

Original Research

Exploring the Differences and Influencing Factors of Public Participation in Environmental Protection Behavior in the Private and Public Spheres in China

Chenyang Wang^{1,2,3*}, Zhe Wang^{1,2,3}, Yu Zhang^{4**}

¹School of Humanities and Social Sciences, University of Science and Technology of China,
No. 96, Jinzhai Road, Hefei, Anhui Province, 230026, China

²Institute of Computational Social Sciences and Media Studies, University of Science and Technology of China,
No. 96, Jinzhai Road, Hefei, Anhui Province, 230026, China

³Science Communication Research Center, Chinese Academy of Sciences,
No. 96, Jinzhai Road, Hefei, Anhui Province, 230026, China

⁴Department of Public and International Affairs, City University of Hong Kong,
No. 83 Tat Chee Avenue, Kowloon, Hong Kong, 999077, China

Received: 25 March 2023

Accepted: 20 May 2023

Abstract

Based on data from the 2013 China General Social Survey (CGSS2013), this study compares the public's participation in environmental protection behaviors in the public and private spheres in China and the differences between urban and rural areas to investigate the differences in the influence of relevant factors on environmental protection behaviors in different spheres. This study found that 1) Chinese public participation in environmental protection is mainly in the private sphere, especially female's participation in the private sphere is significantly higher than men's; 2) compared to urban residents, rural residents are less involved in environmental protection in the private and public spheres; 3) Chinese public recognition of the environmental management work of the Chinese central and local governments is low; 4) individuals' economic income, environmental knowledge, environmental risk perception, evaluation of the effectiveness of local governments' environmental protection efforts, and frequency of media use all significantly and positively affect the Chinese public's participation in environmental protection behaviors, but subjective social class does not affect the Chinese public's participation in environmental protection behaviors. In order to improve the effectiveness of environmental protection work in China, it is recommended that the government,

*e-mail: wcy025@mail.ustc.edu.cn

**e-mail: yzhang3357-c@my.cityu.edu.hk

media, and citizen groups should open up feedback channels on environmental issues, strengthen the dissemination of environmental knowledge, and enhance the public's awareness of environmental protection.

Keywords: environmental protection, pro-environmental behavior, public participation, environmental knowledge, environmental risk perception

Introduction

Since China's reform and opening up in 1978, with the rapid development of its extensive economy, China's environmental pollution problems have become increasingly acute, environmental risks have become increasingly prominent, and phenomena such as water pollution, air pollution, and soil pollution have emerged endlessly. According to the 2021 Bulletin on the State of China's Ecological Environment issued by the Ministry of Ecology and Environment of China, air quality monitoring data from 339 cities at or above the prefecture level nationwide indicate that 121 cities have exceeded the standard in ambient air quality [1]. The problem of environmental pollution has seriously affected public health, daily life and economic development. However, the Chinese public's environmental awareness and environmental protection behavior are not optimistic. In January 2015, China promulgated the Environmental Protection Law, which includes public participation in environmental management as a separate chapter, and improves the public participation system for environmental protection from the top-level design [2]. In the same year, the former Ministry of Environmental Protection of China issued the Measures for Public Participation in Environmental Protection, which proposed to ensure the right of the public to participate in environmental governance [3].

Although the Chinese government has made great efforts to promote public participation in environmental governance, various survey data in recent years have found that public environmental behavior is not easy to know but even more difficult to do, and the public shows ignorance, powerlessness and helplessness in the face of environmental pollution [4, 5]. Overall, China's public environmental protection behavior is still at a low level, with a low level of participation in voluntary environmental protection activities by the public. There is a widespread speculative mentality in the face of environmental issues, and due to the limitations of the current environmental regulatory model, there is a relative lack of channels for citizens to participate in environmental protection, which to some extent also restricts the overall level of environmental participation [6]. An effective environmental protection model requires the joint participation of government, social groups, enterprises and the public, especially the active participation of the public, which will have an important role in promoting the environmental protection actions

of the government and other social entities. Many developed countries around the world have adopted public participation in environmental governance as a basic guideline for environmental protection, and actively promote public participation in environmental governance to explore new environmental protection models of public participation in environmental governance [7]. Therefore, one of the most important measures to solve China's environmental problems is to increase public participation in environmental protection, and to make the public a major driving force and a leading force in environmental protection. It is necessary to clarify the factors that affect the level of public participation in environmental protection in China, and to find effective ways to improve the level of public participation in environmental protection on this basis. Therefore, based on national survey data, this study compares the public's attitude and willingness to participate in environmental protection in the public and private spheres in China to clarify the important factors influencing the public's environmental protection behavior in different spheres, so as to provide a reference for taking targeted measures to mobilize the public's environmental protection enthusiasm, promote environmental protection participation, effectively alleviate China's environmental problems, and improve ecological and environmental quality.

The innovation and academic contribution of this paper is to divide Chinese public participation in environmental protection into private and public spheres, and to compare and analyze the differences in Chinese public participation in environmental protection between private and public spheres based on CGSS2013, a nationally representative survey data in China, and also to study the influence of individual economic income, perception of environmental risk, evaluation of the effectiveness of governments' environmental protection efforts, and frequency of media use on Chinese public participation in environmental protection between private and public spheres. We also examine the effects of individual economic income, perception of environmental risks, evaluation of the effectiveness of the government's environmental protection efforts, and frequency of media use on public participation in private and public spheres of environmental protection in China. The findings of this paper may contribute to a better understanding of Chinese public participation behavior in environmental protection and help to better address environmental issues in the Chinese context.

Literature Review and Research Hypothesis

The influence of individuals' economic income and subjective social class on public environmental behavior

Post materialistic values believe that the public in modern society is more concerned about the common development of post material values such as the ecological environment and quality of life than economic growth and the accumulation of material wealth [8]. With the increase in the economic income of individuals or families, the public is no longer satisfied with low-level needs, and people have increasingly high requirements for the quality of non-material life. For example, in terms of the environment, people pay special attention to the pollution situation of their places of residence, and good environmental quality has become a common requirement of the public, prompting them to take corresponding environmental protection actions. In other words, when people's economic income is high, they are relatively easier to engage in environmental protection activities. A study has found that higher incomes reinforce environmental behavior. Income satisfaction significantly strengthens the relationship between income class and environmental behavior, so when individuals are satisfied with their income, the relationship between the two becomes closer. Income levels and income satisfaction go hand in hand in promoting environmental participation [9]. Zhang et al. studied the pro-environmental behavior of Chinese farmers and showed that farmers' total household income had a significant positive effect on their environmental behavior [10]. In addition, residents with higher class status tend to have more resources and economic power, and their demands for quality of life and the environment are higher, which leads them to adopt more active environmental behaviors [11]. The sense of social responsibility tends to increase with one's status and power. The higher the subjective perceived class status of residents, the more willing they are to participate in public affairs, express their needs and exercise their civil rights, and the more active they are in participating in environmental behaviors in the public sphere [12]. Based on the above analysis, the following hypotheses are proposed in this study.

H1a: Personal income positively affects public participation in environmental protection behavior

H1b: Subjective social class positively influences public participation in environmental protection behavior

The Influence of Environmental Knowledge on Public Environmental Behavior

Environmental knowledge includes three categories: knowledge of the natural environment, perception of environmental problems, and knowledge of environmental action. Environmental action focuses more on positive environmental behaviors.

Environmental problem perception is most closely related to our daily life, which refers to residents' knowledge about natural resources or their perceptions of environmental problems caused by overuse of resources [13]. Previous studies have shown that there is a significant positive relationship between environmental knowledge and environmental behavior. For example, consumers' attitudes toward environmental protection are influenced by environmental knowledge and their behavior changes as a result. The more environmental knowledge consumers have, the more likely they are to be aware of the importance of using products made from recyclable plastics for environmental protection and the more likely they are to purchase such products [14]. Environmental knowledge represents not only the public's understanding of the current state of the environment and the impact of human activities on the environment, but also whether the public cares about the current environmental changes and the impact of their actions on the environment in their daily lives [15]. Schwartz's "norm-action" model also suggests that people behave in an environmentally friendly manner when they attribute existing environmental problems to their own inappropriate behavior, i.e., public environmental behavior is closely related to their environmental knowledge [16]. Therefore, the following research hypothesis is proposed in this study.

H2: Residents' knowledge of environmental protection has a positive impact on their environmental behavior.

The Influence of Environmental Risk Perception on Public Environmental Behavior

Risk perception is a judgment made by people when describing and evaluating certain harmful activities, new technologies, and their potential hazards [17]. Risk perception interacts with the way risk response behaviors are formed, resulting in a social amplification of risk [18]. Previous studies have found that the severity of local environmental pollution has a strong influence on whether people adopt environmental protection behaviors, and the more serious the environmental pollution in the place where they live, the more residents pay attention to environmental protection behaviors in their daily lives, and those who feel the harm of environmental pollution have a more pure motivation to participate in environmental protection [19]. Inglehart analyzed data from the 1990-1993 Worldview Survey and compared 43 countries, finding that the more polluted the country, the stronger the willingness of its citizens to protect the environment [20]. Another study similarly showed that risk perception significantly influenced the public's pro-environmental behavioral intentions and was influenced by knowledge as an environmental trigger. Guilt and social responsibility play an important mediating role in the relationship between risk perception and environmental behavioral intentions [21]. A nationwide study of the Chinese

public found that the severity of local environmental problems has a significant positive effect on residents' environmental behavior, but that citizens' participation in environmental protection is still passive and active only when the environmental pollution in their place of residence is severe [22]. Therefore, the following research hypothesis is proposed in this study.

H3: Environmental risk perception positively influences public participation in environmental protection behavior

The Effect of the Effectiveness of the Government's Environmental Protection Work on the Public's Environmental Protection Behavior

The normative focus theory believes that whether people will adopt more positive environmental behavior in daily life is mainly influenced by social norms, such as the surrounding environment or the behavior of surrounding people. Cialdini et al. found in their investigation of residents' energy conservation behavior that by conducting environmental publicity to the public or formulating a series of behavioral norms, they can have a positive impact on their energy conservation behavior, and the impact of descriptive norms is far greater than the impact of mandatory and prohibited norms such as notices [23]. Fornara et al. analyzed the willingness of Italian urban residents to recycle household waste and reached a similar conclusion that descriptive norms have a more significant impact on residents' waste recycling behavior [24]. In addition, the cleanliness and tidiness of the surrounding environment itself contains descriptive and normative information. Using the suggestive effect of such information to covertly intervene in the public's environmental behavior can often achieve surprising and ideal results [23]. If government departments attach importance to environmental protection, actively carry out media publicity and education, and take reasonable measures to protect the local environment, and achieve desired results, the public will be more inclined to take positive environmental behavior. At the same time, it should also be noted that even the environmental protection policies of the central government of China need to be implemented by local governments at all levels. Due to the prominent imbalance and inadequacy of development among various regions in China, the economic comparative advantages and key industries of different regions are also different. For example, Shanghai City mainly relies on finance, technology and other industries to promote economic development, while Hebei Province and Shanxi Province mainly rely on mining, steel Coal mining and other heavily polluting industries promote economic development. Therefore, there are certain differences between China's central and local governments at all levels in their environmental policies. Therefore, it is reasonable to speculate that there will also be differences in the

degree of impact of the central and local governments on public environmental behavior [25, 26]. Based on the above analysis, this study proposes the following hypotheses

H4: The effectiveness of environmental protection work by government departments has a positive impact on public participation in environmental protection behavior, and the degree of impact of central and local governments is different.

The Relationship between Media Use and Public Environmental Behavior

Many environmental issues, especially global environmental issues, exist outside of the direct experience of the general public. However, due to their professional nature, they are not directly known and understood by the general public, and need to be reported by the media in order to be known and discussed by the public. The media plays the role of educator and agenda-setting intermediary in the process of environmental communication, and without the media to construct environmental issues, most of the public would not know the real situation. The role of the media in environmental communication is to embed the topic into the public's cognitive system in a mediated context [27]. Hao et al. found that media use had a significant effect on college students' environmental awareness and willingness to protect the environment [28]. Another study also found that media use was directly related to environmental behavior [29]. In addition, environmental issues are notable because environmental risks are related to people's quality of life and even survival. The mass media has an important influence on the public's access to environmental information, the shaping of environmental cognition, the promotion of environmental concern, and the implementation of environmental behavior. Studies have shown that the most prominent attribute of ecological and environmental issues is the risk attribute, and the media always stimulate risk awareness when describing and explaining risky environmental issues [30]. Risk is a systematic way of dealing with hazards and insecurities introduced by modernity itself, and it is socially constructed [31]. The environmental risks constructed by the media operate at the level of the audience's perceptions. Previous research has found that media use has a positive and significant effect on public environmental behavior, i.e., the more diverse the access to environmental information, the more information about environmental issues and specific environmental behaviors, the more likely they are to engage in environmental behavior [32]. Therefore, the research hypothesis is proposed:

H5: The more frequently the public uses media, the more they participate in environmental protection behaviors

Materials and Methods

Data Sources

This study is based on data from the 2013 Chinese General Social Survey (CGSS2013). The Chinese General Social Survey (CGSS) is the earliest national, comprehensive and continuous academic survey project in China, and is conducted by the China Survey and Data Center of Renmin University of China. The CGSS2013 uses a multi-stage stratified probability sampling method to survey adult citizens in all 31 provinces (autonomous regions and municipalities directly under the central government) in mainland China. related survey questions on respondents' environmental protection behavior, age, marital status, personal income, media use, self-assessed social class, education level, awareness of environmental issues, knowledge of environmental protection, and government effectiveness in environmental protection, all of which meet the needs of this study. After excluding missing values, a total of 7628 valid samples were obtained, including 4022 males and 3606 females; 6974 Han Chinese and 654 ethnic minorities; the mean age was 48.20±15.799 (M±SD).

Variable Settings

Dependent Variable:

Environmental Protection Behavior

According to Stren et al. classification of environmental behaviors, the dependent variables in this study include "private sphere environmental behaviors" and "public sphere environmental behaviors". Private sphere environmental behaviors refer to environmental behaviors that residents adopt without interacting with others, such as waste separation and recycling, while public sphere environmental behaviors refer to environmental behaviors that require interaction with others in a certain social environment, such as participating in discussions about environmental issues and complaining about existing environmental behaviors. Private environmental behaviors permeate people's daily lives, while public environmental behaviors require a high level of awareness of public participation and a sense of social responsibility [33]. According to the CGSS 2013 questionnaire, the public's environmental protection behaviors were divided into public sphere environmental protection behaviors and private sphere environmental protection behaviors. Among them, the public sphere environmental protection behaviors include 5 measurement questions, which are: a. donating to environmental protection causes; b. actively participating in environmental publicity and education activities organized by the government and units; c. actively participating in environmental protection activities organized by private environmental groups; d. maintaining public

woods or green areas at their own expense; and e. actively participating in complaints and appeals for environmental problems. The above five environmental protection behaviors were measured using a 3-point Likert scale (1 = never; 2 = occasionally; 3 = often), and the respondents' responses to these five questions were summed to generate the variable "environmental protection behavior in the public sphere". Cronbach's $\alpha = 0.736$ for this variable.

The private sphere environmental protection behaviors were also measured by 5 questions: a. Separate garbage; b. Discuss environmental issues with relatives and friends; c. Bring their own shopping baskets or bags when shopping; d. Reuse plastic bags; and e. Actively pay attention to environmental issues and information reported on radio, TV, and newspapers. The above five environmental behaviors were measured on a 3-point Likert scale (0 = never; 1 = occasionally; 2 = often), and respondents' scores on these five questions were summed to generate the variable "environmental protection behavior in the private sphere". Cronbach's $\alpha = 0.754$ for this variable.

Independent Variables

Individual's economic income and subjective social class. In the CGSS2013 questionnaire, economic income refers to the total personal income of the respondents in the past year. In order to avoid the influence of excessive fluctuation of economic income values on the dependent variable, the total personal income in the past year was treated by taking the natural logarithm (ln). In addition, by classifying social classes as 10 classes from 1 to 10 (1 = bottom of society, 10 = top of society), respondents were asked in which class of society they considered themselves to be. The higher the score, the higher the social class the respondent perceived himself/herself to be.

Environmental knowledge. This variable assesses the respondents' knowledge of the environment by determining whether they can correctly answer 10 questions such as "car exhaust is not a threat to human health" and "excessive use of fertilizers and pesticides can cause environmental damage" (0 = wrong answer, 1 = correct answer). The respondents' environmental knowledge base was assessed. The scores of all 10 questions were summed and the total score was the respondents' environmental knowledge base, and the higher the score, the better the respondents' environmental knowledge. The Cronbach's α for this variable was 0.789.

Environmental risk perception. This variable was used on a 7-point Likert scale (1 = no such problem, 2 = not concerned or cannot say, 3 = fair, 4 = not serious, 5 = not too serious, 6 = more serious, 7 = very serious) to assess respondents' perceptions of 11 types of environmental problems (air pollution, water pollution, noise pollution, industrial waste pollution, domestic waste pollution, lack of green space,

destruction of forest vegetation, degradation of arable land quality, shortage of freshwater resources, food pollution, desertification, and wildlife decline) in terms of perceived risk. The scores of the 11 questions were summed up to obtain the respondents' risk perception of environmental problems, and higher scores indicated that the respondents perceived more serious environmental risks. The Cronbach's alpha for this variable was 0.892.

Evaluation of the effectiveness of the central government's environmental protection efforts. This variable was used to ask respondents how they viewed the central government's environmental protection work over the past five years, with 1 = one-sided focus on economic development and neglect of environmental protection work; 2 = not enough attention and insufficient investment in environmental protection; 3 = did their best but ineffective; 4 = did their best and had some success; 5 = achieved a lot. The higher the total score, the more recognition of the effectiveness of the central government's environmental protection work.

Evaluation of the effectiveness of the local government's environmental protection efforts. This variable was measured by asking respondents how they viewed the environmental protection work of local governments over the past 5 years, with 1 = one-sided focus on economic development and neglect of environmental protection; 2 = not enough attention and insufficient investment in environmental protection; 3 = did their best but ineffective; 4 = did their best and had some success; 5 = made great in achievements. The higher the total score, the more recognition there is for the effectiveness of the local government's environmental protection work.

Frequency of media use. In the CGSS2013 questionnaire, the frequency of media use was measured on a 5-point Likert scale (1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = very often), which asked respondents how often they used six types of media, including newspapers, magazines, radio, television, Internet, and smartphones, in the past year. The scores of the six questions were summed and divided by six to obtain the media use frequency score, with higher scores indicating more frequent media use. The Cronbach's alpha for this variable was 0.745.

Control Variables

The control variables in this study mainly include gender, age, ethnicity, and place of residence (urban or rural) of the social security benefits that individuals have. Dummy variables were treated for gender, ethnicity, and place of residence. In the CGSS2013 questionnaire, "social security benefits owned by individuals" were assessed by asking respondents whether they had "basic urban or rural medical insurance," "basic urban or rural pension insurance" "commercial medical insurance" and "commercial

pension insurance" (0 = no, 1 = yes), and the scores of the four questions were summed up, and the total score ranged from 0 to 4. The higher the score, the better the social security treatment.

Results and Discussion

In this study, descriptive statistical analysis and multiple linear regression analysis were performed using IBM SPSS Statistics (Version 27.0) software and GraphPad Prism (Version 9.5.1) software.

Results of Descriptive Statistical Analysis

Firstly, GraphPad Prism software was used to analyze the differences between the Chinese public's participation in environmental protection behaviors in the public and private spheres, as shown in Table 1. This shows that the Chinese public attaches more importance to the environmental situation in the private sphere and is therefore more willing to adopt environmental protection behaviors, while the public's attitude toward environmental protection behaviors in the public sphere is more negative.

Second, as shown in Table 2, the public's overall recognition of the government's environmental protection effectiveness is low and even lower for local governments. Public recognition of the government's environmental protection effectiveness is low, with less than 40% of respondents saying that the government's environmental protection measures have been effective, with the public's recognition of the central government's environmental protection effectiveness slightly higher than that of local governments. This may also be one of the reasons why the public in China is more involved in private than public environmental protection, as residents are generally dissatisfied with local government initiatives to improve the environment in their neighborhoods, so they can only take steps to help themselves to improve their small environment.

Finally, as shown in Table 3, in terms of urban-rural differences, the frequency of rural residents participating in environmental protection is significantly lower than that of urban residents, and rural residents are less involved in public sphere environmental protection. At the same time, whether urban or rural residents, their participation in environmental protection in the private sphere is higher than their participation in environmental protection activities in the public sphere.

Results of Multiple Linear Regression Analysis

Models 1 and 2 are regression analyses of the respective variables on the environmental behavior in the private sphere, while Models 3 and 4 are regression analyses of the respective variables on the environmental behavior in the public sector. The specific model construction process is that demographic

Table 1. Comparison of differences in the participation of the Chinese public in environmental protection behaviors in the private and public spheres.

	M	S.D.	R ²	t	F	p
Environmental protection behaviors in the private	9.474	2.335	0.4332	108.0	2.141	<0.0001
Environmental protection behaviors in the public	5.978	1.596				

Table 2. Evaluation by the Chinese public on the effectiveness of the environmental protection work of the central and local governments in China.

The public's evaluation of the government's environmental protection work	Central Government		Local Government	
	Count	Proportion (%)	Count	Proportion (%)
1 = Neglected environmental protection work	722	9.50	934	12.20
2 = Insufficient attention, insufficient investment in environmental protection	1260	16.50	1721	22.60
3 = Despite efforts, the effect is not good	1992	26.10	1773	23.20
4 = Made great efforts and achieved certain results	2913	38.20	2601	34.10
5 = Achieved great achievements	741	9.70	599	7.90
Mean	3.22		3.03	
Standard Deviation	1.125		1.17	
t-value	10.45			
p-value	0.0005			

Table 3. Comparison of Public Participation in Environmental Protection between Urban and Rural Areas in China.

		Count	M	S.D.	F	t	p	95% CI	
Private sphere	Urban	4393	10.141	2.253	8.086	30.821	0.000	LLCI	ULCI
	Rural	3235	8.569	2.132				1.472	1.672
Public sphere	Urban	4393	6.196	1.742	296.571	14.115	0.000	0.444	0.587
	Rural	3235	5.681	1.316					

variables such as age, gender, education level, residence area, ethnicity, and social security benefits enjoyed by individuals are first included in Model 1 and Model 3 for multiple linear regression analysis, followed by independent variables such as individuals' total income in the previous year, subjective social class, environmental knowledge, environmental risk perception, evaluation of the effectiveness of the central government's environmental protection work, and evaluation of the local government's environmental protection work. After that, the independent variables such as total income in the previous year, subjective social class, environmental knowledge, environmental risk perception, evaluation of the effectiveness of the central government's environmental protection work, and evaluation of the local government's environmental protection work were included in model 2 and model 4 for multiple linear regression analysis. The results of the regression analysis are shown in Table 4.

Economic Income Positively Affects Public Participation in Environmental Protection Behaviors in the Private Sphere in China

The results of the multiple linear regression analysis show that total personal income in the previous year is significantly and positively related to public participation in environmental protection in the private sphere ($B = 0.302$, $p < 0.01$), but there is no significant relationship between total personal income in the previous year and public participation in environmental protection in the public sphere ($B = 0.066$, $p > 0.05$), therefore, hypothesis 1a is partially valid. This may be due to the fact that the private sphere is more involved in the specific daily lives of residents, and practicing environmental protection concepts in daily life is more feasible for most Chinese publics. In addition, public sector environmental behaviors such as environmental donations and participation in environmental activities

Table 4. Results of Multiple Linear Regression Analysis on Influencing Factors of Public Environmental Protection Behavior in China.

	Private sphere		Public sphere	
	Model 1	Model 2	Model 3	Model 4
	B	B	B	B
Constant	8.197***	4.165***	5.538***	3.092***
Age	0.005**	0.018***	-0.003*	0.002
female (male = 0)	0.383***	0.581***	-0.067	-0.002
Education level	0.205***	0.104***	0.111***	0.051***
Rural (urban = 0)	-1.048***	-0.451***	-0.217***	-0.218**
Ethnic minorities (Han = 0)	0.049	0.210	-0.051	0.168
Social security level	0.128***	-0.054	0.082***	0.002
Total annual personal income		0.302**		0.066
Subjective social class		-0.023		-0.018
Environmental knowledge		0.216***		0.058**
Environmental risk perception		0.112***		0.237***
Central government		-0.086		0.001
Local government		0.225***		0.142***
Media usage frequency		0.447***		0.403***
R ²	0.172	0.212	0.075	0.093
DR ²	0.171	0.209	0.074	0.089
F	263.64***	67.818***	102.607***	25.765***
D-W	1.664	1.725	1.570	1.660

of social organizations often require certain costs and resources, which requires high economic income and thus constrains low-income people from adopting public sector environmental behaviors to a certain extent. Multiple linear regression analysis also found that the subjective social class of the public has no significant effect on their environmental behavior in both the private and public spheres; therefore, H1b is not valid.

Environmental Knowledge Positive Impact of Public Participation in Environmental Behavior

From the analysis of Model 2 and Model 4, it can be seen that residents' awareness of environmental issues and their level of environmental knowledge have a significant positive impact on their environmental behavior, and environmental knowledge has a greater impact on environmental behavior in the private sphere. This means that the more sufficient environmental knowledge the Chinese public has, the more consciously they will contribute to environmental protection from their own perspective, and the more positive their environmental attitudes will be. Therefore, H2 is valid.

Environmental Risk Perception Positively Affects Public Participation in Environmental Behavior

From Model 2 and Model 4, it can be seen that environmental risk perception has a significant positive relationship with public participation in environmental behavior in both private and public spheres, and the positive effect of environmental risk perception on environmental behavior in the public sphere is greater, therefore, H3 is valid. This implies that residents' perception of the level of local environmental pollution is more sensitive to the choice of environmental behavior in the public sphere. The more polluted the place they live, the more likely they are to feel that it is difficult to turn around their living and working environment by only relying on a limited range of private sphere environmental actions, and the more likely they are to have a common will to participate in environmental protection organizations or environmental activities to form a strong private voice to urge the government to pay attention to environmental issues, and then take appropriate administrative measures to improve the local environment, which is an effective self-protection strategy.

The Effectiveness of Local Government Environmental Protection Work Positively Affects Public Participation in Environmental Protection Behaviors

From the results of Model 2 and Model 4, it can be seen that the effectiveness of the central government's environmental protection work has no significant effect on the public's participation in environmental protection behavior in both the private and public spheres, and has a negative effect on the public's environmental protection work in the private sphere, although this effect is not significant. However, the effectiveness of local governments' environmental protection efforts has a significant positive effect on the public's participation in both private and public spheres, and therefore, H4 is valid. This result suggests that the more local governments in China pay attention to environmental issues, the more effective their environmental efforts are, and the more frequently the Chinese public performs environmental protection behaviors. In terms of the influence of the effectiveness of the environmental protection work of the central government and the local government, the latter has more influence on the public. The reason for this is that, compared to the central government, the local government's environmental protection work and the effectiveness of environmental protection work are more closely related to the public's daily life, and the quality of the local environment depends on the effectiveness of the local government's environmental protection measures. The better the local government's environmental protection efforts are, the more the residents will be motivated to take part in environmental protection work. Therefore, local governments' actions have a greater influence on the private public's environmental protection behavior.

Media Use Positively Affects Public Participation in Environmental Behavior

The results of Model 2 and Model 4 show that media use has a significant positive effect on public participation in environmental behavior in both the private and public spheres, so H5 is valid. On the one hand, the media is the main channel for communicating environmental risks to the public in modern society, and media coverage of environmental issues and environmental risks has the social amplification effect of risks, which can make more public understand the importance and urgency of participating in environmental protection. On the other hand, environmental protection knowledge and cases disseminated in various media can also help the public to acquire more environmental protection knowledge and skills and better participate in environmental protection work.

Differential Analysis of Demographic Variables Affecting Public Environmental Behavior

First, this study found that age showed a stable and significant positive effect on environmental behavior in the private sphere, i.e., the probability of residents choosing to engage in environmental behavior in the private sphere on a regular basis increased with age, and they would adopt a more positive attitude toward environmental behavior in their daily lives, which is mainly related to the self-discipline of individuals as they grow older. However, the effect of age on residents' environmental behavior in the public sphere was not consistently significant, and after adding variables such as environmental knowledge and perception of environmental risks, the effect of age on residents' participation in environmental behavior in the public sphere was no longer significant. This may be due to the fact that older residents are more knowledgeable about environmental issues and environmental protection, have a stronger perception of environmental pollution in their surroundings, and are more aware of their participation in public affairs such as environmental protection. However, this situation is not absolute, if the residents have more knowledge about environmental protection, or if the environmental pollution level is more serious where they live, or if the government pays more attention to environmental protection issues, then from the young to the old, they will actively take environmental protection actions, and environmental protection will reach a consensus in the whole society. It can be seen that age is not a decisive factor in raising environmental awareness, but through extensive and effective environmental education, either directly or indirectly, we can quickly raise the environmental awareness of residents and make up for the intergenerational differences in environmental awareness, thus laying a solid social foundation for environmental protection.

Second, this study found that female is significantly more motivated to participate in environmental behaviors in the private sphere than male. Possible reasons for this phenomenon are that, on the one hand, previous studies have found that women have more positive attitudes toward environmental protection than men [34]. On the other hand, at this stage of family life in China, women are mostly responsible for household chores, such as purchasing daily necessities and putting out garbage, so it is natural that private environmental behaviors such as "separating garbage," "bringing their own shopping baskets or bags," and "reusing plastic bags" are more relevant to them. Therefore, it is natural that they are more involved in private sector environmental behaviors such as "separating garbage," "bringing their own shopping baskets or bags," and "reusing plastic bags," so women have more opportunities to participate in private sector environmental work and are more motivated than

male. However, this is expected to change over time as household lifestyles and division of labor patterns change in China.

In addition, the education level is significantly and positively related to the public's environmental behavior, i.e., the higher the education level of the residents, the more active they are in implementing environmental behavior. It is worth noting that after adding the variables of environmental knowledge, environmental risk perception, and the effectiveness of the government's environmental protection work, the effect of education level on the public's implementation of environmental protection behaviors tends to decrease. This suggests that while the national education system should be relied on to improve the public's environmental knowledge and willingness to participate in environmental protection, the public's environmental knowledge and perception of environmental risks should also be actively improved through other means.

Finally, both in the private and public spheres, urban residents show a higher level of participation in environmental behaviors than rural residents. The reason for the lower level of participation in environmental behaviors among rural residents in China may be that, compared to urban areas, rural areas are less industrialized and less polluted, and residents can directly perceive fewer problems such as air pollution (e.g., haze), noise pollution, and water pollution, and a large proportion of rural residents' needs are still at the level of basic living needs, and they have lower requirements for quality of life, so they pay less attention to environmental issues. Therefore, they are less concerned about environmental issues. Meanwhile, the promotion of environmental education in rural areas is not as widespread as in urban areas, and rural residents are generally less educated, so their awareness of environmental protection still needs to be improved and they are less willing to implement environmental protection behaviors than urban residents.

Conclusions

This study uses the CGSS 2013 survey data to compare the overall participation of the Chinese public in environmental protection behavior in the private and public spheres, and the urban-rural differences. This study found that 1) the Chinese public's environmental participation is mainly in the private sphere, especially women's participation in the private sphere is significantly higher than men's; 2) compared to urban residents, Chinese rural residents are less involved in environmental protection in the private and public spheres; 3) the Chinese public's recognition of the environmental governance efforts of the Chinese central and local governments is low; 4) individuals' economic income, environmental knowledge, perceived environmental risks, evaluation of the effectiveness of local government environmental

protection efforts, and frequency of media use all significantly and positively affect the Chinese public's participation in environmental protection behaviors, but subjective social class does not affect the Chinese public's participation in environmental protection behaviors. Based on this, this study concludes that the Chinese government, including the central government and local governments, should increase their efforts to further improve the effectiveness of environmental protection; the central government should provide smooth feedback channels for the public to express their environmental demands, and use the public's power to strengthen effective supervision and accountability of local governments' environmental management efforts. The Chinese government and citizen groups should make efforts to expand the channels of environmental knowledge dissemination, improve the level of environmental knowledge of the public, and guide the public to develop good environmental behavior habits.

Acknowledgments

All authors sincerely appreciate the CGSS2013 team of the China Research and Data Center of Renmin University of China. This study has been sponsored by the Chinese Association for Science and Technology (Grant No. KXYJS2022070).

Conflict of Interest

The authors declare no conflict of interest.

References

1. MINISTRY OF ECOLOGY AND ENVIRONMENT OF CHINA. 2021 Bulletin on the State of China's Ecological Environment. Retrieved from http://www.gov.cn/xinwen/2022-05/28/content_5692799.htm **2023**, March 17 [In Chinese].
2. LIU Y., WANG A., WU Y. Environmental regulation and green innovation: Evidence from China's new environmental protection law. *Journal of Cleaner Production*, 297, 126698, **2021**.
3. MINISTRY OF ENVIRONMENTAL PROTECTION OF CHINA. Measures for Public Participation in Environmental Protection. Retrieved from http://www.gov.cn/gongbao/content/2015/content_2961714.htm **2023**, March 17 [In Chinese].
4. ZHANG L., FUKUDA H., LIU Z. Public willingness to pay for sand and dust weather mitigation: A case study in Beijing, China. *Journal of Cleaner Production*, 217, 639, **2019**.
5. CHEN M., MARTENS P. Environmental Concern and Public Attitudes Toward Marine Life in Coastal China. *Anthrozoös*, **36** (1), 117, **2023**.
6. XI W. A Study on China's System of Public Participation in Environmental Protection – Taking Haikou's "Two Constructions" for Example. *IOP Conference Series: Earth and Environmental Science*, **51** (1), 012012, **2017**.
7. CHRISTODOULOU A., STAMATELATOU K. Overview

- of legislation on sewage sludge management in developed countries worldwide. *Water Science and Technology*, **73** (3), 453, **2015**.
8. INGLEHART R. *Culture Shift in Advanced Industrial Society*. Princeton University Press. **1990**.
 9. DU S., CAO G., HUANG Y. The effect of income satisfaction on the relationship between income class and pro-environment behavior. *Applied Economics Letters*, **1**, **2022**.
 10. ZHANG JIAO, LI SHIPING, GUO YUENAN Study on the influencing factors of farmers' environmental behavior based on the protection motivation theory. *Journal of Arid Land Resources and Environment*, **33** (5), 8, **2019** [In Chinese].
 11. HUDDART KENNEDY E., KRAHN H., KROGMAN N.T. Are we counting what counts? A closer look at environmental concern, pro-environmental behaviour, and carbon footprint. *Local Environment*, **20** (2), 220, **2015**.
 12. LI Z.-F., WU J.-C., DENG S. The effect of destination social responsibility on tourists' pro-environmental behavior. *Asia Pacific Journal of Tourism Research*, **27** (12), 1233, **2022**.
 13. HINES J.M., HUNGERFORD H.R., TOMERA A.N. Analysis and Synthesis of Research on Responsible Environmental Behavior: A Meta-Analysis. *The Journal of Environmental Education*, **18** (2), 1, **1987**.
 14. LIU P., TENG M., HAN C. How does environmental knowledge translate into pro-environmental behaviors?: The mediating role of environmental attitudes and behavioral intentions. *Science of The Total Environment*, **728**, 138126, **2020**.
 15. LIN S.-T., NIU H.-J. Green consumption: Environmental knowledge, environmental consciousness, social norms, and purchasing behavior. *Business Strategy and the Environment*, **27** (8), 1679, **2018**.
 16. SCHWARTZ S.H. Normative Influences on Altruism. This work was supported by NSF Grant SOC 72-05417. I am indebted to L. Berkowitz, R. Dienstbier, H. Schuman, R. Simmons, and R. Tessler for their thoughtful comments on an early draft of this chapter. In L. Berkowitz (Ed.), *Advances in Experimental Social Psychology* (Vol. **10**, pp. 221–279). Academic Press. **1977**.
 17. SLOVIC P. Risk Perception and Risk Analysis in a Hyperpartisan and Virtuously Violent World. *Risk Analysis*, **40** (S1), 2231, **2020**.
 18. KASPERSON R.E., RENN O., SLOVIC P., BROWN H.S., EMEL J., GOBLE R., RATICK S. The Social Amplification of Risk: A Conceptual Framework. *Risk Analysis*, **8** (2), 177, **1988**.
 19. FLATØ H. Socioeconomic status, air pollution and desire for local environmental protection in China: insights from national survey data. *Journal of Environmental Planning and Management*, **63** (1), 49, **2020**.
 20. INGLEHART R. Public Support for Environmental Protection: Objective Problems and Subjective Values in 43 Societies. *PS: Political Science & Politics*, **28** (1), 57, **1995**.
 21. YOON A., JEONG D., CHON J. The impact of the risk perception of ocean microplastics on tourists' pro-environmental behavior intention. *Science of The Total Environment*, **774**, 144782, **2021**.
 22. ZHANG J., CHENG M., MEI R., WANG F. Internet use and individuals' environmental quality evaluation: Evidence from China. *Science of The Total Environment*, **710**, 136290, **2020**.
 23. CIALDINI R.B., KALLGREN C.A., RENO R.R. A Focus Theory of Normative Conduct: A Theoretical Refinement and Reevaluation of the Role of Norms in Human Behavior. In M. P. Zanna (Ed.), *Advances in Experimental Social Psychology* (Vol. **24**, pp. 201–234). Academic Press. **1991**.
 24. FORNARA F., CARRUS G., PASSAFARO P., BONNES M. Distinguishing the sources of normative influence on proenvironmental behaviors: The role of local norms in household waste recycling. *Group Processes & Intergroup Relations*, **14** (5), 623, **2011**.
 25. QIAN Y., BEHERENS P., TUKKER A., RODRIGUES J.F. D., LI P., SCHERER L. Environmental responsibility for sulfur dioxide emissions and associated biodiversity loss across Chinese provinces. *Environmental Pollution*, **245**, 898, **2019**.
 26. XU T. The selective centralization in decentralization: China's environmental vertical management reform with a case study in Hebei province. *International Journal of Water Resources Development*, **38** (4), 634, **2022**.
 27. JOHN H. *Environmental Sociology* (3rd Edition). London: Routledge. **2014**.
 28. HAO Y., YASIN M.A.I., BOON SIM N. A study on the influence of media use on college students' environmental protection behaviors. *Management of Environmental Quality: An International Journal*, **34** (1), 177, **2023**.
 29. KARIMI S., LIOBIKIENĖ G., SAADI H., SEPAHVAND F. The Influence of Media Usage on Iranian Students' Pro-Environmental Behaviors: An Application of the Extended Theory of Planned Behavior. *Sustainability*, **13** (15), **2021**.
 30. MILES B., MORSE S. The role of news media in natural disaster risk and recovery. *Ecological Economics of Coastal Disasters*, **63** (2), 365, **2007**.
 31. ADAM B., BECK U., VAN LOON J. *The Risk Society and Beyond: Critical Issues for Social Theory*. London. **2023**.
 32. YANG KUICHEN, HU PENGHUI Perceived social justice, subjective well-being and pro-environmental behavior. *Journal of Arid Land Resources and Environment*, **32** (2), 15, **2018** [In Chinese].
 33. STERN P. Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues*, **56** (3), 407, **2000**.
 34. DHENGE S.A., GHADGE S.N., AHIRE M.C., GORANTIWAR S.D., SHINDE M.G. Gender attitude towards environmental protection: a comparative survey during COVID-19 lockdown situation. *Environment, Development and Sustainability*, **24** (12), 13841, **2022**.