

Article

The Effects of Regional Characteristics and Policies on Individual Pro-Environmental Behavior in China

Zhe Hong [†] and In Kwon Park ^{*,†} 

Department of Urban Administration, University of Seoul, 163 Seoulsiripdaero, Dongdaemun-gu, Seoul 02504, Korea; uosgrad201510@uos.ac.kr

* Correspondence: ikpark@uos.ac.kr; Tel.: +82-2-6490-2721

† The authors contributed equally to the study.

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Abstract: As the Chinese economy grows, Chinese people's environmental behavior enormously affects the environment of neighboring countries as well as China. Many studies have related environmental behavior to personal characteristics such as environmental knowledge and attitude or to *national* policies such as environmental taxes and regulations. Few studies have looked at how *regional* factors affect residents' environmental behaviors, particularly for China. This is a substantive gap in the literature regarding the effects of regional governments on resident behavior at a closer distance via different mechanisms than the national government. This paper examines determinants of individual pro-environmental behavior (PEB) in terms of *regional* attributes as well as personal characteristics in China. For this purpose, we applied a multi-level regression model that regresses the degree of PEB on both individual and regional level factors, using Chinese General Social Survey data and the China Environment Yearbook data for the year 2010. The analysis shows that environmental attitude, willingness to pay for the environment, objective and subjective environmental knowledge, and environmental risk perception all promote PEB at the individual level. These results are in line with the existing literature on environmental behavior. In addition, at the regional level, environmental budgets, administrative enforcement, and economic development have positive impacts on resident PEB, while environmental pollution has a negative effect. Specifically, the levels of regional economic development and administrative enforcement not only directly affect behavior, but also indirectly affect behavior by controlling the influence of individual level variables. This means that the relationships between individual level variables and environmental behavior can be changed by regional contextual factors. These results suggest that regional government efforts for the environment can effectively promote PEB.

Keywords: pro-environmental behavior; regional factors; cross-level interactions; multi-level analysis; China

1. Introduction

Recently, more and more studies on pro-environmental behavior (PEB) are examining multi-level factors influencing individual PEB, looking at not only personal factors such as environmental consciousness, interest, norms, intentions, and values but also external factors such as economic and environmental conditions, culture characteristics, government regulations, and environmental NGOs [1–11]. They note that variations in external factors lead to differences in PEB across countries mainly using data for the Western world. The existing studies focus on *national* policies such as taxation and regulations but do not focus on the impacts of *regional* government attributes and policies on PEB. What will be the effects of regional factors? Will they be the same as those of national factors? Will they

be found in a developing country like China as well? The existing literature does not directly deal with regional factors and, thus, cannot answer these questions well.

Regional governments are entrusted with the task of environmental enforcement from the central government and interface with residents. They play a mediating role between the central government and residents. The same national policy may have different impacts on residents' behavior depending on regional government policies. Thus, it is important to examine the effects of regional characteristics separately.

This study tries to fill the gap in the literature by focusing on the effects on the individual PEB of the factors at the *regional* level, which has been overlooked by the literature, as well as at the personal level. This contributes not only to the academic literature but also to practices as it can suggest regional policies to promote individual PEB. To account for the multi-dimensional nature of PEB determinants, we employ a multi-level model that determines individual PEB based on both personal factors and external factors. For the external factors, we analyze factors at the *regional* level compared to the national level studied previously.

We also try to determine the interaction effects between the individual and regional levels and, thus, the indirect effects of regional factors. According to Steg et al. [12], external contextual factors at the local level can have indirect and direct impacts on PEB by changing the marginal effects of personal factors. However, most existing studies focus only on the direct effects and ignore the indirect influence of regional factors. In recent follow-up empirical research, Pisano et al. [8] demonstrated stronger relationships between pro-ecological attitudes and PEB in more developed countries than in less developed countries.

As a study area, we examine the Chinese provinces. Most PEB studies are limited to Western countries, and few studies have looked at Chinese environmental behavior. Even the Chinese studies focus only on personal characteristics [13–16], while they are not much interested in the effects of external factors such as government policies on PEB.

While China has achieved rapid economic growth and urbanization, it is the world's largest air pollutant emitter. Serious environmental pollution is so harmful to the quality of people's lives in China and neighboring countries that it is urgent for Chinese governments to identify appropriate policies at both national and regional levels. It is very important to promote people's green behavior as it can overcome the inefficiency of the regulations that try to mitigate existing environmental pollution ex-post by inducing behavior for sustainable development ex-ante. In political terms, China follows a centralized authoritarian system, while it financially adopts a decentralized system as Western federalism [17]. Civil society is more dependent on the government in China than in the Western world; thus, environmental NGO influence may be different as well [18]. This unique character makes it difficult to apply the results of research on Western countries to China, and it is necessary to analyze the Chinese case separately focusing on the impacts of regional factors on PEB.

In this vein, this study analyzes individual and regional level factors affecting environmental behaviors in China. Specifically, it aims to analyze the effects of regional conditions and regional government characteristics, including environmental policies and government capabilities. For this purpose, we estimate a multi-level regression model that regresses the degree of PEB on both individual and regional level factors, using Chinese General Social Survey and China Environment Yearbook data for the year 2010.

2. Theoretical Background and Hypotheses

2.1. Theories on PEB

Over the past few decades, many theories and models that predict or explain PEB have focused on personal characteristics such as environmental attitudes, environmental values, environmental concern, subjective norms, perceived behavioral control, environmental threats, and environmental knowledge [19–26]. They assume that individuals take actions according to personal factors such as

willingness, beliefs, and values. However, social and regional circumstances sometimes keep people from acting based on beliefs, goals, aspirations, and expectations. The theories can also not completely explain the gap between thought and environmental behavior. While some people show an interest in environmental problems and positive environmental attitude, they do not undertake PEB in their normal activities [8,12,27].

The attitude-behavior-context (ABC) theory appeared as an alternative model to explain the inconsistency between environmental attitude and behavior. While value-belief-norm (VBN) theory emphasizes the importance of individual value judgments, ABC theory regards personal behavior as a product of interactions between humans and the environment surrounding them [28–30]. According to ABC theory, personal environmental behavior is determined by both internal attitude variables and external context factors. The internal attitude variables are psychological characteristics, such as beliefs, norms, values, and intentions, while external contextual factors are social characteristics, such as economic structure, institutional environment, physical infrastructure, and social competence [29]. As asserted by Milfont et al. [5], pro-environmental actions are jointly determined by a wide range of factors from demographic characteristics of individuals, such as age, income, and education, to situational variables, such as convenience of behavior and economic burden, to community, regional, national attributes such as economic level, environmental quality, regulations, and cultural orientation.

2.2. Factors Influencing PEB

Table 1 summarizes previous PEB research. Two sets of major variables are identified. The first set of major variables are personal factors, such as environmental attitude, norms, values, and knowledge, for explaining PEB “from within”. And the second set of major variables are external factors, such as economic, political, air pollution, government regulations, and environmental NGOs, which determine PEB “from without”. Based on the above content, this study divides the factors influencing PEB into personal factors and regional factors. Specific factors for each category come from a review of existing studies, even if each of the studies deals with only some factors.

Table 1. Previous research on the effect of major variables on pro-environmental behavior.

Study	Major Factors	PEB of Interest	Guiding Theories
De et al. (2015) [22]	Attitude, norms, perceived control, beliefs, concern, intentions	Eco-friendly behaviors	Theory of planned behavior (TPB)
Hadler et al. (2011) [1]	Social bases, attitudes, international NGOs, democratization, environmental ministries, environmental expenditure, human development index (HDI)	Private and public environmental behavior	World society, social movement theories
Pisano et al. (2017) [8]	Social bases, environmental attitudes, GDP, post-materialism, environmental NGOs, education index, environmental performance index (EPI)	Private and public environmental behaviors	Attitude-behavior-context (ABC) theory
Tam et al. (2018) [11]	Environmental concern, generalized trust, Individualism, national wealth	Pro-environmental behaviors	Concern-behavior gap, social dilemma perspective
Doyle (2018) [9]	Socio-demographic variables, environmental knowledge, GDP, welfare targeting, NGOs, EPI, democracy	Private environmental behavior	Institutionalized strategies
Hörisch et al. (2018) [7]	Socio-demographic variables, environmental pressure, environmental taxes, governmental support, unemployment rate, high-technology export, GDP	Environmental entrepreneurship	New institutional theory

2.2.1. Personal Factors

Primarily, environmental attitude and environmental knowledge are listed as the personal determinants of PEB in the literature [19–26,31,32]. Specifically, researchers generally categorize environmental attitude into sub-types of environmental concern, environmental risk perception,

and willingness to pay for environment conservation, and environmental knowledge into subjective and objective knowledge.

First, environmental concerns refer to feelings or emotions about environmental or environmental issues. Based on the traditional attitude-behavior model, some studies show that environmental concerns have a positive effect on PEB [31,33].

Second, the willingness to pay for environment conservation refers to the intention to pay the cost or the willingness of the individual living for the benefit of the environment. According to past studies [32,34,35], the greater the willingness to pay for environment conservation, the more frequently PEB will be shown.

Third, environmental risk perception means subjective assessment of the risk of various environmental problems such as air pollution and water pollution. The reflection hypothesis explains that individuals who directly experience serious environmental problems will have higher environmental consciousness and perform more positive PEB actions than those who do not [36].

Fourth, environmental knowledge is also an important personal factor for PEB [32,37]. It may be divided into subjective knowledge and objective knowledge. While objective knowledge consists of specific and accurate facts about a given phenomenon, subjective knowledge is self-reported and reflects an individual's assessment of what and how much he or she knows about the phenomenon [38]. Although they are clearly distinguishable, both have a close relation with PEB [13,39].

2.2.2. Regional Factors

There are also many studies that analyze PEB at the national level using macro data [1–11,30,40]. As shown in the previous Table 1, while many different external factors have been identified by the extant studies, they could be grouped into four factors: economic status, environmental pollution, government policy, and civil society.

First, economic status has been pointed out to have a major impact on an individual's ability to perform PEB by referring to income levels across the community [8,36,40,41]. The affluence hypothesis supporting this is that environmental consciousness and PEB are closely related to the level of regional income—the higher the level of regional income, the greater the tendency to demand better environment quality. Unlike low-income regions, which are more concerned with economic problems than environmental problems, high-income regions have a relatively high environmental interest because high income levels allow more frequent pro-environmental consumption behavior [41]. In other words, richer people have more purchasing power and willingness to pay for eco-friendly products that are usually expensive in the market.

Second, environmental pollution in the region is another factor impacting PEB. As the quality of the environment is getting worse because of pollution, people may pay more attention to environmental issues [2,8,41,42]. Inglehart [41] established the “Objective Problems and Subjective Values (OPSV)” hypothesis suggesting that people's subjective values such as environmental concerns are largely influenced by objective problems such as their living environment conditions. This hypothesis is based on the “stimulus–response” psychological model as expressed through people who react to the seriousness of various environmental problems. Thus,

H1: *PEB is more likely in regions with higher levels of economic development and more serious environmental pollution.*

Third, government environmental policies have a significant impact on people's environmental behavior [1,43–45]. Environmental policies are generally divided into regulatory policies and economic incentive policies [43]. Given that environmental problems are a high priority, the government would take a ‘carrot-and-stick approach’ to actively promote PEB [1,44–46].

For example, an increase in environmental budgets can expand the overall eco-friendly consumption behavior of residents by providing subsidies or necessary help to social groups that have difficulty purchasing eco-friendly products. Of course, residents can voluntarily perform PEB

without government support in the short-term. In the long run, however, they will have to bear higher financial costs and inconveniences, which may keep them from continuing to participate in PEB. Regulatory policies also can transform regional resident behavior into PEB, whether they are voluntary or involuntary, through strong administrative penalties for individuals or companies that have caused environmental pollution. Thus,

H2: *PEB is more likely in regions with larger environmental budgets and higher levels of environmental administrative enforcement.*

Finally, environmental NGOs also can have a significant impact on the environmental behavior of regional residents, as they are entities that play an important role in regional civil society [1,8,18,45]. Testa et al. [45] studies sustainable consumption behavior and argues that NGOs play an important role in determining the environmental behavior of individuals. This is because environmental NGOs can directly or indirectly affect individual environmental behavior by providing important environmental information and alternative guidelines to residents through various activities. Thus,

H3: *PEB is more likely in regions with more environmental NGOs and more environmental PR activities.*

2.2.3. Cross-Level Interaction between Regional Factors and Personal Factors

Many previous studies have generally analyzed the direct impact of external factors on PEB. However, according to ABC theory, external factors also can be operating as a mechanism that moderates (e.g., enhances or diminishes) the relationship between personal factors and PEB [28,29]. Therefore, external factors can not only directly affect PEB, but also indirectly affect PEB through the interaction with personal factors [12]. This provides an important basis for more accurate prediction of PEB, because studies examining only the main effects can be strongly misleading owing to ignoring the effect of interaction [30].

Recently, some researchers have focused on the interaction between external factors and personal factors on PEB [8,11,30]. Ertz et al. [30] find that objective contextual factors (perceived busyness and wealth) may partially influence personal attitudes and PEB. In a study of 30 countries, Pisano et al. [8] find that in more developed countries, there is a stronger positive correlation between the pro-ecological attitudes and PEB. Using two international survey datasets (World Values Survey and International Social Survey Programme), Tam et al. [11] find that concern-behavior association is stronger among individuals and countries with higher levels of generalized trust.

However, none of the three studies cited above examine cross-level effects using regional policies as the external independent variable. Compared with the central government, regional governments may actively implement environmental policies more in line with the interests of regional residents. Therefore, the impact of the same national policy on PEB can vary with the degree of regional government implementation, which makes regional governments play a crucial role in promoting PEB. The interaction between regional factors and personal factors thus suggests the following hypothesis:

H4: *The impact of environmental attitudes and environmental knowledge on PEB depends on regional characteristics and policies.*

2.2.4. Research Model

The model of this study is presented in Figure 1, each part of which has been discussed in detail above. Although the model comprehensively covers the whole range of factors that determine PEB, the study focuses on the effects of regional factors on PEB and interactions between the individual and regional levels. This study investigates the impacts on PEB of three dimensions of regional attributes: environmental conditions, regional environmental policies, and the influence of civil society in the region. Environmental conditions include economic development, environmental pollution, and public urban facilities such as parks. Environmental policies include environmental budgets

and administrative enforcement. The influence of civil society includes environmental NGOs and environmental PR (public relation) activities by NGOs.

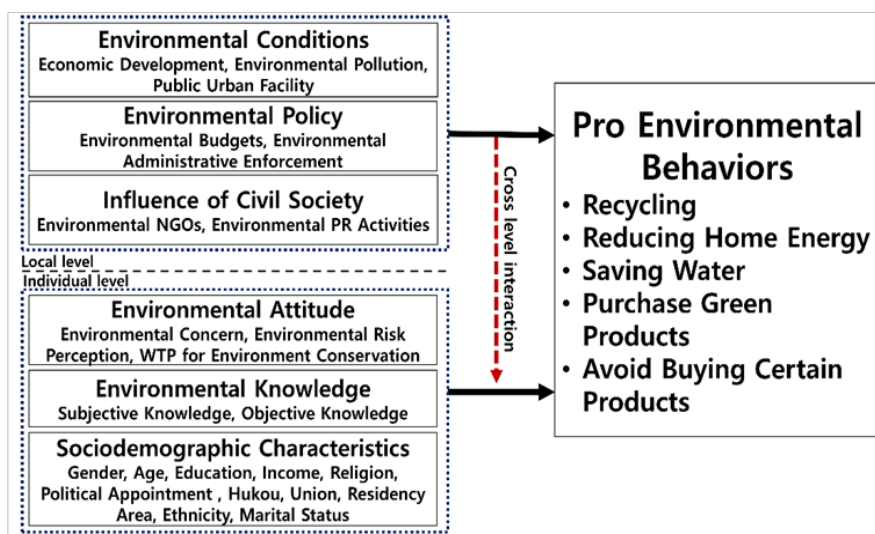


Figure 1. Conceptual framework.

3. Materials and Methods

3.1. Data and Variables

This study uses individual level data from the 2010 Environment Module of the Chinese General Social Survey (CGSS). The data includes 2997 individuals in 30 provinces, with 48.31% men, average age 46.42 years, and median annual personal income of 10,000 yuan. China consists of 34 provincial-level administrative divisions (Shěng-jí Xíngzhèngqū), including 23 provinces (Shěng), 4 municipalities under the direct administration of central government (Zhíxíyáshì), 5 autonomous regions (Zìzhìqū), and 2 special administrative regions (SARs). This study covers 30 except Taiwan Shěng, Tibet Zìzhìqū, and the two SARs, Hong Kong and Macau, which are often omitted from Chinese national surveys. These study areas cover about 97.5% of the total population and 87.0% of the total area in China. The regions in this paper refer to these provincial-level administrative divisions. Note that 112 of the total 2997 observations, which is less than 5%, have missing values for the dependent variable, the objective environmental knowledge variable, or the environmental attitude variables. To preserve sample sizes, we use the EM (Expectation Maximization) method for imputing the missing values of some dependent and independent variables. Region-level data comes from the 2010 of the China Environment Yearbook.

3.1.1. Dependent Variables: PEB

In this study, we measured PEB using five items that asked questionnaire respondents how often (always = 4 to never = 1) they recycle, reduce energy at home, save or reuse water, purchase environmental-friendly products, and avoid buying certain products for environmental reasons. In the 2010 CGSS survey, there are two main types of PEB: one is the daily PEB in the private sphere, and the other is the organizational PEB involving the public sphere. In the early stage of our empirical analysis, we considered both types of PEB. However, after analyzing the reliability and validity, we found that the organizational PEB involving the public sphere does not meet the minimum requirements of reliability and validity. Therefore, we excluded from the models the data on PEB in the public sphere to ensure the quality of the data. In addition, the five questions above were tested with a confirmatory factor analysis (CFA) to verify the construct validity, and the degree of PEB was measured by factor scores for the first factor from principal component analysis (PCA).

Figure 2 shows the geographical distribution of PEB in China. Overall, compared with most developed coastal areas, the level of PEB in the central region is at a lower level. This indicates that the level of PEB between provinces may be closely related to economic development. But there are some exceptional cases such as Chongqing and Qinghai, which deserve our attention. Chongqing as a municipality under the direct administration of the central government has shown a lower level of PEB than most of the areas; on the contrary, with disadvantaged economic conditions, Qinghai has shown a considerable level of PEB. This shows that apart from the local economic level, PEB in certain regions may be influenced by other important external factors, such as government policies or civil society. Of course, all these need to be confirmed in our empirical analysis later.

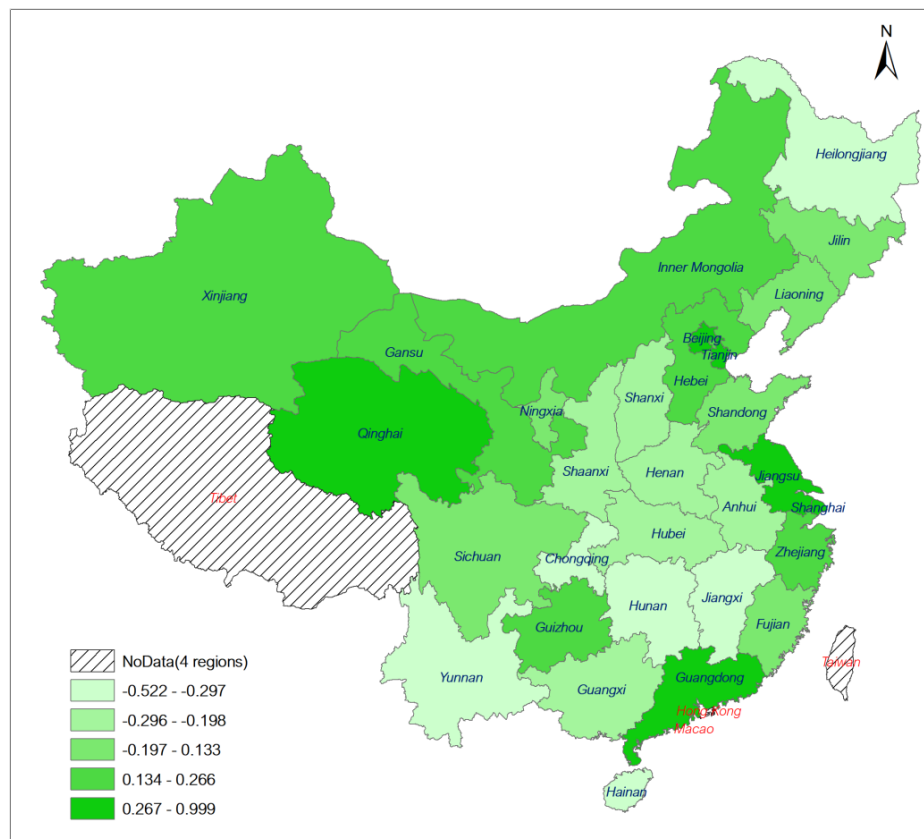


Figure 2. The geographical distribution of pro-environmental behavior in 30 Chinese provinces.

3.1.2. Individual Level Independent Variables

The individual level independent variables include two dimensions—environmental attitude and environmental knowledge. First, based on theoretical considerations, the dimension of environmental attitude was measured in terms of three variables—environmental concern, environmental risk perception, and willingness to pay for environment conservation. Each variable was measured by factor scores from the PCA using the items of CGSS corresponding to the variable.

For environmental concern, we used the items of Dunlap's NEP (New Ecological Paradigm) scale [47]. Following the results of previous studies [48–50], two latent variables of environmental concern are created using CFA. The first latent variable, non-anthropocentric concern, includes seven items that measure how much the respondents agree with (disagree strongly = 1 to agree strongly = 5) the non-anthropocentric worldview of “the fragility of nature's balance”, “the abusing of the environment”, and “concerns over ecological catastrophe” on a 5-point Likert scale. The second latent factor, anthropocentric concern, includes three items that ask how much the respondents agree with the anthropocentric worldview of “the right to modify the natural environment”, “the balance of nature”, and “rule over the rest of nature”. It represents a “profoundly anti-ecological attitude”.

Environmental risk perception was measured by five questions on awareness of the environmental consequences of modern industrial activities: air pollution from industry, water pollution of rivers and lakes from the use of pesticides or chemicals, and the rise in temperature caused by climate change. The five questions were scored from “1 = not dangerous at all for the environment” to “5 = extremely dangerous for the environment”. Following Peng [51], we regarded the response of “can’t choose” as a neutral response and made it equal to the response of “somewhat dangerous = 3”.

Willingness to pay (WTP) for environment conservation was measured by three questions regarding whether the respondents intend to pay more money or taxes and reduce living standards for environmental benefit. The items were scored on a 5-point Likert scale ranging from “1 = very willing” to “5 = very unwilling”.

The dimension of environmental knowledge is divided into two variables—subjective environmental knowledge and objective knowledge. Subjective knowledge was measured by two items asking how much is known about the cause and solution of environmental problems. The items on a 5-point Likert scale range from “1 = know nothing at all” to “5 = know a great deal”. Objective environmental knowledge was measured by five items asking how well the respondents know about objective environmental facts such as “Using detergent powder containing phosphorus will not cause water pollution” (False); “Chlorofluorocarbons (CFC) emission from refrigerators is one of the causes of ozone depletion” (True); “Acid rain has nothing to do with coal burning” (False); “Due to the interdependency among species, one species vanishing will cause chain reactions” (True); and “The increasing carbon dioxide in the atmosphere is one of the factors causing a warming climate” (True). A correct answer earns the respondent 1 point; otherwise, 0.

Finally, we included the following control variables from the CGSS: residency area (1 = urban and 0 = rural), age (in years, 17 = min, 90 = max), gender (1 = male and 0 = female), annual personal income (0 = 0 to 21 = over 100,000 yuan), education (0 = uneducated to 19 = master or higher degree), religion (1 = religious believer and 0 = non-believer), ethnicity (0 = Han and others = 1), marital status (1 = married and 0 = others), Hukou status (1 = city and 0 = others), union membership (1 = yes and 0 = no), and political appointment (1 = yes and 0 = others). Descriptive statistics for the major individual level independent variables in the analyses are summarized in Table 2.

Table 2. Descriptive statistics for the major individual level variables.

Variable		Measurement	Response	AVE	CR
Dependent Variables	Private Environmental Behaviors	Recycling			
		Reducing home energy			
		Saving or reusing water			
		Purchase green products			
		Avoid buying certain products			
Individual Level Independent Variables	Environmental Concern	Anthropocentric concern	Disagree strongly = 1 to Agree strongly = 5	0.524	0.768
		Non-anthropocentric concern		0.528	0.887
	Environmental Risk Perception	Air pollution from industries	Not dangerous at all = 1 to Absolutely dangerous = 5	0.511	0.839
		Air pollution from cars			
		Water pollution from rivers and lakes			
		Dangers of pesticides or chemicals			
	WTP for Environment Conservation	Climate change	Pay more money for environmental profits Pay more taxes for environmental profits Reduce living standards	0.597	0.815
	Subjective Knowledge	Understanding the cause	Know nothing at all = 1 to Know a great deal = 5	0.636	0.777
		Understanding the solution			
	Objective Knowledge	Five items	Incorrect Answer = 0 and Correct answer = 1	0.726	0.929

Goodness of fit: χ^2 : 1347.321(df = 356, $p = 0.000$), GFI: 0.969, AGFI: 0.963, TLI: 0.952, CFI: 0.958, RMSEA: 0.030.

3.1.3. Regional Level Independent Variables

The regional level independent variables constitute three dimensions—environmental conditions, environmental policies, and the influence of civil society. As Table 1 presents, not only environmental conditions but also the other external factors can have many sub-factors. Although we tried models including all plausible external sub-factors as well as the factors included in the current models to make the models as comprehensive as possible, all the other variables turned out insignificant, and, thus, were omitted from the models to maintain the efficiency of the models. The operational definitions and descriptive statistics of the regional level independent variables are presented in Table 3.

First, the dimension of environmental conditions includes three variables—environmental pollution, economic development, and public urban facility. To measure environmental pollution, we used the 2010 carbon dioxide emissions per capita data for the 30 provinces. We estimated regional carbon dioxide emissions using the China Energy Statistical Yearbook data set (see more estimation methods and information from 2006 IPCC Guidelines for National Greenhouse Gas Inventories [52]). The carbon dioxide emissions were measured in tons per capita and ranged from a low of 2.83 tons per capita to a high of 21.33 tons per capita. The average was 7.53 tons (SD = 4.51). Although we have tried to use data including carbon dioxide, dust, sulfur dioxide, and air pollution index (API) to examine their impact on individual PEB, no significant effects have been found for the variables other than carbon dioxide in this study. We also measured economic development by the gross regional domestic product (GRDP) per capita using the data from the China Statistical Yearbook. The average GRDP per capita was 33,895 yuan (SD = 17,172.58). As a measure of public urban facility, we used the number of urban parks per capita from the China Urban Construction Statistical Yearbook. The average was 6.174 (SD = 2.342).

Second, the dimension of environmental policies includes environmental budgets and environmental administrative enforcement. Environmental budgets were measured by the regional government's environmental expenditure per capita. The average environmental expenditure per capita was 217 yuan (SD = 119). The degree of environmental administrative enforcement was measured by the percentage of actual enforcement cases among the total number of reported violations of environmental laws and regulations. The China Environment Yearbook shows how many environmental violations were reported to the regional government, and how many environmental administrative dispositions were implemented for the violations in each year. We took the ratio of the latter to the first to figure out the value for this variable. It was ranged from a low of 47.6% to a high of 100% with the average of 91.5% (SD = 12.99).

Third, the influences of civil society include the number of NGOs and PR activities of environmental NGOs. For this dimension, we used the total number of regional environmental NGOs per 10,000 people and the number of environmental PR activities per 10,000 people from the China Environment Yearbook. The average number of environmental NGOs per 10,000 people was 0.062 (SD = 0.072), and environmental PR activities per 10,000 people was 0.115 (SD = 0.108).

Table 3. Regional Level Independent Variables.

Dimension	Variable	Measurement (Unit)	Mean	Std. Dev.	Min	Max
Environmental Condition	Environmental Pollution	Carbon dioxide emissions per capita (ton)	7.533	4.514	2.826	21.327
	Economic Development	Gross regional domestic product (GRDP) per capita (¥)	33,895	17,173	13,119	76,074
	Public Urban Facility	The number of urban parks per 10,000 people	6.174	2.342	0.825	13.244
Environmental Policy	Environmental Budgets	Environmental expenditures per capita (¥)	217.21	119.23	102.48	642.1
	Environmental Administrative Enforcement	The percentage of actual enforcement cases among the violations of environmental regulations (%)	91.455	12.991	47.614	100
Influence of Civil Society	Environmental NGO	Environmental NGOs per 10,000 people	0.062	0.072	0.016	0.389
	Environmental PR activities	The number of environmental PR activities per 10,000 people	0.115	0.108	0.002	0.506

3.2. Methods

This study employed a multi-level regression model to test the hypotheses. We used a two-level hierarchical linear model consisting of the individual level (level 1) and the regional level (level 2). This regression equation is formally written as [53]:

$$\text{Level 1 (individual): } Y_{ij} = X'_{ij}\theta_j + \varepsilon_{ij}, \varepsilon_{ij} \sim N(0, \sigma^2) \quad (1)$$

$$\text{Level 2 (regional): } \theta_j = Z'_j\beta + u_j, u_j \sim N(0, \Sigma) \quad (2)$$

where Y_{ij} is the degree of PEB for person i in region j ; X_{ij} is a vector composed of individual level variables, including environmental attitudes, environmental knowledge, sex, age, education, income, ethnicity, and so on; θ_j and β are the regression coefficient vectors including the constant term for Levels 1 and 2, respectively; Z_j is a matrix of row vectors created by repeatedly stacking regional level variables, including environmental pollution, economic development, and public urban facility, and additional variables; and ε_{ij} is the error term for Level 1 and u_j the error vector for Level 2.

The analysis proceeded in three steps. First, we estimated the null model (Model 1) only including the constant term without any independent variables. The purpose of this model is to examine how much variance can be attributed to the individual and regional levels, in other words, whether there are systemic differences in PEB among regions. Next, we estimated several random intercept models (Model 2 and Model 3) with random intercepts and fixed regression slopes to identify the effects of variables at both levels. Finally, in Models 4 to 6, we estimated a series of random coefficient models with random effects in both intercepts and regression slopes. In Models 5 and 6, we added cross-level interactions to test whether regional level variables indirectly affect the environmental behavior through changing the effects of individual level variables.

4. Results and Discussion

4.1. Estimation Results

The regression results are presented in Table 4. In the null model (Model 1), the regional level variance is 0.141, and the individual level variance is 0.861; thus, the Intra Class Correlation (ICC) is 0.14. This implies that 14% of the total variance of individuals' PEB can be explained by regional factors in China.

Model 2 includes only regional level variables and Model 3 includes both regional level variables and individual level variables. The inter-regional variance in Model 3 is reduced to 0.023 from 0.065 for Model 2, and the deviance is also significantly reduced from 8128.646 (Model 2) to 7588.553 (Model 3). This decrease in inter-regional variance and deviance implies that Model 3 has higher explanatory power and a better fit than Model 2.

First, we consider individual level factors. The estimation results for Model 3 show that most individual level factors have statistically significant effects on PEB. When a person has a higher level of subjective and objective environmental knowledge, non-anthropocentric concern, and willingness to pay for the environment, he or she practices a higher level of PEB. These results are like the previous research [22,32,36,54], confirming the positive effects of individual psychological factors on PEB.

Regarding socio-demographic factors, living in an urban area, low income status, being female, union membership, and being married positively influence PEB. These results support the previous findings [13,55] that female housewives and city dwellers are highly involved in daily pro-environmental activities such as garbage separation, energy conservation, and purchasing environmental products. However, contrary to expectations, higher income earners have a lower level of PEB. This result contradicts the claims of the post-materialism theory and supports the findings of some previous studies [56,57] that lower income groups have higher levels of PEB than higher income groups. This finding indicates that, because wealthy people experience fewer environmental problems in their communities than poor people, rich people's motivations for PEB are reduced [58].

Next, we consider regional factors. Model 3 shows that an increase in the level of economic development in the region, environmental budget expenditure, and environmental administrative enforcement all have positive effects on PEB, whereas environmental pollution in the region has a somewhat negative effect on PEB. These results support previous findings of macroeconomic development's positive effects [8,41], and that local government can play an important role in resident PEB through a variety of environmental policies [29,44,45]. Note that the effects of regional factors are significantly lower in Model 3 than in Model 2, as regional factors are supplemented with individual level factors, but they are still statistically significant in determining PEB.

As a follow-up model, Model 4 is a random coefficient model where individual level variables significant in Model 3 vary randomly across regions. The results show that residency area, income, union membership, willingness to pay for the environment, environmental risk perception, and non-anthropocentric concern have regional variations, which is in line with previous studies [8,11,55].

Table 4. The multi-level model results.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Fixed Effect	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
Intercept	0.012	0.011	−0.357 **	−0.320 *	−0.319 *	−0.325 *
Individual Level						
Residency Area			0.224 ***	0.222 ***	0.226 ***	0.230 ***
Gender			−0.067 *	−0.061 †	−0.062 †	−0.059 †
Age			0.002	0.001	0.001	0.001
Ethnicity			0.061	0.013	0.013	0.008
Religion			0.042	0.043	0.044	0.042
Education			0.004	0.003	0.003	0.003
Income			−0.008 **	−0.009 **	−0.009 **	−0.009 **
Political Appointment			0.014	0.013	0.013	0.014
Hukou			0.062	0.074	0.072	0.074
Union Membership			0.111 †	0.117 †	0.115	0.127
Marital Status			0.138 **	0.126 *	0.125 *	0.123 *
Anthropocentric Concern			−0.023	−0.018	−0.018	−0.019
Non-anthropocentric Concern			0.106 ***	0.108 ***	0.109 ***	0.105 ***
Environmental Risk Perception			0.139 ***	0.140 ***	0.138 ***	0.141 ***
WTP for Environment Conservation			0.19 ***	0.193 ***	0.193 ***	0.192 ***
Subjective Knowledge			0.111 ***	0.106 ***	0.105 ***	0.107 ***
Objective Knowledge			0.055 **	0.058 *	0.058 *	0.058 *
Cross-Level Interaction						
Environmental Risk Perception × Environmental Administrative Enforcement					0.002 †	
Non-anthropocentric Concern × Economic Development						0.086 **
Regional Level						
Environmental Pollution		−0.019 *	−0.016 †	−0.017 *	−0.016 *	−0.016 *
Economic Development		0.403 *	0.273 **	0.156 *	0.159 *	0.134 *
Public Urban Facility		0.003	0.005	0.004	0.005	0.003
Environmental Budgets		13.208 ***	8.461 **	9.686 ***	9.288 ***	10.106 ***
Environmental Administrative Enforcement		0.005 *	0.004 **	0.004 **	0.003 *	0.004 **
Environmental NGOs		0.086	0.244	−0.403	−0.366	−0.383
Environmental PR Activities		0.638	0.431	0.994 **	1.000 **	0.959 **
Random Effect	Variance	Variance	Variance	Variance	Variance	Variance
Residency Area				0.035 †	0.035 †	0.041 †
Income				0.000 †	0.000 †	0.000 †
Union Membership				0.064 **	0.064 **	0.064 **
WTP for Environment Conservation				0.012 ***	0.012 ***	0.012 ***
Environmental Risk Perception				0.004 ***	0.005 ***	0.004 ***
Non-anthropocentric Concern				0.010 **	0.011 **	0.010 *
Regional Level Variance	0.141 ***	0.065 ***	0.023 ***	0.082 **	0.084 **	0.081 **
Individual Level Variance	0.861	0.861	0.701	0.661	0.661	0.661
Deviance	8139.439	8128.646	7588.553	7517.907	7524.835	7517.558

† $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Note 1: Region(N) = 30, Individual(n) = 2997. Note 2: Models Estimated by Robust Standard Errors.

Finally, we consider the interaction effects across the two levels. To account for variations in the effects of environmental risk perception and non-anthropocentric concern, we estimated interaction effect models (Model 5 and Model 6) by adding to Model 4 the interaction terms between individual variables and regional variables. Although we experimented with all regional factors, we select two regional variables—environmental administrative enforcement and economic development—as they turn out to be significant in interaction terms.

In Model 5, the interaction between environmental risk perception and environmental administrative enforcement is statistically significant. In a region with a higher level of environmental administration enforcement, the effect of an individual's environmental risk perception on PEB is higher. In Model 6, the interaction between non-anthropocentric concern and economic development is statistically significant. In a region with a higher level of economic development, the effect of an individual's non-anthropocentric concern on PEB is also higher.

4.2. Hypothesis Test Results and Discussion

The purpose of this study is to identify factors impacting the environmental behavior of Chinese people. We specifically aim to analyze the effects of regional characteristics and environmental policies of regional governments. For this purpose, hypotheses about the relationship between regional factors and PEB were set up and tested based on the estimation of the models. As the deviances in Table 4 imply that Models 4 to 6 fit the data better than the others, we just focus on the three models for the testing. The results of hypothesis testing are shown in Table 5.

First, the level of economic development among the environmental conditions at the regional level has a positive impact on PEB, partly supporting Hypothesis 1; see the estimate for the variable, *Economic Development* in Models 4 through 6. Interestingly, the higher the individual's income, the lower the level of PEB. This means that the regional level of economic development will promote the level of environmental behavior, particularly for low income groups rather than high income groups. This result is in line with the cross-national studies on the relationship between economic development and PEB, such as Pisano et al. [8] and Hadler et al. [1].

The level of environmental pollution appears to have a negative impact on PEB, partly rejecting Hypothesis 1; see the estimate for the variable, *Environmental Pollution* in Models 4 through 6. This result may be attributed to the choice of variable for environmental pollution in this study. Since carbon dioxide emissions have a wide or global effect rather than a regional effect, this variable should be used to represent the structures of consumption and industrial production practiced in the region rather than to present a visible degree of regional environmental pollution. Regions with high carbon dioxide emissions accommodate industries requiring high levels of energy consumption, and residents enjoy economic benefits rather than experience damage from environmental pollution. Also, note that there is no significant effect of other pollution variables such as dust, Sulphur dioxide, and air pollution index. These results are in line with Marquart-Pyatt et al. [2].

Second, regional government policies such as environmental budgets and environmental administrative enforcement have a positive effect on PEB, supporting Hypothesis 2; see the estimates for the two variables, *Environmental Budgets* and *Environmental Administrative Enforcement* in Models 4 through 6. Note that organizational variables such as the size and the number of environmental organizations of the regional government are not significant and thus omitted from the model. The size of the environmental budget should be viewed as a proxy for the size of environmental projects and incentives. In addition, the rate of enforcement of environmental administration is interpreted as the will of the regional government to enforce environmental regulations. Therefore, the fact that these variables raise the level of an individual's PEB is the result confirming the positive effects of the regional government's environmental projects and incentives, and strong enforcement of environmental regulations. These results are in line with the cross-national studies on the relationship between national policies and PEB such as Hadler et al. [1].

Third, in terms of the influence of regional civic organizations, the environmental PR activities of these groups have a positive effect on PEB, but the number of environmental NGOs does not have a significant effect, partly supporting Hypothesis 3; see the estimates for the two variables, *Environmental NGOs* and *Environmental PR Activities*. These results are quite different from the studies on the Western countries such as Pisano et al. [8] and Hadler et al. [1], and they are interpreted as related to the dependence of Chinese civil society on governments. According to Xie [59], approximately half of the Chinese environmental NGOs are government-organized NGOs (GONGOs) created by governments for promoting issues that the governments want to bring attention to. It is also related to a data problem. The China Environment Yearbook contains information only on registered NGOs, but there are many unregistered grass-root NGOs actively operating in local communities [59]. Since the Chinese GONGOs are not traditional NGOs in the Western sense [18,59,60], their existence itself does not have a significant impact on PEB. But the number of their educational and PR activities about the environment has a positive effect on PEB, because it represents the actual activities of environmental NGOs.

Finally, in cross-level interaction effects, there was statistical significance only in the interactions between environmental administrative enforcement and environmental risk perception and between economic development and ecocentrism attitude; see the estimates for the two *Cross-Level Interaction* terms in Models 5 and 6. These results show that regional factors such as enforcement of environmental administrative dispositions and economic development can not only directly but also indirectly affect PEB by changing the impacts of personal factors. The indirect effect of economic development is also reported by the cross-national studies such as Tam et al. [11] and Pisano et al. [8], while that of environmental administrative enforcement is new to the literature to our knowledge.

Table 5. Hypothesis test results.

Hypotheses	Test Results
Hypothesis 1: PEB is more likely in regions with higher levels of economic development and more serious environmental pollution.	Partly adopted
Hypothesis 2: PEB is more likely in regions with more expenditure on environmental protection and higher levels of administrative enforcement.	Adopted
Hypothesis 3: PEB is more likely in regions with more environmental NGOs and more environmental PR activities by NGOs.	Partly adopted
Hypothesis 4: The impact of environmental attitudes and environmental knowledge on PEB depends on regional characteristics and policies.	Partly adopted

5. Conclusions

Based on the above results, we can draw policy implications that will help to establish policies at the regional level in China to promote PEB in the future. The analysis shows that regional governments can play an important role in inducing individual PEB. To promote PEB, regional governments need to consider the following policies.

First, the test results of Hypothesis 1 imply that environmental pollution does not necessarily raise the degree of PEB and thus regional government should undertake active campaigns for it. This study has found that a high emission of carbon dioxide lowers PEB rather than raises it, and all other pollution variables have no significant impact on PEB at least in China. As the most serious or prominent environmental issues facing each region are not the same across regions, it is difficult to pick a single pollution issue for all the regions to focus on. Each of the regional governments should identify its own issues and undertake campaigns to link the problems to individual PEB in the region.

Second, another implication of Hypothesis 1 test result is that along with economic growth, we can expect that residents' PEB will be strengthened, but it is important to note that this is not a universal phenomenon that appears equally in all classes of people. The results show that, while economic development at the regional level has a positive impact on residents' PEB, an increase in an individual's

income may reduce PEB. This suggests that it is necessary to implement separate policies targeting high-income people to encourage them to engage in PEB.

Third, the test results of Hypothesis 2 imply that raising environmental budgets and strong environmental enforcement is more effective than an expansion of environmental organizations. The analysis results show that the effects of regional governments' environmental spending and rigid enforcement are consistently positive in all the models while the expansion of environmental organizations in terms of the number of organizations and/or employees has no significant effects. It is important that regional governments need to expand environmental projects and incentives represented by the environmental budgets and that they have a commitment to strong enforcement of environmental regulations. The test results of Hypothesis 4 also show that enforcement of environmental dispositions not only directly promotes PEB, but also indirectly contributes to PEB by raising the effect of environmental risk perception. Therefore, regional governments must enforce environmental regulations to give clear signals to local actors.

Fourth, the test results of Hypothesis 2 suggest that regional governments should selectively support environmental NGOs based on their activities. The results of the analysis show that educational and PR activities of environmental NGOs promote PEB while the number of NGOs itself does not in China. Regional governments may be able to provide selective support for environmental education and PR projects in the form of contests where environmental NGOs submit their educational and PR activities plans and receive subsidies based on reviewing the feasibility of the plan and the performance of their past activities.

Closing the paper, we re-examine the significance and limitations of this research. This study is meaningful in that it shows that *regional* characteristics and policies have significant effects on individual PEB, which has been overlooked by the literature. We expect that the results will be able to provide policy alternatives to help Chinese regional governments make policies to promote their residents' PEB. We also have gotten general tendencies of PEB in China and have compared them with those in the Western world. Nonetheless, due to the limitations of the Chinese data, we have not been able to fully identify the effects of other environmental policies by regional governments and other regional factors such as the social capital of the region. In addition, we focused only on daily environmental behaviors such as garbage separation and purchasing green products and excluded social types of PEB such as participation in environmental groups, donations, demonstrations for solving environmental problems, and rallies. We can also extend the area of PEB to specific settings such as PEB of visitors to national parks [61–63] and PEB of community gardeners [64]. Considering and collecting data on all these variables, we can make the models more comprehensive and make possible a deeper comparison with the extant studies on these issues. Finally, the impact of environmental NGOs reflects the specificity of Chinese civil society as of the year 2010, and it is necessary to confirm whether it can be applied to other countries today. On all these points, we will try to obtain more comprehensive and updated data in subsequent research.

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