

Original Research

Can China's Ecologically Civilized Environmental Policy (ECEP) Have a Positive Spillover Effect on Pro-Environmental Behavior? Evidence from the Chinese General Social Survey (2021) Data

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Received: 29 July 2023

Accepted: 8 September 2023

Abstract

Based on the newly released 2023 Chinese General Social Survey data from Renmin University of China, this paper selected 869 Ecological Civilization Pilot Area participants. Study 1 explored the impact of China's Ecological Civilization Environmental Policy (ECEP) on the spillover effects of pro-environmental behaviours (PEBs). Study 2 explored the effects of three types of environmental policy instruments on public value conflicts and PEBs. The results of Study 1 indicate that China's ECEP has positive spillover effects on both private and public-sphere PEBs. Private-sphere PEBs mediate the relationship between ECEP and public-sphere PEBs, and ECEP has "cross sphere" spillover effects on PEBs (private-sphere PEBs to public-sphere PEBs). Public value conflict moderates the relationship between ECEP and private-sphere PEBs. In Study 2, the results showed that the highest level of public value conflict was found in the economic incentive-instrument and the lowest level of public value conflict was found in the voluntary instrument. Whether public or private-sphere PEBs, voluntary versus command-instrument can better stimulate PEBs. Based on the study's results, it is recommended to strengthen the interpretation of environmental policies, resolve public value conflicts, and promote public-sphere PEBs by fostering private-sphere PEBs, thus promoting the spillover effect of "cross- sphere" PEBs.

Keywords: ecologically civilized environmental policies, pro-environmental behavior, spillover effects, public value conflicts, policy instruments

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Introduction

Global climate change, ecological environment deterioration, loss of biodiversity, and other environmental problems are severe threats to human society. From the government's perspective, it is crucial to formulate scientific and practical environmental policies. From the citizens' perspective, promoting the citizens' pro-environment behaviours (PEBs) should not be ignored. In response to climate change, In May 2013, China's Ministry of Ecological Environment and Environmental Protection issued the Indicators for National Advance Demonstration Zones for Ecological Civilization Construction (for Trial Implementation) (Huanfa [2013] No. 58), and the State Council issued the Opinions in August of the same year, which explicitly proposed the establishment of 100 ecological civilization advance demonstration zones across the country to drive the construction of ecological civilization. In this strategic deployment, citizens each practice the strategic goal of ecological civilization [1-3]. However, current studies tend to explore the positive spillover effects of specific micro-level psychological factors on PEBs [4-7] and ignore the impact of macro-level strategic concepts of ecological civilization on citizens' PEBs. In the present study, on the one hand, from a macro-perspective, we explore the mechanism by which ecological civilization environmental policy (ECEP) affects the spillover effect of PEBs. On the other hand, from the micro-perspective, we seek effective environmental policy instruments to stimulate citizens' PEBs.

Spillover effects of PEBs refer to the ability of interventions in specific PEBs to influence other non-specific PEBs, emphasizing the process of interactions and cross-sphere transfers between the two spheres [8-10]. Researchers have further defined PEBs (PEBs) as "public-sphere" and "private-sphere" PEBs [11, 12]. Since the strategic goal of ecological civilization was put forward, China has achieved remarkable results in environmental governance [13]. Nevertheless, the issue of whether the ECEP has a "cross-sphere" spillover between private and public-sphere PEBs has not attracted the attention of researchers, and such "cross-sphere" spillovers of PEBs are essential for governments in environmental governance. Psychology focuses on the PEBs spillover effects of psychological factors at the micro level of individuals [14-16], for example, self-efficacy [17], environmental values [18], environmental identity [19], and other psychological factors can have spillover effects on PEBs. Environmental science focuses on the PEBs spillover effects of macro-level environmental policies. Tobler and Visschers (2018) found that citizens' support for environmental policies and PEBs showed a significant positive correlation [20]. Environmental policy-based studies have found that incentives from different environmental policies can significantly and positively predict an individual's PEBs [21]. Some researchers have even found that environmental policies negatively affect citizens' PEBs

[22]. For example, the current garbage sorting policy in full swing in China significantly increases household electricity consumption, although it can enhance people's garbage sorting and recycling [6].

Studies have also found that the impact of environmental policies on PEBs is related to public value judgments [21, 23, 24]. The public value represents a value based on collective interests and reflects the citizens' collective preferences [25-27]. Public value conflict reflects the ambivalence of the citizens in the face of diverse public value preferences and significantly impact public behavioural decisions [28]. Research has found that public value conflicts harm individual attitudes and PEBs [29, 30]. In China, in the process of ecological civilization construction, facing the conflict between economic value and ecological value, the citizens need to weigh the importance of the two values and then produce ambivalence, which is likely further to affect the spillover effect of ECEP on PEBs, so we introduce the conflict of public value to explore the mechanism of the spillover effect of ECEP on PEBs.

In addition, although recent studies have explored the mechanisms by which macro-environmental policies influence PEB, it should be noted that existing studies have overlooked the pressing question of what specific environmental policy instruments are most effective in stimulating positive spillovers from citizens' PEBs. Currently, the most popular environmental policies are classified into three categories: command-instruments, economic incentive-instruments, and voluntary-instruments [31]. In China's ecological civilization construction strategy, the environmental organization usually designs and implements a variety of environmental policy instruments to intervene in citizens' PEBs to solve environmental problems [32]. However, in the context of China's ECEP, few researchers have explored the impact of environmental policy instruments on PEBs spillovers. In summary, this paper addresses the issues raised in the citation through two studies: Study 1, aims to explore the mechanism of the spillover effect of ECEP on PEBs. Study 2 introduces three types of environmental policy instruments based on the mechanism of ECEP affecting PEBs in Study 1 to provide practical policy implications for effectively stimulating the cross-sphere spillover effect of PEBs.

Study 1: Research on the Influence Mechanism of ECEP on the Spillover Effect of PEBs

Literature Review and Research Hypotheses

ECEP and Pro-Environmental Behavior

Environmental policy-based studies have found that incentives from different environmental policies can significantly and positively predict an individual's PEBs [21] and that complying with policies and implementing

policy-targeted behaviors may change an individual's motivation to be environmentally friendly, and thus influence his or her subsequent decision-making on PEBs [33, 34]. Tang Lin et al.'s (2021) study found that environmental policy can motivate farmers to participate in rural environmental governance [35]. In the study of the policy intervention model, it was found that the identity-enhancing strategy intention of the policy promoted residents' participation in the policy target behavior by increasing their environmental identity [34]. This type of strategy can help audiences recognize that complying with environmental policies and implementing target behaviors is motivated by their intrinsic environmental motivation [6], at which point residents are more willing to engage in other environmental behaviors to express their environmental preferences [33]. Since the strategic goal of ecological civilization was put forward, China has achieved remarkable results in ecological and environmental governance [36]. However, existing studies have not focused on how ECEP affects PEBs. Based on this, the following re-research hypotheses are proposed.

Hypothesis 1a: ECEP has a positive predictive effect on private-sphere PEBs.

Hypothesis 1b: ECEP has a positive predictive effect on public-sphere PEBs.

The Mediating Role of Private-Sphere PEBs.

On the topic of private-sphere PEBs research, scholars have found a positive spillover effect of environmental policies on private-sphere PEBs [37], and some report a negative spillover effect of environmental policies on private-sphere PEBs [33]. Researchers have turned their attention to the spillover effects of PEBs on public-sphere PEBs and have found that private-sphere PEBs intervention policies also have spillover effects on residents' public-sphere PEBs [38]. Studies have also found that past environmental experiences may activate individuals' environmental goals, reinforce people's ecological concerns, and motivate them to engage in other environmental activities, thus catalyzing positive spillovers [33]. Private-sphere PEBs involve more public-private interests, while public-sphere PEBs involve more citizens' public interests. Then, whether private-sphere PEBs also have positive spillover effects on public-sphere PEBs. Accordingly, it is hypothesized that when environmental policies are put in place, the public pays more attention to information related to their interests, and whether environmental policies can produce cross-sphere spillover effects on PEBs in the public-sphere is likely to depend on the citizens' PEBs in the private-sphere. Thus, we propose the following hypothesis.

Hypothesis 2a: Private-sphere PEBs has a positive "cross-sphere" spillover effect on public-sphere PEBs.

Hypothesis 2b: Private-sphere PEBs mediate between ECEP and public-sphere PEBs.

Moderating Effects of Public Value Conflict

Public value conflict reflects the contradiction between citizens facing diverse public value preferences, which has an essential impact on the citizen's behavioral decisions [26, 27, 29, 30]. Related studies have found that public participation in environmental governance is low, and even confrontational behavior occurs in neighborhood conflict situations [39]. It has also been found that citizen participation can effectively dissipate the harmful effects of public value conflict. The citizens should be guided and encouraged to participate in environmental governance actively [30], and the negative spillover effects of PEBs occur when cognitive dissonance occurs in the practice of PEBs by individuals [40]. Environmental policy is an essential intervention tool for the spillover effects of PEBs, so citizens' perception of environmental policy is likely to be one of the main reasons for the emergence of public value conflicts. When citizens face the most prominent economic and ecological public value conflicts in the current environmental governance process, they are bound to make choices about them while generating PEBs. It is reasonable to hypothesize that the higher the citizens' understanding of environmental policy, the weaker their perception of public value conflicts. The interaction between environmental policies and public value conflicts affects citizens' private-sphere PEBs, promoting PEBs in citizens' public-sphere PEBs, creating a "cross-sphere" spillover of PEBs. This paper proposes the following hypothesis.

Hypothesis 3: Public value conflict plays a moderating role between ECEP and private-sphere PEBs.

Based on the literature review and research hypotheses, this paper proposes a theoretical model of the spillover effect of ECEP affecting PEBs as shown in Fig. 1, in order to provide a theoretical basis for verifying the research hypotheses.

Methods

Participants

On March 31, 2023, Renmin University of China officially released the latest data from the China General Social Survey (CGSS 2021) to the public, and we investigated the mechanism of ECEP spillover effects on PEBs based on the relevant measurement items in this database. We selected participants from provinces where China's ecological civilization pilot zones are located, and after data screening and eliminating invalid data, the sample size of valid data ($N = 869$). Among them, 433 were male, accounting for 49.8%, and 436 were female, accounting for 50.2%. The average age was 48.70 ($SD = 16.58$); education level, 68.3% below high school, 17.9% junior college, 12.9% undergraduate, and 1.9% postgraduate; party members accounted for

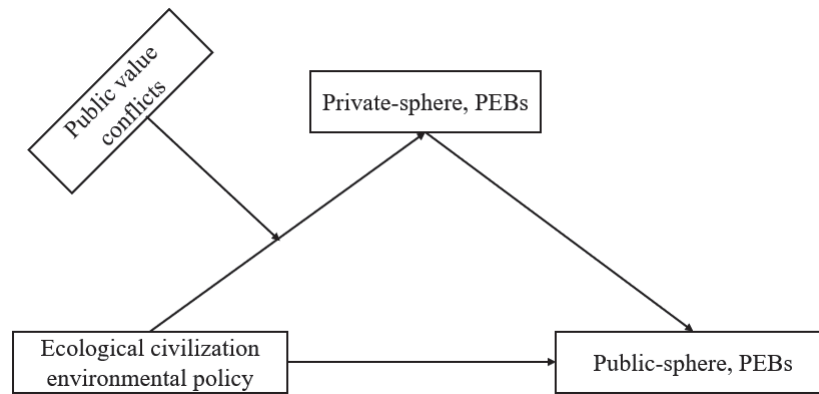


Fig. 1. Theoretical model of “cross-sphere” spillover effects of PEBs.

15.8%, and the general citizens accounted for 84.2%. Rural registered residence accounted for 49.3%, and urban registered residence accounted for 50.7%.

Measures

ECEP

We refer to the study of Liang et al. [41], which used citizen’s knowledge and understanding of ecological civilization and policies related to ecological civilization demonstration zones as a measure of environmental policies, and found six question items reflecting environmental policies in the database, which were measured by a 5-point Likert scale (1 = Completely don’t know, 2 = don’t know, 3 = Uncertain, 4 = know, 5 = Completely know) for the measured with Cronbach’ $\alpha = 0.85$.

Private-Sphere PEBs

Referring to Liu’s definition of private-sphere PEBs [12] and three question items reflecting private-sphere PEBs, and all items measured on a 5-point Likert scale (1 = very not willing, 2 = not willing, 3 = not necessarily, 4 = more willing, 5 = very willing) with Cronbach’s $\alpha = 0.76$.

Public-Sphere PEBs

Referring to Stern’s definition of Public-sphere PEBs [11] and three questions items reflecting public-sphere PEBs, all items measured on a 5-point Likert scale (1 = very not willing, 2 = not willing, 3 = not necessarily, 4 = more willing, 5 = very willing), with Cronbach’ $\alpha = 0.68$.

Public Value Conflict

Based on the study of public value conflict, it was concluded that public value conflict reflects the citizen’s ambivalence in the face of diverse public value preferences [30] and that PEBs face the impact of

conflict between economic public values vs. ecological values. A public value conflict index was calculated using the value conflict model of Thompson and Zanna [42]. One question item, each representing economic and ecological values, was found in the database and measured on a 5-point Likert scale (1 = completely disagree, 2 = relatively disagree, 3 = not necessarily, 4 = relatively agree, 5 = completely agree), and the formula for public value conflict was as follows:

$$Public\ value\ conflict = \frac{(P+N)}{2} - |P - N| + X$$

In this equation, P and N represent the degree of public preference for conflicting economic and ecological values, respectively, and X is a natural number assigned a value, usually taking the value of 1. The principle of the formula is that the size of the public value conflict is equal to the “similarity” of the size of the preferences of the two public values, plus their “intensity”. Intensity” of the two public value preferences. The larger the score, the higher the level of public value conflict.

Control Variables

The study selected gender, age, education, income, political appearance, and household type as control variables, with the gender assigned the value of (0 = male, 1 = female), education assigned the value of (high school and below = 1, college = 2, bachelor’s degree = 3, postgraduate students and above = 4), income as a continuous variable, political party (non-member of the party = 0, member of the party = 1), and type of registered residence (0 = rural, 1 = urban).

Results

Common Method Bias Test

In the survey process, artificial covariation between predictor variables and validity variables is caused by the same data sources or raters, the same measurement

environment, the item context, and the characteristics of the items themselves. Therefore, Harman's one-way analysis of variance was used to conduct the common method bias test. The results of exploratory factor analysis of all question items in the questionnaire showed that the variance explained by the first common factor was 29.78%, which was less than 40%, so there was no serious common method bias in the data of this study.

Descriptive Statistics and Correlation Analysis

The results of the descriptive statistics and correlation analysis of the variables are shown in Table 1, which revealed that there is a significant positive correlation between environmental policy and private-sphere PEBs and public-sphere PEBs ($p < 0.001$), whereas there is a significant negative correlation between environmental policy and public value conflict ($p < 0.001$), while the correlation between public value conflict and public-sphere PEBs was not significant ($p > 0.05$).

Regression Analysis

We conducted regression analyses using SPSS; the results are presented in Table 2. The study found a significant positive predictive effect of ECEP on public-sphere PEBs ($b = 0.23, p < 0.001$), so hypothesis H1a is valid. There is a significant positive predictive effect of ECEP on private-sphere PEBs ($b = 0.11, p < 0.001$), so hypothesis H1b is valid. Private-sphere PEBs positively predict public-sphere PEBs ($b = 0.63, p < 0.001$), so hypothesis H2a is valid. Public value conflict has a significant negative predictive effect on private-sphere PEBs ($b = -0.10, p = 0.029$).

Private-sphere PEBs positively affects public-sphere PEBs (mediation model, $b = 0.62, p < 0.001$), supporting hypothesis H2b. The results of the mediation effect analysis showed that the indirect effect value of private-sphere PEBs between ECEP and public-sphere PEBs was 0.59, 95% CI [0.57, 0.66] and that the mediation effect of private-sphere PEBs was significant, and hypothesis H2b was supported.

The interaction between ECEP and public value conflict negatively affected private-sphere PEBs (moderated mediation model, $b = -0.03, p < 0.05$). Simple slope analysis (Fig. 1) showed that ECEP was a stronger

predictor of private-sphere PEBs at low public value conflict ($b = 0.12, p < 0.001$); conversely, it was weaker ($b = -0.00, p = 0.95$), and hypothesis H3 was supported.

As shown in Table 3, in low public value conflict, ECEP can indirectly affect public-sphere PEBs through private-sphere PEBs ($b = 0.12, 95\% \text{ CI } [0.06, 0.17]$). In high public value conflicts, the indirect effect of ECEP on public-sphere PEBs through private-sphere PEBs is insignificant ($b = -0.00, 95\% \text{ CI } [-0.06, 0.06]$).

Robustness Tests

Due to the consideration of the inherent characteristics of the CGSS2021 data, we used a split-sample regression to test the stability of the study results. Firstly, we divided the whole population into two samples after randomization (Sample 1 $n = 445$, Sample 2 $n = 444$). Secondly, we did regression analysis on the two samples separately. The results of our study, after controlling for six demographic variables: gender, age, education, income, party and residence are shown in Table 4. The results of the robustness test were consistent with those of Study 1, proving the reliability of the study.

Discussion

Study 1 aims to explore the mechanisms by which ECEP affects PEB spillovers. First, we found that ECEP has a positive predictive effect on both private and public-sphere PEBs, and the higher the level of citizens' awareness of ECEP, the more citizens' PEBs can be stimulated, which is consistent with the results of the previous study [6, 20, 21]. Second, we found that private-sphere PEBs mediate between ECEP and public-sphere PEBs; we found a "cross-sphere" spillover effect of PEBs. We reason that private PEBs play an intermediary role between ECEP and public PEBs is that when ECEP is implemented, it is the citizens' life and behaviour in the private-sphere PEBs that will have the most significant impact, and when the citizens develop healthy pro-environmental habits in the private-sphere PEBs under the influence of ECEP (garbage sorting, conserving electricity and water), it will subconsciously influence the citizen's public-sphere PEBs (environmental donations, participation in environmental governance). Thirdly,

Table 1. Descriptive statistics and correlation analysis.

Variable	<i>M</i>	<i>SD</i>	1	2	3	4
ECEP	1.34	0.40	1	.13**	.22**	-.10**
Private-sphere PEBs	4.07	0.69	.13**	1	.57**	-.12**
Public-sphere PEBs	3.59	0.80	.22**	.57**	1	-.11**
Public value conflict	0.10	0.81	-.10**	-.12**	-.11**	1

Note*. $P < 0.05$, **. $P < 0.001$

Table 2. Results of regression analysis.

	Private-sphere PEBs		Main effect	Public-sphere PEBs	
	Mediated model	Moderated model		Mediated model	Moderated mediation model
Constant	12.82	12.70	11.38	3.34	3.31
Gender	-0.25	-0.25	-0.38	-0.22	-0.22
Age	-0.01	-0.01	-0.01	0.00	0.00
Education	-0.04	-0.04	-0.09	-0.06	-0.06
Income	-0.11	-0.11	-0.18	-0.11	-0.11
Party	0.02	0.01	0.21	0.13	0.13
Residence	0.12	0.13	-0.14	-0.15	-0.15
Independent variable					
ECEP	0.108**	0.16**	0.23**	0.16**	0.14**
Mediating variables					
Private-sphere PEBs				0.62**	0.62**
Moderating variables					
Public value conflict (PVC)		0.11**			-0.02
Interaction					
(ECEP×PVC)		-0.03**			0.01
<i>F</i>	3.85	3.86	10.89	60.48	48.43
<i>R</i> ²	0.03	0.04	0.08	0.35	0.36
ΔR^2	0.02	0.03	0.05	0.32	0.33
<i>N</i>	856.00	856.00	856.00	856.00	856.00

Note*. $P < 0.05$, **. $P < 0.001$

Table 3. Analysis of mediated effects of moderated.

	PE→Private-sphere (PEBs)→Public-sphere (PEBs)			
	Indirect effect	SE	95% CI	
Lower-public value conflict (<i>M+ISD</i>)	0.12	0.02	0.06	0.17
Public value conflict (<i>M</i>)	0.06	0.02	0.01	0.10
Higher-public value conflict (<i>M-ISD</i>)	0.00	0.03	-0.06	0.06

Note*. $P < 0.05$, **. $P < 0.001$

public values as citizens' preferences and psychological needs for governmental environmental governance [27, 29], and public value conflicts can inhibit citizens' PEBs, and the exciting finding is that public value conflicts mediate between ECEP and private-sphere PEBs. We reasoned that the main reason was public value conflict as the public on economic value and ecological value after the judgment of the contradictory psychology; this ambivalence can be directly affected by the citizen's daily behaviour, the higher the level of conflict, the private-sphere PEBs is less likely to be stimulated.

Study 2: An experimental study on the effect of environmental policy instruments on PEBs' spillovers

Literature Review and Research Hypotheses

In order to solve environmental problems effectively, governments promulgate environmental policies, such as China's ECEP, and in the process of policy implementation, local governments usually use specific environmental policy instruments to assist in the practical realization of environmental policies.

Table 4. Robustness test of the study results.

	Sample 1 (n = 434)					Sample 1 (n = 435)				
	Private-sphere (PEBs)		M3	Public-sphere (PEBs)		Private-sphere (PEBs)		M3	Public-sphere (PEBs)	
	M1	M2		M4	M5	M1	M2		M4	M5
Constant	11.86**	11.12**	9.60**	2.34**	2.51**	11.20**	10.88**	11.38**	2.36**	2.63**
ECEP	0.09*	0.18**	0.16**	0.11**	0.08*	0.13**	0.21**	0.23**	0.09**	0.14**
Private-sphere PEB				0.61**	0.62**				0.63**	0.62**
Public value conflict (PVC)		0.33**			-0.11		0.24**			-0.08
(ECEP×PVC)		-0.05			0.02		-0.45			0.02
F	4.94	3.91	13.89	91.45	45.96	11.27	6.49	10.89	110.07	55.41
R ²	0.01	0.03	0.03	0.29	0.29	0.02	0.04	0.08	0.33	0.34

Note*. M1: Mediated model. M2: Moderated model. M3: Main effect. M4: Mediated model. M5: Moderated mediation model.

Environmental policy instruments include three types (command vs. economic incentive vs. voluntary) [31, 43]. Command-instruments are used to enforce the realization of environmental governance objectives by enacting regulations and orders. Economic incentive-instruments are mainly implemented through environmental taxes and fees, government subsidies, interest subsidies, and other means to achieve environmental governance goals. Voluntary-instruments are mainly implemented through non-compulsory means such as government information and citizens opinion, consultation, exhortation, moral indoctrination and civic participation to change the cost-benefit structure or environmental morality of the regulated parties to make the regulated parties take voluntary actions to improve the quality of the environment.

The popularity of the three types of policy instruments varies due to differences in effectiveness. In the U.S., command and economic incentive instruments are most commonly used [44], and most states have passed new statutes encouraging municipalities to provide recycling services to households and requiring all municipalities to establish curbside fee programs [45], and developed countries often use economic incentive instruments (e.g., “pay for what you throw away” [46]. The European Union (EU) promotes PEBs in waste management through regulations, economic incentives (e.g., landfill taxes), voluntary measures (e.g., eco-labelling), and other policy instruments. The European Union (EU) also adopts regulations, economic incentives (e.g., landfill tax), and voluntary measures (e.g., eco-labelling) to promote PEBs of the public in waste management [47]. In China, since the promulgation of the ECEP, local governments have also designed and implemented various environmental policy instruments to intervene with the citizens to solve environmental problems. However, few researchers have explored the effects of different policy instruments on the spillover effects of PEBs.

In summary, we conclude from the results of Study 1 that ecological ECEP has a positive predictive effect on policy instruments, while public value conflicts play a moderating role between ECEP and private-sphere PEBs. Ideally, we would like to find one of the three policy instruments with less public value conflict and more PEBs to help environmental problems.

Methods

Experimental Design and Participants

A one-way between-subjects experimental design was used, with the independent variable being environmental policy instruments (command vs. economic incentive vs. voluntary) and the dependent variables being public value conflict and private PEBs.

In CGSS (2021) database, by asking, “Which of the following do you think is the way to enable the citizens and their families to protect the environment in China during the implementation of the ECEP?”{Command-instruments group A = heavily penalizes individuals who damage the environment; Economic incentive-instruments group B = uses tax instruments to reward individuals who protect the environment; Voluntary-instruments group C = provides individuals with more information and training on the benefits of protecting the environment}. Participants were randomized to different policy instrument groups, with Group A (n = 244), Group B (n = 182), and Group C (n = 443).

Measure

Public Value Conflict

Public value conflicts are measured in the same way as in Study 1 One question item each representing economic and ecological values was found in the

database and measured on a 5-point Likert scale. A public value conflict index was calculated using the value conflict model of Thompson and Zanna [42].

Pro-Environmental Behavior

PEBs was measured in the same way as in Study 1, private-sphere and public-sphere PEBs six questions items reflecting in the database were measured on a 5-point Likert scale.

Results

The Effect of Environmental Policy Instruments on Public Value Conflicts

A one-way ANOVA was used to find a significant main effect of environmental policy instruments $F(2, 866) = 2.765, p = 0.005, \eta^2 = 0.01$. Simple effects analyses found significantly high perceived public value conflict in economic incentive-instruments ($M = 0.22, SD = 0.72$) is significantly higher than in voluntary-instruments ($M = 0.04, SD = 0.86$), $t(623) = 2.48, p < 0.05, Cohen's d = 0.825$. Perceived public value conflict between command-instruments ($M = 0.11, SD = 0.75$) and economic incentive-instruments ($M = 0.22, SD = 0.72$) is in significantly. There was no significant difference between command and voluntary instruments.

Effect of Environmental Policy Instruments on Private-Sphere PEBs

A one-way ANOVA was used to find a significant main effect of environmental policy instruments $F(2, 866) = 3.35, p < 0.05, \eta^2 = 0.01$. A simple effects analysis found that private-sphere PEBs in the economic incentive-instruments ($M = 3.96, SD = 0.68$) was significantly lower than in the voluntary-instrument ($M = 4.12, SD = 0.67$), $t(623) = -2.56, p < 0.05, Cohen's d = 0.67$, while the command-instruments ($M = 4.04$,

$SD = 0.04$) and were not significantly different from voluntary-instrument.

Environmental Policy Instruments on Public-Sphere PEBs

The main effect of environmental policy instruments was significant, $F(2, 886) = 3.56, p < 0.05, \eta^2 = 0.01$. Simple effects analyses found that public-sphere PEBs in the economic incentive-instruments ($M = 3.47, SD = 0.81$) was significantly lower than the voluntary-instrument ($M = 3.66, SD = 0.82$), $t(623) = -2.61, p < 0.001, Cohen's d = 0.82$, while the command-instrument ($M = 3.55, SD = 0.74$) and were not significantly different from voluntary-instrument. The results of policy instruments affecting public value conflict and PEBs are shown in Fig. 2.

Discussion

Study 2 – we designed an experiment to explore the effects of environmental policy instruments on public value conflicts and PEBs in the context of ECEP, and together, we looked for policy instruments that effectively deal with public value conflicts and stimulate public PEBs. First, we found that public value conflicts in the three environmental instruments are differentiated, with the highest level of citizen's public value conflicts in the economic incentive-instruments. As we mentioned in the introduction, the citizens are currently faced with a conflicting trade-off between the house of economic and ecological values, and between the two, the citizens are likely to prefer the economic values, and thus the highest level of public value conflicts in the economic incentive-instruments.

Second, we found that the citizens have the highest level of PEBs in voluntary-instrument, followed by command-instruments, and lowest in economic incentive-instruments, in both public and private-sphere PEBs. On the one hand, we hypothesize that the voluntary-instrument is characterized by autonomy

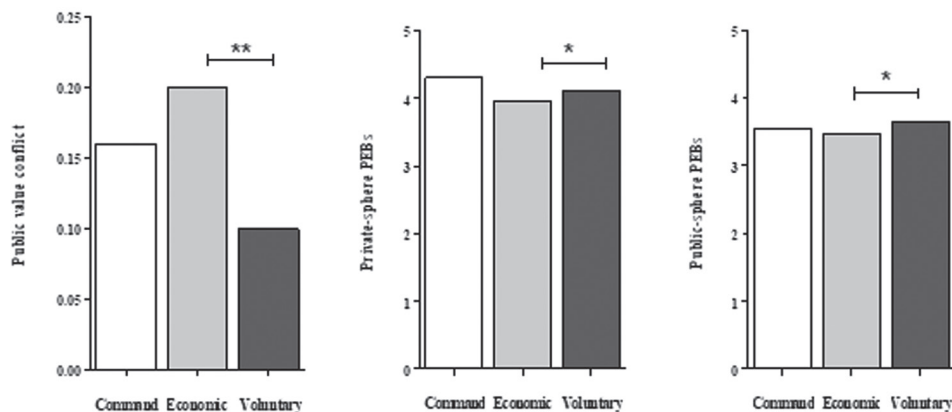


Fig. 2. Public values conflict and PEBs in different policy instruments.

and non-coercion, which is more likely to stimulate the citizens' pro-environmental motivation and realize the PEBs' interests, thus stimulating PEBs to a greater extent. On the other hand, the command-instrument is characterized by coercion and punishment, and the citizens are likely to fear that such punishment will damage private interests and thus be forced to make more PEBs. Based on our two main findings, which may provide some insights into the formulation and implementation of environmental policies at a later stage.

General Discussion

Theoretical Contributions

The main marginal contributions of this paper are reflected in four dimensions: first, previous studies focus on studying the psychological factors affecting the spillover effect of PEBs [17-19], and lack in-depth research on the mechanism of PEBs spillover effect occurrence and the direction of spillover effect, and lack in-depth research on the mechanism of spillover effect occurrence and the direction of the spillover effect of PEBs. Using the CGSS (2021) data, we systematically explore the impact of environmental policies on the spillover effect of PEBs, especially the "cross-sphere" spillover effect of PEBs, which enriches the research results on the spillover effect of PEBs. Secondly, this paper introduces the public value theory as a theoretical explanation of PEB spillover effects, which provides a new perspective on PEB spillover effects. Taking public value conflict as a moderating variable, it forms a complete public-sphere PEBs generation logic based on public value, private sphere, and public-sphere PEBs interaction, providing a concrete theoretical reference for explaining and stimulating citizens' PEBs. Third, in study 2, we explore the impact of environmental policy instruments on public value conflict and PEBs. Effective policy instruments are found for resolving public value conflicts arising from environmental problems and stimulating citizens' PEBs. Fourth, our study verifies the effectiveness of ECEP in environmental governance and provides a policy basis for the response to global ecological and environmental problems.

Practical Implications

Based on the results of Study 1, this paper proposes three specific implications. Firstly, use ECEP as a fulcrum to promote citizens' PEBs. Increase the publicity and education of environmental policies to guide and deepen citizens' perception and understanding of environmental policies. We take the difference of that individual and the difference of the area of residence, personalized publicity for different groups, and can use the "point system" and other market and voluntary mechanisms to stimulate the public to form the PEB

in the private sphere. Secondly, good PEB habits can be cultivated through a "public-private combination." The governments should focus on guiding the public to form personal habits of private PEBs (garbage classification, saving electricity and water) to promote citizens' PEBs (environmental protection donations, environmental protection tax payments). Thirdly, environmental policy-making should consider citizens' public value preferences and opportunities. We suggest that environmental protection departments consider citizens' preferences in the process of policy-making, patiently explain the damage that the implementation of environmental policies may cause to the interests of some citizens in order to gain their support and recognition of environmental policies, and avoid the negative impact of public value conflicts on citizens' PEBs.

Based on the findings of Study 2, two implications are proposed: First, the voluntary-instrument has a better effect on resolving public value conflicts in ecological environmental governance than the command-instruments and the economic incentive-instruments. Second, on how to stimulate citizens' PEBs in ecological environmental governance, we should focus on the preference and recognition of policy instruments, and we find that the effect of voluntary-instruments is better than the effect of command and economic incentive-instruments. From the policy design perspective, if we want to stimulate citizens' PEBs, relying on voluntary-instruments unexpectedly stimulates citizens' PEBs.

Limitations and Future Research

Although this paper explores the effects of environmental policies on spillovers from PEBs and the role of policy instruments on PEBs and public value conflicts through two experiments, there are some limitations.

In Study 1, although this study proves the initial hypothesis of the study through the data available in the database, the questionnaire method makes it difficult to make rigorous causal inferences, and it should be noted that the environmental policy variables in this study are derived from citizens' perceptions of the national macro-level environmental policies. Future research can take the following two perspectives to explore further the mechanism of environmental policies' spillover effects on PEBs. First, the reexamination model can be tested again with the help of survey experiments or laboratory experiments to verify the causal relationship between environmental policies and the spillover effects of PEBs. Second, based on the specific research field of environmental governance, artificial intelligence technology, and web crawler technology are used to obtain significant data to draw more reliable conclusions and promote PEBs with scientific and practical environmental policies.

In Study 2, this paper only explores the study of the impact of a single policy instrument on PEBs and

public value conflict, and future research can be carried out to investigate the spillover effects of PEBs in the combination of policy instruments (i.e., voluntary and economic incentives-instruments) in order to find more effective policy instruments for solving the environmental problems.

Funding

The present study was supported by the Northwestern University Graduate Research Innovation Program (CX2023021).

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 authors.

Acknowledgements

This is to acknowledge the contributions of the Department of Public Administration at Northwestern University, for their help in writing and revising the article.

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.

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