Check for updates

The influence of public environmental concern on the rural living environment in China

Wenguang Zhang[1], Qinlei Jing[1]* and Ji Lu[2]

[1]School of Government, Beijing Normal University, Beijing, China, [2]Department of Business and Social Sciences, Faculty of Agriculture, Dalhousie University, Truro, NS, Canada

Background: Despite China's economic growth, rural living environments have often lagged behind. While public participation is gaining importance in environmental governance, the magnitude and mechanism of its impact remain understudied.

Purpose: This research investigates the relationship between public environmental concerns and the rural living environment in China and explores how public concerns impact living conditions.

Methodology: Using panel data from 245 prefecture-level cities (2012−2021), we employed the entropy method to measure rural living environment scores and used fixed-effect models to analyze the relationship between public concern and the living environment.

Results: The findings demonstrate a positive relationship between strong public environmental concerns and improved rural living environments. Further analysis suggests that local government environmental attention acts as a partial mediator in this relationship.

Conclusion: This study reveals that public participation can influence government policies, ultimately leading to positive environmental outcomes. Promoting public participation in environmental governance is crucial for improving the rural living environment.

KEYWORDS

public environmental concern, rural living environment, government environmental attention, environment governance, fixed-effect model

1 Introduction

The rural living environment (RLE) refers to the conditions where rural residents produce and live (Liu Q. et al., 2023). The United Nations General Assembly recognizes that a healthy, clean, and sustainable living environment is a basic human right. Currently, there is a substantial gap between the RLE in China and its relatively developed urban areas (Liu et al., 2022). Despite the economic development and improving living standards in rural communities, the living environment in many communities has deteriorated (Zhou and Azam, 2024). Notable issues include pollution from domestic garbage, sewage, and toilet waste (Han et al., 2018; Deng et al., 2022). In 2019, China's rural communities generated about 299 million tons of domestic waste, with a 66.11% growth rate from 2017 (Liu Y. et al., 2023). In 2020, the proportion of household garbage being properly treated in rural China was only 48.46% (Deng et al., 2022). In 2022, only 31% of the rural household sewage was treated (Wang B. et al., 2023). Untreated garbage, sewage, and feces affect the health of rural residents (Liu and Liu, 2020), pollute land and water resources, and release large

amounts of greenhouse gases and odorous gases, damaging the natural environment of rural areas (Wang et al., 2018). The deterioration of RLE affects the health and welfare of rural inhabitants (Hammer and Spears, 2016), while the improvement of RLE quality can reduce medical and health expenses (Liu and Liu, 2020; Liang et al., 2023) and help rural communities' sustainable development (Wang and Zhu, 2023). Therefore, the improvement of RLE has been identified as an urgent task in China.

The public policies regarding environment protection in China are developed by the central government. Local governments are tasked with implementing these policies and meeting the policy targets (Cheng and Yu, 2023; Du and Ullah, 2024). The central government has noticed that environmental problems have led to the deterioration of RLE and the wellbeing of rural inhabitants and has proposed a national policy for Rural Ecological Civilization Construction (Peng and Zhang, 2019) with a Three-Year (2018–21) and a Five-Year (2021–25) action plans for improving the RLE to set the policy goals: "…the focus should be on rural toilet revolution, waste management, and community beatification to address the prominent issues in the RLE…" However, despite the central government's political intention, the attention resources of local governments in China are not always focused on rural environmental issues (Li et al., 2018); local governments may prioritize economic development or other policy objectives to satisfy performance evaluations and boost local fiscal revenues (Tu et al., 2024). As the effectiveness of local governments' actions depends on the allocation of their attention resources (Meng et al., 2024), the lack of attention toward the RLE can lead to the failure of central environmental governance policies (Harmon, 1995).

The environmental governance system emphasizes protecting the ecological environment through the collaborative actions of governments, businesses, and communities (Geng et al., 2023). However, the effects of public environmental concern (PEC) in managing rural environment have not received sufficient attention in policies and related research (Long et al., 2022). The PEC is residents' knowledge and perception of issues regarding the environment and natural resources, as well as their efforts to address these problems (Dunlap and Jones, 2002). It represents the public's concern for ecological incidents, the demand for better living conditions, and the engagement in the governance of environmental issues (Zhang M. et al., 2024). This bottom-up supervision from the public is a significant force in environmental governance (Li L. et al., 2023) and has been recognized by the Chinese government (Xu et al., 2024). As stakeholders in the RLE, residents are motivated to express their concerns to local authorities. The public can engage in environmental governance through surveillance, pollution complaints, and news media reports, which can monitor the execution of environmental policies (Cao and Chen, 2024) and exert external pressure on local governments. The external pressure may push local authorities to focus more on environmental issues (Pan and Fan, 2023) and improve the RLE.

Assessing the influence of public concerns on the RLE and understanding its working mechanism holds significant theoretical and practical value. However, the role of PEC in rural environmental governance has not been extensively recognized and studied in policies and related research in China (Long et al., 2022). Research has studied the impacts of household income (Han et al., 2018), rural economy (Peng and Zhang, 2019), and public service (Liu et al., 2022) on RLE. Some research has investigated the impact of PEC on business participation (Li L. et al., 2023; Guo et al., 2020), air quality improvement (Zhang et al., 2018; Wang S. et al., 2023) and urban environmental governance (Zheng et al., 2013). Therefore, this study tries to collect empirical evidence to examine the relationship between PEC and RLE directly. This article reports a study using panel data on 245 jurisdictions at the prefecture level in China from 2012 to 2021 to describe the effect and working mechanism of PEC on improving RLE.

2 Literature review and hypothesis

2.1 Rural living environment (RLE) governance

China's RLE governance is built on the national strategy of Ecological Civilization Construction, organizes and utilizes existing resources to help rural communities overcome pollution problems, create a clean and beautiful rural environment, and promote sustainable development (Zhou et al., 2024). Currently, air, water, and soil pollution are affecting the health and quality of life of China's rural inhabitants. As such, the RLE governance in China has been focusing on rural household garbage disposal, sewage and human waste discharge, and ecological environment restoration (Deng et al., 2022; Liu and Liu, 2020). Studies have shown that the implementation of RLE governance is effective in controlling rural pollution (Deng et al., 2022), lowering illness rates and healthcare costs (Liang et al., 2023), and enhancing the overall wellbeing of rural inhabitants (Zhang et al., 2023).

Socioeconomic conditions, such as the economic growth and the living patterns of the village community, impact the quality of the RLE. For example, the relationship between rural household waste and households' disposable income looks like an inverted U-shape. Waste generation increases as income rises, but it starts to decrease once disposable income per capita surpasses $2,500 (Han et al., 2018). Currently, empirical studies based on rural China have found that the RLE often deteriorates as the rural economy develops. For example, the enhancement of rural living conditions (Liu et al., 2015), the growth of the rural economy (Peng and Zhang, 2019; Zhang F. et al., 2024), and the extensive use of express delivery service (Liu and Huang, 2014) has increased the rural household solid waste and sewage and damaged the RLE.

Governments try to alleviate or solve the pollution problems of rural China by providing public services, such as improving the infrastructure (Li et al., 2021), allocating financial resources to local communities (Li and Hu, 2023), and incentivizing environmental services (Zhang et al., 2023). According to public service motivation theory, it is essential to increase the public service motivation of local government officials to address pollution problems, improve rural living conditions, and protect the interests of rural residents (Liu et al., 2022). Environmental concerns from the public can exert supervisory pressure to motivate public servants to leverage more public services to reduce pollution (Su Y. et al., 2023) and improve the RLE. A grassroots-based governance model is a critical factor contributing to better RLE (Xiao et al., 2022; Su Y. et al., 2023). Including rural residents' participation in environmental

governance (Du and Jiao, 2023; Su Y. et al., 2023) and the improvement of rural infrastructure Li Y. et al. (2022) can enhance the quality of RLE.

The central government in China has primary authority over environmental governance, with local governments tasked with carrying out its policies and meeting its goals (Cheng and Yu, 2023). The central government establishes governance structure and performance criteria in accordance with existing environmental laws, while local governments develop specific action plans based on central government policies, taking into account local factors such as local economic development (Du and Ullah, 2024). This top-down governance system can effectively monitor large-scale environmental pollution sources but is less effective in regulating a large number of scattered, small-scale pollution sources due to the high costs of regulation (Tian et al., 2020). Public engagement can fill these regulatory gaps in environmental governance (Yu et al., 2023); public participation in environmental governance may address these gaps by monitoring pollution and waste disposal behaviors of enterprises in the private sector and pushing local authorities to fulfill their environmental governance obligations (Li X. et al., 2022).

2.2 Public environmental concern (PEC)

Public environmental concerns (PEC) have caught the attention of scholars and are primarily categorized into three types. The first type includes public actions such as complaints, petitions, and proposals. Public expression of environmental concerns through these methods contributes to improving wastewater treatment (Langpap and Shimshack, 2010), reducing industrial emissions (Zhang M. et al., 2024), and enhancing technological efficiency in enterprises (Cao and Chen, 2024). Moreover, these concerns have been found to discourage foreign direct investment, leading to a decrease in pollution in the host nations (Xu et al., 2024), and it is particularly effective in developed but polluted cities (Zhou et al., 2024). Conversely, Zhang et al. (2019) propose that public environmental complaints have no impact on the living environment. The second form involves environmental incidents reporting in news media, such as newspapers, radio, and television, which has demonstrated positive impacts on water pollution control in India (Kathuria, 2007) and on the environmental performance of enterprises in South Korea (Mamingi et al., 2008). The third approach entails using online media (search engines, microblogs, Twitter) to express environmental concerns. Raising PEC through online media has contributed to alleviating smog pollution (Wang J. et al., 2023), improving air quality (Zhang et al., 2018), and driving green technological innovation in heavily polluting industries (He et al., 2022). Furthermore, research on measuring PEC based on statistical data from search engines such as Google and Baidu have shown that an elevated PEC can promote government pollution control (Zheng et al., 2013), reduce rural-urban environmental inequality (Long et al., 2022), alleviate air pollution (Yu et al., 2023), and reduce greenhouse gas emission (Wang Y. et al., 2024). The impact of the PEC on emissions control is particularly pronounced in North China and cities that focus on resource recovery and sustainability (Wang Y. et al., 2024).

Meanwhile, the PEC can also encourage corporate environmental investments (Li L. et al., 2023) and green innovation (Geng et al., 2023) and suppress the share yields of heavily polluting firms (Guo et al., 2020). PEC not only obstructs the market entry of polluting firms (Du et al., 2023) but also encourages the outward migration of such enterprises, leading to the phenomenon of pollution transfer (Wang Z. et al., 2024). Ren and Ren (2024) argue that PEC enhances enterprise ESG performance, whereas Chen et al. (2024) assert that these concerns amplify enterprise risk exposure, adversely impacting enterprise ESG performance.

Previous research focuses on the impact of PEC on industrial environmental performance and urban environmental governance. However, few research examines the effects of PEC on rural environmental governance. This gap provides an opportunity for this research to investigate the association between PEC and RLE.

2.3 Hypothesis

Public concerns can motivate people to participate in governance and potentially impact policies through two models. In a classical "voting with feet" model, the public has the right to move, and they can express their concerns with political, economic, and social conditions by choosing to leave the jurisdiction in which they reside, work, or invest (Tiebout, 1956). The outflow of taxpayers, talent, or capital will significantly impact the local economy, and the government may be motivated to improve social conditions. Thus, "voting with feet" puts pressure on local governments to improve public services and force them to tighten environmental regulations (Tiebout, 1956). Hirschman (1972) described another model of public participation, "voting by hand," which holds that the public expresses their concerns about political, economic, and social policies and public services through formal elections, voting, or appeals. This public participation model encourages governments to be more responsive to public interests, consider public satisfaction, and assess the real-world impact of policies during implementation. With the rising living standards in China's rural communities, rural residents' environmental concerns and desires for a better living environment are also increasing (Su M. et al., 2023), and the public has demonstrated a strong willingness to participate in the governance of the RLE (Zheng et al., 2013). Meanwhile, with the democracy development, Chinese governments increasingly accept more forms of public participation in governance, and online media channels are widely used in the discussion of social and environmental problems and empower the public to voice their concerns (Wang J. et al., 2023). Partly because online platforms are convenient for stakeholders to openly express their opinions anywhere and anytime (Li X. et al., 2022), public participation in environmental governance through online media channels has made a more significant impact than traditional channels of complaint (Tu et al., 2024).

PEC is becoming increasingly important in environmental governance (Liu and Mu, 2016). PEC encompasses various aspects, including attitudes toward environmental pollution and support for environmental protection initiatives (Jones and Russo, 2024). This concern prompts individuals to advocate for upgrades in pollution control facilities, the optimization of clean production

technologies, and enhanced environmental management in rural areas. Furthermore, PEC enables effective monitoring of pollution activities by enterprises and the private sector in rural areas, urging local governments to fulfill their environmental governance tasks (Li X. et al., 2022), thereby boosting the performance of RLE governance. As a result, PEC can encourage local governments to implement measures to address deficiencies in rural environmental governance (Long et al., 2022), leading to improvements in the RLE. Based on this, the study presents its first research hypothesis.

H1: Public environmental concerns can improve the rural living environment.

While research indicates that public engagement can improve environmental governance (Long et al., 2022; Yu et al., 2023), the intrinsic mechanisms of PEC affecting the RLE warrant further exploration. This paper proposes that local governments' attention is a critical mechanism connecting public concern and improving the rural environment. Attention is the process through which managers are focused on specific pieces of information and ignore other information (Simon, 1947). Local governments are more likely to act on issues and problems that are deemed to be high priorities, and the effectiveness of action is determined by how much of the government attention is allocated to the issue (Flavin and Franko, 2017; Meng et al., 2024). The attention management theory states that attention, as a scarce resource, determines the content and focus of organizational decision-making (Ocasio, 1997). Governments must be selective in their concerns (Fan et al., 2022), as an organization's attentional focus reflects how the organization prioritizes the objectives and allocates time, finance, workforce, and other resources (Ocasio, 2011). Government attention allocation is a process in which authorities assign attention and resources to selected problems and solutions (Jones and Baumgartner, 2005). Therefore, the allocation of government attention to environmental problems is important for local governments to reach the RLE-related policy objectives. However, the government's attention does not always focus on social and environmental issues. Local governments in China tend to focus on economic growth. Such a "mismatch of attention" between environmental, societal, and economic growth (Tu et al., 2024) could adversely affect improvements in the RLE.

External pressure can sometimes push local authorities to pay attention to matters of public concern (Pan and Fan, 2023; Zhang M. et al., 2024). As the stakeholders of the RLE, the public or social groups often try to communicate with relevant governments through social media and other channels to report pollution issues and demand a better RLE. The dissemination of opinions or attitudes through popular online media can sometimes quickly form a salient Internet public opinion (Wang Z. et al., 2023). Such publicly expressed environmental concerns can exert external pressure on local governments and force them to focus more on improving the RLE. Since 2011, China's central government has launched a number of policies requiring governments at all levels to develop mechanisms to collect, analyze and respond to Internet public opinion, as well as to actively address the public's concerns on key issues. The Office of Cybersecurity and Information of local governments is responsible for tracking and responding to Internet public opinion (Yuan et al., 2023), including public

concerns for the RLE. Moreover, public opinions and attitudes, if expressed through the Internet, can form social phenomena and adversely affect the reputation of local governments. If local governments fail to adequately address significant public concerns, it may prompt accountability inquiries from higher levels of government (Sun et al., 2024). As such, when public concern is visible on the Internet, local governments may be forced to pay attention to issues related to the RLE. The increased environmental attention may facilitate the government departments to identify the problems, find solutions, and allocate resources (Li S. et al., 2023). Therefore, the study proposes a mechanism: PEC can pressure local governments, affecting their attention allocation and consequently improving the RLE.

H2-a: Government environmental attention is positively affected by public environmental concerns.
H2-b: The rural living environment is positively affected by government environmental attention.

3 Study design

3.1 An overview of data

This research analyzed the panel data from prefectural cities in China over the period 2012 to 2021. In China's administrative structure, a prefecture-level city is a jurisdictional division below the province level and has regional-level administrative authority and functions. A prefectural-level city can include several counties, autonomous counties, or county-level cities. A prefectural city typically contains multiple cities, towns, and rural areas. The governments of prefectural-level cities in China are responsible for overseeing and managing environmental issues and rural development within their jurisdictions (Ran, 2017). There are 294 prefecture-level cities in China, while 280 prefecture-level cities with 10-year panel data were identified through an initial scan of databases needed for this study. Some prefecture-level cities identified in the initial scan had missing data. After removing these jurisdictions, the data of 245 cities were used in the analyses. The data on PEC came from the Baidu Index, while the frequency of environment-related keywords was extracted from local authorities' yearly publications. Other data were derived from various statistical yearbooks, particularly at the prefectural level. The study employed data from the rural regions of each prefecture-level authority to analyze the RLE. Data pertaining to rural areas were collected from each prefecture-level city's statistical yearbooks and bulletins.

3.2 Measurements

3.2.1 Public environmental concerns (PEC)

Similar to Google, Baidu is China's most commonly used search engine. The Baidu Index system is a platform established by Baidu providing analyses of social trends based on their users' search behaviors. A given Baidu Index is calculated as the sum of search frequencies of keywords, adjusted by factors such as relevance and user intent, related to a specific topic (Long et al., 2022; Geng et al., 2023) and can reflect the level of public concern about the issue (Du et al., 2023). This study utilized methods similar to those of Geng

TABLE 1 Assessment framework of RLE.

Level I indicator	Level II indicator (denotation)	The meaning of level II indicators	Unit
Rural living environment (RLE)	Domestic sewage treatment (sewage)	Proportion of administrative villages in a prefectural level city treating domestic sewage in a proper way	%
	Household solid waste treatment (waste)	Proportion of administrative villages disposing and treating domestic solid waste in a proper way	%
	Sanitary toilets (toilet)	Penetration rate of sanitary toilets in rural communities	%
	Rural greening (green)	Rural green area coverage rate in the living areas of rural communities	%

et al. (2023), searching for terms like "environmental pollution" and "haze" within the Baidu Index to gather data from prefectural cities (2012–2021) to quantify PEC.

3.2.2 Rural living environment (RLE)

The central government of China set four policy goals for the RLE, which are to improve rural household solid waste disposal and treatment, popularize rural sanitary toilets (i.e., rural toilet revolution), accelerate the treatment of domestic sewage, and promote rural greening and beautification. Rural environmental greening refers to the planting of protective forests, roadside trees, and various plants in residential areas and parks in rural areas to beautify the rural environment. Following the widely adopted approaches (e.g., Li and Hu, 2023), this research uses these four policy goals to assess the yearly performance of the RLE in each prefectural city. Table 1 listed the indexes used in this study: domestic sewage treatment (sewage), household solid waste disposal (waste), sanitary toilet popularity (toilet), and rural environmental greening (green).

The entropy method calculates weights for indicators based on their variability and information content and is extensively applied in research such as economics. This method effectively reduces the interference of subjectivity by assigning higher weights to indicators with more significant variation (information entropy). Normalization ensures data comparability, maintaining objectivity and accuracy of the calculated score. By using the entropy method, researchers can construct indices that are less influenced by subjective judgments and provide a more reliable representation of the underlying phenomenon (Zhang Y. et al., 2024). The final value of RLE ranges from 0 to 1, and a larger value indicates a better quality of RLE. The calculation steps are as follows:

First, standardize the data for indicators

$$x'_{ij} = \frac{x_{ij} - min(x_{ij})}{max(x_{ij}) - min(x_{ij})} \quad (i = 1, 2, \ldots, n; \ j = 1, 2, \ldots, m) \quad (1)$$

Second, the weight of the ith prefecture-level city under the jth indicator

$$p_{ij} = \frac{x'_{ij}}{\sum_{i=1}^{n} x_{ij}} \quad (j = 1, 2, \ldots, m) \quad (2)$$

Third, the entropy of the jth indicator

$$e_j = \frac{1}{ln(n)} \sum_{i=1}^{n} p_{ij} ln(p_{ij}) \quad (3)$$

Third, the differentiation coefficient of the jth indicator

$$g_j = 1 - e_j \quad (4)$$

Fourth, the weight of the jth indicator

$$w_j = \frac{g_j}{\sum_{j=1}^{m} g_j} \quad (j = 1, 2, \ldots, m) \quad (5)$$

Fifth, the sore of RLE

$$S = \sum_{j=1}^{m} w_j \times p_j \quad (6)$$

Where, n is the number of prefecture-level cities and m is the number of indicators.

3.2.3 Government environmental attention (gov_attention)

This study adopted a commonly used approach to measure government environmental attention, that is, the share of environmentally related keywords in government reports (Chen et al., 2018). Chinese governments issue annual reports to summarize the work of the past year and describe future plans. To construct the indicator of government attention (gov_attention), the study first gathered the work reports of 245 cities from 2012 to 2021, counted the occurrences of environment-related keywords, and got the percentage of the keywords to the word count of these reports. Drawing on the method of Zhang and Chen (2021), the keywords related to environmental protection include words describing sustainable natural environment (e.g., blue sky), sustainable practice (e.g., energy saving), pollution (coal), and greenhouse gases (e.g., carbon dioxide).

3.2.4 Control variables

The analyses also included a set of control variables. Economic development (economy) has a direct impact on environmental governance (Tang et al., 2021), and it is also closely associated with the RLE (Han, 2020). This study selects per capita gross domestic product (GDP) as the indicator of the economic development for each prefecture-level city. The level of industrialization (industrialization) is constructed as the share of the secondary industry output in the regional GDP. The secondary industry mainly includes the manufacturing, construction, and processing industries. The industrialization level is associated with pollution, as pollutants discharged in the production process have negative impacts on the natural environment. The ability of a government to allocate resources represents the potential influence of the local

TABLE 2 Means and standard deviations (SD) of key measurements.

Measurment	Mean	SD	Minimum value	Maximum value
RLE	0.3963	0.1491	0.0033	0.9721
PEC	71.2193	72.0761	0.7787	575.1284
gov_attention	0.0034	0.0014	0.0003	0.0124
industrialization	45.4788	10.1230	10.68	87.96
government	0.1913	0.0832	0.0439	0.6754
economy	57,866.6	35,527.84	10,090	467,749
FDI	58.2514	104.223	0.0020	908.4635

FIGURE 1
The trend of average scores for the RLE.

government (Liu X. et al., 2024). This research uses the proportion of the general expenses of a local authority over the prefecture-level city's GDP to reflect the ability of government intervention (government). A higher ratio indicates that the local government posits a stronger intervention capacity. Foreign direct investment (FDI) is calculated as the total annual FDI received each year by each prefecture-level city converted to Chinese yuan (CNY) at the exchange rate in the current year. Some literature has identified a pollution halo effect: foreign direct investment can make high-tech flow into the host country, increase the efficiency of resources and energy use, and then decrease pollution (Xu et al., 2024). On the contrary, some studies have revealed a pollution paradise effect (Singhania and Saini, 2021), that foreign investments will transfer pollution-intense industries to the host country, leading to increased pollution in local communities. Table 2 shows the statistics used to describe the variables.

Figure 1 depicts the trend from 2012 to 2021 based on the average scores of the RLE in 245 cities at the prefecture level. The average score of China's RLE generally exhibits an upward trend over this period. Over these 10 years, the RLE score increased from a low of 0.379 to a high of 0.413, marking an improvement of 8.97%. This is in concordance with the findings by Peng and Zhang (2019) and Liang et al. (2023), which suggest a gradual improvement in China's RLE. Notably, Table 2 shows a large variance between the highest and lowest values of PEC, indicating substantial disparities in public environmental awareness among different prefecture-level cities.

3.3 Measurements

This study employs panel data for empirical analysis, incorporating a cross-sectional (245 prefecture-level cities) and a time series dimension (10 years: 2012–2021). Since panel data have a cross-section and a time dimension, utilizing ordinary least squares (OLS) regression to estimate panel data would face problems such as omitted variable bias and cross-sectional heterogeneity (Kim and Wang, 2024). The fixed-effect model adopts a robust standard error structure to correct the heteroscedasticity problem and considers the influence of time dimension, which can better capture the relationship between variables and the long-term trend of panel data (De Chaisemartin and D'Haultfoeuille, 2020), thereby enhancing the precision and
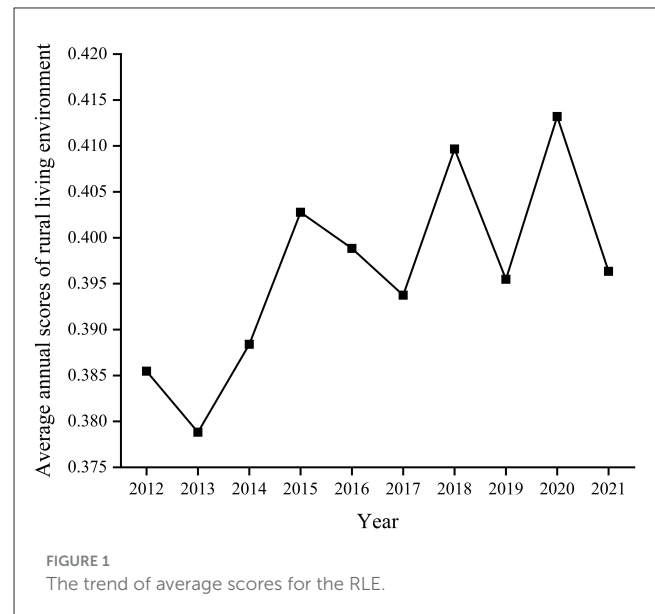
consistency of the estimations and increasing the reliability of the regression estimates (Liu L. et al., 2024; Kim and Wang, 2024). Therefore, this research applies a fixed-effect model to examine the association between the PEC and the RLE. The baseline model equation of this research is as follows:

$$ln(RLE)_{it} = \beta_0 + \beta_1 ln(PEC)_{it} + \lambda ln(controls)_{it} + \phi_t + \varepsilon_{jt} \quad (7)$$

Here, i and t indicate the ith prefecture-level city and the tth year, PEC indicates the variable of public environmental concern, and RLE represents the rural living environment. The coefficient β_1 represents the influence of PEC on the RLE. Controls are control variables that may affect the RLE, the coefficient λ represents the influence of control variables on RLE. The two error terms, ϕ_t and ε_{jt} represent a fixed time effect and model error terms. All the variables in the model are log transformed.

4 Results

4.1 Multicollinearity test

Since data heteroscedasticity can affect the accuracy of the empirical analysis results, this paper has logarithmically treated all the variables in the empirical analysis. Logarithmic processing can make the data distribution closer to the normal distribution and better satisfy the assumption of residual equal variance in linear regression models, thus reducing the influence of heteroscedasticity and further improving the reliability of the empirical results (Silva and Tenreyro, 2006). The study checked correlations between the key variables. Table 3 shows Pearson correlation coefficients for each pair of variables. Considering that the high correlation among independent variables may cause a multicollinearity problem, resulting in distortion of the model estimation results, this paper conducted the variance inflation factor (VIF) test. Table 4 shows that the VIF values of all variables are <10, with a

TABLE 3 Pearson correlation coefficient.

	ln(RLE)	ln(PEC)	ln(industrialization)	ln(government)	ln(economy)	ln(FDI)
ln(RLE)	1.000					
ln(PEC)	0.192***	1.000				
ln(industrialization)	−0.116***	0.082***	1.000			
ln(government)	−0.156***	−0.487***	−0.468***	1.000		
ln(economy)	0.057***	0.427***	0.201***	−0.678***	1.000	
ln(FDI)	0.173***	0.576***	0.198***	−0.545***	0.486***	1.000

***$p < 0.01$.

TABLE 4 Variance inflation factor test results.

	ln(PEC)	ln(industrialization)	ln(government)	ln(economy)	ln(FDI)
VIF	1.65	1.36	2.76	1.98	1.77
1/VIF	0.6046	0.7342	0.3628	0.5043	0.5648

TABLE 5 Estimated coefficients (standard errors) of benchmark regressions.

	ln(RLE)			
	(1)	(2)	(3)	(4)
ln(PEC)	0.166*** (0.0183)	0.0779** (0.0239)		
L.ln(PEC)			0.0957*** (0.0256)	
L2.ln(PEC)				0.106*** (0.0268)
ln(industrialization)		−0.563*** (0.0659)	−0.532*** (0.0699)	−0.509*** (0.0735)
ln(government)		−0.505*** (0.0681)	−0.477*** (0.0731)	−0.449*** (0.0798)
ln(economy)		−0.257*** (0.0520)	−0.259*** (0.0561)	−0.274*** (0.0620)
ln(FDI)		0.0309* (0.0121)	0.0301* (0.0124)	0.0323* (0.0128)
Constant	−1.687*** (0.0745)	2.600*** (0.5376)	2.499*** (0.5773)	2.575*** (0.6484)
FE	Yes	Yes	Yes	Yes
N	2,450	2,450	2,205	1,960
Adj.R^2	0.0451	0.0982	0.0958	0.0950

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$; (1) and (2) list the estimated coefficients of the fixed effect models with and without control variables. (3) and (4) present the result of models with first-order [L.ln(PEC)] and second-order [L2.ln(PEC)] lag of PEC.

mean of <5, indicating that the model does not present serious multicollinearity problems.

4.2 Benchmark regression

To investigate the influence of PEC on RLE, this paper used fixed-effect model for the benchmark regression test, and the results were reported in Table 5. Column (1) included only

PEC as the predictor, and the other columns added control variables and lag variables of the PEC. The results of the first and second columns showed that the coefficient of PEC was positive and significant, suggesting that PEC had a soft environmental constraint effect that could enhance the RLE. Research hypothesis 1 was supported. Furthermore, the third and fourth columns considered the lagged effects of PEC on the RLE. The analysis demonstrated that both the first- and second-order lag variables of public environment concerns were positive predictors of RLE. Regarding the coefficients of the control variables, the ln(FDI) was a significant and positive predictor, which supported the "pollution halo" hypothesis of FDI; More foreign investment was associated with a better living environment. The level of industrialization, government intervention, and economic development had negative effects on the RLE.

4.3 Robustness test

4.3.1 Substitution variable test

Measuring the explained variables from different perspectives will affect the model estimation. To minimize the bias introduced by the choice of metric indicators, this paper selected the secondary indicators in the evaluation index system of RLE: domestic sewage treatment (sewage), household solid waste disposal (waste), sanitary toilet popularity (toilet), and rural environmental greening (green) as the proxy variables of RLE. The coefficients of domestic sewage treatment (sewage), household solid waste disposal (waste), sanitary toilet popularity (toilet), and rural environmental greening (green) were positive at 1% significance level (see Table 6 for the results), which verifies that the public environ-mental concerns can improve the RLE. Hypothesis 1 is further supported, and the public environment concerns were positively associated with all aspects of the RLE, including solid waste, sewage, toilets, and green living spaces in rural communities. The significance of the control variables' coefficients also aligned closely with the benchmark models, further verifying the earlier findings.

4.3.2 Eliminate the policy impacts

The central government enacted the Guidelines for Public Involvement in Environmental Protection (The Guideline) in 2015, explicitly setting out the policies and methods of public engagement in environmental protection and the obligations of government departments in supporting public engagement. To alleviate the endogeneity issues, this research took the year 2015 as the policy impact point and further divided the entire sample data into two time periods of 2012–2015 and 2016–2021 for regression (see Table 7 for the results). For both time periods, the coefficient of PEC was significant and positive, indicating that PEC improved the RLE, no matter whether the Guidelines were enacted.

4.4 Mediating effect

The analyses so far show that PEC likely influences the RLE through government attention. Mediating effect analysis is an important method of multivariate analysis, which is used to explain how independent variables affect dependent variables through mediating variables, with the purpose of revealing the complex action path and internal mechanism between variables. If an independent variable (X) influences a dependent variable (Y) through a third variable (M), then M is considered a mediator in the relationship between X and Y (Wen et al., 2004). Following the mediation effect analysis method introduced by Wen et al. (2004), this research developed Equation (9) and (8) based on Equation (7) to test whether government environmental attention mediates the association between PEC and the RLE.

$$ln(gov\_attention)_{it} = \alpha_0 + \alpha_1 ln(PEC)_{it} + \lambda ln(controls)_{it}$$
$$+ \phi_t + \varepsilon_{jt} \qquad (8)$$
$$ln(RLE)_{it} = \beta_2 + \beta_3 ln(PEC)_{it} + \beta_4 ln(gov\_attention)_{it}$$
$$+ \lambda ln(controls)_{it} + \phi_t + \varepsilon_{jt} \qquad (9)$$

Figure 2 illustrates the procedure for testing mediation effects as outlined by Wen et al. (2004). First: Without including the mediator, Equation (7) examines the influence of the PEC on the RLE. If the coefficient β_1 is not significant, it suggests that PEC do not improve the RLE, and the analysis should cease; otherwise, the analysis continues. Following the results shown in Table 3, PEC positively affects the RLE, warranting further analysis. Second: Equation (8) examines the effect of PEC on government attention, yielding the estimated coefficient α_1. Third: Building on Equation (7), government environmental attention is added to form Equation (9) to investigate the association among PEC, government environmental attention, and the RLE, obtaining the estimated coefficients β_3 and β_4. If both coefficients β_4 and α_1 are significantly positive, it implies the existence of a mediating effect of government attention. If coefficient β_3 is not significant, it implies that government attention exerts a complete mediating effect; otherwise, it suggests a partial mediating effect. According to the results of the mechanism examination (see Table 8), both the coefficients of PEC and government attention are significant, and the relationship is positive, showing a partial mediating effect

TABLE 6 Estimated coefficient (standard errors) in substitution variable test.

	ln(waste)	ln(sewage)	ln(toilet)	ln(green)
ln(PEC)	0.0621*** (0.0140)	0.0655*** (0.0140)	0.0592*** (0.0138)	0.0591*** (0.0144)
ln (industrialization)	−0.435*** (0.0370)	−0.432*** (0.0370)	−0.437*** (0.0370)	−0.407*** (0.0386)
ln(government)	−0.285*** (0.0380)	−0.275*** (0.0380)	−0.292*** (0.0379)	−0.285*** (0.0393)
ln(economy)	−0.0862** (0.0296)	−0.0855** (0.0299)	−0.0888** (0.0297)	−0.0988** (0.0304)
ln(FDI)	0.0065 (0.0066)	0.0053 (0.0066)	0.0059 (0.0066)	0.0081 (0.0069)
Constant	4.517*** (0.3043)	4.506*** (0.3069)	4.756*** (0.3061)	3.955*** (0.3136)
FE	Yes	Yes	Yes	Yes
N	2450	2450	2450	2450
Adj.R²	0.1572	0.1536	0.1566	0.1431

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

TABLE 7 Estimated coefficient (standard errors) of eliminating the policy impacts.

|	ln(RLE)	
	2012−2015	2016−2021
ln(PEC)	0.121* (0.0512)	0.0667* (0.0269)
ln(industrialization)	−0.702*** (0.1172)	−0.508*** (0.0799)
ln(government)	−0.656*** (0.1001)	−0.433*** (0.0902)
ln(economy)	−0.251** (0.0833)	−0.254*** (0.0679)
ln(FDI)	−0.0089 (0.0230)	0.0418** (0.0140)
Constant	2.704*** (0.7876)	2.526*** (0.7222)
N	735	1715
FE	Yes	Yes
Adj.R²	0.1406	0.0841

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

of government attention in the positive association between PEC and the RLE. Hence, Research Hypothesis 2 is validated. Consistent with the theoretical analysis, PEC exerts external influence on the allocation of government environmental attention, enhancing the government's focus, importance, and resource investment in the RLE, thus improving it.

5 Discussions

The public participation is an important force pushing governments to take action to protect and improve the wellbeing of communities. This research examined the role of PEC in promoting the RLE in China. The findings indicate a strong positive correlation between PEC and RLE. PEC has the greatest influence on domestic sewage treatment, followed by

FIGURE 2
The mediating effect test procedure.
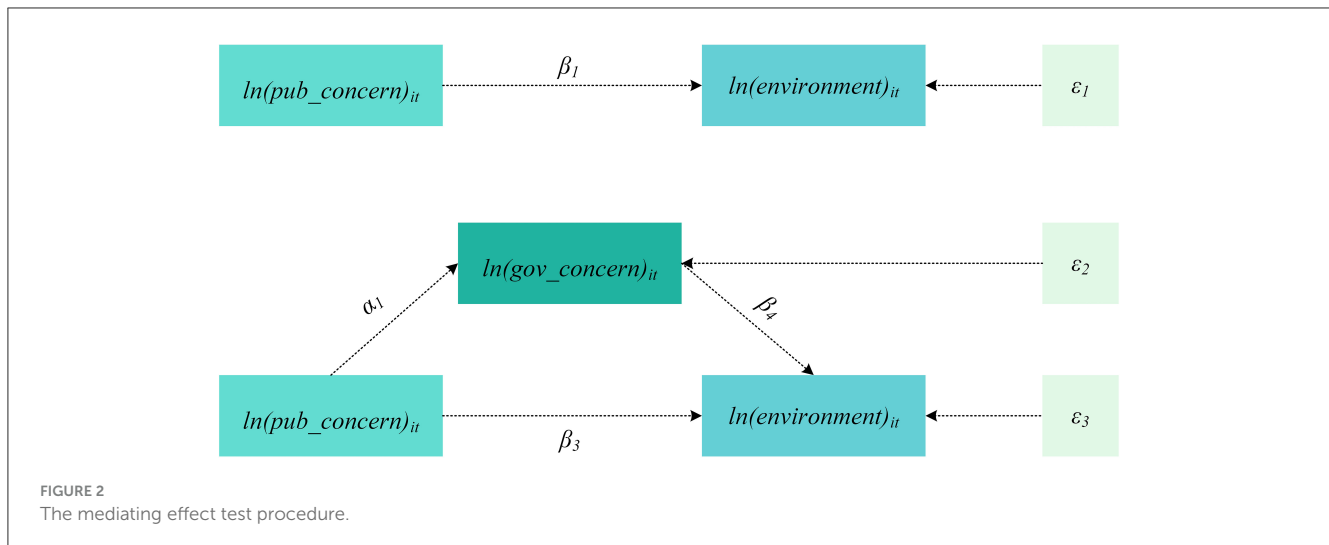
domestic solid waste disposal, sanitary toilet revolution, and rural environmental greening.

The finding is consistent with the literature showing that PEC can promote the environmental performance of corporations (Chen et al., 2024) and alleviate air pollution (Yu et al., 2023), and the study further suggests that public concerns can also influence the environmental governance in rural areas. The finding contradicts the conclusion of a study (Zhang et al., 2019) showing that public environmental complaints did not improve the living conditions. These conflicting findings may reveal a changing trend in environmental governance in China. Zhang's study analyzed the data that covered an earlier period (2006–2014), and only the traditional ways (through regular postal service) of public complaints were studied. In a more recent period covered in this study (2012–2021), the public is increasingly willing to express their environmental concerns and demand a better RLE (Su M. et al., 2023). Meanwhile, Chinese governments are increasingly open to more ways of public participation, and online media channels have been recognized as an essential way of public engagement (Wang Z. et al., 2023). In the past decade, public engagement in environmental governance through online media channels (such as online search and Weibo public opinion) has been becoming increasingly important, and the impact is significantly higher than that of traditional channels (Tu et al., 2024). Facing pollution problems in rural communities, the public appeals through internet searches, Weibo (a popular micro-blogging platform), and other social media channels (Tu et al., 2024). Compared to writing letters or filing complaints through conventional channels, expressing concerns through online media is publicly visible, may initiate public discussions, and form a notable social force. Such public discussions may push authorities to adopt necessary measures to deal with the pollution problems and improve the RLE.

The study further reveals how PEC can impact the RLE. The results show that government attention may mediate the relationship between PEC and the RLE. Governments may pay attention to issues that the public openly discusses and cares about, and government attention can impact resource allocation and ultimately improve the living conditions of rural communities. This conclusion expands the study of the impact of public engagement

in Chinese governance, indicating that PEC is an influential factor in the allocation of government attention. Government attention is a finite resource (Li S. et al., 2023) and key to leveraging actions to solve problems (Jones and Baumgartner, 2005). Historically, environmental protection was not a top priority for local governments in China because economic development and social stability were often more critical policy objectives (Zhou et al., 2023; Cao and Chen, 2024). However, this dynamic is changing. Public attitudes and opinions over pollution incidents, amplified by online media, can now exert significant pressure on local governments. Several factors contribute to this: increased government monitoring of online public opinion, a desire to maintain social reputation, the fear of accountability from higher authorities, and the need to meet public demands (Wang Z. et al., 2023). As a result, China sees more timely reallocation of resources and stricter enforcement of environmental laws. Therefore, the allocation of government attention to environmental issues is important for the RLE. Our finding is in line with the literature showing that external pressure can impact the attention allocation of local governments (Pan and Fan, 2023). The findings are also in accordance with literature showing that the authorities' attention can help relevant departments of a government to obtain necessary resources, such as human resources, material, and funding (Li S. et al., 2023) to improve the RLE.

While this research underscores how PEC can enhance the RLE by influencing local government environmental attention, it acknowledges that local governments are not always passive actors in environmental governance (Kuang and Lin, 2021). The relationship between public opinion and government attention found in this study may also be due to the government's influence on public concerns. Some studies suggest that PEC may be shaped by governmental focus and action on environmental issues (Zhang M. et al., 2024). Nonetheless, due to high regulatory costs and limited access to information about environmental pollution, local governments have struggled to effectively tackle dispersed environmental issues (Tian et al., 2020). Public participation in expressing demands for environmental governance can assist local governments in addressing these challenges (Buntaine et al., 2024; Zhang M. et al., 2024). Thus, public opinion can further compel

TABLE 8 Estimated coefficients (standard errors) in mediation test.

	ln(gov_attention)	ln(RLE)
ln(PEC)	0.0421** (0.0147)	0.0753** (0.0238)
ln(gov_attention)		0.0601* (0.0296)
ln(industrialization)	0.189*** (0.0470)	−0.5745*** (0.0669)
ln(government)	0.258*** (0.0397)	−0.5204*** (0.0701)
ln(economy)	0.155*** (0.0269)	−0.2661*** (0.0527)
ln(FDI)	−0.0166** (0.0060)	0.0319** (0.0121)
Constant	−7.834*** (0.2920)	3.0706*** (0.6134)
FE	Yes	Yes
N	2,450	2,450
Adj.R^2	0.077	0.0995

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

governments to refine environmental governance approaches, increase environmental attention, and boost the efficiency of pollution management (Zeng et al., 2023). Of course, further empirical research is needed to explore such causal relationships.

This study included FDI, industrialization levels, economic development and government intervention as control variables in explaining the RLE. The findings show that FDI is associated with better RLE, which supports the "pollution halo" hypothesis of FDI (Xu et al., 2024). Increased FDI in rural areas brings newer technology and greater efficiency of regional sewage and waste treatment, thereby mitigating pollution emissions in rural areas. Industrialization levels, government intervention, and economic development show negative impact on the rural environment. The findings are consistent with those of previous research. Economic development is a major task for Chinese governments at all levels, which has led to a "promotion tournament" based on GDP, industrialization, and urbanization (Tang et al., 2021). This competition allocates local financial resources toward developing high-value-added but high-polluting industries (Singhania and Saini, 2021). While giving a boost to regional economic development, these industries often take heavy toll on the RLE (Peng and Zhang, 2019; Liu and Huang, 2014). Industrial pollutants negatively impact the ecological environment surrounding the production sites. In China, urban expansion and urban planning increasingly situate industrial facilities near rural areas to avoid high financial and social cost, and the pollutant discharges by these factories significantly harm the RLE. In addition, China's environmental protection policies tend to pay more attention to more populated urban areas than to rural areas (Li et al., 2018), which hinders government intervention aimed at rural environmental pollution mitigation.

This study is distinct from previous research in two aspects. First, it concentrates on the important issue of the RLE. It acknowledges the positive effect of PEC on improving living conditions and expands the research scope into the rural development. While existing studies frequently explore the effect of PEC focusing its impacts on corporates behavior (Li L. et al., 2023), air quality control (Wang S. et al., 2023), and urban environmental governance (Zheng et al., 2013), this study is among the first to investigate the public engagement in rural environmental

governance. Second, built on the attention-based view theory, this study introduces government environmental attention as a mediator. It outlines a pathway through which internet public opinion exerts external pressure on local authorities to pay more attention to the problems and lead to improvements in the RLE.

6 Conclusions

In the context of China's endeavors to improve the RLE, this research analyzes data from 245 prefecture-level cities for the period 2012–2021. It creates an index system for the assessment of RLE and uses the entropy method for assessment. Employing fixed effects and mediation effect models, the study investigates the influence and pathways of PEC on the RLE. PEC was found to have a positive influence on RLE, a finding that withstands robustness testing involving variable substitution and the removal of policy shocks. The most significant effect of PEC is on domestic sewage treatment, followed by household waste disposal, sanitary toilet reform, and rural environmental greening. Mechanism testing demonstrates that PEC motivates local governments to increase their environmental focus, which subsequently improves the RLE.

Although the results enrich the understanding of the dynamics of public involvement in governance and governments, this study has certain limitations. First, while the study discloses the relationship between PEC and the RLE, it is constrained by the consistency of observable indicators. It has not established a unified index system to separately measure both urban and rural living environments, resulting in a lack of analysis on the differences in PEC between urban and rural living environments. Second, this study only explored one transmission mechanism by which PEC impacts the RLE through government environmental attention. The association with PEC and the RLE is complex, and PEC may improve the RLE through alternative pathways. Therefore, further research will explore the association between PEC and the living environment from these two aspects.

Despite its limitations, this study's findings provide valuable policy implications for enhancing public participation and improving the rural living environment in China. First, to reach the environmental governance policy goals, it is critical to raise awareness and advocate about environmental issues and to foster public engagement in governance. To increase public participation, governments at various levels can take some measures, such as adopting multiple channels to raise public concern about the environment and launching educational programs advocating sustainable development. Meanwhile, it is also essential to protect citizens' right to report environmental incidents and express their opinions, lower the barriers to public participation, and empower the public to monitor pollution issues. The study points out that local governments' attention can link public concerns with actual living environment improvements. The government of China has established a national strategy for sustainable development with economic, social, and environmental policy goals. This study revealed that the rural environment is worse in more industrialized and high-income jurisdictions. This implies that local governments need to switch their attention to development goals other than GDP growth. Furthermore, the higher-level authority should optimize the allocation of attention to help local authorities turn their

environmental attention into action. Finally, Chinese people are increasingly embracing the digitalized society (Wang Z. et al., 2023) and are accustomed to participating in social discussions through digital platforms such as social media (Tu et al., 2024). Governments need to improve their digital public service platform and listen to public opinions on the internet.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

WZ: Conceptualization, Data curation, Formal analysis, Writing – original draft, Writing – review & editing. QJ: Conceptualization, Data curation, Formal analysis, Writing – original draft, Writing – review & editing. JL: Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

Buntaine, M. T., Greenstone, M., He, G., Liu, M., Wang, S., and Zhang, B. (2024). Does the squeaky wheel get more grease? The direct and indirect effects of citizen participation on environmental governance in China. *Am. Econ. Rev.* 114, 815–850. doi: 10.1257/aer.20221215

Cao, X., and Chen, H. (2024). The impact of public participation in environmental governance on the technical efficiency of enterprise. *Finance Res. Letters* 10:5112. doi: 10.1016/j.frl.2024.105112

Chen, S., Mao, Z., Li, Y., and Kang, J. (2024). The effect of China's public climate concern on ESG disclosure. *Finance Res. Lett.* 62:105132. doi: 10.1016/j.frl.2024.105132

Chen, Z., Kahn, M. E., Liu, Y., and Wang, Z. (2018). The consequences of spatially differentiated water pollution regulation in China. *J. Environ. Econ. Manage.* 88, 468–485. doi: 10.1016/j.jeem.2018.01.010

Cheng, Z., and Yu, X. (2023). Can central environmental protection inspection induce corporate green technology innovation?. *J. Clean. Prod.* 387:135902. doi: 10.1016/j.jclepro.2023.135902

De Chaisemartin, C., and D'Haultfoeuille, X. (2020). Two-way fixed effects estimators with heterogeneous treatment effects. *Am. Econ. Rev.* 110, 2964–2996. doi: 10.1257/aer.20181169

Deng, M., Liu, H. T., and Ouyang, Z. (2022). Characteristics and driving factors of coastal rural domestic waste of the Yellow River Delta in China. *J. Clean. Prod.* 353:131670. doi: 10.1016/j.jclepro.2022.131670

Du, W., Li, M., Fan, Y., and Liang, S. (2023). Can public environmental concern inhibit the market entry of polluting firms: Micro evidence from China. *Ecol. Indic.* 154:110528. doi: 10.1016/j.ecolind.2023.110528

Du, X., and Jiao, F. (2023). How the rural infrastructure construction drives rural economic development through rural living environment governance—case study of 285 cities in China. *Front. Environm. Sci.* 11:1280744. doi: 10.3389/fenvs.2023.1280744

Du, X., and Ullah, S. (2024). Environmental governance-public supervision and participation nexus under state supervision system and carbon neutrality targets in China. *Environ. Sci. Pollut. Res.* 31, 14208–14217. doi: 10.1007/s11356-024-31974-2

Dunlap, R. E., and Jones, R. E. (2002). Environmental concern: Conceptual and measurement issues. *Handbook environm. Sociol.* 3, 482–524.

Fan, Z., Christensen, T., and Ma, L. (2022). Policy attention and the adoption of public sector innovation. *Public Manag. Rev.* 2022, 1–20. doi: 10.1080/14719037.2022.2050283

Flavin, P., and Franko, W. W. (2017). Government's unequal attentiveness to citizens' political priorities. *Policy Stud. J.* 45, 659–687. doi: 10.1111/psj.12184

Geng, Y., Chen, J., Liu, T., and Tao, D. (2023). Public environmental attention, media coverage, and corporate green innovation: evidence from heavily polluting industries in China. *Environ. Sci. Pollut. Res.* 30, 86911–86926. doi: 10.1007/s11356-023-28369-0

Guo, M., Kuai, Y., and Liu, X. (2020). Stock market response to environmental policies: evidence from heavily polluting firms in China. *Econ. Model.* 86, 306–316. doi: 10.1016/j.econmod.2019.09.028

Hammer, J., and Spears, D. (2016). Village sanitation and child health: Effects and external validity in a randomized field experiment in rural India. *J. Health Econ.* 48, 135–148. doi: 10.1016/j.jhealeco.2016.03.003

Han, J. (2020). Prioritizing agricultural, rural development and implementing the rural revitalization strategy. *China Agricultural Econ. Rev.* 12, 14–19. doi: 10.1108/CAER-02-2019-0026

Han, Z., Liu, Y., Zhong, M., Shi, G., Li, Q., Zeng, D., et al. (2018). Influencing factors of domestic waste characteristics in rural areas of developing countries. *Waste Managem.* 72, 45–54. doi: 10.1016/j.wasman.2017.11.039

Harmon, M. M. (1995). *Responsibility as Paradox: A Critique of Rational Discourse on Government*. Thousand Oaks, CA: SAGE Publications.

He, Z., Cao, C., and Feng, C. (2022). Media attention, environmental information disclosure and corporate green technology innovations in China's heavily polluting industries. *Emerg. Markets Finance Trade* 58, 3939–3952. doi: 10.1080/1540496X.2022.2075259

Hirschman, A. O. (1972). *Exit, Voice, and Loyalty: Responses to Decline in Firms, Organizations, and States*. Cambridge, MA: Harvard University Press.

Jones, B. D., and Baumgartner, F. R. (2005). A model of choice for public policy. *J. Public Administration Res. Theory* 15, 325–351. doi: 10.1093/jopart/mui018

Jones, J., and Russo, A. (2024). Exploring the role of public participation in delivering inclusive, quality, and resilient green infrastructure for climate adaptation in the UK. *Cities* 148:104879. doi: 10.1016/j.cities.2024.104879

Kathuria, V. (2007). Informal regulation of pollution in a developing country: evidence from India. *Ecol. Econ.* 63, 403–417. doi: 10.1016/j.ecolecon.2006.11.013

Kim, J. S., and Wang, L. C. (2024). The differential effects of exchange rate fluctuations on local housing price growth: evidence from Australia. *Reg. Stud.* 58, 135–150. doi: 10.1080/00343404.2023.2187044

Kuang, Y., and Lin, B. (2021). Public participation and city sustainability: evidence from urban garbage classification in China. *Sustai. Cities Soc.* 67:102741. doi: 10.1016/j.scs.2021.102741

Langpap, C., and Shimshack, J. P. (2010). Private citizen suits and public enforcement: Substitutes or complements? *J. Environ. Econ. Manage.* 59, 235–249. doi: 10.1016/j.jeem.2010.01.001

Li, D. Q., Hou, L. L., Min, S., and Huang, J. K. (2021). The effects of rural living environment improvement programs: evidence from a household survey in 7 provinces of China. *J. Manag. World* 10, 182–194. doi: 10.19744/j.cnki.11-1235/f.2021.0163

Li, G., He, Q., Shao, S., and Cao, J. (2018). Environmental non-governmental organizations and urban environmental governance: evidence from China. *J. Environ. Manage.* 206, 1296–1307. doi: 10.1016/j.jenvman.2017.09.076

Li, J. P., and Hu, Y. J. (2023). Can fiscal decentralization promote the rural living environment governance in China. *China Populat. Res. Environm.* 33, 172–180. doi: 10.12062/cpre.20230343

Li, L., Zhang, J., Bai, Y., and Yang, R. (2023). Public environmental concern and enterprise environmental protection investment: from the perspective of enterprise life cycle. *Environm. Dev. Sustainab.* 2023, 1–35. doi: 10.1007/s10668-023-03233-w

Li, S., Miao, X., Feng, E., Liu, Y., and Tang, Y. (2023). Urban Governmental Environmental Attention Allocation: Evidence from China. *J. Urban Plann. Dev.* 149:04022055. doi: 10.1061/JUPDDM.UPENG-3984

Li, X., Hu, Z., Cao, J., and Xu, X. (2022). The impact of environmental accountability on air pollution: a public attention perspective. *Energy Policy* 161:112733. doi: 10.1016/j.enpol.2021.112733

Li, Y., Huang, Z., Li, Y., and Xu, P. (2022). Research on the long-term governance mechanism of urban and rural living environment based on the ordered logistic-ism model in the perspective of sustainable development. *Int. J. Environ. Res. Public Health* 19:12848. doi: 10.3390/ijerph191912848

Liang, C., Lin, C., and Wang, S. S. (2023). Sanitation, public health and medical burden: analysis based on the chinese rural toilet revolution. *J. World Econ.* 46, 197–224. doi: 10.19985/j.cnki.cassjwe.2023.12.005

Liu, C. M., and Liu, Y. (2020). Research on the impact of rural toilet reform on Farmers' health expenditure. *Issues Agric. Econ* 10, 89–102. doi: 10.13246/j.cnki.iae.2020.10.010

Liu, D. (2024). Local government competition and resource allocation efficiency. *Finance Research Lett.* 60:104830. doi: 10.1016/j.frl.2023.104830

Liu, J., Wang, X., and Hou, Y. (2022). The impact of village cadres' public service motivation on the effectiveness of rural living environment governance: an empirical study of 118 Chinese villages. *SAGE Open* 12:21582440221079795. doi: 10.1177/21582440221079795

Liu, L., Wang, Y., and Xu, Y. (2024). A practical guide to counterfactual estimators for causal inference with time - series cross - sectional data. *Am. J. Pol. Sci.* 68, 160–176. doi: 10.1111/ajps.12723

Liu, Q., Liu, Z., Yu, Z., and Zhao, P. (2023). The living environment and intravillage activity-travel: A conceptual framework based on participant observation in Guangdong, China. *J. Rural Stud.* 99, 121–133. doi: 10.1016/j.jrurstud.2023.03.006

Liu, X., Cifuentes-Faura, J., Zhao, S., and Wang, L. (2024). The impact of government environmental attention on firms' ESG performance: evidence from China. *Res. Int. Busin. Finance* 67:102124. doi: 10.1016/j.ribaf.2023.102124

Liu, X., and Mu, R. (2016). Public environmental concern in China: Determinants and variations. *Glob. Environ. Change* 37, 116–127. doi: 10.1016/j.gloenvcha.2016.01.008

Liu, Y., and Huang, J. (2014). Rural domestic waste disposal: an empirical analysis in five provinces of China. *China Agricult. Econ. Rev.* 6, 558–573. doi: 10.1108/CAER-05-2013-0076

Liu, Y., Zhou, Y., and Wu, W. (2015). Assessing the impact of population, income and technology on energy consumption and industrial pollutant emissions in China. *Appl. Energy* 155, 904–917. doi: 10.1016/j.apenergy.2015.06.051

Liu, Y., Zhu, H. G., and Zhang, L. M. (2023). Can information intervention improve the effectiveness of farmers' waste classificaion evidence from a farmers' behavior experiment in the Taihu lake basin. *J. Agrotech. Econ.* 2023, 1–15.

Long, F., Liu, J., and Zheng, L. (2022). The effects of public environmental concern on urban-rural environmental inequality: evidence from Chinese industrial enterprises. *Sustainable Cities and Society* 80:103787. doi: 10.1016/j.scs.2022.103787

Mamingi, N., Dasgupta, S., Laplante, B., and Hong, J. H. (2008). Understanding firms' environmental performance: does news matter? *Environm. Econ. Policy Stud.* 9, 67–79. doi: 10.1007/BF03353983

Meng, X., Kong, F., Fu, H., Li, S., and Zhang, K. (2024). Is more always better? How government ecological attention influences corporate environmental responsibility: empirical evidence from Chinese listed companies. *Ecol. Indic.* 159:111686. doi: 10.1016/j.ecolind.2024.111686

Ocasio, W. (1997). Towards an attention-based view of the firm. *Strategic Managem. J.* 18, 187–206.

Ocasio, W. (2011). Attention to attention. *Organizat. Sci.* 22, 1286–1296. doi: 10.1287/orsc.1100.0602

Pan, T., and Fan, B. (2023). Institutional pressures, policy attention, and e-government service capability: evidence from China's prefecture-level cities. *Public Perf. Managem. Rev.* 46, 445–471. doi: 10.1080/15309576.2023.2169834

Peng, C., and Zhang, C. (2019). Rural residential environment quality and its influencing factors. *J. Macro-qual. Res.* 7, 66–78. doi: 10.13948/j.cnki.hgzlyj.2019.03.005

Ran, R. (2017). Understanding blame politics in China's decentralized system of environmental governance: actors, strategies and context. *China Q.* 231, 634–661. doi: 10.1017/S0305741017000911

Ren, X., and Ren, Y. (2024). Public environmental concern and corporate ESG performance. *Finance Res. Lett.* 61:104991. doi: 10.1016/j.frl.2024.104991

Silva, J. S., and Tenreyro, S. (2006). The log of gravity. *Rev. Econ. Statis.* 2006, 641–658. doi: 10.1162/rest.88.4.641

Simon, H. A. (1947). *Administrative Behavior: a Study of Decision-Making Processes in Administrative Organization. New York:* Free Press.

Singhania, M., and Saini, N. (2021). Demystifying pollution haven hypothesis: Role of FDI. *J. Bus. Res.* 123, 516–528. doi: 10.1016/j.jbusres.2020.10.007

Su, M., Fan, P. F., Zhang, L., and Feng, S. Y. (2023). The impact of social supervision on household's sewage discharge behavior: evidence from Jiangsu province. *J. Natural Res.* 38, 1349–1365. doi: 10.31497/zrzyxb.20230515

Su, Y., Qiu, Y., Xuan, Y., Shu, Q., and Li, Z. (2023). A configuration study on rural residents' willingness to participate in improving the rural living environment in less-developed areas—Evidence from six provinces of western China. *Front. Environ. Sci.* 10:1104937. doi: 10.3389/fenvs.2022.1104937

Sun, Y., Jia, R., Razzaq, A., and Bao, Q. (2024). Social network platforms and climate change in China: Evidence from TikTok. *Technol. Forecast. Soc. Change* 200:123197. doi: 10.1016/j.techfore.2023.123197

Tang, P., Jiang, Q., and Mi, L. (2021). One-vote veto: the threshold effect of environmental pollution in China's economic promotion tournament. *Ecol. Econ.* 185:107069. doi: 10.1016/j.ecolecon.2021.107069

Tian, Z., Tian, Y., Chen, Y., and Shao, S. (2020). The economic consequences of environmental regulation in China: from a perspective of the environmental protection admonishing talk policy. *Busin. Strat. Environ.* 29, 1723–1733. doi: 10.1002/bse.2464

Tiebout, C. M. (1956). A pure theory of local expenditures. *J. Polit. Econ.* 64, 416–424. doi: 10.1086/257839

Tu, C., Liang, Y., and Fu, Y. (2024). How does the environmental attention of local governments affect regional green development? Empirical evidence from local governments in China. *Human. Soc. Sci. Commun.* 11, 1–14. doi: 10.1057/s41599-024-02887-9

Wang, B., He, J., Che, L. L., Dai, C., Zheng, L. J., and Wang, X. H. (2023). Utilization of rural domestic sewage as a resource: progress, dilemmas, and future. *J. Agricult. Res. Environm.* 40, 1255–1264. doi: 10.13254/j.jare.2023.0089

Wang, F., Cheng, Z., Reisner, A., and Liu, Y. (2018). Compliance with household solid waste management in rural villages in developing countries. *J. Clean. Prod.* 202, 293–298. doi: 10.1016/j.jclepro.2018.08.135

Wang, J., Wei, Y. D., and Lin, B. (2023). How social media affects PM2. 5 levels in urban China? *Geograph. Rev.* 113, 48–71. doi: 10.1080/00167428.2021.1884979

Wang, S., Zhang, R., Wan, L., and Chen, J. (2023). Has central government environmental protection interview improved air quality in China? *Ecol. Econ.* 206:107750. doi: 10.1016/j.ecolecon.2023.107750

Wang, Y., Zhao, Z., Shi, M., Liu, J., and Tan, Z. (2024). Public environmental concern, government environmental regulation and urban carbon emission reduction—Analyzing the regulating role of green finance and industrial agglomeration. *Sci. Total Environm.* 924:171549. doi: 10.1016/j.scitotenv.2024.171549

Wang, Y., and Zhu, Y. (2023). Exploring the effects of rural human settlement on rural development: Evidence from Xianju County in Zhejiang Province, China. *Environm. Dev.* 46:100845. doi: 10.1016/j.envdev.2023.100845

Wang, Z., Sun, H., Ding, C., and Zhang, X. (2024). Does Public Environmental Concern Cause Pollution Transfer? Evidence from Chinese Firms' Off-site Investments. *J. Clean. Prod.* 14:2825. doi: 10.1016/j.jclepro.2024.142825

Wang, Z., Zhang, S., Zhao, Y., Chen, C., and Dong, X. (2023). Risk prediction and credibility detection of network public opinion using blockchain technology. *Technol. Forecast. Soc. Change* 187:122177. doi: 10.1016/j.techfore.2022.122177

Wen, Z., Chang, L., Hau, K. T., and Liu, H. (2004). Testing and application of the mediating effects. *Acta psychologica Sinica* 36:614.

Xiao, C., Zhou, J., Shen, X., Cullen, J., Dobson, S., Meng, F., et al. (2022). Rural living environment governance: a survey and comparison between two villages in Henan Province of China. *Sustainability* 14:14136. doi: 10.3390/su142114136

Xu, Y., Du, Z., Kong, L., and Xu, K. (2024). Research on the impact of public environmental participation on foreign direct investment: evidence from China. *Environ. Res. Commun.* 6:025019. doi: 10.1088/2515-7620/ad2a8f

Yu, C., Long, H., Zhang, X., Tan, Y., Zhou, Y., Zang, C., et al. (2023). The interaction effect between public environmental concern and air pollution: evidence from China. *J. Clean. Prod.* 391:136231. doi: 10.1016/j.jclepro.2023.136231

Yuan, Y. P., Dwivedi, Y. K., Tan, G. W. H., Cham, T. H., Ooi, K. B., Aw, E. C. X., et al. (2023). Government digital transformation: understanding the role of government social media. *Gov. Inf. Q.* 40:101775. doi: 10.1016/j.giq.2022. 101775

Zeng, H., Huang, Z., Zhou, Q., He, P., and Cheng, X. (2023). Corporate environmental governance strategies under the dual supervision of the government and the public. *Business Soc.* 62, 860–907. doi: 10.1177/00076503221 114792

Zhang, F., Shao, J. J., and Zhou, L. (2024). Impact of the rural collective economy on improving the rural living environment. *China Popul. Res. Environm.* 34, 118–126. doi: 10.12062/cpre.20230730

Zhang, G., Deng, N., Mou, H., Zhang, Z. G., and Chen, X. (2019). The impact of the policy and behavior of public participation on environmental governance performance: Empirical analysis based on provincial panel data in China. *Energy Policy* 129, 1347–1354. doi: 10.1016/j.enpol.2019.03.030

Zhang, J. P., and Chen, S. Y. (2021). Financial development, environmental regulations and green economic transition. *J. Finance Econ.* 47, 78–93. doi: 10.16538/j.cnki.jfe.20210918.301

Zhang, M., Yang, Y., Du, P., Wang, J., Wei, Y., Qin, J., et al. (2024). The effect of public environmental participation on pollution governance in China: the mediating role of local governments' environmental attention. *Environ. Impact Assess. Rev.* 104:107345. doi: 10.1016/j.eiar.2023.107345

Zhang, Q., Zhao, Y. F., Qiao, M., Xue, C. X., and Wang, B. W. (2023). Impact of farmer's payment system on rural human settlements improvement performance. *J. Arid Land Resour. Environm.* 37, 31–36. doi: 10.13448/j.cnki.jalre.2023.109

Zhang, S., Li, Y., Hao, Y., and Zhang, Y. (2018). Does public opinion affect air quality? Evidence based on the monthly data of 109 prefecture-level cities in China. *Energy Policy* 116, 299–311. doi: 10.1016/j.enpol.2018.02.025

Zhang, Y., Yu, Z., Zhang, J., and Zhang, W. (2024). Research on China's regional carbon quota allocation based on the entropy weight-TOPSIS method and CRITIC-VIKOR model. *Environm. Dev. Sustainab.* 2024, 1–23. doi: 10.1007/s10668-024-04804-1

Zheng, S. Q., Wan, G. H., Sun, W. Z., and Luo, D. L. (2013). Public appeal and urban environmental governance. *Manage. World* 6, 72–84. doi: 10.19744/j.cnki.11-1235/f.2013.06.006

Zhou, D., Yin, X., and Xie, D. (2023). Local governments' environmental targets and green total factor productivity in Chinese cities. *Econ. Model.* 120:106189. doi: 10.1016/j.econmod.2023.106189

Zhou, L., and Azam, S. F. (2024). The impact of green-listed companies on rural ecological environments in China: a spatial heterogeneity and empirical analysis. *J. Environ. Manage.* 356:120687. doi: 10.1016/j.jenvman.2024.120687

Zhou, X., Cao, G., Peng, B., Xu, X., Yu, F., Xu, Z., et al. (2024). Citizen environmental complaint reporting and air quality improvement: a panel regression analysis in China. *J. Clean. Prod.* 434:140319. doi: 10.1016/j.jclepro.2023.140319