

‘What if I feel it is mine?’ – The impact of psychological ownership on public participation in China’s transboundary watershed eco-compensation

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Abstract

Clarifying the impact of psychological ownership on public participation in transboundary eco-compensation will contribute to compensation transforming from the current government-led economic incentive mode to the normative guidance of effective public participation, which is of great significance to transboundary management of water resources. From the perspective of social psychology, this paper uses a double hurdle model, empirically analyzes the impact of psychological ownership on public participation, and explores the internal laws and driving mechanisms of behavior. Results show the willingness to participate mainly depends on the public’s judgment of self-ability and their own responsibility and values, while the degree of participation depends on the judgment and grasp of self-governance ability. The more they agree that protecting the environment is the responsibility and obligation of citizens, the lower their willingness to pay. China’s long-term ‘government-led environmental governance’ mode has led to the formation of a serious government dependence psychology among the public.

Keywords: China; Double hurdle model; Eco-compensation; Psychological ownership; Public participation; Transboundary watershed

Highlights

- We analyze the impact of the psychological ownership on the public participation in China’s transboundary eco-compensation.
- Empirical results show that public’s willingness to participate and the degree of participation are two different decision-making processes.

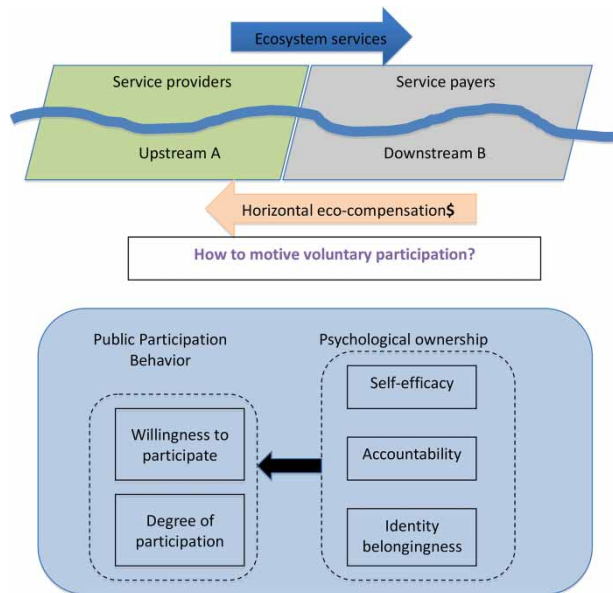
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- It is of great significance to internalize the government-led eco-compensation into individual protection behavior norms to promote public participation.

Graphical Abstract



Introduction

Administrative divisions disserve ecosystem integrity, which has led to the increasing difficulty of transboundary management and governance of the global ecosystem (Furber *et al.*, 2015). Most of the world's rivers cross the jurisdictional boundaries of two or more countries (Uitto & Duda, 2002). There are many transboundary river basins in China, which have a distribution of about 30% of territory (Zhang, 2013). The river is the link between the upper, middle, and lower reaches of a specific basin and the carrier of ecosystem services. The unidirectional fluidity of its movement produces spillover between upstream and downstream regions (Huang *et al.*, 2017). Except for being used locally, the ecosystem services provided by the upstream can also be used in the downstream or even wider areas (Liu *et al.*, 2015). On the one hand, the public directly affects and changes the ecosystem; on the other hand, in order to slow down the degradation of the ecosystem caused by human activities, they try to build compensation mechanisms to ensure the sustainable and continuous supply of ecosystem services (Zhen *et al.*, 2010). Therefore, the establishment of a transboundary horizontal eco-compensation mechanism can effectively balance the conflict of interests between the ecosystem service providers (producers) and compensation payers (consumers) between upstream and downstream regions (Peng *et al.*, 2017).

China's constitution stipulates that the property rights of water resources in river basins belong to the state, but the specific use rights are specifically implemented and managed by the local government

where the water flows through. Based on their own interests, each administrative subject rational thinking in the river basin often falls into the ‘prisoner’s dilemma’, which leads to the dilemma of the establishment and implementation of China’s transboundary eco-compensation mechanism. In practice, China’s transboundary eco-compensation projects currently have issues such as the definition of property rights, coordination costs, and administrative barriers among regions (Zhang, 2018). They are often implemented through top-down multi-level administrative orders, usually led by the central government and actively or passively negotiated by local governments (Shang et al., 2018). China’s eco-compensation is often criticized by the government’s massive participation, due to the problems of incomplete information, poor management, and corruption (Bennett, 2008). In practice, compensation standards are usually based on cost rather than benefit measurement for the advantages of operability and simplicity, resulting in low compensation standards and difficulty in realizing the principle of fairness in eco-compensation. At the same time, compensation efficiency is low and public participation is insufficient, failing to stimulate the enthusiasm of ecosystem service providers for voluntary protection (Xu et al., 2018), resulting in short-term compensation effects and mere formality.

Effective participation of stakeholders in decision-making has been widely recognized as a key element to achieve transboundary management of water resources (Furber et al., 2015). As the direct user of watershed ecosystem services and beneficiary of ecological protection, and the ultimate executor and implementer of compensation policy, effective public participation in compensation plays an important role in transboundary water resources management (Zhang et al., 2019). Although public participation has not been institutionalized in China’s environmental management (Xu et al., 2020), most scholars believe that it is not only helpful for the public to fully understand the current status of eco-compensation, but can also effectively prevent the decision-making risks and improve the efficiency of compensation policies (Yi, 2014). Public participation in eco-compensation is essentially the public’s consumption behavior regarding the environmental goods supplied by the upstream of the river basin, which is a complex environmental behavior affected by internal and external factors (Shipeng et al., 2018). The willingness to participate is generally affected by socio-economic variables such as age, gender, income, and education level (Ge et al., 2009; Jie et al., 2011; Zong, 2013; Zhou & Li, 2015; Qi et al., 2019). In addition, studies have found that social capital (Guo et al., 2014), implementation effect of compensation policy (Zhang, 2019), and ecological cognition (Shi et al., 2017; Zhang et al., 2019) also have a significant impact on the willingness of the public to participate.

It has been generally accepted that ecological, social, and economic methods are not the only methods for analyzing and managing natural resources; the importance of social psychology and interdisciplinary methods is increasingly recognized and valued (White et al., 2009). Psychological ownership as an academic concept originated in organizational research (Mattila & Ikkvalko, 2003; Pierce & Jussila, 2010; Brown et al., 2014), and was subsequently applied to consumer behavior (Asatryan & Oh, 2008), entrepreneurship (Townsend et al., 2009), and the field of health (Karnilowicz, 2011). In recent years, some scholars have applied psychological ownership to natural resource management (Lähdesmäki & Matilainen, 2014). The sense of ownership of the target has an important and potentially powerful behavioral impact. Psychological ownership helps to better understand the internal reasons behind natural resource conflicts and management, and can effectively promote the successful cooperation of different stakeholders (Matilainen et al., 2017).

The essence of transboundary eco-compensation is the trust-based interaction and cooperative governance behavior between upstream and downstream regions (Zhang et al., 2012). From the current government-led economic incentive mode to the normative guidance of effective public participation,

to realize the solidification of ecological system protection behaviors into longer-term social behaviors, truly motivate the public to actively and voluntarily participate, it is necessary to understand the internal driving mechanism of public participation in compensation behavior from the psychological level of the public. Therefore, the main contribution of this paper is from the perspective of social psychology, using the double hurdle model to empirically analyze the impact of the psychological ownership of the downstream public on the participation in compensation to the upstream ecosystem services' providers, and to explore the inherent law of participation behavior, so as to stimulate ecosystem service consumers to participate in environmental governance spontaneously, and to provide a basis and reference for the construction of China's transboundary eco-compensation mechanism.

We structure the rest of this paper as follows. The section below reviews the theoretical analysis related to psychological ownership and is followed by a section introducing data collection and related variable description, as well as the theoretical model setting. A results section follows showing the empirical results. Then, key findings are discussed and policy recommendations proposed. The paper ends with conclusions.

Theoretical analysis framework

Psychological ownership is a kind of psychological reaction of possession and attachment to the target. It refers to a psychological state in which an individual feels that the object is 'mine' in whole or in part (Pierce & Dirks, 2001). It is a very common phenomenon for individuals to perceive the ownership of objects psychologically. As long as they touch or carefully think about a target, they can perceive that the object belongs to them (Lessard-Bonaventure & Chebat, 2015). People can easily experience the psychological connection between the self and the target, resulting in psychological ownership (Jussila et al., 2015). Therefore, the target becomes an extension of self-concept. When an individual regards the target as a part of himself, he will naturally have a sense of responsibility for the target, thus stimulating a positive attitude and protective behavior towards the target (Furby, 1978; Beaglehole, 2017). Heider (1958) points out that when individuals have a sense of ownership of the target, they tend to like the target, and they will form a more positive evaluation of the target, and actively integrate themselves and their belongings. Beaglehole (2017) believes that the sense of ownership can stimulate the sense of responsibility, which produces a series of positive effects, including organizational citizenship behavior, altruistic behavior, and risk-taking behavior. Jussila et al. (2015) believe that even if there is no legal ownership of an object, that is, an object is not legally owned by oneself, individuals can possess the object psychologically, such as the psychological ownership of the river by the residents of the basin. Pierce & Dirks (2001) believe that self-efficacy, spatial sense, and self-identity are the motivations of psychological ownership. Avey et al. (2009) construct a multi-dimensional scale of psychological ownership and believe that psychological ownership consists of four dimensions: self-efficacy, self-identity, sense of belonging, and sense of responsibility. Chen (2011) test and revise the scale of psychological ownership proposed by Avey et al. (2009) for Chinese situations, and combine the sense of belonging and self-identity into identity belongingness. They believe that psychological ownership consists of three dimensions: self-efficacy, accountability, and identity belongingness.

Psychological ownership of rivers partly comes from residents' sense of efficacy in achieving production or life goals. Owning a river means controlling the river, which enables residents to protect

or change the ecological environment of the basin, meet the needs of production or life, and greatly satisfy their internal needs. At the same time, there is a need of space for residents in the basin. Owning a river can satisfy the residents' sense of belonging similar to 'home'. The traditional belief is that no one cares about items more than their owners. Residents have a sense of psychological ownership of the river, which can stimulate their sense of responsibility for the river, so that they can maintain and treat the river with master consciousness, and reduce the tolerance of river loss. Individuals with a sense of psychological ownership will take care of the target more carefully, and are more likely to fight for the target in public (Zhang *et al.*, 2015). Similarly, some scholars have proposed that the psychological ownership of a specific target may promote the individual to exhibit, talk about, and enjoy the target (Pierce & Dirks, 2001). Residents' cognition or awareness of river property rights will positively affect the results of willingness to pay (Zhou & Li, 2015). In addition, according to the endowment effect, the value of river assessed by residents depends on whether they own it. If they feel that they own the river, they value the river more than when they do not have it. Therefore, if residents develop a sense of psychological ownership, their tolerance for river ecological damage will be lower and their willingness to pay for eco-compensation will be higher.

Social learning theory points out that human behavior is affected by both the resultant factors and the predecessor factors. The individual's perception of self-behavior, that is, self-efficacy, is an important predecessor factor that affects behavior. The resultant factor of behavior can stimulate and maintain the motivation of behavior, which in turn controls and regulates behavior. Before the behavior is implemented, a subject will speculate or judge the result of the behavior and whether he can perform a certain behavior, which is called self-efficacy (Yue, 2014). Self-efficacy refers to an individual's subjective judgment on whether he can complete a certain behavior at a certain level, including the ability, belief, self-control, and feeling of the behavior (Bandura, 1997). Self-efficacy can affect the choice and attitude towards behavior. Previous studies have found that self-efficacy is significantly positively correlated with behavior (Allen & Ferrand, 1999).

Value-belief-norm theory believes that environmental accountability refers to the individual's sense of responsibility to take measures to solve specific environmental problems or prevent the deterioration of environmental quality. Environmental accountability is the most basic factor determining whether environmental behavior is implemented or not (Stern, 2000). Hines *et al.* (1987) find that there is a strong correlation between individual environmental accountability and behavior, that is, the stronger the individual's sense of accountability for mitigating environmental problems or improving environmental quality, the higher the possibility of implementing environmental behavior. Nie (2016) analyzes the differences in low-carbon emission reduction behaviors of urban and rural residents and finds that environmental accountability can drive rural residents to implement more low-carbon behaviors. Value-belief-norm theory believes that when actors are faced with the dilemma of personal interests and social interests, the internalized environmental responsibility will be awakened, which in turn encourages individuals to implement environmental behaviors.

Identity is regarded as a part of self-concept and also a manifestation of psychological ownership (Avey *et al.*, 2009). Avey *et al.* (2009) point out that through interaction with tangible and intangible property, self-identity can be established, maintained, reproduced, and transformed. The goal of ownership is often used as a description of self-identity. Shamir & Arthur (1993) point out that we identify ourselves through 'self-identity', and individuals gain a sense of meaning and connection. Because people are expressive and seek opportunities to identify themselves, the need for self-identity can be seen as a potential component of psychological ownership (Avey *et al.*, 2009). Many studies have

emphasized the link between identity and behavior (Biddle *et al.*, 1987; Eagly & Chaiken, 1993; Stets & Biga, 2003). When our identity determines that we behave in a certain way, identity may even override attitude, regardless of how we feel about this behavior (Charng *et al.*, 1988). Social psychologists have clarified people's needs for housing or shelter (Ardrey, 1966; Duncan, 1981), which is a fundamental need, is not only a physical need, but also a sense of psychological belonging. The feeling of belonging through attachment to a certain place or object becomes a personal 'home' or place (Pierce & Dirks, 2001). Residents in the river basin have domain or spatial needs. Owning a river can satisfy residents' needs for a sense of belonging similar to 'home' (Zhao & Tao, 2017). A strong sense of environmental belonging has a positive impact on environmental behavior (Gachoka, 2007).

In conclusion, psychological ownership has an important impact on public participation in trans-boundary watershed eco-compensation behavior. Based on this, the research framework is shown in Figure 1.

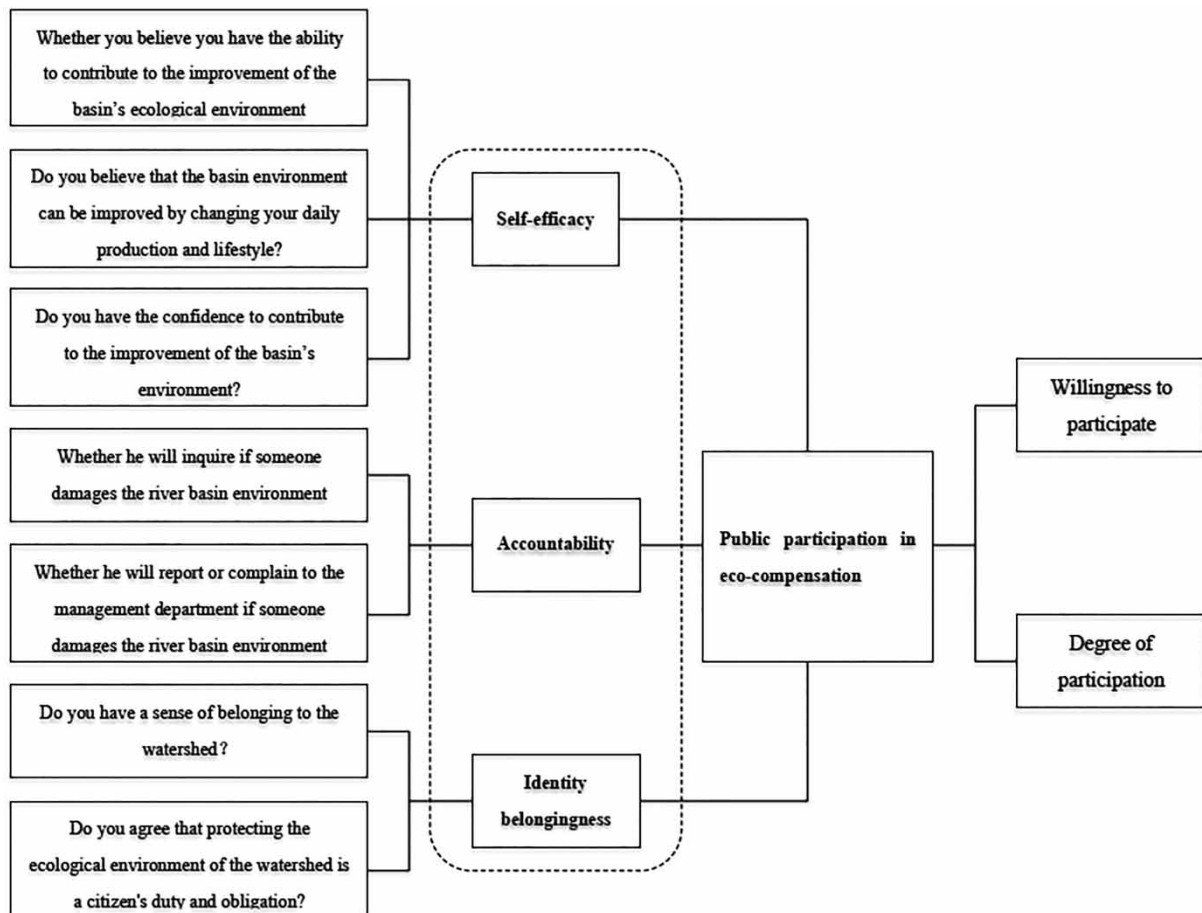


Fig. 1. The research framework.

Data collection, variable description, and model setting

Data collection

This paper takes the downstream of the Wei River Basin (Figure 2) in China as the research area, and aims to study the impact of the public's psychological ownership of the river on participating in transboundary eco-compensation. The Wei River is the largest tributary of the Yellow River, straddling the two provinces of Gansu and Shaanxi. From the perspective of the allocation and definition of property rights, in order to ensure the quality and quantity of water in the upper reaches of the basin, Gansu province must abide by and implement stricter protection standards than the downstream province. Therefore, Gansu province may lose some development opportunities and equal development rights, leading to the shrinking of industrial development, the limitation of agricultural production, and the decline of living standards of some people. Meanwhile, from the perspective of externality, Gansu province, as the supplier of ecosystem services, provides certain ecological services for the consumers of ecosystem services in Shaanxi province in the downstream of the river basin, so the resulting positive externalities need to be internalized through horizontal eco-compensation. Therefore, in order to stimulate the enthusiasm of the upstream as ecological protectors, realize the fairness and efficiency of regional development and the sustainable development of water resources in the basin, the establishment of transboundary eco-compensation mechanism has great significance for the economic and social development of western China, and plays an important role in promoting the ecological protection and high-quality development of the Yellow River Basin.

We carried out a household survey in the Wei River Basin of Shaanxi province in October 2018. The survey adopted a combination of stratification and random sampling. According to the samples of each district (city) population and economy, we randomly selected three to four towns, and each township stratified a random three to four villages. The survey was conducted by the method of home survey by investigators. Finally, a total of 719 questionnaires were obtained. After deleting some samples with missing variables, the final valid samples were 704, and the effective rate was 97.9%.

Variable descriptions

Dependent variables. The dependent variables include the willingness and degree of participation of the public in the river basin for transboundary eco-compensation: willingness to participate is a binary dummy variable; the degree of participation is a continuous variable, characterized by the public

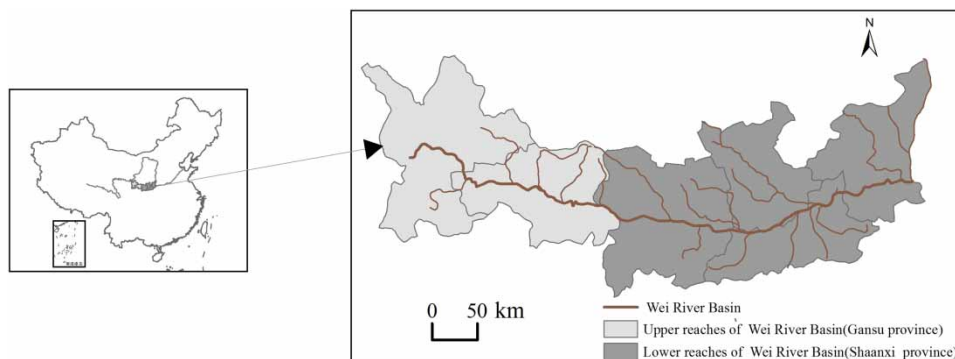


Fig. 2. Map of the location of the Wei River Basin.

willingness to pay for eco-compensation. Combined with the pre-survey and the actual situation of the basin, this paper sets the scenario of public participation as follows: If ecological protection and pollution control are carried out in the upstream basin, the ecological environment in your area will be improved. Suppose that through the upstream governance, the water quality, water quantity, biodiversity and ecological landscape of the section flowing from Gansu Province to Shaanxi Province will be improved ten years later. However, your family needs to pay a certain cost for the improvement of the local ecological environment (such as the increase of living expenses and tax revenue caused by the implementation of government policies). Are you willing to participate in the compensation for the upstream protectors? The answer is yes = 1, no = 0. If the respondent answered 1 in the first stage, continue with the second-stage willingness to pay survey. The question is set as: ‘How much is your family willing to pay for compensation each year?’ Statistical analysis found that in the overall sample, there are 593, that is 84.23% of the public, willing to participate, indicating that the downstream watershed public has a relatively strong willingness to participate in transboundary eco-compensation. However, the higher average level of willingness to participate is not equal to the higher expected willingness to pay. Further analysis of the statistical results shows that the average annual cost of the 593 sample respondents is 282.028 yuan, of which, the lowest is 10 yuan per year, and the highest is 5,000 yuan per year. There exist large individual differences.

Independent variables. The core independent variable of this paper refers to the multi-dimensional measurement table of psychological ownership constructed by Avey *et al.* (2009), and combining the actual situation in China (Chen *et al.*, 2012) to divide psychological ownership into three levels of variables: self-efficacy, accountability, and identity belongingness. At the level of self-efficacy, three indicators are set, including: ‘Whether you believe you have the ability to contribute to the improvement of the basin’s ecological environment’, which reflects the respondents’ ability to perform behaviors; ‘Do you believe that the basin environment can be improved by changing your daily production and lifestyle?’, which reflects the respondents’ grasp and feelings about their own behaviors; and, ‘Do you have the confidence to contribute to the improvement of the basin’s environment?’, which reflects the respondents’ belief in whether they can perform their behaviors. At the accountability level, two indicators are set: ‘Whether he will inquire if someone damages the river basin environment’ and ‘Whether he will report or complain to the management department if someone damages the river basin environment’. At the level of identity belongingness, two indicators are set: ‘Do you have a sense of belonging to the watershed?’ and ‘Do you agree that protecting the ecological environment of the watershed is a citizen’s duty and obligation?’. The above-mentioned three-level indicators of psychological ownership are discrete variables that are assigned values from low to high according to their degree (1 = I strongly disagree, 5 = I strongly agree with the statement).

Control variables. In this paper, several variables that may affect public participation in eco-compensation are controlled. First, considering that the data used in this paper are mainly micro data, there may be a certain interaction between the heterogeneity of respondents and the willingness and degree of participation in compensation. Respondents’ age, education level, per capita annual household income, consumption habits, institutional trust, and risk preference are taken as control variables. Among them, the larger the consumption habits, institutional trust, and risk preference, the more irrational consumption behaviors of the respondents; the higher the level of institutional trust and the more risk they prefer. The definition, assignment and descriptive statistics of the above variables are shown in Table 1.

Table 1. The overview of variables.

Variable category	Variable name	Variable definition	Mean	S.D.
Dependent variable	Willingness to participate	Willing = 1, unwilling = 0	0.842	0.365
	Degree of participation	Willingness to pay for eco-compensation to upstream ecosystem providers/yuan	282.028	356.838
Independent variable	Psychological ownership	Self-efficacy		
		Whether you believe you have the ability to contribute to the improvement of the basin's ecological environment	3.267	0.922
		Do you believe that the basin environment can be improved by changing your daily production and lifestyle?	3.443	0.979
		Do you have the confidence to contribute to the improvement of the basin's environment?	3.625	0.928
		Accountability		
		Whether he will inquire if someone damages the river basin environment	3.104	0.902
		Whether he will report or complain to the management department if someone damages the river basin environment	3.226	1.010
		Identity belongingness		
		Do you have a sense of belonging to the watershed?	3.899	0.979
		Do you agree that protecting the ecological environment of the watershed is a citizen's duty and obligation?	4.232	0.884
Control variable	Age	Age of respondent	48.926	15.077
	Education	No schooling = 1, primary school = 2, junior high school = 3, senior high school = 4, junior college = 5, bachelor degree or above = 6	3.641	1.327
	Per capita household income	Per capita income of respondents' families (ten thousand yuan)	1.693	1.289
	Consumption habits	Whether there is impulse or blind consumption behavior: never = 1, occasionally = 2, general = 3, more = 4, very much = 5	1.956	0.783
	Institutional trust	The degree of trust in the government	3.226	0.758
	Risk preference	Risk aversion = 1, risk neutral = 2, risk preference = 3	1.535	0.555

Model setting

The public's participation in transboundary eco-compensation in this paper is divided into two stages: willingness to participate and willingness to pay. Tobit model cannot solve this problem at the same time (Shi *et al.*, 2018). Therefore, this paper refers to studies by Cragg (1971) and Cai & Zhu (2014), under the assumption that the public's willingness to participate and willingness to pay are independent of each other, and constructed a double hurdle model to empirically analyze the impact of psychological ownership on public participation in transboundary eco-compensation. The double hurdle model decomposes the individual's participation in the compensation process into two stages: willingness to participate and willingness to pay, and only when these two stages are established at

the same time can it constitute a complete decision (Xie et al., 2018). The specific model is constructed as follows.

First, considering the public's willingness to participate in eco-compensation, the following equations can be constructed:

$$Prob[y_i = 0|x_{1i}] = 1 - \Phi(x_{1i}\alpha) \quad (1)$$

$$Prob[y_i > 0|x_{1i}] = \Phi(x_{1i}\alpha) \quad (2)$$

Equation (1) indicates that the public's willingness to participate in watershed eco-compensation is 0. Equation (2) indicates that the public's willingness to participate in watershed eco-compensation is not 0; $\Phi(\cdot)$ represents the cumulative distribution function of the standard normal distribution; y_i represents the dependent variable, that is, the willingness of the public to pay for the eco-compensation; x_{1i} represents independent variables such as self-efficacy, accountability, and identity belongingness; α represents the corresponding estimated parameter; i represents the observation sample i .

Second, considering the degree of public participation, the public's willingness to pay for eco-compensation is established as follows:

$$E[y_i|y_i > 0, x_{2i}] = x_{2i}\beta + \delta\lambda(x_{2i}\beta/\delta) \quad (3)$$

where $E(\cdot)$ represents the conditional expectation, that is, the public willingness to pay for eco-compensation; $\lambda(\cdot)$ is the inverse Mills ratio; x_{2i} represents self-efficacy, accountability, and identity belongingness; β is the standard deviation of the intercepted normal distribution.

Based on Equations (1)–(3), the logarithmic likelihood function can be established as follows:

$$\begin{aligned} \ln L = & \sum_{y_i=0} \{ \ln[1 - \Phi(x_{1i}\alpha)] \} + \sum_{y_i>0} \{ \ln\Phi(x_{1i}\alpha) - \ln\Phi(\beta x_{2i}/\delta) - \ln(\delta) \\ & + \ln\{\Phi[y_i - x_{2i}\beta/\delta]\} \} \end{aligned} \quad (4)$$

$\ln L$ represents the value of the log-likelihood function. Using the maximum likelihood estimation method to estimate Equation (4), the relevant parameters needed in this paper can be obtained.

Empirical results

Distribution of willingness to pay for public participation in transboundary eco-compensation

Table 2 exhibits the distribution of willingness to pay. According to the statistical results, among the 704 valid samples, 593 respondents are willing to pay for eco-compensation ($WTP > 0$), accounting for 84.23% of the total samples. The range of willingness to pay, corresponding to the maximum adjustment frequency is (100, 200) yuan per household per year (148 samples in total, accounting for 24.96%), followed by (300, 400) yuan per household per year (total 117 samples, accounting for 19.73%), and there are 40 respondents who are willing to pay less than 100 yuan per household each year, and the adjustment frequency is 6.75%.

Table 2. The distribution of willingness to pay for eco-compensation.

Willingness to pay (WTP)/yuan	Absolute frequency/person	Relative frequency/%	Adjustment frequency/%	Cumulative frequency/%
$WTP < 100$	40	5.68	6.75	6.75
$100 \leq WTP < 200$	148	21.02	24.96	31.71
$200 \leq WTP < 300$	95	13.49	16.02	47.73
$300 \leq WTP < 400$	117	16.62	19.73	67.46
$400 \leq WTP < 500$	34	4.83	5.73	73.19
$500 \leq WTP < 600$	100	14.20	16.86	90.06
$600 \leq WTP < 700$	15	2.13	2.53	92.58
$700 \leq WTP < 800$	2	0.28	0.34	92.92
$800 \leq WTP < 900$	7	0.99	1.18	94.10
$900 \leq WTP < 1,000$	1	0.14	0.17	94.27
$WTP \geq 1,000$	34	4.83	5.73	100.00
Willing to participate	593	84.23	100.00	
Refusal to participate	111	15.77		
Total	704	100.00		

Note: The adjustment frequency is the ratio of the absolute frequency of the corresponding willingness to pay to the frequency of the number of people willing to participate in the eco-compensation of the basin ($WTP > 0$).

Empirical results

Before the empirical analysis, considering that there may be some internal correlation between the three-level factors of psychological ownership, this paper diagnoses the multicollinearity of variables, and the results show that there is no significant collinearity among the variables. The double hurdle model is on this basis further used to analyze the impact of the three-level factors of psychological ownership on the willingness to participate and pay for eco-compensation. The model estimation results are shown in Table 3. The Wald chi-square test value reached the significance level of 1%, indicating that the model is applicable. Next, this paper discusses the influence factors on the public participation from four aspects: self-efficacy, accountability, and identity belongingness and control variables.

Self-efficacy. It can be seen from the estimated results that among the three variables that characterize self-efficacy, the public's judgment on self-governance ability and their own grasp and feelings has a significant positive impact on their willingness to participate in eco-compensation; the estimated coefficient is 0.807 and 0.618, respectively. The public's belief in making changes to improve the basin environment has a significant negative impact on their willingness to participate. The public's judgment of self-governance ability has a significant positive impact on its willingness to pay, indicating that the more the public believe that they have the ability to contribute to the ecological environment, the higher their willingness to pay will be.

Accountability. The two variables that characterize accountability both have a positive impact on willingness to participate, but have no significant impact on willingness to pay. The possible explanation is that when the public are faced with the dilemma of personal interests and social interests, internalized personal norms will give rise to a strong sense of environmental responsibility, which in turn, will promote their willingness to participate in environmental protection activities. However, due to China's special

Table 3. Estimation results of double hurdle model.

Variables	Willingness to participate	Degree of participation
Whether you believe you have the ability to contribute to the improvement of the basin's ecological environment	0.807** (0.347)	32.640* (19.223)
Do you believe that the basin environment can be improved by changing your daily production and lifestyle?	0.618** (0.268)	−6.003 (19.561)
Do you have the confidence to contribute to the improvement of the basin's environment?	−0.621** (0.290)	30.720 (20.472)
Whether he will inquire if someone damages the river basin environment	0.501* (0.270)	37.006 (19.514)
Whether he will report or complain to the management department if someone damages the river basin environment	0.714** (0.277)	20.829 (16.384)
Do you have a sense of belonging to the watershed?	0.688*** (0.260)	37.180** (17.520)
Do you agree that protecting the ecological environment of the watershed is a citizen's duty and obligation?	0.956*** (0.276)	−42.358* (23.436)
Age	−0.035* (0.020)	0.439 (1.195)
Education	−0.165 (0.224)	−3.661 (13.385)
Per capita household income	0.094 (0.150)	74.223*** (11.308)
Consumption habits	−0.157 (0.245)	43.501** (21.178)
Institutional trust	0.379 (0.274)	40.142** (19.542)
Risk preference	−0.230 (0.418)	109.686*** (30.777)
Constant term		−564.044*** (162.880)
Log likelihood		−4,337.077
Wald square value		192.824***

Note: *, **, and *** are significant at the statistical levels of 10, 5, and 1%, respectively. The values in parentheses are the regression standard errors.

historical reasons, it has been focusing on economic development and neglecting environmental protection for a long time. It was only after the 1970s that the urgency of environmental protection began to be recognized. At the same time, China has long pursued the ‘government-led environmental governance’ mode. The government’s excessive role in environmental protection and governance has led to the formation of a serious government dependence psychology among the public (Hong, 2007), who therefore lack a sense of responsibility when it comes to self-interest and need to pay a certain cost.

Identity belongingness. Among the variables that characterize identity belongingness, the greater the sense of belonging to the watershed significantly positively affects the public’s willingness to participate and willingness to pay for eco-compensation. Acknowledging that protecting the ecological environment of a river basin is citizens’ responsibility and obligation has a significant positive impact on willingness to participate, but negative impact on willingness to pay.

Control variables. At the statistical level of 10%, respondents’ age has a significant negative impact on the willingness to participate, but has no significant impact on the willingness to pay. The education level has no significant impact on the respondents’ willingness to participate and willingness to pay. Household income per capita, consumption habits, institutional trust, and risk preference have no

significant impact on the willingness to participate. The per capita income of households has a significant positive impact on their willingness to pay at the 1% statistical level, indicating that the better the economic conditions of the households, the higher the willingness to pay. Consumption habits have a significant positive impact on willingness to pay at the 5% statistical level, indicating that the more irrational consumption habits in the daily life of residents, the higher the amount they are willing to pay. Institutional trust has a significant positive impact on the willingness to pay, indicating that the more the public trust the government, the higher the level of willingness to pay. Risk preference has a significant positive impact on the willingness to pay, indicating that the more likely the resident is to take risks, the higher the amount of compensation they are willing to pay.

Discussion

Public participation in transboundary eco-compensation in river basins is a complex decision-making process. This paper divides the decision-making process into two stages: willingness to participate and degree of participation. The willingness to participate refers to whether the public is willing to participate in the compensation of upstream ecosystem service providers. On the basis of identifying the willingness to participate, the degree of participation reflects the extent to which the public is willing to participate. The empirical results show that the public's willingness to participate and the degree of participation are two different decision-making processes, and the influence and internal mechanism behind them are quite different. Therefore, only by accurately distinguishing participation willingness and payment can the respondents' decision-making behavior on transboundary eco-compensation be better explained.

Analysis of the public's willingness to participate in transboundary eco-compensation

Among the three variables that characterize self-efficacy, the public's judgment of self-governance ability and their own grasp and feelings have a significant positive impact on their willingness to participate, while the public's belief in making changes for the improvement of a watershed environment has a significant negative impact on their willingness to participate in the compensation, which indicates that the stronger the public's judgment on the self-governance ability and the more positive their grasp and feelings are, the more willing they are to participate for the upstream ecosystem services providers. Among the variables that characterize the environmental accountability, someone who damages the basin environment will definitely inquire, report or complain to the government department, both of which have a positive impact on the willingness to participate. Among the variables that characterize identity belongingness, the greater the sense of belonging to the river basin, the more the public's willingness to participate. And acknowledging that protecting the ecological environment of the river basin is a citizen's responsibility and obligation has a significant positive impact on the willingness to participate. The more confident the public is that they can contribute to the improvement of the basin environment, the lower their willingness to participate. This may be because when the public think that they can directly improve the ecological environment of the local watershed by changing their daily production and living habits, such as saving water and reducing the use of chemical fertilizer in agricultural production, they will not indirectly improve the river basin environment by participating in the compensation for upstream. This is essentially due to the fact that people do not regard the water

resources of the basin as a whole ecosystem, but pay more attention to the direct improvement of their own local environment, which is closely related to their production and life. Among the control variables, respondent age significantly negatively affects the willingness to participate at a statistical level of 10%, indicating that younger respondents are more willing to participate in eco-compensation.

Analysis on the degree of public participation in the transboundary eco-compensation

Among the three variables that characterize self-efficacy, the public's judgment on self-governance ability has a significant positive impact on willingness to pay for compensation, which indicates that the more the public believe that they have the ability to contribute to the ecological environment of the basin, the higher their willingness to pay. The ability judgment here is the respondents' comprehensive judgment on their own governance ability, including the household income, labor, time, etc. That is to say, the respondent thinks that he is more capable, which means he thinks he has more income, or more labor, or more time to participate in compensation for upstream. Neither variables that characterize environmental accountability have any significant impact on the willingness to pay. When someone damages the basin environment, it is a supervision behavior of the public with a high sense of responsibility to question, report, or complain to the relevant government departments. However, the level of environmental accountability has no correlation with the willingness to pay. Among the variables that characterize identity belongingness, the greater the sense of belonging to the watershed significantly positively affects willingness to pay for eco-compensation. Acknowledging that protecting the ecological environment of a river basin is a citizen's responsibility and obligation has a significant negative impact on their willingness to pay. Based on the actual situation in the survey, it is found that the Chinese public generally believes that compensation should be a government action. Although the public agree that it is their responsibility and obligation to protect the basin environment, the compensation behavior means that they need to spend a certain amount. At the same time, the uncertainty of upstream watershed governance and governance capacity means that transboundary eco-compensation behavior has certain risks, and the consequences of compensation behavior are unknown to the downstream public. Due to the lag of the positive externalities of the upstream governance behavior to the downstream, when the public are faced with the trade-off between the current loss of personal interests and the future benefits, they often choose to avoid the current risks, so as to lower the level of willingness to pay. Because of China's special historical reasons, it has focused on economic development and neglected environmental protection for a long time. Only after the 1970s has it gradually realized the urgency of environmental protection. Meanwhile, China has long pursued the 'government-led environmental governance' mode. The excessive role of the government in environmental protection and governance has led to the formation of a serious government dependence psychology among the public (Hong, 2007).

Among the control variables, the household per capita income has a significant positive impact on the willingness to pay at the statistical level of 1%, which indicates that the better the economic conditions of the household, the more willingness to pay. Consumption habits have a significant positive impact on willingness to pay at the statistical level of 5%, indicating that the more frequent irrational consumption habits in daily life, the higher the willingness to pay. Risk preference has a significant positive impact on the willingness to pay, which indicates that the more risk the public prefer, the higher the amount of compensation they are willing to pay. Institutional trust has a significant positive impact on residents' willingness to pay, which indicates that the more trust the public has in the government, the higher the

level of willingness to pay. Governments of various countries have formulated a large number of environmental protection measures and policies in terms of environmental governance, but the effectiveness of governance varies greatly. One of the most important reasons is whether citizens cooperate with the implementation of environmental policies. Yusuf *et al.* (2014) find that government trust factors have a significant positive impact on residents' willingness to pay. In countries with a relatively high level of governance, citizens show stronger willingness to pay for environmental protection because they trust the government (Chi *et al.*, 2017).

Conclusion

The essence of China's transboundary watershed eco-compensation is the cooperative governance behavior between upstream and downstream regions. How to transform from the current government-led economic incentive mode to the normative guidance of effective public participation, so as to solidify the behavior of protecting the ecosystem into a longer-term society behavior which truly stimulates the public's voluntary participation, is of great significance to the transboundary management of water resources. Therefore, from the perspective of social psychology, this paper uses the double hurdle model to empirically analyze the impact of the psychological ownership of the downstream public on the behavior of transboundary eco-compensation, to explore the internal laws of public participation and understand the internal driving mechanism of their participation behavior, so as to stimulate ecosystem service consumers to participate in environmental governance spontaneously, and provide the basis and reference for the establishment of transboundary watershed eco-compensation policy. The main conclusions are as follows: (1) the decision-making process of public participation can be divided into two stages: willingness to participate and degree of participation. These two stages are different decision-making processes, and the influence and internal mechanisms behind them are quite different. The willingness to participate mainly depends on the public's judgment of self-ability and their own environmental responsibility and values, while the degree of participation depends more on the public's judgment and grasp of self-governance ability; (2) the public's psychological ownership is divided into three dimensions: self-efficacy, accountability, and identity belongingness. The public's judgment of self-governance ability and their own grasp and feelings, environmental responsibility, sense of belonging to the watershed and agreeing that protecting the ecological environment of the watershed is a citizen's responsibility and obligation, all have a positive impact on the willingness to participate; (3) the public's judgment on self-governance ability has a significant positive impact on their willingness to pay, and the more they signify their identity, the more they have a sense of belonging to the basin, which positively affects their willingness to pay; (4) China's long-term government-led environmental governance mode results in the excessive role of the government in environmental protection and governance, which has led to the formation of a serious government dependence psychology among the public. The more people agree that protecting the ecological environment is the responsibility and obligation of citizens, the lower their willingness to pay. Combined with the actual situation in the survey, it is found that the Chinese public generally believes that compensation should be a government action. When the public are faced with the trade-off between the loss of current personal interests and future benefits, they often choose to avoid the current risks, thus the lower the level of willingness to pay. (5) Among the control variables, younger respondents have higher willingness to participate; the higher the level of per capita household income, the more irrational consumption behaviors, the more

risk preference, and the higher the level of institutional trust, the higher the degree of participation. The lack of trust capital is the primary problem in current transboundary cooperative governance (Zhang et al., 2012). It is necessary to enhance the downstream public's trust in upstream governance capabilities, promote the accumulation of trust capital, and build a soft environment for the sound operation of regional cooperative governance. By strengthening the self-efficacy of the public on their own governance ability judgment and feeling, and internalizing their environmental values into personal norms of protection behavior, is of great significance for developing countries to promote effective public participation in transboundary watershed eco-compensation.

Data availability statement

Data cannot be made publicly available; readers should contact the corresponding author for details.

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