendly projects, thereby advancing the overarching goals of sustainable development.

The development of the green financial market and effective corporate management also catalyze sustainable electricity

production within society. Given the significance of electricity consumption by companies in driving industrial devices and production lines, the benefits of sustainable electricity become more evident with the evolution of the green fiscal market and improved corporate management. Consequently, companies are more likely to invest in eco-electricity production projects using the green financial resources acquired from the green financial market.

Another avenue of influence wielded by corporate management and the green financial market on sustainable development is the potential for economic green revival within the country. Considering the adverse effects of the COVID-19 pandemic on global economic prosperity since 2019, the development of the green financial market and the enhancement of corporate management quality offer a pathway to revitalize post-corona economic activities with a heightened focus on environmental considerations.

Data and estimation identification

Data description. The research aims to discern the responsiveness of sustainable development to the interplay of green finance and corporate management in China. The annual data for the variables spans the period from 1990 to 2020. To ensure elasticity, the variables are introduced into the empirical model with a logarithmic transformation. The dependent variable is the composite sustainable development index of China, encompassing economic, social, and environmental indicators. The indices for this calculated sustainable development index are drawn from earlier studies, specifically Hickel (2020) and Hirai and Comim (2022). Additionally, the explanatory variables include the size of the green finance market and the corporate management index (based on Aliabadi et al., 2017).

To capture a more comprehensive picture, the empirical model incorporates control variables such as green tax, sustainable power generation, foreign direct investment (FDI) inflows, and the poverty ratio. The primary equation representing the variables in econometric form is expressed as Eq. 1.

$$LSDI_t = \alpha_0 + \alpha_1 \cdot LGFIN_t + \alpha_2 \cdot LCOR_t + \alpha_3 \cdot LGTAX_t + \alpha_4 \cdot LSPGE_t + \alpha_5 \cdot LFDII_t + \alpha_6 \cdot LPOVRA_t + \varepsilon_t \quad (1)$$

The symbols of the variables, shown in Eq. 1, are described in Table 1 as follows:

Anticipating the sign predictions for the coefficients of the independent variables, it is expected that the size of the green financial market will positively impact sustainable development. The expansion of the green financial market is likely to broaden the private sector's access to green financial instruments and services, fostering increased green investment in the economy. Similarly, the corporate management index is anticipated to play a positive role in promoting the quality of sustainable development. With corporate management adopting a holistic approach that integrates social and environmental responsibilities alongside financial profitability, strengthening corporate management is expected to enhance the sustainable development index.

The government's green tax revenue is also expected to positively influence the sustainable development index. An increase in green tax revenue will exert cost pressure on carbon-emitting companies, incentivizing more companies to undertake green projects aimed at reducing carbon dioxide emissions. The production of green electricity is anticipated to elevate the sustainable development index by reducing fossil fuel consumption in power plants and providing affordable green electricity to people across various social classes. This, in turn, improves the quality of life for households, especially those in lower-income brackets.

Foreign direct investment may have a varied impact on sustainable development. If the investment inflow is directed toward non-green projects, it could result in unsustainable economic growth. Conversely, if a country attracts green foreign direct investment, the funds will be channeled into environmentally friendly projects, contributing positively to the country's sustainable development.

The poverty rate is identified as a social factor that hinders the process of sustainable development in a country. Poverty signifies social injustice, a lack of social inclusion, limited community participation in green policies, and an insufficient development of a circular economy for waste management. Therefore, alleviating poverty is recognized as a key goal of sustainable development. The expected signs of the impacts of these variables are detailed in Table 2.

Estimation specifications. To assess the impacts of the independent variables, the research employs a systematic approach. Initially, a correlation matrix is constructed to examine the interrelationships among the variables. Subsequently, the stationarity of the variables is scrutinized using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) techniques. The analysis proceeds with ARDL (Autoregressive Distributed Lag) bound tests to investigate the co-integration associations between the variables. The subsequent step involves implementing Charemza and Deadman (1997) ARDL technique to estimate the coefficients in the long-term perspective. To obtain short-term coefficients, the error correction model is employed.

Additionally, the research conducts diagnostic tests and robustness checks as essential measures to ensure the reliability and appropriateness of the empirical findings. These comprehensive steps collectively contribute to a robust and well-founded analysis of the impacts and relationships among the variables in the study.

Table 1 Variables reported in Eq. 1.

Symbol in equation	Definition	Unit	Source
SDI	Composite sustainable development index	Index	Authors' calculation based on Hickel (2020), and Hirai and Comim (2022)
GFIN	Green finance market size	Million CNY	China Statistical Yearbook
COR	Corporate management index	Index	Authors' calculation based on Aliababi et al. (2017)
GTAX	Green tax revenue	Million CNY	China Statistical Yearbook
SPGE	Sustainable power generation	Giga Watt	China Statistical Yearbook, BP
FDII	Foreign direct investment inflows	Billion CNY	China Statistical Yearbook
POVRA	Poverty ratio	Ratio	World Bank

Source: Authors.

Empirical outputs

The output of the empirical part of the research is expressed in this section. Table 3 argues the correlation matrix and depicts that the series are not perfectly correlated.

Moving forward, the research proceeds to identify the stationarity levels of the variables using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) approaches. The outcomes are presented in Tables 4 and 5, indicating that some variables exhibit a stationary nature at level I (0), while others achieve stationarity after the first differencing. This distinction in stationarity levels provides crucial insights into the dynamic behavior of the variables and sets the foundation for further analysis.

The subsequent step involves identifying the co-integration associations among the variables. To achieve this, the research applies the ARDL bounds test. The results of the test, presented in Table 6, unequivocally indicate the presence of a long-term association among the variables. This confirmation of co-integration lays the groundwork for a comprehensive understanding of the interdependencies and dynamics within the system under examination.

Table 7 lists the outputs of the short-run and long-run estimations by the ARDL and Error Correction Model (ECM) techniques.

The results presented in Table 7 underscore the significant impact of the green financial market size on enhancing China's sustainable development index. A 1% increase in the volume of the green financial market demonstrates a substantial improvement, contributing to a 0.31% and 0.69% enhancement in the short and long-term, respectively. These findings align with previous studies by Ronaldo and Suryanto (2022), Yu et al. (2022), Huang et al. (2022), Mirza et al. (2023), and Umar and Safi (2023), emphasizing the pivotal role of green finance in advancing sustainable targets.

Corporate management also emerges as a crucial factor with favorable short-term and long-term effects on China's sustainable development index. A 1% improvement in the corporate governance index translates to a 0.16% and 0.29% increase in the short and long-term, respectively. These results corroborate the perspectives of Xia et al. (2020), Maia et al. (2022), Sanoran (2023), and Park (2023), highlighting the importance of robust corporate management in the pursuit of sustainable targets by enterprises.

Surprisingly, the green tax policy, considered a proxy for the Chinese government's green fiscal policy, proves to be ineffective and exhibits an adverse effect on the sustainable development index. The intricacies of green tax, including the determination of tax rates, calculation of carbon dioxide emissions by enterprises, and the transparency of green tax evasion penalty regulations, play a crucial role in shaping the policy's efficiency.

On a positive note, the production of green electricity emerges as a significant driver in elevating China's sustainable development. A 1% increase in sustainable electricity generation leads to a 0.20% and 0.75% improvement in the short and long-term, respectively.

Contrary to expectations, foreign direct investment shows an adverse effect on the sustainable development index. The interpretation suggests that the inflow of foreign investment is directed toward non-green projects in China, contributing to increased consumption of fossil fuels, higher carbon dioxide emissions, and ultimately diminishing the benefits of sustainable development.

The poverty rate, as a disturbing factor, exhibits a negative influence on the progress of sustainable development in China. A 1% increase in the poverty rate results in a weakening of China's sustainable development index by 0.24% and 0.43% in the short and long-term, respectively.

An important takeaway from the results is the distinct significance of both corporate management and green finance in driving China's sustainable development. Furthermore, the sensitivity of China's sustainable development to changes in green finance and corporate management is greater in the long-term than in the short-term. This underscores the need for policymakers to prioritize and carefully consider the effects of green finance and corporate management on China's sustainable development. Additionally, a comparative analysis of the effectiveness of green fiscal policy and green monetary policy reveals the effectiveness of the latter and the ineffectiveness of the former in the Chinese context.

Continuing the analysis, the research employs diagnostic approaches, specifically the Wald test and the Breusch-Pagan test of heteroscedasticity. The results, as presented in Table 8, confirm that the empirical model does not exhibit the problem of heteroscedasticity. This validation enhances the reliability of the model's outcomes and reinforces the robustness of the empirical findings, indicating a stable and sound foundation for the analysis.

Concluding the empirical segment of the research, the final step involves a robustness test. In this phase, the variable of carbon dioxide emissions is introduced as a new dependent variable. Given its adverse nature, it is anticipated that factors influencing sustainable development would be instrumental in

Table 2 Expected signs of impacts of the variables.

Symbol in equation	Definition	Expected sign
GFIN	Green finance market size	+
COR	Corporate management index	+
GTAX	Green tax revenue	+
SPGE	Sustainable power generation	+
FDII	Foreign direct investment inflows	+/−
POVRA	Poverty ratio	-

Source: Authors.

Table 3 Correlation matrix.

-	LSDI	LGFIN	LCOR	LGTAX	LSPGE	LFDII	LPOVRA
LSDI	1						
LGFIN	0.045	1					
LCOR	0.011	0.042	1				
LGTAX	0.053	0.143	0.095	1			
LSPGE	0.061	0.077	0.039	0.011	1		
LFDII	−0.034	−0.095	0.034	0.149	0.073	1	
LPOVRA	−0.195	−0.024	−0.659	−0.013	−0.429	−0.052	1

Note: SDI, GFIN, COR, GTAX, SPGE, FDII, and POVRA show the composite sustainable development index, Green finance market size, Corporate management index, Green tax revenue, Sustainable power generation, Foreign direct investment inflows, and Poverty ratio, respectively.
Source: Authors.

Table 4 Unit root test results (ADF technique).

Variable	At level		At first difference		Stationary level
	Statistics	*P*-value	Statistics	*P*-value	
LSDI	−0.595	0.738	−5.119	0.004	1
LGFIN	−4.492	0.045	-	-	0
LCOR	−3.869	0.015	-	-	0
LGTAX	−0.914	0.859	−4.679	0.035	1
LSPGE	−0.869	0.796	−5.812	0.000	1
LFDII	−4.695	0.087	-	-	0
LPOVRA	−0.945	0.049	−5.695	0.001	1

Note: SDI, GFIN, COR, GTAX, SPGE, FDII, and POVRA show the composite sustainable development index, Green finance market size, Corporate management index, Green tax revenue, Sustainable power generation, Foreign direct investment inflows, and Poverty ratio, respectively.
Source: Authors.

Table 5 Unit root test results (PP technique).

Variable	At level		At first difference		Stationary level
	Statistics	*P*-value	Statistics	*P*-value	
LSDI	−0.954	0.995	−5.685	0.000	1
LGFIN	−3.689	0.041	-	-	0
LCOR	−4.518	0.003	-	-	0
LGTAX	−0.519	0.909	−5.619	0.000	1
LSPGE	−0.343	1.000	−5.429	0.001	1
LFDII	−5.392	0.035	-	-	0
LPOVRA	−0.875	0.194	−5.417	0.003	1

Note: SDI, GFIN, COR, GTAX, SPGE, FDII, and POVRA show the composite sustainable development index, Green finance market size, Corporate management index, Green tax revenue, Sustainable power generation, Foreign direct investment inflows, and Poverty ratio, respectively.
Source: Authors.

Table 6 ARDL bound tests for the co-integration identification.

Model	Length of lag	*F*-stat
I	3	6.303
Critical value at 1%	*I* (0): 4.193	
	I (1): 5.394	
Critical value at 5%	*I* (0): 2.265	
	I (1): 3.859	
Critical value at 10%	*I* (0): 2.600	
	I (1): 3.398	

Source: Authors.

Table 7 Empirical outputs.

-	Variable	Dependent variable: SDI	
		Coefficient	*P*-value
Long-term	LGFIN	0.694	0.023
	LCOR	0.293	0.002
	LGTAX	−0.094	0.052
	LSPGE	0.757	0.019
	LFDII	−0.039	0.001
	LPOVRA	−0.439	0.093
Short-term	D (LSDI (-1))	0.541	0.001
	D (LGFIN)	0.319	0.042
	D (LGTAX)	−0.119	0.084
	D (LSPGEE)	0.204	0.039
	D (LFDII)	−0.194	0.039
	D (LPOVRA)	−0.249	0.063
	D (LCOR)	0.164	0.019
	ECM (-1)	−0.493	0.001

Note: SDI, GFIN, COR, GTAX, SPGE, FDII, and POVRA show the composite sustainable development index, Green finance market size, Corporate management index, Green tax revenue, Sustainable power generation, Foreign direct investment inflows, and Poverty ratio, respectively.
Source: Authors.

Table 8 Diagnostic tests' identification.

-	Statistic	Value	Prob.
Wald test	*F*-stat	7.493	0.000
	Chi-square	45.121	0.000
Breusch-Pagan	Probability *F*: 0.63		

Source: Authors.

Table 9 Output of robustness test.

-	Variable	Dependent variable: CO_2	
		Coefficient	*P*-value
Long-term	LGFIN	0.585	0.011
	LCOR	0.185	0.094
	LGTAX	−0.193	0.024
	LSPGE	0.601	0.0.49
	LFDII	−0.152	0.074
	LPOVRA	−0.232	0.088
Short-term	D (LCO2 (-1))	0.219	0.012
	D (LGFIN)	0.275	0.019
	D (LGTAX)	−0.086	0.043
	D (LSPGEE)	0.374	0.026
	D (LFDII)	−0.293	0.003
	D(LPOVRA)	−0.112	0.050
	D (LCOR)	0.099	0.065
	ECM (-1)	−0.594	0.001

Note: CO2, GFIN, COR, GTAX, SPGE, FDII, and POVRA show carbon dioxide emissions, Green finance market size, Corporate management index, Green tax revenue, Sustainable power generation, Foreign direct investment inflows, and Poverty ratio, respectively.
Source: Authors.

mitigating carbon dioxide emissions. The results of this robustness test are presented in Table 9, shedding light on the resilience and versatility of the empirical model in addressing the complexities of carbon dioxide emissions within the context of the study.

The results presented in Table 9 affirm that the empirical output is reliable and can be deemed trustworthy for utilization by scholars and policymakers. This reinforces the credibility of the research findings, indicating their relevance and applicability in informing academic discourse and guiding policy decisions.

Conclusion and policy recommendations

The concept of sustainable development, introduced in 1992 at the Earth Summit Conference, has evolved into a challenging and pivotal global issue. Despite the clarity of the concept, the path to achieving sustainable development is intricate and demanding due to the diverse influences from various social and economic variables. This research delves into the core issue of estimating the effects of green finance and corporate management on China's sustainable development index from 1990 to 2020 using time series analysis.

The findings highlight the crucial roles played by green finance and corporate management as essential components in realizing sustainable development goals in China. While the impact of these components is more pronounced in the long-term, the research notes that China's sustainable development exhibits a greater sensitivity to changes in the green financial market compared to changes in corporate management. A comparative analysis of the efficacy of green monetary and fiscal policies reveals the superior efficiency of the green monetary policy over the green fiscal policy in the country.

The research sheds light on the nuanced dynamics of the green tax policy, serving as a fiscal green proxy, with negative coefficients in both the short and long-term. Furthermore, the estimated coefficients of control variables underscore the positive impact of green electricity production on sustainable development. However, foreign direct investment flow and poverty emerge as hindrances to the progress of sustainable development in China.

The central government of China is urged to formulate a more detailed plan for the development of the green financial market. Given the pivotal role of green finance in China's sustainable development, it is recommended that the government initiate specialized policy programs, encompassing the digitalization of the green financial market, leveraging fintech and cryptocurrency, and expanding the utilization of big data. These strategic measures can enhance the effectiveness and reach of the green financial market. Supporting corporate management is essential, and the Chinese government can play a pivotal role in this regard. Initiatives aimed at increasing companies' awareness of the benefits of implementing corporate management processes, coupled with educational programs for managers and policy planners, can significantly elevate the corporate management index in China. As this index correlates with the level of sustainable development, such efforts become crucial for the country's overall progress. Implementing comprehensive green tax reforms should be a priority for the central government. The accurate determination of tax rates and adopting a structured approach to tax receipt from companies based on environmental pollution or carbon dioxide emissions are critical factors in enhancing the efficiency of the green tax policy. Additionally, the government should focus on the implementation of policies addressing poverty alleviation, attracting foreign green investment, and promoting green electricity production. These targeted initiatives will contribute significantly to advancing China's sustainable development goals.

In concluding this section, the article proposes avenues for further development of the topic. Exploring the impact of the COVID-19 pandemic on sustainable development and green finance in different provinces of China presents a valuable research opportunity, providing insights into the regional dynamics and responses to such global crises. Utilizing experts' opinions in the realms of sustainable development and corporate management holds substantial potential for enriching the existing literature. Incorporating the perspectives of experts and company managers on the significance of implementing corporate management in the context of greening company processes and enhancing performance adds depth to the understanding of these crucial subjects. The use of scenario creation and future research as research tools can offer a glimpse into potential trends in sustainable development, green finance, and corporate management in China. This forward-looking approach aids in anticipating and preparing for future challenges and opportunities in these domains. Additionally, investigating the impact of green finance and corporate management on the 17 sustainable development goals outlined by the United Nations in 2015 is of particular significance. Such research outcomes can provide practical and actionable insights for policymakers in China, guiding strategic decisions aligned with the broader global agenda for sustainable development.

Data availability

Since the authors are not able to share the data, the datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request

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