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Determinants of Residents' Willingness to Accept and Their Levels for Ecological Conservation in Ganjiang River Basin, China: An Empirical Analysis of Survey Data for 677 Households

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Received: 10 September 2019; Accepted: 23 October 2019; Published: 4 November 2019

Abstract: Using the contingent valuation method and the Heckman two-stage model, we explore residents' willingness to accept (WTA) compensation and their WTA level for ecological conservation compensation in the upstream of the Ganjiang River Basin in China. The findings reveal that 86.26% of the respondents are willing to accept compensation, and the average compensation level is ¥789.60/household per year. The residents' gender, annual disposable income, residential location, decision on whether or not the watershed environment is important, and their satisfaction with water quality and quantity are significantly related to their WTA. The influencing factors that significantly affect compensation level are residents' occupation, educational background, annual disposable income, family size, residential location, decision on whether or not the watershed environment is important, and their satisfaction with water quality and quantity. The results of this empirical research have important policy implications: the government should strengthen advocacy and education of watershed ecological environment protection, intensify farming and other agricultural activities, establish a differentiated and diversified compensation strategy, so as to protect and improve the ecological environment of the Ganjiang River Basin.

Keywords: willingness to accept; compensation level; Ganjiang River Basin; Heckman two-stage model

1. Introduction

Amid rapid growth of China's economy, there are increasingly serious problems of water resource shortages and ecological deterioration of the country's watershed environment [1], which has a profound impact on humans [2]. As an important tributary of the Yangtze River and the largest river basin in Jiangxi province [3], the Ganjiang River Basin has made significant contributions to the improvement of the ecological environment [4]. However, the Ganjiang River Basin also suffers from ecological environmental problems, including water quality deterioration and water quantity fluctuation (Figure 1).

Figure 1. The compliance rate for water quality in the Ganjiang River Basin. (Note: The data comes from the Jiangxi Province Environmental Status Bulletin 2009–2018.)

In Figure 1, we see that the compliance rate for water quality in the Ganjiang River Basin remained at around 80% from 2009 to 2014, but the compliance rate for water quality declined significantly in 2010. The compliance rate refers to the proportion of water quality reaching Class III or above. According to the People's Republic of China Surface Water Environmental Quality Standards, the water quality for Class III means that it can be used for drinking after treatment. In addition, data released by the Jiangxi Provincial Environmental Protection Department shows that the level of pollutants in the upper reaches of the Ganjiang River Basin was relatively high from 2009 to 2014 [5], indicating a high possibility of further deterioration of the water quality in the river basin. To effectively resolve this issue, the central government introduced a series of policy plans. In November 2014, the Economic Civilization Demonstration Zone Construction Implementation Plan of Jiangxi Province was officially approved by six Chinese ministries [6]. This plan committed to "strengthen the protection of water conservation areas and river headwaters" and "strengthen the protection of the headwaters of the five rivers in Jiangxi province." In October 2017, the Chinese government published the National Ecological Civilization Experimental Zone (Jiangxi) Implementation Plan, which proposed to explore a new model for coordinated ecological, economic, and social development of river basins, and played an exemplary role in the protection and development of national river basins [7]. Based on the government's focus on watershed ecological compensation [8] in the Ganjiang River, the headwater areas have continuously strengthened ecological environmental conservation efforts, effectively improving water resources in the downstream regions. It can be seen from Figure 1, that the water quality in the Ganjiang River Basin has improved after 2012. We collected data for the mean compliance rate of the water quality in the upper reaches of the river basin from 2015 to 2018, and adopted the Kriging method [9] using ArcGis software [10] to analyze the figures. The analysis is presented in Figure 2.

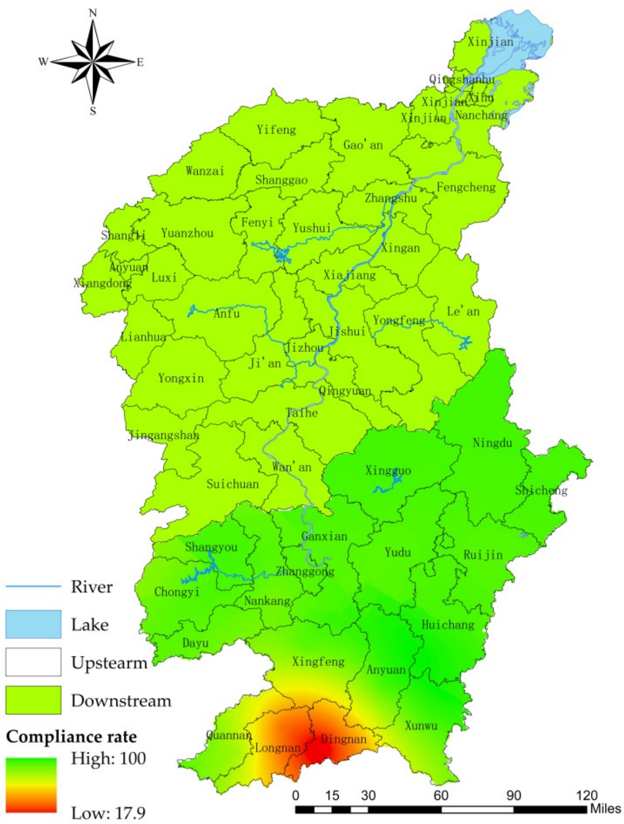

Figure 2. Annual average compliance rate for water quality in the upper reaches of the Ganjiang River Basin. (Note: Due to lack of data, we could only obtain figures from 2015 to 2018 for analysis. The data were provided by the Ganzhou Ecological Environment Bureau.)

Longnan and Dingnan have abundant rare earth resources [11], and the development of these resources has a great impact on the watershed ecological environment. This is why the compliance rate for water quality in these areas is extremely low. Although the protective development and water quality control of rare earth resources have been continuously strengthened in recent years, many pollutants are still lost during the treatment process, resulting in a decline in the water quality in the river basin. Through a series of governance measures, the water quality compliance rate from the upstream to the downstream areas of the Ganjiang River Basin has reached more than 98%, which indicates that the water quality in the upper reaches significantly improved, thus improving the compliance rate of the whole basin. The water quality in the upper reaches significantly improved due to watershed conservation efforts by the central and local governments, especially to limit the utilization and protect the development of important rare-earth resources in Ganzhou. The government's protective development of these resources has further improved the river basin environment, but to a certain extent, it has also reduced and restricted the rights of the residents in the upper reaches of the Ganjiang basin. Regarding the basic principle of "who benefits and who pays, who protects who receives compensation," residents in the upper reaches of the Ganjiang River Basin have been restricted or have lost the right to develop land to some extent due to the national policy for preserving the watershed environment, and thus, the downstream has to compensate the upstream [12]. For these reasons, the Measures for Ecological Compensation of River Basins in Jiangxi Province, promulgated by the Jiangxi Provincial People's Government in January 2018, stated that ecological compensation should be implemented for the Ganjiang River Basin [13]. Although the aforementioned documents clarified that the lower reaches need to pay for protecting the ecological environment of the upper reaches, the compensation standard is calculated based on water environmental quality, forest ecological quality, and water resources management, but ignores the willingness to accept (WTA) compensation of the direct stakeholders (watershed residents) of the river basin. It is likely that the calculated compensation standard is low, which results in a partial effect of the compensation policy. Further, while the government is active, residents' participation in conservation is limited. As a result, the effects of the watershed ecological compensation policy and watershed ecological environmental conservation efforts are greatly weakened. Therefore, we explore the willingness of the river basin stakeholders to compensate the residents in the upper reaches, so as to provide a theoretical basis for further improvement of the watershed compensation criteria.

We studied the WTA levels of residents in the upper reaches of the Ganjiang River Basin based on field survey data collected by the Nanchang Institute of Technology from 2017 to 2019. This article focuses on the following three issues: first, whether upstream residents are willing to accept compensation for watershed ecological conservation; second, what is the compensation level of residents who are willing to accept; and third, which factors influence residents' WTA and at which levels. "Levels" means that the residents are willing to accept the compensation levels for ecological conservation of the Ganjiang River Basin. Based on the aforementioned research issues, we make targeted and constructive policy recommendations that could contribute to the improvement of the watershed ecological environment and construction of the watershed ecological compensation mechanism in the Ganjiang River Basin. At present, the ecological compensation mechanism [14] of the Ganjiang River Basin has been established, and the funds come mainly from the Jiangxi Provincial Government. The Provincial Government examines water quality, ecological quality, and the comprehensive management of the water environment to determine whether or not to compensate the local governments. However, the establishment of this compensation mechanism did not take the factors of the residents into account, leading to an inefficient amount of compensation, especially to the ordinary residents who did not receive compensation. Consequently, this could not mobilize the initiative and enthusiasm of the residents to protect the ecological environment of the Ganjiang River Basin. Meanwhile, the Ganjiang River Basin is a pilot area for the formulation and implementation of watershed ecological compensation policy in China. Based on the calculated residents' WTA, we can infer the compensation value of the entire Ganjiang River Basin. Moreover, we analyze the result to evaluate whether it is possible to implement. Therefore, this study focuses on the determinants of residents' WTA and their levels for ecological conservation in Ganjiang River Basin, and the results of this study can provide reference and basis for central government of china and even to other Asian countries to improve ecological compensation measures for the river basin by increasing residents participation in watershed ecological environment protection.

The rest of this paper is organized in four sections. Section 2 reviews the relevant literature on watershed ecological compensation. Section 3 summarizes the study area and discusses our research design and methods. Section 4 explains the empirical findings. Finally, Section 5 summarizes the results and offers policy recommendations.

2. Literature Review

The concept of watershed ecological compensation emerged in China in the late 1990s [15]. In the international arena, it is more commonly referred to as payment for watershed ecosystem services [16]. In recent years, theoretical research on and practice of watershed ecological compensation has been a key topic in academic and political circles. For watershed ecological compensation, there are government-mandated methods and policy instruments based on market behavior [17]. Scholars generally believe that market-based approaches can better mobilize enthusiasm of stakeholders to protect and optimize the watershed environment [18]. Therefore, if ecological service providers (or recipients) directly participate in watershed ecological compensation and accept (or pay) compensation according to their WTA (or willingness to pay), social and economic links will be established between the upstream and downstream of a river basin, resulting in an improved watershed ecological environment [15]. There is a vast literature on the willingness to pay of the direct stakeholders of river basins [19,20], but there are few studies on residents' WTA for watershed ecological conservation.

In terms of research objects, Del Saz-Salazar et al. [21] used the contingent valuation method (CVM) to assess surveying people on their willingness to accept compensation if the Water Framework Directive improvements were not carried out in Europe. Seroa Da Motta and Ortiz [22] applied CVM to analyze the farmers' willingness to accept (WTA) compensation for ecosystem services in the Paraíba do Sul River basin, and the findings showed that the farmers' decisions to join the program depend not only on their opportunity costs, but also on their perceptions about specific issues. Beharry-Borg et al. [23] adopted a choice experiment (CE) to explore the minimum compensation level of ecological compensation for farmers in Yorkshire, England, who are willing to protect the water quality of river basins. Other scholars used the CVM to analyze residents' WTA for the Jinghe River Basin [24] and Yangtze River Basin [25]. Scholars have not only explored residents' WTA for watershed ecological conservation, but also conducted in-depth analysis of its influencing factors. In the aspect of research methods, Li et al. [25] conduct an empirical analysis on the affecting factors for the residents' WTA with a logit model, and Zhou et al. used the right interception (right censored) model to analyze the influencing factors on farmers' WTA in watershed ecological compensation [26]. Furthermore, some scholars also adopted the random parameter logit model [27], the generalized multinomial logit [28], and the ordinal logistic model [29] to empirically analyze the influencing factors of residents' willingness to pay for environmental protection.

The aforementioned studies mainly adopt the CVM to estimate residents' WTA and its level for ecological conservation; this is a simple and flexible non-market method [30], which is generally applied to cost-benefit analysis and environmental impact assessment of non-market resources [16], such as the energy utilization of crop straw [31]; improvement of water quality [32]; and prevention of mother-to-child transmission of diseases [33]. Moreover, the method has been widely accepted by scholars [34]. Through empirical analysis, researchers have concluded that water quality is one of the main factors affecting the WTA, and this finding has been directly applied to the practice of ecological compensation policy [28]. Therefore, theoretical research has made tremendous contributions to practical application. However, although the literature on residents' compensation WTA for watershed ecological conservation is expanding, few studies concentrate on both the influencing factors of residents' WTA and their levels. In some studies, two models have been used for empirical analysis, which may lead to sample selection bias. However, the Heckman two-stage model can effectively resolve this issue [35,36]. There are other scholars using Heckman model to analyze WTA for biodiversity [37] and forest landscape protection [38]. However, it is a pity that no scholars have used this method to study the factors affecting the willingness to accept of residents for the watershed ecological protection. We use the CVM to calculate the willingness to accept and its level for residents, and the Heckman two-stage model for an empirical analysis on determinants which affect the residents' WTA and its levels. Therefore, this paper makes contribution in research objects and research methods. Meanwhile, the results can be useful in improvement of the watershed ecological compensation standards.

3. Research Design and Methods

3.1. Research Area

Ganjiang is the largest river in Jiangxi, which flows from south to north through 52 counties under the jurisdiction of five districts: Cangzhou, Ji'an, Xinyu, Pingxiang and Nanchang [39]. The whole territory of Ganzhou is located along the upper stream of the Ganjiang River Basin [40]. Additionally, Ganzhou is a resource-based city. Ionic medium heavy rare earth is mainly distributed here, which can be used for nuclear magnetic resonance and in the production of special metals and medical and aerospace materials. As the Government of Jiangxi continuously strengthens ecological environmental conservation for the river source in the Ganjiang River Basin, in 2014, it was restricted or forbidden from developing river basin resources in Ganzhou by limiting the exploitation of rare earths, shutting down polluting companies, etc. According to the basic principle of "whoever suffers the damage shall be compensated," the upper reaches of the river basin have to accept compensation for watershed ecological conservation. Therefore, this study covers the whole territory of Cangzhou City as the research area, including 18 counties such as Zhanggong, Nankang, Dayu, Longnan, Yudu, Ganxian, Shangyou, Chongyi, Quannan, Ruijin, Huichang, Dingnan, Xinfeng, Ningdu, Xingguo, Shicheng, Anyuan and Xunwu. The details are shown in Figure 3 and Table 1.

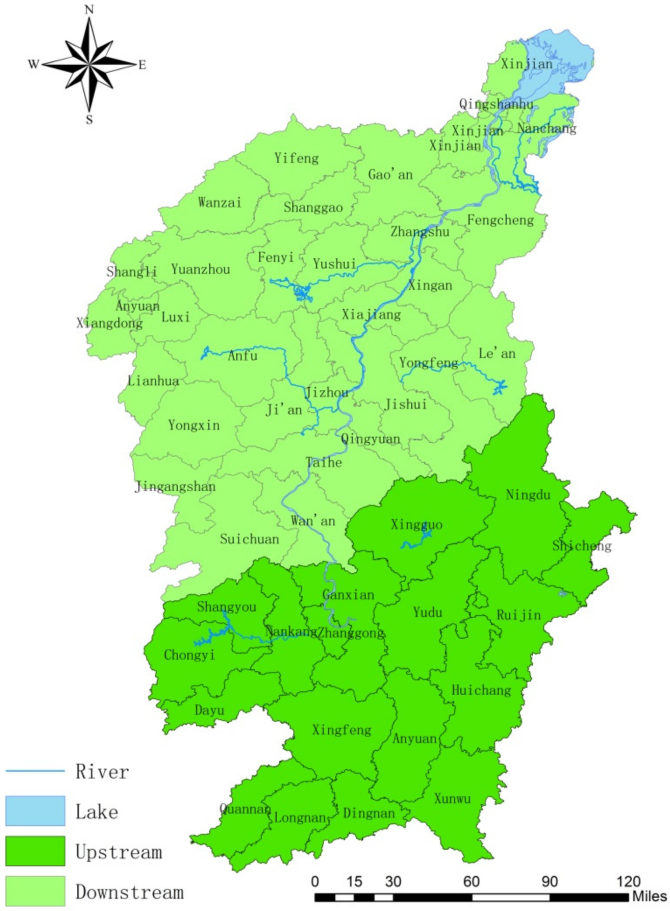

Figure 3. Map of the Ganjiang River Basin.

According to the proportion of the primary industry in the gross regional domestic product, we divided our research area into three regions—(I) agriculture: occupies a relatively small area, (II) agriculture: occupies a medium area, and (III) agriculture: occupies a relatively large area—for convenience of the subsequent comparative study (Table 1).

Table 1. Three regions of the research area [1].

Type	Counties	Proportion	Area
I	Zhanggong, Nankang, Dayu, Longnan, Yudu	<15%	Agriculture: occupies a relatively small area
II	Ganxian, Shangyou, Chongyi, Quannan, Ruijin, Huichang, Dingnan	15%–20%	Agriculture: occupies a medium area
III	Xinfeng, Ningdu, Xingguo, Shicheng, Anyuan, Xunwu	>20%	Agriculture: occupies a relatively large area

Note: [1] The data source is the "Jiangxi Statistical Yearbook 2017".

3.2. Data Sources and Sampling Scheme

The data used in our study were taken from field surveys conducted in 2017, 2018, and 2019 to evaluate the WTA of residents in the upper reaches in the GanjiangRiver Basin for protecting and improving the watershed ecological environment.

We created a simple random sample (SRS) for the pilot survey and calculated that a minimum of 368 respondents were needed for adequate representation of the population. The questionnaire consisted of four sections. Section 1 introduced the basic circumstances of the Ganjiang River Basin to provide respondents with an understanding of the current situation of the watershed. Section 2 built upon the personal and family information collected from respondents to develop explanatory variables for the residents' WTA and its level, including the residents' age, gender, occupation, educational background, annual disposable income, family size, and so on. Section 3 addressed the residents' WTA and its level for protecting the watershed environment, which were applied to the explained variable in the empirical analysis. Section 4 enquired about the methods for accepting compensation by the residents, which can provide a reference for the government to implement specific policies.

To ensure the sampling results are representative of the population, we used a three-stage method to sample the residents in the study area. In the first stage, stratified sampling (SS) was used to choose two towns from each county. In the second stage, we adopted the probability proportionate to size sampling (PPS), and two villages were selected for each of the towns adopted in the first stage. In the third stage, we applied SRS to select 10 residents from each of the villages selected in the second stage. The specific sampling scheme is shown in Table 2.

Table 2. Specific sampling scheme.

Stage	Object	Number	Method
1	Town	36	Stratified sampling (SS)
2	Community	72	Probability to size sampling (PPS)
3	Residents	720	Simple random sample (SRS)

In line with the sampling scheme in Table 2, we distributed 720 questionnaires and recovered 677 valid questionnaires, with an effective response rate of 94.03%. The main reason for such a high response rate was the use of the face-to-face questionnaire survey method. Furthermore, the number of valid questionnaires was greater than the minimum number of observations required, so the empirical results obtained from the samples can be inferred to the population.

3.3. Research Methods

3.3.1. CVM

In this paper, we used the CVM to measure residents' WTA and its level for the upper reaches of the Ganjiang River Basin. The elicitation techniques for WTA included an open ended question, acceptance card, which was the same as "payment card" meaning the resident selects an amount that he or she wishes to accept, repeat bidding, and so on [41]. They were gradually employed to obtain the residents' WTA of watershed environmental conservation. The acceptance card induction mode had the advantage of convenience in collecting the residents' WTA, avoiding extreme values and information deviation. Therefore, we adopted the induction mode of acceptance card. The specific formula was as follows:

$$WTA_j = \sum_{i=1}^{M_i} \beta_{ji} P_{ji} \tag{1}$$

In the above equation, WTA_i signifies the average compensation level of the residents who dwell in region j. j can be assigned to I, II, III, and ALL, which respectively signify Region I, Region II, Region III, and the entire research region. The specific partitions were classified as shown in Table 1.

β_{ji} signifies the compensation level of resident i who lives in region j, and P_{ji} signifies the frequency of the compensation level of resident i in region j. M_i signifies the number of all surveyed residents in region j.

3.3.2. Heckman Two-Stage Model

We employ the Heckman two-stage model for an empirical analysis to assess the determinants of the residents' WTA and its level for the upper reaches of the Ganjiang River Basin. The research consisted of two stages. Stage 1 is the decision-making phase to empirically analyze the influential factors of the residents' WTA. It should be noted that the residents who did not indicate WTA in the first stage did not progress to the next stage of the research. In Stage 2, the compensation level was determined based on an empirical analysis of the factors affecting the compensation level for the residents. Therefore, the Heckman two-stage model was divided into two sub-models: Model 1 and Model 2.

The Probit model was used in Model 1 [42] to conduct an empirical analysis of the influencing factors of whether the residents in the upper reaches of the Ganjiang River Basin had the willingness to accept compensation. The detailed formula is as follows:

$$Z = \gamma_0 + \gamma_1 U_1 + \gamma_2 U_2 + \gamma_3 U_3 + \cdots + \gamma_m U_m + \varepsilon \quad (2)$$

In Equation (2), Z represents the explained variable, that is, the probability that the residents who inhabit the upstream areas have the willingness to accept. $\gamma_0, \gamma_1, \gamma_2, \gamma_3, \cdots, \gamma_m$ represent the regression coefficients of the variables; $U_1, U_2, U_3, \cdots, U_m$ represent the explanatory variables; and ε represents the residual.

The multiple linear regression model was used in Model 2 [43], which primarily analyzed the determinants affecting the residents' WTA in the upstream of the Ganjiang River Basin. The specific formula was as follows:

$$Y = \delta_0 + \delta_1 U_1 + \delta_2 U_2 + \delta_3 U_3 + \cdots + \delta_m U_m + \delta_{m+1} Lambda + \theta \quad (3)$$

In Equation (3), Y represents the explained variable, that is, the residents' compensation level in the upstream regions. $\delta_0, \delta_1, \delta_2, \delta_3, \cdots, \delta_m$ represent the regression coefficients of the variables; $U_1, U_2, U_3, \cdots, U_m$ represent the explanatory variables; Lambda represents the Mills ratio; and θ represents the residual. Based on a review of the literature, we designed ten explanatory variables to evaluate the residents' WTA and its level in the upper reaches of the basin in conjunction with the specific circumstances of the Ganjiang River Basin. See Table 3 for details. The research findings from Table A2 in the Appendix A revealed either no correlations or weak correlations between the variables.

Table 3. Description and explanation of variables.

Variable	Unit/Assignment	Description	Support Literature
Age (U_1)	Year	These variables reflect the personal characteristics of the respondents, mainly to examine whether they have a significant impact on the respondent's willingness to accept (WTA) and its level.	[12,24]
Gender (U_2)	Male = 1, Female = 2		[12,24]
Occupation (U_3)	Civil servant = 1, Public institution staff = 2, National enterprise staff = 3, Individual business = 4, Private enterprise employees = 5, Farmer = 6, Student = 7, Freelancers = 8, Others = 9		[12,24]
Educational background (U_4)	Junior high school = 1, Senior high school = 2, Junior college = 3, College = 4, Master's degree candidate = 5, Doctoral candidate = 6		[12]

Table 3. *Cont.*

Variable	Unit/Assignment	Description	Support Literature
Annual disposable income (U_5)	RMB	These variables reflect the characteristics of respondents' families and mainly examine whether they have significant influence on respondents' WTA and its level.	[12]
Family size (U_6)	Persons		[12]
Residential location (U_7)	Region I = 1, Region II = 2, Region III = 3		[12,24]
Whether the watershed environment is important (U_8)	Yes = 1, No = 2	These variables mainly examine that whether watershed environmental factors have a significant impact on respondents' WTA and its level.	[12,24]
Satisfaction with water quality (U_9)	Extreme displeasure = 1, Displeasure = 2, Normal = 3, Pleasure = 4, Extreme pleasure = 5		[12]
Satisfaction with water quantity (U_{10})	Extreme displeasure = 1, Displeasure = 2, Normal = 3, Pleasure = 4, Extreme pleasure = 5		[12,24]

4. Research Results and Discussion

4.1. Willingness to Accept and Compensation Level

Among the 677 households, 584 had the willingness to accept, and 93 did not have the willingness to accept, accounting for 86.26% and 13.74%, respectively, of the total number of households surveyed. The details are shown in Table 4.

Table 4. Residents' WTA in the upper reaches of the Ganjiang River Basin.

Are You Willing to Accept Compensation?	Assignment	Household	Proportion
Yes	1	584	86.26%
No	0	93	13.74%

Table 4 shows that the majority of surveyed residents would like to receive ecological compensation, while a small number of surveyed residents did not wish to receive compensation. We also found that residents did not need compensation as they already benefited from the improvement of the watershed ecological environment.

In addition, we substituted the collected data into Equation (1) and the details are as follows:

$$\mathrm{E}(WTA_I) = \sum_{i=1}^{M_i} \delta_{Ii} P_{Ii} = 555.12 \tag{4}$$

$$\mathrm{E}(WTA_{II}) = \sum_{i=1}^{M_i} \delta_{IIi} P_{IIi} = 810.84 \tag{5}$$

$$\mathrm{E}(WTA_{III}) = \sum_{i=1}^{M_i} \delta_{IIIi} P_{IIIi} = 984.35 \tag{6}$$

$$\mathrm{E}(WTA_{ALL}) = \sum_{i=1}^{M_i} \delta_{ALLi} P_{ALLi} = 789.60 \tag{7}$$

The research results in Equations (4)–(7) show that the average compensation level for ecological conservation in the upper reaches of the Ganjiang River Basin was ¥789.60 per household, that in

Region I it was ¥555.12 per household, that in Region II it was ¥810.84 per household, and that in Region III it was ¥984.35 per household. Ganzhou had a population of 3.2 million households in 2018. According to the "Gangzhou Statistical Yearbook 2018", the estimated number of households in Ganzhou City is 3.2 million. The total compensation of the Ganjiang River Basin was set to ¥2526 million per year. The current ecological compensation fund invested by Jiangxi Province in the river basin was about ¥2500 million per year. The area of the Ganjiang River Basin accounts for about half of the total area in Jiangxi Province, and the ecological compensation fund invested in the Ganjiang River Basin was about 1250 million. Overall, the compensation fund is still obviously insufficient, so Jiangxi Provincial Government and the Central Government need to increase the watershed ecological compensation fund. The research results in Figure 4 showed that the residents living in Region III had the highest compensation level, while those who inhabited Region I had the lowest compensation level. The reason maybe that the higher the agricultural output value is, the greater the agricultural loss will be due to the increasing control and restrictions in environmental protection. As a result, local residents may wish to obtain higher ecological compensation to make up for incurred losses.

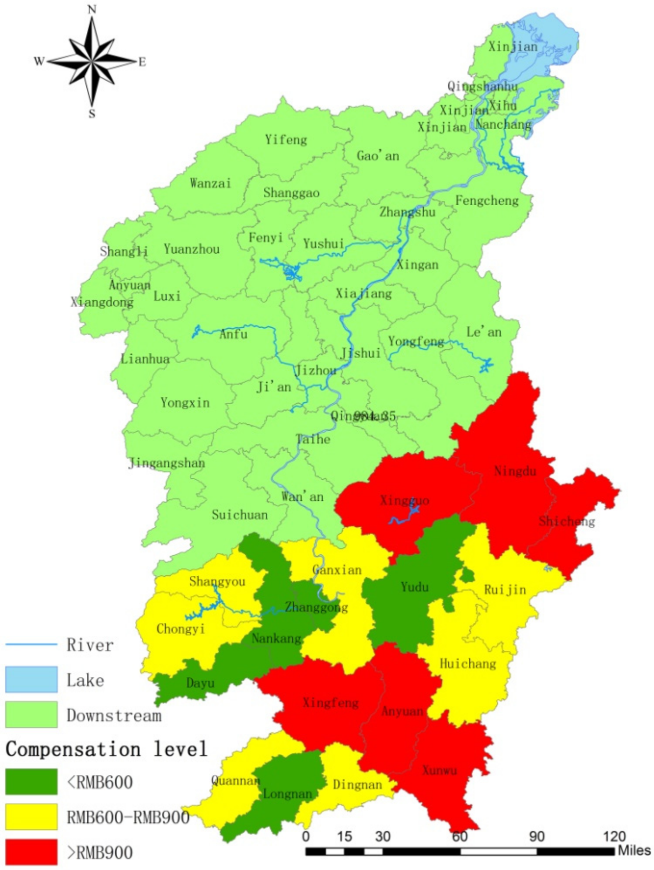

Figure 4. The compensation level for the upstream of the Ganjiang River Basin.

4.2. Empirical Results and Discussion

Using the Stata12.0 software, we applied Heckman's two-stage model to analyze determinants for influencing the residents' WTA and their level in the upper reaches of the Ganjiang River Basin. The empirical results are shown below.

According to the data in Table 5, the Wald value was 142.61 and the P value was 0.000, which indicates that it rejects the original hypothesis and the entire model is valid.

Table 5. Model validity analysis.

Number of Observations	Censored Observations	Uncensored Observations	Wald Chi2 (8)	Prob > Chi2
677	93	584	142.61	0.000

The empirical results in Table 6 show the residents' gender (U_2), annual disposable income (U_5), residential location (U_7), whether the watershed environment is important (U_8), the satisfaction with water quality (U_9) and the satisfaction with water quantity (U_{10}) are significantly correlated with their WTA, while the residents' age (U_1), occupation (U_3), educational background (U_4), family size (U_6) are not significantly correlated with their WTA. U_2 is significantly positively related to the residents' WTA, which indicates that women have a stronger WTA for the watershed ecological compensation than men. It may be that women are more sensitive to the environmental improvement of the Ganjiang River Basin due to the increasing environmental protection in the upper reaches of the Ganjiang River Basin, which in turn causes them to have a stronger willingness to accept compensation. U_5 had a significantly positive relation to the residents' WTA, which signified that the higher the annual disposable income of the household was, the stronger the WTA. This may be because the higher the household income, the more important it is to understand the watershed environment, and the more willing they are to accept compensation. U_7 had a significantly positive correlation with the residents' WTA, indicating that the residents who are living in areas with larger agricultural output had a stronger WTA. This is mainly because the ecological environmental conservation in the upper reaches of the Ganjiang River Basin will increase the investment and treatment costs of agriculture, which in turn will affect the residents' income. Therefore, their willingness to accept compensation will be stronger. U_8 had a significantly negatively correlated with the residents' WTA, showing that the residents who realized the watershed environment is important had a stronger WTA. In turn, residents believed that the more important the watershed environment is, then environmental protection in the upper reaches of the Ganjiang River Basin will have a bigger impact on the lower reaches, and thus they have a higher willingness to accept. U_9 and U_{10} were significantly positively correlated with the residents' WTA, meaning that higher satisfaction over water quality and quantity will result in stronger WTA among residents. Coincidentally, the better the water quality or the more abundant the water of the Ganjiang River Basin, the more benefits the downstream residents will receive, and so the residents in the upstream of the Ganjiang River Basin will have a stronger WTA.

Table 6. Heckman first-stage model empirical findings.

Variable	Coefficient	Standard Error	Z	P >|z|
U_1	-5.46×10^{-5}	0.008	−0.010	0.994
U_2	0.268 **	0.137	1.960	0.050
U_3	−0.40	0.033	−1.200	0.230
U_4	0.060	0.058	1.030	0.305
U_5	4.78×10^{-6} **	2.20×10^{-6}	2.170	0.030
U_6	−0.026	0.045	−0.570	0.566
U_7	0.167 **	0.084	1.980	0.048
U_8	−0.671 ***	0.233	−2.880	0.004
U_9	0.168 **	0.068	2.490	0.013
U_{10}	0.301 ***	0.066	4.540	0.000
Constant	−0.219	0.603	−0.360	0.716

Note: "*", "**", and "***" indicate a significant relationship at the 5% and 1% levels, respectively.

It should be noted that the premise of the Heckman two-stage model is that the explanatory variables of the first-stage model should be more than the explanatory variables of the second-stage model [44]. Therefore, the variables selected in Heckman's second-stage model in this paper were eight of the ten explanatory variables in Heckman's first-stage model. We excluded these two explanatory variables (U_1 and U_2) because they had no significant correlation with the compensation level for the surveyed residents.

The research findings in Table 7 indicated that residents' occupation (U_3), educational background (U_4), annual disposable income (U_5), family size (U_6), residential location (U_7), decision on whether the watershed environment is important or not (U_8), satisfaction with water quality (U_9) and satisfaction with water quantity (U_{10}) had significant correlation with the compensation level. U_3 was significantly positively related to the residents' compensation level, indicating that the more stable the work, the lower the compensation level. This is mainly because the residents with stable jobs demand less compensation, while for those who do not have regular jobs or do not have good jobs, higher compensation is preferred to increase their income sources. U_4 was significantly positively correlated with the residents' compensation level, which means that the better the educational background, the greater the amount of compensation that they would like to accept. The reason is that the higher the education level, the more clearly they realize that the upstream residents that preserve the watershed environment have enabled the downstream residents to enjoy a better watershed ecological environment, which in turn will bring more benefits from the lower reaches of the Ganjiang River Basin. U_5 was significantly positively correlated with the residents' compensation level, which indicated that the higher the annual disposable income, the more compensation residents want to accept. Additionally, residents with more disposable income have relatively more family wealth, which in turn caused them to be more satisfied with a higher compensation level [45]. U_6 had a significantly positive relation to the residents' compensation level, which meant that with the increase of family size, the amount of compensation they would like to receive would be larger. The larger the number of households in the upper reaches of the Ganjiang River Basin, the greater the impact of ecological environmental protection efforts, so they hoped to accept more compensation to make up for their losses. U_7 was significantly positively associated with the residents' compensation level, indicating that the residents who live in Region III had the highest compensation level, while the residents who inhabited Region I have the lowest compensation level. This is mainly because the continuous strengthening of ecological conservation in the upper reaches of the Ganjiang River Basin will directly impact agriculture output, which in turn encourages the residents in the agriculturally dominant area to request more compensation. U_8 showed a significantly positive relation to the residents' compensation level, which meant that the residents who were willing to accept compensation believed that the watershed ecological environment was more important, and they hoped to receive the lower compensation. The reason is that the residents who believed that the watershed environment was more important had found that while protecting the ecological environment of the Ganjiang River Basin, they also had benefited from the improvement of the watershed ecological environment, which led to a relatively low compensation level that they were willing to receive. U_9 and U_{10} were significantly positively correlated with the residents' compensation level, which indicated that the higher the satisfaction of the residents on water quality or water quantity, the higher their compensation level. As such, the higher the satisfaction of residents on water quality or water quantity, the better the water quality or the more abundant the water; as such the downstream residents received more ecological value. Therefore, the upstream residents hoped to obtain more compensation to cover the potential losses incurred as they were unable to develop any industries as a result of their focus on protecting the watershed environment. In addition, the data in Table 7 shows that the Lambda coefficient was positive and had marginal significance [46], which indicates that sample selection bias did exist in this study. Therefore, it was necessary to use Heckman two-stage model in this paper.

Table 7. Heckman second-stage model empirical findings.

Variable	Coefficient	Standard Error	Z	P >|z|
U_3	32.567 *	17.714	1.840	0.066
U_4	117.809 ***	29.076	4.050	0.000
U_5	0.003 ***	0.001	2.790	0.005
U_6	131.947 ***	23.532	5.610	0.000
U_7	220.032 ***	51.052	4.310	0.000
U_8	384.752 **	174.668	2.200	0.028
U_9	129.669 ***	47.630	2.720	0.006
U_{10}	203.216 ***	52.483	3.870	0.000
Constant	−2361.911 ***	365.138	−6.470	0.000
Lambda	805.701	543.575	1.480	0.138
Rho	0.949			
sigma	849.295			

Note: "*", "**", and "***" indicate a significant relationship at the 10%, 5% and 1% levels, respectively.

5. Policy Recommendations

We propose the following five targeted policy recommendations based on the research results, so as to better preserve and ameliorate the ecological environment of the Ganjiang River Basin.

First, strengthen advocacy and education of watershed ecological environment protection to promote enhanced awareness of environmental conservation. In accordance with the empirical results of this paper, women have stronger WTA than men, and there is a positive correlation between education and the residents' compensation level. Further, the more important the watershed environment is, the lower the compensation level is for the residents that accept. Based on this analysis, we should increase advocacy on the improvement and protection of the river basin's ecological environment, so that more residents can understand and recognize the important role of the watershed ecological environment to our humanity and the enormous value it can generate, especially for women. We also propose to incorporate the knowledge of ecological environmental protection into the curriculum of primary and secondary schools and universities so as to inform students of the great value that the watershed ecological environment can produce and the significant effects it has on the whole ecosystem. Through the above methods, students will realize the importance of the watershed ecological environment and be encouraged to join ecological conservation efforts in the Ganjiang River Basin.

Second, intensify farming and other agricultural activities, and continuously reduce the pollution of the watershed ecological environment. The empirical results of this study show that residents who are living in areas with a relatively high proportion of agricultural activity have a higher WTA. In view of the research results, we should increase assistance for agricultural production, and actively carry out various agricultural production training for farmers, and promote intensive farming and breeding of livestock in the upper reaches of the Ganjiang River Basin. While the above-mentioned practices can increase agricultural income, they can also effectively curb the issue of non-point source pollution caused by excessive spraying of pesticides and chemical fertilizers, and thus further reduce pollution of the watershed ecological environment.

Third, continue to strengthen the protection and improvement of water quality and quantity for the Ganjiang River Basin. The above research findings show that the higher the water quality or the more abundant the water, the higher the perceived value to people in general, which can bring better ecological environment to the residents. In view of this, we should continuously strengthen the conservation of the Ganjiang River Basin, and rectify the damage caused to the atmosphere by closing businesses operating along the river basin to promote the continuous improvement of the water quality and water quantity for the Ganjiang River Basin and more sustainability.

Fourth, we should establish a differentiated and diversified compensation strategy to promote residents' enthusiasm to preserve the ecological environment of the Ganjiang River Basin. The empirical findings in Table 7 show that the residents' family size and residential location have a significant impact on the compensation level. Meanwhile, in the field investigation, we found that in terms of monetary compensation, residents are more willing to accept compensation in cash and financial subsidies. In terms of non-monetary compensation, residents are more willing to accept infrastructure construction and land compensation. Therefore, the government could add the above options to the census questionnaire as a basis for collecting feedback to develop a differentiated watershed ecological compensation scheme. If compensation preference is taken into consideration by the government through an exploratory approach, the government may be able to maximize the compensation benefits of the limited ecological compensation funds, and stimulate residents' enthusiasm to preserve the environment of the Ganjiang River Basin.

Fifth, raise compensation funds from various sources. According to the result, Jiangxi Provincial Government spends about ¥1250 million annually on ecological conservation for the Ganjiang River Basin, and the annual compensation for the upstream residents of the Ganiang River Basin is about ¥2526 million, implying that the sufficiency of funds is less than 50%. In order to effectively make up for the shortage of funds, we should raise funds from various sources for the watershed ecological conservation. It has been found in the existing literature that residents in the lower reaches of the Ganjiang River Basin are willing to pay for the improvement of the watershed environment, with the average annual payment of ¥316 per household [12]. Meanwhile, the methods of raising funds that the residents are more willing to accept are the ecological tax and utility bills [12]. Therefore, the government can charge the downstream residents to make up for the deficiency. In addition, the central government may also subsidize the ecological compensation funds in the basin of Jiangxi Province through financial transfer payment.

6. Conclusions

This paper explored residents' willingness to accept (WTA) compensation and their WTA level for ecological conservation compensation in the upstream of the Ganjiang River Basin in China. The findings reveal that 86.26% of the respondents are willing to accept compensation, and the average compensation level is ¥789.60/household per year. The residents' gender, annual disposable income, residential location, decision on whether or not the watershed environment is important, and their satisfaction with water quality and quantity are significantly related to their WTA. The influencing factors that significantly affect compensation level are the residents' occupation, educational background, annual disposable income, family size, residential location, decision on whether or not the watershed environment is important, and their satisfaction with water quality and quantity. Meanwhile, the results of this empirical research have important policy implications: the government should strengthen advocacy and education of watershed ecological environment protection, intensify farming and other agricultural activities, continue to strengthen the protection and improvement of water quality and quantity, establish a differentiated and diversified compensation strategy, raise compensation funds from various sources, so as to protect and improve the ecological environment of the Ganjiang River Basin.

Author Contributions: Questionnaire design, K.X.; data collection, K.X.; model construction and measurement, K.X.; writing—review and editing, N.Z.; research design and methods, F.K.; constructive suggestions, C.-C.K.

Funding: This research was funded by the Science and Technology Project of Jiangxi Education Department, grant number GJJ180964; China Postdoctoral Science Foundation, grant number 2017M612146; National Social Science Fund of China, grant number 18AJY006; the 2017 Research Project of Humanities and Social Sciences of Jiangxi Province, grant number JJ17222 and Jiangxi Social Science Research 2017 Annual Plan Project, grant number 17YJ39.

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. Main questions in the questionnaire of residents' WTA and its level for ecological compensation in the Ganjiang River Basin.

Main Questions in the Questionnaire	Details	Answers
Questions for individual and family characteristics	Age; gender; occupation; educational background; annual disposable income; family size; residential location; whether the watershed environment is important; satisfaction with water quality; satisfaction with water quantity.	Keep records according to specific circumstances.
Selection questions for the residents' WTA	We assume that the residents in the upper reaches of the Ganjiang River Basin need to participate in the improvement of the watershed ecological environment so as to effectively preserve and ameliorate the watershed ecological environment. We ask: "Are you willing to accept compensation for ecological conservation of the Ganjiang River Basin?"	Yes, I am willing to accept compensation. No, I am not willing to accept compensation.
Elicitation questions for compensation level	If the answer is "Yes, I am willing to accept compensation," next, we ask: "How much do you need as compensation for protecting the ecological environment of the Ganjiang River Basin?"	The respondent selects an acceptance amount in the acceptance card.
	If the answer is "No, I am not willing to accept compensation," next, we ask: "What is the reason that you don't want to accept compensation?"	Protecting the watershed ecological environment is also beneficial to our own health.
Questions of the methods for accepting compensation	If the answer is "Yes, I am willing to accept compensation," we ask: "Which method for accepting compensation will you select?"	The main answers are cash, financial subsidies, infrastructure construction, land compensation and so on.

Table A2. Variable correlation analysis.

Variable	Category	U_3	U_4	U_5	U_6	U_7	U_8
U_3	Pearson correlation coefficient	1	0.000	−0.030	0.028	0.026	−0.083 *
	Significance	-	0.982	0.440	0.473	0.500	0.032
	Number	677	677	677	677	677	677
U_4	Pearson correlation coefficient	0.000	1	0.073	0.007	0.025	0.089 *
	Significance	0.982	-	0.056	0.863	0.511	0.020
	Number	677	677	677	677	677	677
U_5	Pearson correlation coefficient	−0.030	0.073	1	0.043	−0.037	0.044
	Significance	0.440	0.056	-	0.260	0.336	0.255
	Number	677	677	677	677	677	677
U_6	Pearson correlation coefficient	0.028	0.007	0.043	1	−0.006	0.014
	Significance	0.473	0.863	0.260	-	0.878	0.708
	Number	677	677	677	677	677	677
U_7	Pearson correlation coefficient	0.026	0.025	−0.037	−0.006	1	0.080 *
	Significance	0.500	0.511	0.336	0.878	-	0.037
	Number	677	677	677	677	677	677
U_8	Pearson correlation coefficient	−0.083 *	0.089 *	0.044	0.014	0.080 *	1
	Significance	0.032	0.020	0.255	0.708	0.037	-
	Number	677	677	677	677	677	677

Note: * represents the significance at 5%.

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