Proceedings of ICEMGD 2025 Symposium: Resilient Business Strategies in Global Markets
DOI: 10.54254/2754-1169/2025.CAU27075

Confucian Culture and Firms' Green Innovation: Value Guidance from Informal Institutions

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Abstract. Against the backdrop of building an innovation-driven nation, how traditional culture can exert contemporary value and function has become a core issue urgently requiring exploration. This paper examines the mechanisms and pathways through which the Confucian tradition shapes contemporary firms' green innovation behaviors. Empirical evidence shows that Confucian culture has a clear promoting effect on firms' green innovation; specifically, the deeper a firm is influenced by Confucian culture, the higher its level of green patent output. Further tests reveal two channels: Confucian culture fosters green innovation mainly by alleviating agency conflicts within firms and enhancing awareness of environmental responsibility. Meanwhile, Confucian culture as an informal institution and the formal legal environment exhibit a substitution relationship in promoting corporate innovation. From a micro-enterprise perspective, this study explicates the underlying mechanisms by which Confucian thought advances green innovation, thereby moving beyond entrenched ruts in prior research on the value of Confucian culture. The findings not only contribute empirical evidence from an Eastern context to the international literature on "culture and corporate decision-making," but also, at a practical level, underscore the need to strengthen cultural confidence and proactively draw on the wisdom of China's fine traditional culture to address real-world problems—achieving an innovation pathway that unifies knowledge and action.

Keywords: Confucian tradition, culture, green innovation, promoting effect

1. Introduction

Green innovation serves as the core engine of ecological civilization and the fundamental driving force of sustainable economic and social development. According to the 14th Five-Year Plan and the 2035 Long-Range Goals Outline, promoting green development and fostering harmony between humanity and nature are established national strategic objectives. The Action Plan for Carbon Peaking before 2030 further deploys a major strategy to "build a green, low-carbon, circular development economic system." The realization of a green innovation-oriented nation and high-quality development requires not only top-level design but also a solid micro-level foundation. As the most fundamental and vital market supply entities, enterprises are the main forces driving the green transition. Therefore, only by stimulating firms' innovative vitality and improving the

DOI: 10.54254/2754-1169/2025.CAU27075

efficiency of green achievement transformation can the foundation for building a “Beautiful China” be firmly established.

Existing literature has explored the key factors influencing firms’ green innovation from multiple perspectives, such as corporate governance mechanisms [1], government subsidies [2], CEOs’ green experiences [3], and financing constraints [4], yielding fruitful results. However, most of these studies have focused on rigid constraints and incentive mechanisms under formal institutional frameworks, while overlooking the influence of implicit norms such as social culture on the behavioral patterns of innovation actors. Culture is an important factor that affects social, political, and economic activities. Emerging research further confirms that beyond formal institutions, informal institutions such as culture also exert significant influence on corporate decision-making. In particular, China, as a “transition + emerging” economy, has a formal institutional framework that is not yet fully developed in terms of construction and implementation, whereas its cultural traditions have been continuously inherited across generations. Compared with formal institutions, culture has broader coverage and longer durability; it can consolidate social consensus, guide collective thought, and thus constitutes an important part of informal institutions. Therefore, when exploring the variety of challenges faced by Chinese enterprises during the transition period, it is insufficient to focus solely on the construction, absorption, and optimization of formal institutions. Equal attention must also be paid to traditional culture, which has gradually evolved through history and exerts profound influence.

China once held a dominant position in the evolution of human civilization. However, since the Industrial Revolution, its technological innovation advantage has been gradually replaced by the West. This historical turning point led some scholars to attribute China’s lag in modern science and technology to the restrictive effects of the Confucian tradition on innovative thinking. They argue that Confucian advocacy of hierarchical order and obedience may hinder information exchange and intellectual collision, while its orientation toward collectivism and harmony may suppress individual development. At the same time, however, other scholars contend that collectivist culture can effectively enhance firms’ strategic execution capacity, thereby conferring advantages in breakthrough innovation. Xixiong Xu and Wanli Li [5] were the first to propose a theoretical framework showing how the Confucian tradition promotes corporate innovation. Their empirical study identified three transmission channels: alleviating agency conflicts, enhancing investment in human capital, and reducing risks of patent infringement. This study not only corrected the academic misperception of the value of Confucian culture but also provided theoretical support and practical guidance for revitalizing traditional wisdom in China’s process of high-quality development. Admittedly, certain elements of Chinese tradition have indeed hindered innovation—such as prioritizing agriculture over commerce, valuing Daoist philosophy while disparaging technical skills, and advocating harmony while restraining competition. Yet, at a deeper level, Chinese tradition contains rich innovative genes. Classical texts record aphorisms such as “Though Zhou is an ancient state, its mandate lies in renewal,” “As Heaven maintains vigor through movement, the gentleman should strive for self-improvement without rest,” and “If one can renew oneself for a day, one should renew oneself every day, and continue renewing day after day.” These maxims embody the reformist wisdom of the sages. Clearly, traditional Chinese culture has always contained an enterprising spirit of transformation and renewal, an inclusive outlook of moral magnanimity, a liberal philosophy of governing by noninterference, a critical spirit of skepticism and truth-seeking, and a scientific ethos of following the principles of nature.

This study makes contributions along three main dimensions. First, it extends the knowledge boundaries of research on corporate innovation. Although innovation management has always been

DOI: 10.54254/2754-1169/2025.CAU27075

a central issue in academic inquiry, existing literature predominantly focuses on macro-level constraints and micro-level incentives within formal institutional frameworks. By contrast, this paper takes a different approach by adopting an informal institutional perspective. It systematically examines how cultural factors and their implicit norms influence the decision-making behaviors of innovation actors, and it empirically reveals the internal mechanisms through which Confucian ethics promote firms' green innovation. This research model deepens the understanding of the foundational role of culture and broadens the theoretical framework of key drivers of green innovation.

Second, it broadens the scope of research on Confucian culture. Although the Confucian tradition has had extensive and long-standing influence on Chinese society, existing academic research on Confucian culture remains largely confined to the realms of philosophy and sociology. This study innovatively integrates empirical analysis with Confucian thought by using the density of Confucian temple distribution to measure the intensity of Confucian culture. Drawing on data from A-share listed companies, it empirically uncovers the impact and internal mechanisms of Confucian culture on corporate green innovation. In doing so, it not only expands the research dimensions of Confucian ethical values but also deepens micro-level theoretical understanding of the economic consequences of Confucian culture, thereby making a substantive contribution to contemporary Confucian studies.

Third, it highlights the contemporary value of traditional culture. With its long history and profound heritage, Confucian culture embodies rich resources for modern application. By exploring the mechanisms through which Confucian thought drives corporate green innovation, this paper demonstrates the adaptive value of Chinese traditional culture within the modern economic-ecological system. It promotes the creative integration of traditional wisdom with the modern economy, as well as the synergistic alignment of classical ethics with contemporary science and technology, thereby contributing to the dual goals of economic growth and ecological civilization. Moreover, by offering an innovative reinterpretation of Confucian culture in the context of modernization and treating it as an important cultural resource and strategic asset, this study reconstructs its theoretical significance. Such reconstruction helps to strengthen national cultural identity and confidence, facilitates the creative transformation of traditional civilization, and injects cultural momentum into the sustainable development of the Chinese economy.

2. Theoretical analysis

Compared with formal institutions that promote firms' green innovation through regulatory tools such as guidance, incentives, and constraints, Confucian culture—as an informal institution—functions primarily through value orientation. On the one hand, the Confucian ethic of zhongxin (loyalty and trustworthiness) directly addresses the core challenge of insufficient corporate innovation incentives arising from the imbalance between costs and returns of innovation. On the other hand, its doctrine of yi–li (the balance between righteousness and profit) helps mitigate agency conflicts and restrains managers' tendency to avoid green innovation investment for the sake of personal gain. Accordingly, the positive influence of Confucian culture on corporate green innovation can be realized through two channels: alleviating agency conflicts and enhancing firms' awareness of environmental responsibility.

First, the Confucian ethic of zhongxin contributes to alleviating agency conflicts. Compared with ordinary innovation, green innovation is characterized by high risk, long cycles, and low success rates. Out of self-interest, corporate managers often prefer to avoid green innovation activities. Agency theory suggests that in the absence of adequate monitoring and incentive mechanisms,

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senior executives and other innovation decision-makers may strategically abandon difficult, risky projects that would benefit the firm's long-term development, and instead channel resources into short-term projects with quick payoffs—even if such projects bring little substantive benefit to the enterprise. Furthermore, motivated by career reputation concerns, managers tend to favor projects with high success rates in investment decisions. Clearly, the inherently low success rate of green innovation does not align with managers' interests. For this reason, firms need to improve monitoring and incentive systems to mitigate agency conflicts. Within this theoretical framework, Confucian culture serves as an implicit moral constraint. Its emphasis on zhongxin—loyalty and trustworthiness—can effectively reduce managerial inertia in green innovation, while curbing problems of moral hazard and adverse selection in green innovation practices. Specifically, Confucian classics affirm that "Since ancient times all men must die, but without trust the people cannot stand" (Analects, Yan Yuan), that "Sincerity is the way of Heaven; the thinking of sincerity is the way of man" (Mencius, Li Lou I), and that one should ask, "In planning for others, have I failed to be loyal? In dealings with friends, have I failed to be trustworthy?" (Analects, Xue Er). These maxims illustrate that zhongxin, as a universal social norm, imposes strong internal moral constraints on managerial behavior. Such constraints help reduce opportunistic conduct and enhance agency efficiency. In summary, Confucian culture can mitigate agency conflicts, weaken managers' self-interested avoidance of green innovation, and thereby raise firms' levels of green innovation.

Second, the Confucian doctrine of yi–li (righteousness versus profit) helps enhance firms' awareness of environmental responsibility. Compared with other forms of innovation, the most salient feature of green innovation lies in its environmental benefits. Due to the externality of environmental benefits, green innovators must bear high costs and risks on their own, yet they cannot capture the full social gains generated by their innovation outcomes. This potential imbalance between costs and returns deprives self-interested managers of the fundamental motivation to engage in green innovation. Even when facing mounting environmental governance pressure, firms often prefer to adopt cheaper end-of-pipe treatment rather than invest in green innovation to meet regulatory requirements. The Confucian core concepts of ren (benevolence), yi (righteousness), and li (propriety) can effectively correct managers' egoistic thinking. For example, the Analects state: "If you wish to establish yourself, help others to establish themselves; if you wish to succeed, help others to succeed." The underlying notion of ren requires firms not only to take from society in their development but also to maintain a balance between giving and receiving, a principle consistent with the prosocial orientation advocated in corporate social responsibility (CSR) theory. Likewise, sayings such as "Wealth and honor obtained immorally are as fleeting clouds to me" (Analects, Shuer) and "The gentleman understands righteousness; the petty man understands profit" (Analects, Liren) highlight the principle that a true gentleman prioritizes righteousness over profit. This resonates with the altruistic orientation implicit in CSR theory, suggesting that firms should uphold a proper balance between righteousness and profit, adhering to moral obligations while pursuing economic returns, and thereby strengthening their sense of social responsibility. Moreover, Mencius observed: "If food is consumed in due season, and resources are used with propriety, they will be inexhaustible" (Mencius, Jin Xin I). This embeds the use of natural resources within the moral framework of li (propriety), situating resource utilization within the philosophical doctrine of the unity of heaven and humanity (tian ren he yi). Such an ecological ethic emphasizes harmony between humans, heaven, and earth, aligning closely with the environmental consciousness required in CSR. In sum, the Confucian notion of yi–li contributes to deepening firms' recognition of environmental responsibility, thereby stimulating their willingness to engage in green innovation.

Based on the above analysis, this paper proposes the following hypothesis:

DOI: 10.54254/2754-1169/2025.CAU27075

H_1: Confucian culture exerts a promoting effect on firms' green innovation.

3. Research design

3.1. Sample selection

This study selects data from A-share listed companies in China covering the period 2008–2021. The sample was filtered as follows: financial and insurance firms, ST and PT firms, foreign-controlled firms, and firms with missing data were excluded. The final sample consists of 36,012 firm-year observations. The key explanatory variable, "Confucian culture," was manually compiled (see definition below). Patent data were collected from the CSMAR database and the State Intellectual Property Office (SIPO) of China. Corporate governance and financial data were obtained from WIND and CSMAR databases. To mitigate the influence of extreme values, all continuous variables were winsorized at the 1% level.

3.2. Variable definition and measurement

3.2.1. Measurement of confucian culture

A review of the literature reveals that there is no consensus in academia on how to measure Confucian culture. Existing methods for measuring culture are mainly of two types: the Hofstede index and survey-based approaches. The Hofstede index is widely used to examine how national cultural traits influence individual behavior. However, its cultural dimensions do not fully capture the core values of Confucian culture, such as the doctrine of yi–li (righteousness versus profit), the ethic of zhongxin (loyalty and trustworthiness), the principle of junzi shendu (self-discipline in solitude), and the emphasis on knowledge and education. Thus, using this approach fails to comprehensively reflect the impact of Confucian culture on innovation mechanisms. The survey method, while potentially providing an objective reflection of the impact of Confucian culture on corporate green innovation, is limited in its ability to fully capture Confucian ideas such as ren, yi, li, zhi, xin (benevolence, righteousness, propriety, wisdom, and trustworthiness). Moreover, precise financial and innovation data at the firm level are difficult to obtain through surveys, making large-scale application impractical. To date, there are still relatively few empirical studies on the relationship between Confucian culture and corporate behavior, largely due to challenges in measuring Confucian culture.

Confucian temples (Kongmiao) serve as important carriers of Confucian culture, and their historical development reflects the trajectory of Confucian thought dissemination. A distinctive feature of Confucianism is its use of ritual and propriety (li) to regulate social order, ultimately achieving the ideal of "transforming the people through ritual and music." Since Emperor Wen of the Han dynasty initiated the policy of "revering Confucianism," imperial decrees mandated the construction of Confucian temples in all prefectures, gradually making them core sites for transmitting Confucian culture. By the Tang dynasty, the Confucian temple system was structured at three levels: the central Taixue (Imperial Academy) temple, prefectural-level temples built by local governments, and community-level temples built by commoners. During the Song dynasty, the system became more elaborate, with official and folk temples coexisting. From the mid-Ming dynasty onward, as grassroots academies flourished, local temples increasingly surpassed official temples, becoming important platforms for the spread and exchange of Confucian culture. Building on studies such as Zhihui Gu [6] and Xixiong Xu & Wanli Li [5], this paper measures the strength of

DOI: 10.54254/2754-1169/2025.CAU27075

Confucian culture based on a distance model, using the density of Confucian temples within a given radius of a firm's registered location.

Specifically, we manually collected the geographic coordinates (latitude and longitude) of Confucian temples using Baidu Maps and other online tools, and likewise obtained the coordinates of firms' registered locations. We then calculated the geographic distance between each firm's registration site and nearby temples. The greater the number of temples within a given radius, the stronger the influence of Confucian culture on that firm. In this study, we use the number of Confucian temples within 200 kilometers (Confu_200) and 300 kilometers (Confu_300) of a firm's registered location as proxy variables for the intensity of Confucian cultural influence.

3.2.2. Measurement of corporate green innovation

There are several approaches to measuring corporate innovation capability. First, innovation input is used. For example, Jun Wen and Genfu Feng [7] measure innovation capability by the ratio of R&D expenditure to sales revenue. Second, innovation output is employed. Wenjing Li and Manni Zheng [2] use the number of green patent applications to measure corporate green innovation. Although the ratio of R&D expenditure to sales revenue reflects innovation input and output, it does not fully capture innovation capability. Additionally, Guozhong Yang [8] adopts the ratio of the value-added of intangible assets to total assets as a proxy for corporate green innovation. However, these methods still fail to accurately reflect the "green" nature of technological innovation. Drawing on the approaches of Shaozhou Qi et al. [9] and Dongmin Kong et al. [10], this study uses the natural logarithm of the sum of green invention patent applications and green utility model patent applications plus one as a proxy variable for corporate green innovation.

3.3. Model construction

To examine the impact of Confucian culture on corporate green innovation, the following model is constructed:

$$TGreen_{i,t} = \alpha_0 + \alpha_1 Confucian_{i,t} + \sum \alpha_k Controls_{i,t} + Industry + Year + \varepsilon_{i,t} \quad (1)$$

where the dependent variable TGreen represents green innovation, measured by the number of green patent applications (LnPatent). The key explanatory variable Confucian measures the intensity of Confucian culture, proxied by Confu_200 and Confu_300.

Following prior studies, the model introduces a set of control variables, including firm size (Size), firm age (FirmAge), leverage ratio (Lev), return on assets (ROA), fixed assets ratio (FIXED), sales growth rate (Growth), and CEO duality (Dual). All control variables are lagged by one period. Industry and year fixed effects are also controlled. Since corporate green innovation data exhibit a left-truncated "count data" distribution, this paper employs an OLS regression model for empirical estimation.

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Table 1. Variable definitions

Variable Name	Symbol	Definition
Green Innovation	LnPatent	Natural logarithm of 1 plus the sum of green invention patent applications and green utility model patent applications
Confucian Culture	Confu_200	Natural logarithm of 1 plus the number of Confucian temples within 200 km of firm's registered location
	Confu_300	Natural logarithm of 1 plus the number of Confucian temples within 300 km of firm's registered location
Firm Size	Size	Natural logarithm of total assets
Firm Age	FirmAge	Natural logarithm of years since establishment
Leverage	Lev	Total liabilities / total assets
Return on Assets	ROA	Net profit / average total assets
Fixed Asset Ratio	FIXED	Net value of fixed assets / total assets
Sales Growth	Growth	(Sales revenue in current year – sales revenue in previous year) / sales revenue in previous year
CEO Duality	Dual	Equals 1 if the CEO concurrently serves as chairman, 0 otherwise
Industry Effect	Industry	Industry dummy variables
Year Effect	Year	Year dummy variables

4. Empirical analysis

4.1. Descriptive statistics

Table 2 reports the descriptive statistics of the main variables. The mean value of green patent applications (LnPatent) is 0.644, with a maximum of 4.205 and a minimum of 0. The standard deviation (1.020) is larger than the mean, suggesting substantial heterogeneity in green patent applications across firms and indicating that corporate green innovation capability varies considerably. For the proxy variables of Confucian culture, the mean value of Confu_200 (Confu_300) is 2.514 (3.094), with a maximum of 3.555 (4.220) and a minimum of 0. This implies that the extent to which firms are influenced by Confucian culture differs significantly.

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Table 2. Descriptive statistics of main variables

Variable	Obs	Mean	Std. Dev.	Median	Min	Max
LnPatent	36012	0.644	1.020	0.000	0.000	4.205
Confu_200	36012	2.514	0.757	2.639	0.000	3.555
Confu_300	36012	3.094	0.754	3.258	0.000	4.220
Size	36012	22.121	1.303	21.936	19.765	26.150
FirmAge	36012	2.837	0.368	2.890	1.609	3.497
Lev	36012	0.432	0.207	0.428	0.053	0.896
ROA	36012	0.041	0.064	0.040	-0.231	0.218
FIXED	36012	0.218	0.164	0.184	0.002	0.708
Growth	36012	0.178	0.402	0.116	-0.562	2.505
Dual	36012	0.262	0.440	0.000	0.000	1.000

4.2. Baseline regression

Table 3 presents the regression results of Confucian culture on firms' green innovation. Columns (1) and (4) report the results with only the core explanatory variables Confu_200 and Confu_300, respectively. The coefficients of Confu_200 (0.0864) and Confu_300 (0.0972) are both significantly positive at the 1% level. Columns (2)–(3) and (5)–(6) sequentially include control variables as well as year and industry fixed effects. The coefficients of Confu_200 remain significantly positive at 0.0798 and 0.0685, and those of Confu_300 remain significantly positive at 0.0851 and 0.0767, all at the 1% significance level. These findings indicate that the stronger the influence of Confucian culture, the higher the number of green patent applications filed by firms. This result is consistent with Xixiong Xu and Wanli Li [10], who argue that as an essential informal institution, Confucian culture—through values such as altruism and the unity of man and nature—encourages firms to prioritize social welfare and assume environmental responsibilities. Moreover, the Confucian emphasis on "righteousness over profit" helps firms pay greater attention to environmental issues and restrains the tendency to divert resources away from green innovation for short-term self-interest. Overall, the results strongly support our hypothesis (H1): firms more deeply embedded in Confucian culture are more active in pursuing green innovation. The results of the control variables are largely consistent with previous studies.

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Table 3. Baseline regression results

	(1)	(2)	(3)	(4)	(5)	(6)
	LnPatent	LnPatent	LnPatent	LnPatent	LnPatent	LnPatent
Confu_200	0.0864***	0.0798***	0.0685***			
	(14.021)	(14.028)	(12.435)			
Confu_300				0.0972***	0.0851***	0.0767***
				(15.988)	(15.236)	(14.086)
control	No	Yes	Yes	No	Yes	Yes
Year	No	No	Yes	No	No	Yes
Industry	No	No	Yes	No	No	Yes
N	36012	36012	36012	36012	36012	36012
r2_a	0.0041	0.1652	0.3095	0.0051	0.1657	0.3101
F	196.5851	580.6134	288.8962	255.6098	583.9065	289.2767

Note: Robust standard errors clustered at the industry level are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. The same as below.

4.3. Mechanism analysis

The baseline results suggest that Confucian culture promotes firms' green innovation. But through what channels does this influence operate? Based on our theoretical framework, we propose two potential mechanisms: (1) The Confucian emphasis on the ethics of loyalty and trust (zhongxin) and the principle of self-discipline even in solitude (junzi shendu) helps to align the interests of managers with those of shareholders, thereby encouraging managers to engage in long-term strategic activities such as green R&D. (2) The Confucian doctrine of righteousness over profit (yili guan) cultivates a sense of environmental and social responsibility among executives, motivating firms to internalize environmental externalities and invest in green innovation. Following this logic, we empirically test these two mechanisms in turn.

First, we examine the impact of Confucian culture on corporate agency conflicts. In this study, the ratio of operating and management expenses (Ope) is used as a proxy variable to measure agency problems. The operating and management expense ratio is calculated as the sum of management and selling expenses divided by total revenue, with a higher ratio indicating higher agency costs. The regression results in Table 4 show that the coefficients of Confu_200 and Confu_300 on Ope are -0.0123 and -0.0118, respectively, both significant at the 1% level. This indicates that, holding other factors constant, a 1% increase in the number of Confucian temples within 200 km and 300 km of a firm's registered location corresponds to a reduction in the firm's operating and management expense ratio of 0.0123% and 0.0118%, respectively. These findings suggest that Confucian ethics of loyalty and trust (zhongxin) effectively help reduce corporate agency conflicts and improve agency efficiency. Therefore, mitigating agency conflicts represents an important channel through which Confucian culture promotes corporate green innovation.

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Table 4. Confucian culture and agency conflicts

	(1)	(2)
	Ope	Ope
Confu_200	-0.0123***	
	(-10.569)	
Confu_300		-0.0118***
		(-9.952)
control	Yes	Yes
Year	Yes	Yes
Industry	Yes	Yes
N	36011	36011
r2_a	0.2379	0.2377
F	217.0868	216.5913

Second, we examine the impact of Confucian culture on corporate environmental awareness. The frequency of green transformation-related terms (GreUmia) is used as a proxy variable to reflect firms' environmental responsibility awareness. A higher frequency indicates stronger environmental awareness. The regression results in Table 5 show that the coefficients of Confu_200 and Confu_300 on GreUmia are 0.0732 and 0.0520, respectively, both significant at the 1% level. This indicates that, all else equal, a 1% increase in the number of Confucian temples within 200 km and 300 km of a firm's registered location corresponds to an increase in green transformation term frequency of 0.0732% and 0.0520%, respectively. These results demonstrate that the Confucian principle of righteousness over profit (yili guan) effectively enhances firms' environmental awareness and fosters altruistic values among executives. This suggests that Confucian culture can provide robust theoretical support for green innovation by strengthening corporate environmental responsibility.

Table 5. Confucian culture and environmental responsibility

	(1)	(2)
	GreUmia	GreUmia
Confu_200	0.0732***	
	(19.708)	
Confu_300		0.0520***
		(14.971)
control	Yes	Yes
Year	Yes	Yes
Industry	Yes	Yes
N	33989	33989
r2_a	0.6289	0.6275
F	1.6e+03	1.6e+03

DOI: 10.54254/2754-1169/2025.CAU27075

5. Conclusion

This study uses data from A-share listed companies in China for the period 2008–2021 to systematically examine the influence of Confucian tradition on contemporary firms' green innovation from the perspective of informal institutions. The empirical results indicate a significant promoting effect of Confucian culture on firms' green innovation: the stronger a firm is influenced by Confucian culture, the higher its level of green patent output. The main findings can be summarized as follows: First, Confucian doctrines—such as the principle of righteousness over profit (yili guan), the ethics of loyalty and trust (zhongxin), and the principle of self-discipline even in solitude (junzi shendu)—effectively mitigate agency conflicts and enhance firms' environmental responsibility awareness, thereby promoting green innovation. Based on the theoretical framework, we employ OLS regression models for empirical analysis, which confirm that Confucian culture indeed facilitates firms' green innovation. Further mechanism tests reveal that Confucian culture primarily influences firms' innovation decisions through two channels: reducing agency conflicts and raising environmental responsibility awareness. Second, in socio-economic operations, informal institutions such as Confucian culture and formal institutions such as the legal environment exhibit a substitutive relationship in promoting green innovation. Literature suggests that when formal institutional support is insufficient, firms tend to rely more on informal institutions, including traditional culture and religious beliefs, as complementary mechanisms. For instance, foreign cultural shocks can weaken the constraining effect of Confucian culture on firms' risk preferences. Considering China's unique institutional and cultural context, this study incorporates foreign cultural influence into the analytical framework to examine its interaction with Confucian culture in fostering green innovation. The results show that the incentivizing effect of Confucian culture on green innovation is more pronounced in firms less affected by foreign cultural shocks than in those more exposed. In summary, this study highlights the contemporary value of Confucian culture as an informal institution in guiding firms toward sustainable innovation. It provides empirical evidence that traditional cultural wisdom can complement formal regulatory mechanisms and contribute to the dual goals of economic growth and ecological civilization.

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