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Does Confucian culture reduce firms' pollution emissions

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Abstract

This paper explores the influence of Confucian culture on firms' emissions. We measure Confucian culture during the Ming and Qing dynasties using the density of *jinshi* in that region and test the causal relationship between Confucian culture and firms' emissions using the Annual Survey of Industrial Firms (ASIF) and China's Environmental Statistics Database (CESD) from 1998 to 2013. Our research reveals that regions with a stronger Confucian cultural influence have a significant reduction in pollution emissions from their firms. Further analysis demonstrates that the government in regions with a strong Confucian cultural influence attaches more importance to environmental protection and enforces stricter environmental regulations on firms. Besides, the people demonstrate heightened environmental awareness, incorporating it into economic development, thus reducing firms' pollution emissions. In addition, Confucian culture can reduce pollution emissions by improving the total factor productivity of firms.

KEYWORDS
Confucian culture, environmental awareness, environmental regulations, firms' pollution emissions, *jinshi* density

1 | INTRODUCTION

In the process of China's continuous economic development, environmental pollution is becoming increasingly serious (Li & Achal, 2020). In 2021, according to the World Air Quality Report published by the World Health Organization, only three countries out of 117 met the WHO air quality standards. The most severely affected are developing countries that rely on fossil fuels for power generation. As an emerging nation, China is deeply impacted by air pollution, incurring substantial human and financial costs. According to a report by the OECD, the annual cost of air pollution to China is at least 1.4 trillion US dollars. Pollution emission of firms is a significant ethical issue. Meanwhile, pollution emission of firms during production is a major source of environmental pollution (Bowen Frances et al., 2018). Given that firms primarily aim to maximize shareholder interests, there may be a tendency for shareholders to prioritize short-term gains, potentially leading to adverse consequences (Miralles-Quiros et al., 2017).

Numerous scholars have investigated corporate pollution. Some contend that the environmental awareness characteristics of corporate executives are pivotal in influencing firms' pollution emissions. Research suggests that under senior executives' leadership, companies might embrace eco-friendly practices (Ghimire et al., 2021; Huang et al., 2021; Nguyen et al., 2021; Zhang & Vigne, 2021). Walls and Berrone (2017) argue that CEOs with environmental expertise are likely to encourage the adoption of green strategies, thereby reducing pollution. Conversely, Zhang, Ren, et al. (2020) find that CEO overconfidence may elevate pollution levels. Walls and Berrone (2017) also observe that any form of CEO authority, whether formal or informal, can drive shareholder activism to promote environmentally responsible corporate behavior. Additionally, some scholars believe that external supervision can reduce corporate pollution behavior. Tang and Tang (2016) point out that government and public behavior can prompt companies to seek remedies for their environmental pollution; Li and Achal (2020) find that government involvement and the designation of environmental policies significantly improve environmental performance and reduce pollution behavior. Kolsi and Attayah (2018) highlight the effectiveness of government-mandated disclosure of corporate social responsibility (CSR) in curbing pollution emissions. Haque and Ntim (2018) investigate the effects of environmental policy, sustainable development frameworks, and corporate governance

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mechanisms on the environmental performance of UK listed firms and find that although companies may symbolically comply with regulations, it does not have a substantial impact on corporates' pollution emissions.

As the dominant traditional culture in China, Confucian culture exerts a profound influence on modern Chinese society, shaping the moral standards of its people (Li et al., 2020). A crucial element of Confucian culture is the imperial examination system, which has served as a key institutional framework for selecting talent since the Sui Dynasty. Functioning as a foundational institutional framework, this system integrates cultural, educational, social, and political aspects. It not only facilitates social mobility but also serves a mediating and stabilizing role within society (Gan, 2008). The imperial examination was the only way for a "scholar" to become a "senior official", which was highly admired and appreciated at that time and was also an important way for the common people to transcend class (Ko, 2017).

Numerous prior studies have explored the enduring impact of Confucian culture. In education, Chen, Huang, and Lin (2019); Chen, Jin, et al. (2019) find that the doubling density of regional *jinshi* (successful candidates in the imperial examination) increases the average number of years of education in the region by 8.5% in 2010, exerting a significant positive impact on the contemporary accumulation of human capital. In addition, Confucian culture significantly improves corporate ethics and social responsibility. Confucian values shape the behavior of managers through the construction of specific social norms such as "honesty and trustworthiness" (Li et al., 2020; Stulz & Williamson, 2003). At the same time, Confucian culture reduces corporate violations and risk-taking, and curbs shareholders' hollowing-out behavior, promotes corporate social responsibility as well (Du, 2015; Du, 2016). Yu et al. (2021) find that Confucian culture effectively restrains corporate earnings management, fostering greater honesty in financial reporting. Chen, Huang, and Lin (2019); Chen, Jin, et al. (2019) find that Confucian culture significantly improves the investment efficiency of listed companies in China. This improvement is achieved by reducing excessive investment without causing insufficient investment. Xu, Li, and Chen (2019) emphasize that Confucian culture significantly reduces specific corporate collapse risks. This reduction is primarily attributed to the mitigation of institutional conflicts, the enhancement of financial information quality, and the inhibition of overconfidence among managers. While much research has focused on the impact of Confucian culture on corporate behavior, few studies have studied its impact on firms' pollution emissions. Will Confucian culture influence the pollution emissions of firms? To address this question, this paper uses the density of *jinshi* in various regions during the Ming and Qing dynasties to measure the influence of Confucian culture in those regions and uses the 1998–2013 industrial firm database combined with data on firm emissions to conduct regression. The study reveals that Confucian culture significantly reduces the pollution emissions of firms. On average, if the number of *jinshi* per 10,000 people during the Ming and Qing dynasties doubles, the wastewater emissions by firms per unit of output in the city will reduce by 12.2%. These results remain consistent across various robustness checks. Furthermore, to overcome potential endogenous issues, this paper uses the average distance from each region to the nearest bamboo and pine forests as an instrumental variable. It finds that the above results still hold. Based on this, this paper further analyzes the mechanism of Confucian culture in reducing firms' pollution emissions. It finds that Confucian culture enables the government to place greater emphasis on environmental protection and strengthen environmental regulation to reduce firms' pollution emissions. At the same time, Confucian culture also enhances the environmental awareness among the public, improves the innovation capacity of firms, and ultimately reduces firms' pollution emissions. The results of the mechanism analysis in this paper show that in regions with a strong Confucian cultural influence, both the local government and the public have a stronger environmental awareness and are more inclined to create an environment-friendly development. Confucian culture not only enhances the environmental awareness of firms but also improves the innovation capacity of firms to reduce pollution emissions. In summary, Confucian culture has a significant and positive impact on the environmental attitudes and behavior of local firms.

This paper contributes to the existing literature in several ways. First, unlike previous literature that focused on the influence of Confucian culture on firm business behavior, this paper studies the influence of Confucian culture on firm behavior from the perspective of environmental pollution. It also explains the impact mechanism, which enriches the relevant research concerning Confucian culture's impact on firms. Second, this paper finds that Confucian culture stimulates the environmental awareness of the government and firms, forcing firms to reduce pollution emissions. Third, this paper differs from existing literature that uses the number and distance of Confucian temples as indicators of Confucian culture. Instead, it uses the density of *jinshi* during the Ming and Qing dynasties as an explanatory variable for estimation. This paper adopts the method of Chen, Kung, and Ma (2020), Chen, Ye, et al. (2020) and selects the more exogenous average distance from each region to bamboo and pine forests as an instrumental variable to conduct instrumental variable estimation for the benchmark regression and mechanism test. This approach enhances the precision of identifying the causal relationship between Confucian culture and firms' pollution emissions. Finally, a new perspective has been provided for environmental protection, emphasizing the role of excellent traditional culture in environmental protection.

The remainder of this paper is arranged as follows: Section 2 presents the theoretical analysis and research hypothesis; Section 3 introduces the identification strategies; Section 4 provides the analysis of empirical results; Section 5 discusses the results of this paper; Section 6 presents the main conclusions and implications of this paper.

2 | THEORY AND HYPOTHESIS

Hofstede (1980) and Schwartz (1994) argue that society's cultural beliefs deeply influence the thinking and behavioral norms of its

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members, directly impacting their economic behaviors. From a macro-societal perspective, culture shapes ideologies and value judgments, influencing the allocation of social resources (Stulz & Williamson, 2003). From a micro-individual perspective, different cultural characteristics affect individuals' risk preferences, thus guiding their economic decisions (Li et al., 2013).

An increasing number of articles indicate that culture, as an informal institution, significantly impacts environmental pollution (Park et al., 2007; Zacharias et al., 2021). Bickerstaff (2004) suggests that social and cultural factors influence how people perceive risks, potentially reducing air pollution. Peng and Lin (2009) argue that ethnic culture, mediated through education, can significantly positively affect environmental performance. Ye et al. (2016) point out that Chinese Nian culture may contribute to environmental pollution due to fireworks and firecrackers. Milfont and Schultz (2016) conduct cross-cultural research on the influence of culture on environmental protection and find that the most individuals influenced by culture prioritize environmental protection. Hence, culture has a significant impact on the environment, but whether it is beneficial or harmful remains inconclusive. Furthermore, culture exerts a subtle influence on individuals, governments, and businesses. Shareef et al. (2016) compare cultural differences between Bangladesh and the United States and find that cultural factors significantly impact consumer choices, emphasizing the need for considering cultural factors in government policy-making. Zhao (2011) studies samples from 84 countries worldwide and discovers that ethnic culture significantly influences whether governments adopt e-government practices. Chen and Biswas (2023) point out that culture affects the spread of COVID-19 by influencing individual perceptions and government containment strategies. Lee et al. (2013) highlight the impact of cultural differences on mobile phone usage, noting that in individualistic cultures, people tend to seek information from direct and formal sources, while in collectivist cultures, they rely more on subjective evaluations of innovation. Ribbink and Grimm (2014) investigate the influence of culture on negotiations between buyers and suppliers, revealing that cultural differences encountered in the daily business interactions of global supply chains have a substantial impact on negotiation outcomes.

Confucian culture, deeply rooted in traditional Chinese society, exerts significant influence on various aspects of contemporary life, potentially affecting firms' pollution emissions. Schwartz (1994) outlines cultural traits in three dimensions: conservatism, harmony, and egalitarianism, while Hofstede (1980) categorizes cultural traits into four dimensions: individualism, power distance, uncertainty avoidance, and masculinity. Based on these, this paper investigates the impact of Confucian culture, which emphasizes values such as benevolence, harmony, justice, wisdom, and the rule of law, on firms' environmental practices as perceived by government entities, residents, and the firms themselves. Based on this, we propose three hypotheses.

Confucian culture values harmony and unity between human and nature. On the one hand, it emphasizes the necessity for human to coexist harmoniously with nature. On the other hand, it acknowledges the shared origin of human and nature. Confucius says, "Heaven doesn't speak in words. It speaks through the rotation of the four seasons and the growth of all living things" (*Analects of Confucius*, *Yangshuo*), expressing his reverence for the laws of nature. Xunzi proposes that the management of mountains, forests, and rivers, the rational development and protection of natural resources, should be included in the rules. He insists that logging and hunting must follow certain seasons in order to protect biological resources. Confucius regards environmental protection as an important content of "benevolent governance". This indicates that Confucian culture requires rulers to place environmental preservation at the forefront of statecraft, a philosophy that still resonates in modern governance. On 18 October 2017, General Secretary Xi Jinping underscored this connection at the 19th National Congress of the Communist Party of China: "Human and nature are a community of life. Human beings must respect nature, conform to nature and protect nature. Only by following the rules of nature can human effectively prevent going astray in the development and utilization of nature. The harm of human to nature will ultimately hurt themselves, which is an irresistible law." This is consistent with the natural view advocated by Confucian culture. Governments in regions heavily influenced by Confucian culture will attach more importance to environmental protection. While building the economy, developing nature, and using resources, they will pay more attention to the relationship between human and nature. Such a government has stricter environmental regulations on firms, thus reducing pollution emissions.

Hypothesis 1. Confucian culture can enhance the government's environmental regulation of firms, thereby reducing firms' pollution emissions.

Moreover, Confucian culture also affects public environmental awareness. For the public, environmental protection transcends legal obligation, representing a moral imperative. Therefore, Confucian culture does not solely shape public environmental awareness, it also molds the public's environmental attitudes through a moral framework. Confucius says, "The wise man comprehends righteousness; the villain comprehends profit." (*Analects of Confucius*, *Li Ren*). He believes that gentlemen should pay more attention to social justice, while villains will focus more on their own interests. Therefore, people and firms influenced by Confucian culture will be more willing to take on social responsibilities (Wang & Juslin, 2009) and be more conscious of protecting the environment. Confucius regards "benevolence" as the core of Confucian culture, and believes that "ritual, righteousness, integrity, shame, filial piety, brotherhood, loyalty, and trust" all revolve around "benevolence". Living in harmony with the environment is also an important part of "benevolence". Therefore, under the influence of Confucian culture's "benevolence", the public's environmental awareness will also be enhanced. The stronger the local environmental awareness, the lower the firms' pollution emissions.

Hypothesis 2. Confucian culture can reduce pollution emissions from local firms by raising the public

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environmental awareness and nurturing a deeper respect for nature.

In addition, Confucian culture can improve the innovation capacity of firms, leading to a reduction in pollution emissions. First, Confucian culture emphasizes the importance of education and the spread of knowledge. Therefore, regions profoundly influenced by Confucian culture tend to have higher levels of education and produce a surplus of talented individuals. This abundance of talent and intellectual resources empowers firms to bolster their innovation capabilities (Jang et al., 2016). Second, Confucian culture emphasizes "sincerity". Confucius says, "A man without honesty is capable of nothing." (*Analects of Confucius*, *Government*), considering sincerity as the foundation of a person. Sincerity is seen as indispensable for an individual's success in society. This adherence to sincerity fosters more standardized behavior among competitors in regions heavily influenced by Confucian culture, reducing the risk of intellectual property theft and imitation of innovative accomplishments. In general, Confucian culture enhances the innovation capacity of firms and reduces their pollution emissions.

Hypothesis 3. Confucian culture can reduce firms' pollution emissions by enhancing their innovation capacity.

3 | EMPIRICAL STRATEGY AND DATE

Existing literature on the environmental pollution among Chinese enterprises mostly utilizes data from listed companies (Cai et al., 2020; Song et al., 2017). However, the number of listed companies in China is small and geographically concentrated in economically developed regions. The distribution of listed companies is directly proportional to the economic strength of the provinces where the companies are located. For instance, Guangdong has the highest number of listed companies, with 577, accounting for 16.42% of the national total. In contrast, underdeveloped provinces like Guangxi, Qinghai, Shanxi, and Inner Mongolia have no listed companies (Chen et al., 2022). However, the topic of this study, Confucian culture, involves geographical distribution. Confucian culture influences various regions in China, not just economically developed regions. Therefore, the firm data used in this article from 1998 to 2013 comes from ASIF provided by National Bureau of Statistics, and the data on firm pollution emissions are obtained from CESD provided by China's Ministry of Environmental Protection. The firm samples are distributed across various regions in China, covering a significant portion of firms from different industries, representing 85% of China's industrial output (Chen et al., 2022). Considering the availability and completeness of the data, the wastewater emissions per unit of output and SO_2 emissions per unit of output are finally used as the explained variables to measure the pollution emissions of firms. Regarding the measurement methods of the degree of Confucian culture influence in different regions, there are mainly three types of indicators used in current literature: First, the distance from different firms to Confucian temples or the number of Confucian temples within a certain distance radius of the firm is used as the indicator for measuring the influence of Confucian culture on the firm (Chen, Kung, & Ma, 2020; Chen, Ye, et al., 2020; Fu et al., 2022). However, Confucian temples that still exist today are likely to be highly correlated with contemporary economic, social, and cultural conditions. Therefore, it results in a high degree of endogeneity. Second, the number of genealogies in different regions is used to measure the degree of Confucian cultural influence (Xu, Duan, & Yan, 2019; Yan et al., 2021). However, according to research by Chen et al. (2022), the number of genealogies is not a measure of Confucian culture, but rather a reflection of clan power. Third, the number of *jinshi* in different regions during the Ming and Qing dynasties is also a commonly used indicator (Chen et al., 2022). This paper uses these indicators to measure the influence of Confucian culture. In Confucian culture, being an official is the most respected, and the civil exam was the only road to officialdom for common people (Chen et al., 2022). China's civil examination system comprises three levels. At the entry level is the prefectural exam, passing this examination leads to the qualification of a *shengyuan*. The next level up is the provincial exam, which only the qualified *shengyuan* are allowed to take. If they pass this exam, they will be awarded a *juren*. Finally, only those with a *juren* qualification are permitted to take the *jinshi* exam. Passing the *jinshi* examination bestows the title of *jinshi*, guaranteeing a position in mid-to-high-level government administration. Those who take the exam have a 0.016% chance of getting a *jinshi* (Chen et al., 2022). *Jinshi* not only presents the highest status level that can be obtained through the imperial examination system, but also symbolizes the highest honor of Confucian culture. The larger the number, the deeper the influence of Confucian culture. Considering the substantial population variations among regions during the Ming and Qing dynasties, using the density of *jinshi* in each region as the measurement is more reasonable. Consequently, this paper finally selects the density of *jinshi* in each prefecture-level city during the Ming and Qing dynasties (ln*jinshi*) as the main measure of Confucian culture and simultaneously uses the density of *juren* and *shengyuan* in each region as robustness checks.

Based on this, the benchmark equation for identifying the impact of Confucian culture on firms' pollution emissions in this paper is set as follows:

$$\text{Pollution}cjit = \alpha + \beta Rujiac + \gamma Xcjit + vt + up + wj + \epsilon cjit.$$

Among them, the explained variable $Pollution_{cjit}$ is firms' pollution emissions, represented by the logarithmic value of the firm wastewater and SO_2 emissions per unit of output. $Rujia_c$ is the core explanatory variable, representing the degree to which each city is influenced by Confucian culture. In the benchmark regression analysis, $Rujia_c$ is represented by the density of *jinshi* in each city during the Ming and Qing dynasties. X_{cjit} represents the matrix of relevant control variables, mainly including the size of the firm *lnsize*, represented by the logarithm value of the number of employees; the proportion of sales to total output *sale*; the logarithm value of the age of the firm *lnage*;

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TABLE 1 Descriptive statistics.

Variable	Obs	Mean	SD	Min	Max
lnw	22,324	0.131	2.163	−10.947	12.115
lnSO_2	20,219	−0.443	2.217	−12.014	8.132
ln*jinshi*	25,822	1.313	0.923	0	3.959
ln*juren*	25,822	2.289	1.024	0	5.901
ln*shengyuan*	25,822	4.713	0.653	0	5.825
bprvdist	25,822	7.173	5.816	0	20.027
lnER	24,994	−6.992	0.586	−8.855	−5.336
lnTFP	25,822	6.735	1.154	−1.129	11.789
sale	25,779	1.153	0.524	0.3555	4.184
lnsize	25,822	5.602	1.075	2.079	9.716
lnage	25,197	2.331	1.048	0	7.601
Q1	2573	3.068	0.864	1	4
Q2	2595	4.210	2.532	1	8
Q3	2571	2.897	0.917	1	4
Q4	2591	2.565	0.963	1	4

whether the firm is state-owned *soe*; and the fixed effects of year, province, and industry v_t, u_p, and w_j.

Table 1 lists the descriptive statistic results of the main variables in this study. The mean value of the firm wastewater emissions intensity is 0.131, and the standard deviation is 2.163. The mean value of the firm SO_2 emission intensity is −0.443, and the standard deviation is 2.217. It indicates that there are significant differences in the wastewater and SO_2 emissions of different firms. The density of *jinshi* during the Ming and Qing dynasties, that is, the number of *jinshi* per 10,000 population, its logarithm has a mean value of 1.313 and a standard deviation of 0.923; the logarithm of the density of *juren* has a mean value of 2.289 and a standard deviation of 1.024; the logarithm of the density of *shengyuan* has a mean value of 4.713 and a standard deviation of 0.653, indicating significant differences in the influence of Confucian culture in different regions.

In terms of distribution of other control variables, the mean value of the logarithm of the number of employees *lnsize* is 5.602, with a standard deviation of 1.075; the mean value of the logarithm of the age of the firm *lnage* is 2.331, with a standard deviation of 1.048. There is a large difference between the size and age of sample firms. The mean value and standard deviation of the sales ratio *sale* are 1.153 and 0.524, respectively. The firms' sales accounted for a relatively high proportion of total output, indicating that the sales of firms are relatively good and there are not many accumulated inventories. To more intuitively show the distribution of the density of *jinshi* in the Ming and Qing dynasties in various regions, Figure 1 plots the geographical distribution of *jinshi* density. It can be seen that the geographical distribution of *jinshi* during the Ming and Qing dynasties shows a clear clustering feature, and the *jinshi* density in the Yangtze River Delta region is significantly higher than in other regions. In order to avoid the possibility that the results are driven mainly by the above regions, a sub-sample regression is required to ensure the robustness of the empirical results.

4 | EMPIRICAL RESULTS

Table 2 reports the results of the benchmark regression. To alleviate the endogenous issues caused by omitted variables and obtain more accurate estimates, the benchmark regression controls the fixed effects of province, industry, and year. The explanatory variables of the model corresponding to column (1) only include *jinshi* density and fixed effects. The regression results reveal that the estimated coefficient of *jinshi* density is −0.0246, significant at the 1% level. This coefficient indicates that if the number of *jinshi* per 10,000 people during the Ming and Qing dynasties doubles, the wastewater emissions of firms per unit of output will decrease by 2.46%. The column (2) corresponds to a model that further includes control variables on the basis of column (1) regression model. The results indicate that the estimated coefficient of *jinshi* density is −0.024, significant at the 1% level. After adding relevant control variables, the coefficient of *jinshi* density does not show a significant change, indicating that this variable has a certain exogeneity. Simultaneously, after adding control variables, if the number of *jinshi* per 10,000 people during the Ming and Qing dynasties doubles, the unit wastewater emissions of firms will decrease by 2.4%. The corresponding model in column (4) takes the SO_2 emission of firms as the explained variable, and only takes the *jinshi* density and fixed effects as explanatory variables. The results show that the estimated coefficient of the *jinshi* density is −0.122, significant at the 1% level, meaning that if the number of *jinshi* per 10,000 people during the Ming and Qing dynasties doubles, then the unit SO_2 emissions of firms will decrease by 12.2%. The corresponding model in column (5) further includes control variables based on the regression model in column (4). The results show that the estimated coefficient of *jinshi* density is −0.0986, significant at the 1% level. This result indicates that if the number of *jinshi* per 10,000 people during the Ming and Qing dynasties doubles, the unit SO_2 emissions of firms will decrease by 9.86%. This result confirms the influence of culture on the environment and demonstrates that Confucian culture can significantly reduce firms' pollution emissions. Therefore, the government should continue to promote and strengthen the dissemination of Confucian culture, and firms should enhance their learning about Confucian culture.

Considering the complex and diverse factors that affect firms' pollution emissions, even though this article has controlled for fixed effects from province, region, and year, there may still be problems with omitted variables. If other unobserved factors (such as genes, etc.) simultaneously affect the imperial examination in different regions during the Ming and Qing dynasties and the contemporary firm pollution emissions, this would still lead to endogenous issues. For this reason, this article refers to Chen, Kung, and Ma (2020) and Chen, Ye, et al. (2020) and employs the average distance from each region to the nearest bamboo and pine forest as an

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FIGURE 1 Distribution of jinshi density.

TABLE 2 Confucian culture and firms' pollution emissions: benchmark regression.

	(1) FE lnw	(2) FE lnw	(3) IV lnw	(4) FE $lnSO_2$	(5) FE $lnSO_2$	(6) IV $lnSO_2$
ln*jinshi*	−0.0246***	−0.0240***	−0.0511***	−0.122***	−0.0986***	−0.148***
	(0.00634)	(0.00696)	(0.0100)	(0.00628)	(0.00695)	(0.0100)
lnsize		0.0878***	0.0888***		−0.139***	−0.137***
		(0.00587)	(0.00587)		(0.00575)	(0.00576)
sale		0.0730***	0.0731***		0.0604***	0.0605***
		(0.00348)	(0.00348)		(0.00297)	(0.00297)
lnage		0.243***	0.242***		0.138***	0.138***
		(0.00588)	(0.00588)		(0.00560)	(0.00560)
Constant	0.326***	−0.849***		−0.0625***	0.305***	
	(0.00954)	(0.0354)		(0.00899)	(0.0346)	
Year FE	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y
Province effects	Y	Y	Y	Y	Y	Y
Cragg-Donald Wald F			9.3e+04			8.5e+04
Obs.	126,627	100,862	100,862	116,537	92,320	92,320
R^2	0.309	0.329	0.027	0.464	0.477	0.017

Note: Standard errors in parentheses.
***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

instrumental variable. During the Ming and Qing dynasties, success in the imperial examination hinged largely on candidates' proficiency in Confucian classics, necessitating access to authoritative texts. Bamboo served as a crucial raw material for paper production, and pine trees were used to make ink. Both materials were indispensable for printing and book production. Due to the region's transportation constraints, regions closer to these resources had a distinct advantage in accessing scholarly materials, correlating geographical conditions with the availability of study resources for the imperial examinations. Therefore, the distance of each region to bamboo and pine forests as an instrumental variable is closely related to the *jinshi* density, satisfying the correlation condition for instrumental variables.

Bamboo forests and pine forests, as natural products, are not artificially cultivated for the specific purpose of book printing, they exhibit strong exogeneity. The average distance to bamboo forests

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TABLE 3 Confucian culture and firms' pollution emissions: robustness I.

	(1) FE lnw	(2) FE lnw	(3) IV lnw	(4) FE $lnSO_2$	(5) FE $lnSO_2$	(6) IV $lnSO_2$
ln*juren*	−0.0470***	−0.0394***	−0.0473***	−0.0875***	−0.0708***	−0.139***
	(0.00605)	(0.00663)	(0.00930)	(0.00587)	(0.00648)	(0.00945)
Constant	0.401***	−0.790***		−0.0187	0.353***	
	(0.0146)	(0.0374)		(0.0137)	(0.0365)	
Controls	N	Y	Y	N	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y
Cragg-Donald Wald F			1.0e+05			8.1e+04
Obs.	126,627	100,862	100,862	116,537	92,320	92,320
R^2	0.309	0.329	0.027	0.463	0.477	0.015

Note: Standard errors in parentheses.
***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

and pine forests only affects the availability of books, which in turn affects the performance of each region in the imperial examination, with little correlation with other factors. Therefore, it can be considered that the instrumental variable only affects the explained variable through the endogenous variable of *jinshi* density. The instrumental variables chosen in this article also meet the assumptions. Columns (3) and (6) in Table 2 report the regression results with instrumental variables, adding control variables and fixed effects. Column 3 shows the estimated coefficient of *jinshi* density is −0.051, significant at the 1% level. The estimated coefficient is approximately twice the ordinary least squares estimate, which means if the number of *jinshi* per 10,000 people during the Ming and Qing dynasties doubles, the firm wastewater emissions per unit of output will decrease by 5.11%. Column (6) shows that the estimated coefficient of *jinshi* density is −0.148, significant at the 1% level. It means that if the number of *jinshi* per 10,000 people during the Ming and Qing dynasties doubles, then the SO_2 emissions of firms per unit of output will decrease by 14.8%, consistent with the results of the fixed effects model. In addition, the instrumental variable passes the Cragg-Donald test, indicating that the instrumental variable selected in this article is not a weak instrumental variable.

In the benchmark regression, this paper uses the *jinshi* density during the Ming and Qing dynasties to measure Confucian culture, while *juren* and *shengyuan* are also important levels of status in the ancient imperial examination system. The degree of Confucian cultural influence may be underestimated in regions with a high density of *juren* and *shengyuan* but a low density of *jinshi*. Using different variables of status levels to measure Confucian culture may lead to different results. Based on this, the density of *juren* and *shengyuan* in different regions during the Ming and Qing dynasties is used to replace the *jinshi* density. In this way, the degree of Confucian cultural influence in different regions is measured and the influence of Confucian culture on firms' pollution emissions is re-estimated. The results are shown in Tables 3 and 4. Column (2) in Table 3 shows that the estimated value of *juren* density coefficient is −0.047, significant at the 1% level. It indicates that if the number of *juren* per 10,000 people during the Ming and Qing dynasties doubles, the firm wastewater emissions per unit of output will decrease by 3.94%. Column (5) shows that the estimated coefficient of *juren* density is −0.0708, significant at the 1% level. It means that if the number of *juren* per 10,000 people during the Ming and Qing dynasties doubles, the firm SO_2 emissions per unit of output will decrease by 7.08%. It can be seen that regardless of which status level density variable, the same conclusion can be drawn, that Confucian culture significantly reduces the pollution emissions of firms.

Table 4 presents the estimated results using the density of *shengyuan* as the regional proxy variable for Confucian culture. The results in column (2) of the table show that the estimated coefficient for *shengyuan* density is −0.0833, significant at the 1% level. It means that if the number of *shengyuan* per 10,000 people during the Ming and Qing dynasties doubles, the firm wastewater emissions per unit of output will reduce by 8.33%. The results in column (5) show that the estimated coefficient of *shengyuan* density is −0.209, significant at the 1% level. It means that if the number of *shengyuan* per 10,000 people during the Ming and Qing dynasties doubles, the firm SO_2 emissions per unit of output will reduce by 20.9%. It can be seen that even if using the lowest status level (*shengyuan* density) as the proxy variable of Confucian culture, there are still significant effects of Confucian culture on reducing firms' pollution emissions. This conclusion will not change with the measurement indicators. It indicates that the results of this article have good robustness for different ways of measuring Confucian culture.

As a significant way for selecting talents in ancient China, the imperial examination system was characterized by qualities such as

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TABLE 4 Confucian culture and firms' pollution emissions: robustness II.

	(1) FE lnw	(2) FE lnw	(3) IV lnw	(4) FE $lnSO_2$	(5) FE $lnSO_2$	(6) IV $lnSO_2$
ln*shengyuan*	−0.0953***	−0.0833***	−0.207***	−0.226***	−0.209***	−0.594***
	(0.0127)	(0.0141)	(0.0407)	(0.0117)	(0.0130)	(0.0405)
Constant	0.740***	−0.496***		0.837***	1.144***	
	(0.0597)	(0.0728)		(0.0544)	(0.0678)	
Controls	N	Y	Y	N	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y
Cragg-Donald Wald F			1.4e+04			1.1e+04
Obs.	126,627	100,862	100,862	116,537	92,320	92,320
R^2	0.309	0.329	0.026	0.464	0.478	0.009

Note: Standard errors in parentheses.
***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

TABLE 5 Confucian culture and firms' pollution emissions: removal of Yangtze River Delta.

	(1) FE lnw	(2) FE lnw	(3) IV lnw	(4) FE lnSO|	(5) FE $lnSO_2$	(6) IV lnSO2
ln*jinshi*	−0.102***	−0.0955***	−0.0679***	−0.160***	−0.135***	−0.154***
	(0.00751)	(0.00820)	(0.0112)	(0.00754)	(0.00829)	(0.0114)
Constant	0.395***	−0.869***		0.00531	0.317***	
	(0.0107)	(0.0389)		(0.0101)	(0.0381)	
Controls	N	Y	Y	N	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y
Cragg-Donald Wald F			4.7e+04			9.1e+04
Obs.	108,932	87,067	87,067	101,260	80,443	80,443
R^2	0.295	0.318	0.029	0.459	0.473	0.018

Note: Standard errors in parentheses.
***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

background, equal competition, open examination, and survival of the fittest. However, due to the need for a large number of books and a significant amount of time to participate in the exam, family background is also an important factor in achieving a good ranking. This also resulted in a concentration of *jinshi* in southern regions (now the Yangtze River Delta region, as shown in Figure 1). Therefore, it may lead to bias when using the full sample for estimation. The conclusion of the benchmark regression may not exist after excluding the influence of this region. To address this concern, this study re-estimated the samples of the remaining regions after excluding related prefecture-level cities in the Yangtze River Delta region (Zhejiang, Anhui, Shanghai, and Jiangsu), and the results are shown in Table 5.

Column (2) in Table 5 shows that the estimated coefficient of the *jinshi* density is −0.0955, significant at the 1% level. Following the exclusion of high-density *jinshi* regions, the coefficient not only remains stable but also exhibits a significant increase. It indicates that the benchmark conclusion of this study is not entirely driven by the high *jinshi* density in the Yangtze River Delta region. This estimated coefficient means that in the remaining regions outside of the Yangtze River Delta, if the number of *jinshi* per 10,000 people during the Ming and Qing dynasties doubles, the firms' wastewater emissions per unit of output will decrease by 9.55%. Column (5) shows that the coefficient of the *jinshi* density is −0.135, significant at the 1% level. In the remaining regions outside the Yangtze River Delta, if the number of *jinshi* per 10,000 people during the Ming and Qing

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TABLE 6 Confucian culture and firms' pollution emissions: removal of wastewater industry.

	(1) FE lnw	(2) FE lnw	(3) IV lnw	(4) FE $lnSO_2$	(5) FE $lnSO_2$	(6) IV $lnSO_2$
ln*jinshipop*	−0.0614***	−0.0532***	−0.0637***	−0.150***	−0.121***	−0.161***
	(0.00814)	(0.00893)	(0.0126)	(0.00830)	(0.00911)	(0.0129)
Constant	0.101***	−0.905***		0.0105	0.516***	
	(0.0122)	(0.0456)		(0.0116)	(0.0454)	
Controls	N	Y	Y	N	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y
Cragg-Donald Wald F			6.3e+04			5.6e+04
Observations	79,579	63,947	63,947	72,105	57,593	57,593
R^2	0.246	0.262	0.029	0.530	0.542	0.022

Note: Standard errors in parentheses.
***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

dynasties doubles, the firm SO_2 emissions per unit of output will decrease by 13.5%. The estimated result of using the instrumental variable is consistent with this. Therefore, it can be seen that even if the influence of the Yangtze River Delta region is removed, the Confucian culture in the remaining regions also significantly reduces firms' pollution emissions.

Chen et al. (2018) indicate that China regulates certain water pollution industries such as agriculture, textile, clothing, paper, oil and coal, chemical products, and metal products. These industries may be subject to government water pollution monitoring, which could affect the regression results of the study. This means that the pollution reduction found in the study may be due to the government's strict monitoring. To account for this, the study removes samples from water pollution industries and re-estimates the results. Table 6 shows these results.

The results in column (2) of Table 6 show that the estimated coefficient of the *jinshi* density is −0.0532, significant at the 1% level. This means that if the number of *jinshi* per 10,000 people during the Ming and Qing dynasties doubles, the firm wastewater emissions per unit of output will decrease by 5.32%. Column (5) shows an estimated coefficient of −0.121 of the *jinshi* density, which is significant at the 1% level. It means that if the number of *jinshi* per 10,000 people during the Ming and Qing dynasties doubles, the firm SO_2 emissions per unit of output will decrease by 12.1%. The results using instrumental variables are consistent with these results. It suggests that even after removing water pollution industries, Confucian culture still significantly reduces the pollution emissions of remaining firms. The estimated results are still robust. Additionally, the coefficients of the *jinshi* density are higher than those in the benchmark regression. It indicates that we may have underestimated the influence of Confucian culture on firms. Due to the government's pollution monitoring, firms in regions with weak Confucian cultural influence are forced to reduce pollution emissions. The results of Tables 5 and 6 collectively demonstrate the widespread influence of Confucian culture. Confucian culture not only affects the pollution emissions of firms in economically developed regions but also has an impact on the pollution emissions of firms across various regions nationwide. Additionally, Confucian culture reduces pollution emissions from both heavily polluting firms and regular firms. This implies that when the government promotes Confucian culture, it should not focus solely on economically developed regions and heavily polluting firms but should also consider less economically developed regions and regular firms.

TABLE 7 Confucian culture and firms' pollution emissions: intensity of environmental regulation.

	(1) FE lnER	(2) FE lnER	(3) IV lnER
ln*jinshi*	0.106***	0.0959***	0.0749***
	(0.00354)	(0.00428)	(0.00687)
Constant	−7.135***	−6.910***	
	(0.00557)	(0.0608)	
Controls	N	Y	Y
Year FE	Y	Y	Y
Industry FE	Y	Y	Y
Province FE	Y	Y	Y
Cragg-Donald Wald F			2.5e+04
Obs.	30,403	30,403	30,403
R^2	0.203	0.220	0.049

Note: Standard errors in parentheses.
***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

The Confucian culture values the harmony between human and nature, advocating for the unity of both. It promotes a philosophy of "benevolence for all things" and encourages a compassionate and

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caring attitude towards the world. This perspective on nature exerts a significant impact on our behaviors and values. General Secretary Xi Jinping pointed out in a speech at Peru's Congress on November 21, 2016, that the Chinese people have always followed the principle of "sincerity as the way, benevolence as morality". Therefore, regions where Confucian culture has a strong influence tend to prioritize environmental protection and stronger environmental regulations. With stronger environmental regulations, firms are compelled to reduce pollution emissions further (Ionescu et al., 2020; Li & Achal, 2020; Zhang & Vigne, 2021).

Therefore, this paper explores the relationship between Confucian culture and the environmental regulation intensity of each region. To measure the environmental regulation intensity, we employ the logarithm of the proportion of words related to environmental protection in the work report of the prefecture-level city government as a proxy variable. A higher index indicates that environmental protection is a more significant focus in the government's work report, reflecting stronger environmental regulations. The estimation results are listed in Table 7. It shows that the estimated coefficient of *jinshi* density is 0.0959, significant at the 1% level. This means that if the number of *jinshi* per 10,000 people during the Ming and Qing dynasties doubles, the intensity of local environmental regulation will increase by 9.59%. In addition, it is consistent with the results of the instrumental variable regression. Confucian culture can strengthen the environmental regulation of local governments, thus reducing the intensity of firm pollution emissions. This result is consistent with our Hypothesis 1. Confucian values of benevolence and harmony lead the government to emphasize environmental impacts alongside economic development. Additionally, Confucian principles of legalism and rule awareness prompt the government to reduce firm pollution emissions through environmental regulations. Based on this, regular learning activities on Confucian culture can be held within the government, and government staff should enhance their learning of Confucian culture. There is also greater consideration of culture in the development of environmental policies.

Confucian culture's view of nature not only affects the government's environmental regulation but also affects the public's environmental awareness. In regions where Confucian culture has a greater impact, residents tend to exhibit a higher level of environmental consciousness and a greater respect for the environment. They prioritize environmental protection as a moral standard. The Confucian culture emphasizes "ethics", encouraging individuals to govern themselves with virtuous moral conduct. In such a moral framework, people naturally pay more attention to environmental preservation. The stronger the public's awareness of environmental protection, the lower the pollution emissions of local firms (Chen, Huang, and Lin (2019); Chen, Jin, et al. (2019); Wang et al., 2016; Fu et al., 2020). This article uses the 2010 Chinese General Social Survey (CGSS) questionnaire, which measures residents' environmental awareness, to conduct a regression analysis on four questions about residents' environmental awareness. Q1: Do you often refrain from buying certain products for environmental protection? (In the lower scores, environmental awareness is stronger); Q2: Do you often separate glass, aluminum cans, plastic, or newspapers to facilitate recycling? (In the lower scores, environmental awareness is stronger); Q3: Do you often reduce your home's energy or fuel consumption to protect the environment (In the lower scores, environmental awareness is stronger); Q4: Do you often conserve water or reuse water for environmental protection (in the lower scores, environmental awareness is stronger)? The related estimated results are shown in Table 8. The coefficients of each column are significantly negative, indicating that a higher *jinshi* density in a region corresponds to stronger environmental awareness and a greater commitment to environmental protection among residents. This result is consistent with our Hypothesis 2. This illustrates that the Confucian culture's emphasis on benevolence and harmony significantly influences people's values, making them prioritize the harmonious coexistence of humans and nature and fostering stronger environmental awareness. Consequently, pollution emissions from regional firms decrease. This implies that the government should enhance the promotion of Confucian culture at the local level, encouraging the public to learn about Confucian culture to strengthen environmental consciousness.

Tian et al. (2018) reveal that benevolence as a Confucian virtue can trigger innovation by forcing a user-centered focus and widening managers' perspectives of stakeholder interests. Another Confucian principle, the Doctrine of the Mean, can also boost innovation by defining the employee-management relationship. Based on this, this paper uses total factor productivity (TFP) to represent the innovation ability of the firm for mediating effect testing, and the results are shown in Tables 9 and 10. The coefficient in column (2) of Table 9 is 0.0436, significant at the 1% level. This means that the number of *jinshi* per 10,000 people during the Ming and Qing dynasties doubles will increase the TFP of the firm by 4.36%. The regression results of the instrumental variable are also consistent with this. Confucian culture can significantly improve the TFP level of local firms. The coefficient of *jinshi* density in column (2) of Table 10 is −0.0462, significant at the 1% level. This means that the number of *jinshi* per 10,000 people during the Ming and Qing dynasties doubles will decrease the firms' wastewater emissions per unit of output by 4.62%. In addition, the instrumental variable regression results are consistent with this. The coefficient in column (5) is −0.152, significant at the 1% level. It means that the number of *jinshi* per 10,000 people during the Ming and Qing dynasties doubles will decrease the firms' SO_2 emissions per unit of output by 15.2%, and the instrumental variable results are also consistent with this. Therefore, it can be seen that Confucian culture can reduce firms' pollution emissions by improving firms' innovation ability. This result is consistent with our Hypothesis 3. Confucian culture plays an important role in the development of firms, and firms should also fully leverage the role of Confucian culture in the development process. The Confucian cultural encourages firms to prioritize learning and innovation. Consequently, in regions heavily influenced by Confucian culture, firms place greater importance on innovation. Firms with stronger innovation capabilities tend to have lower pollution emissions.

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TABLE 8 Confucian culture and environmental attitude of public.

	(1) Q1	(2) Q2	(3) Q3	(4) Q4
OLS				
ln*jinshi*	−0.109***	−0.372***	−0.101***	−0.139***
	(0.0210)	(0.0615)	(0.0226)	(0.0233)
Constant	3.055***	3.855***	2.892***	2.754***
	(0.0643)	(0.188)	(0.0691)	(0.0713)
Controls	Y	Y	Y	Y
Obs.	2230	2247	2232	2244
R^2	0.021	0.027	0.010	0.020
2SLS				
ln*jinshi*	−0.110***	−0.585***	−0.0959***	−0.170***
	(0.0334)	(0.0986)	(0.0362)	(0.0372)
Controls	Y	Y	Y	Y
Cragg-Donald Wald F	1.44e+03	1.44e+03	1.43e+03	1.43e+03
Obs.	2230	2247	2232	2244
R^2	0.021	0.022	0.010	0.019

Note: Standard errors in parentheses
***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

TABLE 9 Confucian culture and firms' pollution emissions: productivity of firms.

	(1) FE lnTFP	(2) FE lnTFP	(3) IV lnTFP
ln*jinshi*	0.0806***	0.0436***	0.0769***
	(0.00325)	(0.00374)	(0.00542)
Constant	6.682***	3.231***	
	(0.00469)	(0.0196)	
Controls	N	Y	Y
Year FE	Y	Y	Y
Industry FE	Y	Y	Y
Province FE	Y	Y	Y
Cragg-Donald Wald F			9.1e+04
Obs.	189,303	101,036	101,036
R^2	0.024	0.287	0.261

Note: Standard errors in parentheses.
***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

5 | DISCUSSION

The aim of this study is to explore how Confucian culture influences pollution emissions of firms based on ASIF and CESD. Our research findings indicate that Confucian culture significantly reduces pollution emissions of firms by strengthening government environmental regulations and regional environmental awareness. This provides strong evidence for the discussion of cultural factors' impact on the environment.

More and more scholars pay attention to the environmental implications of informal institutions (Gaganis et al., 2021; Wicher, 2014; Xie et al., 2023). Culture, as an informal institution, significantly affects environmental pollution. Boyle (1998) points out that the cultural characteristics of Thailand, India, and Malaysia lead to a reliance on authority, with hierarchy and status as principles of social organization. Environmental institutions with lower status have little power or authority, lacking the necessary interagency cooperation for effective environmental impact assessment. This leads to the isolation of environmental agencies and the public's demand for environmental protection, making it difficult for environmental institutions to implement environmental impact assessments. However, Arbuckle and Konisky (2015) argue that religious culture inhibits environmental protection, as members of the Jewish-Christian tradition are less concerned about environmental protection compared to their non-religious peers, which contradicts the results of this paper. Li et al. (2013) indicate that culture can enhance employees' environmental awareness, thus reducing environmental pollution by businesses, which aligns with the results of this paper. This may be due to cultural differences between countries having different influences on company behavior (Bacsi, 2020; Gallego-Álvarez & Ortas, 2017). Vitolla et al. (2019) suggest that cultures emphasizing collectivism and constraints have a positive impact on environmental protection, while Meng et al. (2018) suggest that cultures that avoid uncertainty tend to be more environmentally protective. Undoubtedly, Confucian culture emphasizes rule compliance (Tsai & Tsai, 2022), collectivism (Ye et al., 2022), and risk avoidance (Du et al., 2022; Wang et al., 2023). The conclusions of this paper are consistent with such literature and results.

Additionally, this study differs from the literature review methods used by previous scholars. For example, Zheng et al. (2021) synthesize

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TABLE 10 Confucian culture and firms' pollution emissions: productivity of firms.

	(1) FE lnw	(2) FE lnw	(3) IV lnw	(4) FE $lnSO_2$	(5) FE $lnSO_2$	(6) IV $lnSO_2$
lnTFP	−0.362***	−0.564***	−0.562***	−0.483***	−0.520***	−0.517***
	(0.00589)	(0.00682)	(0.00683)	(0.00625)	(0.00738)	(0.00739)
ln*jinshi*	−0.0422***	−0.0462***	−0.114***	−0.158***	−0.152***	−0.244***
	(0.00829)	(0.00817)	(0.0117)	(0.00895)	(0.00899)	(0.0129)
Constant	2.764***	1.200***		3.099***	2.908***	
	(0.0396)	(0.0463)		(0.0421)	(0.0494)	
Controls	N	Y	Y	N	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y
Province FE	Y	Y	Y	Y	Y	Y
Cragg-Donald Wald *F*			8.5e+04			7.6e+04
Obs.	90,483	87,838	87,838	83,256	80,682	80,682
R^2	0.066	0.116	0.092	0.125	0.143	0.090

Note: Standard errors in parentheses.
***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

academic knowledge from 300 publications to explore the relationship between cultural values and the societal achievement of sustainable development goals. Piwowar-Sulej (2022) conducts research on the impact of cultural dimensions on corporate sustainability using citation counts. They also utilize Hofstede's framework to measure cultural dimensions (Heydari et al., 2021; Taras et al., 2023). This paper employs regional Ming-Qing era scholar density as a proxy variable for Confucian culture and utilizes instrumental variable methods to overcome endogenous issues and accurately identify the causal relationship between Confucian culture and firms' pollution emissions. It also reveals the mechanisms through which Confucian culture influences firms' pollution emissions, providing a more precise understanding of how culture impacts pollution emissions of firms. Moreover, previous literature has mostly focused on how culture influences individuals' environmental awareness (Falamarzi et al., 2021; Yang et al., 2021). This paper, for the first time, suggests that Confucian culture may reduce firms' pollution emissions by influencing government behavior. This implies that not only should individuals learn and inherit Confucian culture, but policymakers should also draw lessons from Confucian culture.

6 | CONCLUSION

Since the Han Dynasty, Confucian culture has remained a dominant force within traditional Chinese culture, silently influencing generation after generation of Chinese people. This paper uses the *jinshi* density during the Ming and Qing dynasties as a proxy variable for Confucian culture. Based on data from the ASIF and CESD (from 1998 to 2013), this paper examines the causal relationship between Confucian culture and firms' pollution emissions. Unlike previous studies that used distance to Confucian temples (Chen, Kung, & Ma, 2020; Chen, Ye, et al., 2020; Fu et al., 2022) or the number of Confucian academies (Yan et al., 2021) as measures, this paper can better address the endogenous issues and more accurately identify the causal relationship between Confucian culture and firm pollution. Besides, this paper accurately identifies the impact of Confucian culture on environmental pollution, not just environmental awareness (Xu et al., 2014; Zhang, Xie, et al., 2020) or environmental investment (Xu, Duan, & Yan, 2019). The empirical results show that Confucian culture can significantly reduce firms' pollution emissions. Using the average distance from the nearest bamboo forest and pine forest as an instrumental variable, the two-stage least squares estimator results still indicate that Confucian culture can significantly reduce firms' pollution emissions. Further analysis also shows that Confucian culture can reduce firms' pollution emissions by influencing the intensity of government environmental regulations. In regions deeply influenced by Confucian culture, the government will attach more importance to environmental protection and strengthen environmental regulations, thereby reducing firms' pollution emissions. Moreover, Confucian culture also affects the environmental awareness of the public. In regions profoundly impacted by Confucian culture, people's environmental protection awareness is stronger, which makes local firms reduce pollution emissions. Lastly, Confucian culture can also reduce firms' pollution emissions by enhancing firms' innovation levels. In regions significantly influenced by Confucian culture, stronger firm innovation capacities lead to reduced pollution emissions.

For a long time, there has been considerable debate regarding whether Confucian culture positively or negatively affects the development of contemporary society. Instead of external regulation, this

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article provides a new perspective on the governance of firms' pollution emissions, by influencing people's values and promoting self-initiated environmental protection to solve firms' pollution emissions. These findings indicate that it is not appropriate to dismiss traditional Confucian culture unilaterally. Instead, we should assess the impact of Confucian culture on modern society more comprehensively, rationally, and objectively, facilitating the heritage and evolution of Confucian culture in the new region. Furthermore, the role of culture in environmental protection should be given greater importance.

The findings of this article have enriched the theoretical understanding of how cultural factors influence firms' pollution emissions. For emerging economies like China, where formal institutions may not be fully developed, informal institutions like Confucian culture can complement formal systems, serving as implicit governance mechanisms to constrain and guide firm pollution behavior. Environmental governance, particularly regarding firms' emissions, should not be exclusively dependent on formal regulations but can also be effectively orchestrated through informal institutions. Additionally, this article reveals a new mechanism in which culture influences government actions and subsequently affects firm behavior, providing a new perspective for future research.

Furthermore, the conclusions of this article offer insights for addressing firms' pollution emissions in practice. During the development of emerging economies, there is often a trade-off between economic growth and environmental sacrifice. Therefore, it is essential to instill in the public the idea of balancing ecological and social benefits, and Confucian culture can play a role in this. Governments should promote the concept of green development rooted in Confucian culture throughout society and utilize Confucian culture's guiding influence to gradually advance ecological civilization. Moreover, within the government, there should be a stronger emphasis on learning and integrating Confucian culture. When formulating development policies, more consideration should be given to environmental impact and the compatibility of these policies with Confucian culture. For firms, managers should recognize that Confucian culture can subtly influence their values and decision-making processes. Increasing the representation of executives with backgrounds in human and social sciences within top management teams can facilitate the integration of Confucian culture into firm culture.

Some limitations of this study could lay the groundwork for future research in this field. Firstly, this paper focuses on the causal relationship between Confucian culture and firms' pollution emissions, attempting to explain the mechanisms through which Confucian culture influences such emissions. However, the paper does not delve into how different aspects of Confucian culture might impact firms' pollution emissions differently. Future research could potentially draw inspiration from Hofstede's framework to measure various facets of Confucian culture in more detail, revealing distinct effects on firms' pollution emissions. Furthermore, this study utilizes ASIF's data, but unfortunately, the latest available data only extends up to 2013. Subsequent research could benefit from using more up-to-date data for further investigation. Lastly, the study's research sample consists of Chinese manufacturing firms. Perhaps future research could focus on specific subsectors within China's manufacturing industry, allowing for comparative analysis of the results. Additionally, using similar methods to assess the traditional cultures of different countries and analyzing the variations in how different national cultures affect firms' pollution emissions could be explored further.

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