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Factors Influencing Farmers' Willingness to Participate in Wetland Restoration: Evidence from China

Honggen Zhu [1,2,†], Zhengfei Guan [3,4,*,†] and Xuan Wei [3,†]

1. School of Marketing and Logistics Management, Nanjing University of Finance & Economics, 3 Wen Yuan Road, Xian Lin University City, Nanjing 210023, China; zhgen2004@163.com
2. School of Economics and Management, Jiangxi Agricultural University, Nanchang Economic and Technological Development District, 1101 Zhimin Road, Nanchang 330045, China
3. Gulf Coast Research and Education Center, University of Florida, 14625 CR 672, Wimauma, FL 33598, USA; wei.xuan@ufl.edu
4. Food and Resource Economics Department, University of Florida, P.O. Box 110240 IFAS, Gainesvile, FL 32611, USA

* Correspondence: guanz@ufl.edu; Tel.: +1-813-633-4138

† These authors contributed equally to this work.

Academic Editor: Vincenzo Torretta

Received: 25 August 2016; Accepted: 12 December 2016; Published: 15 December 2016

Abstract: The Poyang Lake wetland has been at the center of discussion in China's wetland restoration initiative because of the extent of its ecosystem degradation. The purpose of this paper is to model farmers' willingness to participate in wetland restoration and analyze factors that will affect farmers' participation decisions. A household survey was conducted among 300 randomly selected farm-households in the Poyang Lake area, Jiangxi Province. A binary probit regression model is applied to investigate the impacts of farmer demographics, farm characteristics, and farmers' perceptions of wetland and wetland restoration policies on willingness to participate in wetland restoration. Results show that farmers' education level, household migrant members, number of dependents, household net income, farm type, and distance to urban areas have significant effects on farmers' participation in wetland restoration. Farmers' perceptions about the ecological values and benefits of wetlands and their knowledge about wetland restoration policies do not appear to significantly influence farmers' willingness to participate. A gap is identified between awareness of the importance of wetland restoration and willingness to take actions to restore wetlands. Farm-households tend to weigh personal needs and economic conditions when making participation decisions.

Keywords: wetland restoration; willingness to participate; farmer household; Poyang Lake; probit

1. Introduction

In the last few decades China has achieved unprecedented economic growth which has lifted hundreds of millions of people out of poverty. Over the years, however, the government's emphasis on growth has caused serious environmental issues. Since the 1950s, the government has actively promoted wetland "development", reclaiming wetlands and turning them into agricultural lands, to feed its increasingly large population. Land reclamation has caused widespread destruction of wetland ecosystems over the years. The consequences and implications have only been fully recognized in recent years due to frequent natural disasters and disruptions in agricultural production. In the last few years, Poyang Lake wetland restoration has been at the center of discussion in China's wetland ecosystem restoration initiative because of the scale and socioeconomic functions of the wetlands to this region. As the largest freshwater lake in China, Poyang Lake has experienced shrinking wetland areas, increased soil erosion, frequent floods and droughts, and a decline in wildlife species.

Wetlands, a valuable natural resource and an important feature in the landscape, are considered the most biologically diversified and productive ecosystem [1–3]. The Poyang Lake wetlands not only provide beneficial services to the communities and agricultural production, but also play a crucial ecological role in maintaining the ecosystem of the region and beyond, including water quality improvement, flooding buffers, climate regulation, wildlife habitat protection, and soil erosion and degradation prevention [4].

Recognizing these important functions and services provided by wetland ecosystems and the consequences of wetland destruction, the Chinese government has dramatically changed its policies in recent years. The central and provincial governments are now actively promoting wetland protection and pushing to return agricultural lands back to wetlands. Meanwhile, various wetland protection and management policies are being implemented or proposed to ensure harmonious interaction between economic development and environmental protection [5]. More than 20 laws and regulations related to wetland and wildlife protection have been enacted such as the China National Wetland Conservation Action Plan (issued on 8 November 2000) [6] and the China National Wetland Conservation Project Planning (issued on 2 February 2004) [6]. Since 2006, a series of programs in wetland protection and restoration have been initiated, and more than 30 billion RMB (equivalent to about 5 billion US dollars) have been invested in wetland conservation.

Among the many initiatives, the central government explicitly stated in the National Wetland Protection Plan that the Poyang Lake wetlands should be restored and protected. In response to this Plan, the provincial and local governments in the Poyang Lake area have made tremendous efforts to address the environmental problems caused by agricultural activities.

Local farmers' willingness to participate is crucial for the success of wetland restoration in the Poyang Lake area. However, promoting wetland restoration can be difficult because of the potential economic loss it could bring to farmers due to lost farmland. Hence, it is important to understand factors that affect farmers' willingness to participate and to identify effective policy instruments to motivate farmers' participation and to ensure success of such policies.

In the literature, there are a number of economic studies that focus on identifying factors affecting willingness to participate in wetland restoration [3,7–10] However, there are limited studies that address China's wetland issues in these respects. In this study, we employ a probit model to investigate the factors that influence farmers' willingness to participate in wetland restoration and, based on the model results, make policy recommendations to promote sustainable development in the Poyang Lake area. Understanding the factors that affect participation is crucial to improving the design and implementation of wetland restoration programs, thus making the programs more effective and achieving higher participation levels.

The rest of the paper is organized as follows: in Section 2, we review previous economics literature on wetlands and wetland restoration. Section 3 provides background information on the study area and describes the data, followed by the empirical model. Section 4 presents and discusses estimation results. The final section concludes the paper with a discussion on policy implications.

2. Previous Literature

There is a rich literature that describes individual participation decisions in environmental programs [8,11–14]. In this review, we focus on empirical studies analyzing participation incentives and identifying factors affecting wetland restoration program participation (see Table 1 for more details). Söderqvist [15] studied the determinants of farmer incentives to adopt the wetlands creation program in southern Sweden. Results indicated that private profitability was not the only factor swaying farmers' participation; environmental benefits were also essential in determining participation. Both Ambastha et al. [16] and Yu and Belcher [10] found farm characteristics such as farm size or cultivation area had significant influences on farmers' willingness to support wetland protection and conservation. Meanwhile, Ghosh and Mondal [17] examined the effects of socioeconomic factors on households' willingness to contribute to the Chanda Beel freshwater wetland management program in Bangladesh; they showed that education and household income were positively associated with willingness to contribute while age was negatively associated with willingness to contribute. Kim and Petrolia [18] estimated factors that affect local households' willingness for preventing future loss of Louisiana coastal wetlands in the United States. In addition to the positive effect of individual characteristics such as age, race, and income, perceived hurricane protection benefits, environmental and recreational benefits of wetland restoration as well as an individual's confidence in government policy were also found to be important factors for respondents to support wetland conservation. Furthermore, Dedah [19] showed that in addition to landowner characteristics, landowners' attitudes toward wetland conservation played an important role in determining the likelihood of participation in coastal wetland restoration projects in Louisiana.

In contrast to the rich literature discussed above, there has been little attention on China's wetland restoration programs except by Zhang et al. [20] and Kong et al. [21]. Zhang et al. [20] examined factors affecting farmers' participation in the conversion of cultivated land to wetlands in the Sanjiang National Nature Reserve. They concluded that age, education, cultivated land size, and farmers' perceived benefits and risks of wetland restoration were important factors for farmer participation. In contrast, Kong et al. [9] investigated determinants for farmers' willingness to pay (WTP) to retain the right for using cultivated wetlands for production purposes; they found that variables such as farmers' income source, geographical location, arable land area, and benefits associated with improvement of wetland resources were significantly related to farmers' willingness to contribute to wetland restoration. In this study, we propose an empirical model to analyze farmers' participation decisions in restoring wetlands from production and identify factors influencing farmers' decisions to participate in wetland restoration in the Poyang Lake area. Based on model predictions, we further provide policy recommendations that address issues related to program design, program effectiveness, and farmer incentives to participate in restoring wetlands in the Poyang Lake area.

Table 1. Main factors and identified effects in empirical studies of wetland westoration participation.

Study	Main Factors and Identified Effects	
Ambastha et al. [16]	Negative:	Kharif season land size
	Positive:	Land area in reserve, Rabi season land size
	Not Significant:	Education, Household size
Dedah [19]	Positive:	Ownership, Wetland conservation attitudes
	Negative:	Land used for agricultural production
Ghosh and Mondal [17]	Negative:	Age
	Positive:	Education, Income
	Not Significant:	Gender, Occupation
Kim and Petrolia [18]	Positive:	Age, Race, Income, Environmental benefits, Policy
Kong et al. [21]	Negative:	Residential location
	Positive:	Income source, Farmland size, Benefits associated with improvement of wetland resources
	Not Significant:	Gender, Household size, Household income
Söderqvist [15]	Negative:	Residence, Private profitability
	Positive:	Environmental benefits
	Not Significant:	Age
Yu and Belcher [10]	Negative:	Farm size, Farming experience, Risk/cost associated with wetlands
	Positive:	Payment, Benefit associated with wetland
	Not Significant:	Age, Education
Zhang et al. [20]	Negative:	Age, Farmland size, Perceived risks
	Positive:	Education, Location, Perceived benefits
	Not Significant:	Gender, Lengths of residency, Household size, Income

Notes: Only those factors relevant to this study are reported in this table.

3. Materials and Methods

3.1. Survey and Data Information

The study area for this research is approximately 41,200 km^2 and is located in the southern part of China (Figure 1). The region is in a subtropical climate zone, with an annual average temperature of

16–18 °C and annual average precipitation of 1600 mm. With its rich biodiversity, the Poyang Lake wetlands, the sixth largest wetlands in the world and the largest wildlife habitat for migratory birds in Asia, is referred to as the "second Great Wall" and the "rare bird kingdom" of China.

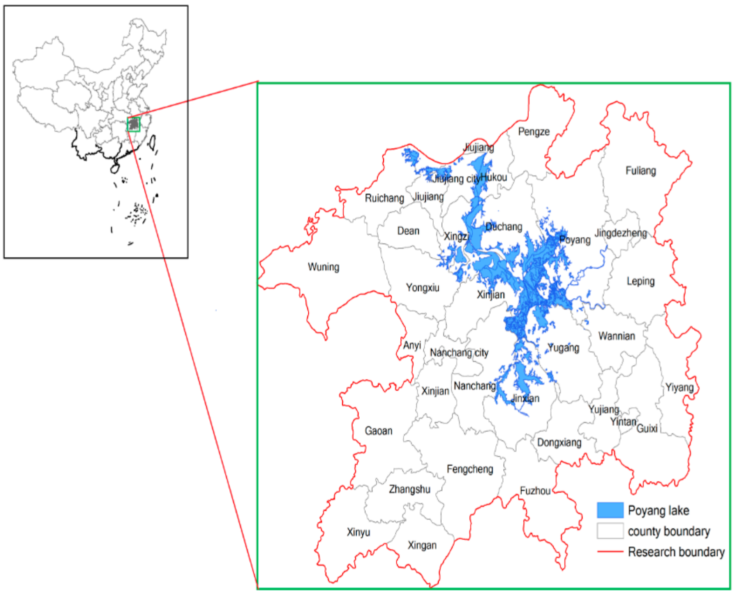

Figure 1. Location of Poyang Lake Wetlands.

The data used for this study were collected from a household survey conducted in the Poyang Lake area in 2012. The survey contained 45 questions eliciting information on: (i) farmers' individual characteristics, including gender, age, and education level; (ii) farmers' household characteristics, such as distance of household to urban areas, number of workers, migrant members, and dependent(s) in household; (iii) farm operation characteristics such as farm size, farmer type, net annual household income, and proportion of agricultural profits to net annual household income; and; (iv) farmers' knowledge and attitude toward wetland ecological functions, wetland restoration policies, and wetland restoration. Originally, 300 farm households in Poyang Lake area were randomly selected for the survey questionnaire. After excluding questionnaires with missing or inconsistent information (i.e., incomplete or inconsistent information on farmer demographics, farm characteristics, and knowledge and attitude toward wetlands), the final total was 256 respondents.

Table 2 presents the summary statistics of the data. More than 80% of the respondents were older than 30 years old, and the majority (65.6%) of respondents were male. For the heads of household, 66.4% had a primary school or middle school education level while 25.4% had a high school or above education level. Most (89.1%) of the surveyed households had dependent(s) defined as senior or minor, 46.1% of the households had two or three farm workers, 20.3% of the households had five or more farm workers, and 78.3% of the households had migrant members. The number of migrant household members in the Poyang Lake area was slightly higher than the provincial average of 70% in Jiangxi, which is one of the most important migrant-sending provinces in China. Of the surveyed households owning farmland, 9.8% owned 0.067 hectares (1 mu) or less, 45.7% owned between 0.20 and 0.467 hectares (between 3 and 7 mu), and 20.7% owned over 0.467 hectares (7 mu). In this survey, 33.2% of the households indicated that their agricultural income accounted for less than or equal to 20% of their total household net income while 26.6% of the households indicated that their agricultural income exceeded 50% of their total household net income. Respondents living 30 km or more from urban areas accounted for 44.5% of the sample.

Table 2. Summary statistics of variables.

Variable Name		Definition	Mean	Std. Err
Dependent variable				
Willingness to participate		binary, 1 if willing to participate in wetland restoration, 0 otherwise	0.512	0.501
Independent variables				
Age		farmer's age in years	44.363	14.531
Gender		binary, 1 if male, 0 otherwise	0.656	0.476
Education		1 if illiterate, 2 if primary school, 3 if middle school, 4 if high school, 5 vocational school or above	2.867	1.073
Dependent		binary, 1 if household has dependent, 0 otherwise	0.891	0.313
Manpower		number of available workers in the household	3.395	1.160
Migrant		binary, 1 if household has migrant members, 0 otherwise	0.738	0.440
Acreage		farmland acreage owned or managed: 1 if acreage < 0.0667, 2 if acreage = 0.0667~0.2001, 3 if acreage = 0.2001~0.4669, 4 if acreage > 0.4669	2.773	0.888
Net income		net household income divided by 1000 (RMB)	47.676	67.466
Agriculture profit ratio		proportion of agricultural profit to net household income	0.365	0.274
Cropper		binary, 1 if the farmer mainly works in cropping, 0 otherwise	0.723	0.448
Non-agriculture		binary 1 if the farmer works in non-agricultural area, 0 otherwise	0.133	0.340
Distance		distance from urban areas (km)	33.668	36.645
Policy knowledge		1 if the farmer knows about the wetland restoration policies, 0 otherwise	0.465	0.500
Benefit knowledge		1 if the farmer knows about the ecological benefits and values of wetland, 0 otherwise	0.621	0.486
Wetland functions	Controlling flood and drought	1 if the farmer chooses controlling flood and drought as one of the three most important ecological functions, 0 otherwise	0.716	0.452
	Conserving Water	1 if the farmer chooses conserving water as one of the three most important ecological functions, 0 otherwise	0.494	0.501
	Regulating climate	1 if the farmer chooses regulating climate as one of the three most important ecological functions, 0 otherwise	0.451	0.499

In general, the responses toward wetland restoration were positive. More than 62% of respondents (159 farmers) indicated that they had certain knowledge about the ecological benefits and values of wetlands. Respondents were then asked to choose the three ecological functions of wetlands they believed to be the most beneficial to their daily lives and agricultural production activities among the following six: improving water quality, regulating climate, controlling flood and drought, conserving water, settling sediment and pollutants, and conserving biodiversity. The top three wetland functions chosen by the respondents were flood and drought control (184 votes), water conservation (143 votes), and water quality improvement (127 votes). All the 127 farmers who chose purifying water also chose conserving water as the most important functions in their answers. Hence, in the regression model, the function of regulating climate change is used instead, to create the third wetland function dummy in addition to the controlling flood and drought function and the conserving water function to avoid collinearity. Only eight farmers believed that wetlands are important for biodiversity conservation in the ecosystem (see details in Table 3).

Table 3. Farmer perceived importance of wetland functions.

	Wetland Functions	Observations
1	Controlling flood and drought	184
2	Conserving water	143
3	Improving water quality	127
4	Regulating climate change	116
5	Settling sediments and pollutants	33
6	Conserving biodiversity	8

In addition, about half of the respondents (46.5%) indicated that they know about government policies related to wetland restoration and protection. Almost all respondents (98%) agreed that wetlands should be protected and restored. Nonetheless, positive attitudes toward wetland restoration do not necessarily imply that farmers are willing to participate in wetland restoration. Among the 256 respondents in the final sample, 131 farmers expressed willingness to participate in wetland restoration (accounting for 51.2% of the total) while 125 farmers showed no willingness to participate (accounting for about 48.8% of the total).

3.2. Econometric Model

An individual farmer is assumed to maximize the expected utility gain from participating in wetland restoration. Let U_P^* be the expected utility when a farmer is willing to participate and U_N^* be the expected utility of not participating in wetland restoration. We then can define the farmer's decision process as follows:

$$Willingness\ to\ Participate = \begin{cases} 1 & \text{if } U_P^* - U_N^* > 0 \\ 0 & \text{if } U_P^* - U_N^* \leq 0 \end{cases}. \tag{1}$$

Hence, a farmer is willing to participate in wetland restoration if and only if the expected utility from participating is greater than that of not participating, that is, $U_P^* > U_N^*$.

In this paper, a probit model is proposed to estimate the binary choice of farmers' willingness to participate (For a robustness check, a logit model and a linear probability model (LPM) are also estimated (see Table 4 for details)). Following Wooldridge [22], the binary choice of willingness to participate is assumed to be generated by a linear latent variable model. The latent variable (y_i^*) indicates farmers' net utility gain by participating in the wetland restoration program. $\boldsymbol{x}$ is a vector of attributes determining farmers' willingness to participate in wetland restoration, containing farmers' individual and household characteristics; farm operation characteristics; and variables representing farmers' perceptions about wetland value and benefits and farmers' knowledge about wetland restoration policies. The random term e is assumed to follow a normal distribution with a zero mean and variance σ^2.

Table 4. Estimated coefficients and marginal effects.

Explanatory Variable	Dependent Variable: Willingness to Participate (1 = Willing to Participate, 0 = Not Willing to Participate)				
	Probit		Logit		Linear Probability Model (LPM)
	Coefficient	Marginal Effects	Coefficient	Marginal Effects	Coefficient/Marginal Effects
Age	0.010 (0.009)	0.003 (0.003)	0.016 (0.016)	0.003 (0.003)	0.004 (0.003)
Gender	0.083 (0.195)	0.024 (0.057)	0.149 (0.336)	0.026 (0.057)	0.024 (0.060)
Education	0.357 *** (0.133)	0.105 *** (0.037)	0.620 *** (0.234)	0.106 *** (0.038)	0.111 *** (0.039)
Dependent	−0.597 ** (0.295)	−0.175 ** (0.085)	−0.992 * (0.509)	−0.170 ** (0.086)	−0.181 * (0.093)
Manpower	−0.029 (0.099)	−0.008 (0.029)	−0.053 (0.171)	−0.009 (0.029)	−0.043 (0.029)
Migrant	0.408 * (0.222)	0.119 * (0.064)	0.651 * (0.382)	0.112 * (0.065)	0.145 ** (0.074)
Acreage (Hectares)	0.169 (0.127)	0.049 (0.036)	0.284 (0.225)	0.049 (0.038)	0.039 (0.040)
Net Income	−0.009 ** (0.004)	−0.003 *** (0.001)	−0.015 ** (0.006)	−0.003 *** (0.001)	−0.001 (0.000)
Agricultural profit ratio	0.269 (0.397)	0.079 (0.118)	0.444 (0.684)	0.076 (0.117)	0.126 (0.115)
Cropper	−0.946 *** (0.342)	−0.277 *** (0.099)	−1.584 ** (0.638)	−0.272 ** (0.106)	−0.268 *** (0.097)
Non-agriculture	−0.514 (0.393)	−0.150 (0.115)	−0.841 (0.695)	−0.144 (0.119)	−0.127 (0.114)
Distance	−0.007 ** (0.003)	−0.002 ** (0.001)	−0.013 ** (0.006)	−0.002 ** (0.001)	−0.002 ** (0.001)
Policy knowledge	−0.343 (0.217)	−0.100 (0.062)	−30.597 (0.373)	−0.103 (0.063)	−0.115 (0.065)
Benefit knowledge	−0.297 (0.220)	−0.087 (0.374)	−0.508 (0.374)	−0.087 (0.063)	−0.103 (0.070)
Function_flood&drought	0.031 (0.219)	0.009 (0.063)	0.014 (0.380)	0.002 (0.065)	−0.010 (0.071)
Function_conservation	0.477 ** (0.222)	0.140 ** (0.064)	0.804 ** (0.381)	0.138 ** (0.064)	0.179 ** (0.071)
Function_climate	0.031 (0.206)	0.009 (0.060)	0.063 (0.356)	0.011 (0.061)	0.004 (0.066)
No. of Observations	256		256		256
Prob > χ^2	0.000		0.000		0.000
Pseudo R^2	0.254		0.255		0.294
Log likelihood	−132.35		−132.11		-

Notes: Robust standard errors are reported in parentheses. * Significant at 10%, ** Significant at 5%, *** Significant at 1%.

$$y_i^* = \boldsymbol{x_i\theta} + e_i \quad e_i|\boldsymbol{x_i} \sim N\left(0\,,\,\sigma^2\right) \tag{2}$$

$$Willingness\ to\ Participate = \begin{cases} 1 & \text{if } y_i^* > 0 \\ 0 & \text{if } y_i^* \leq 0 \end{cases} \tag{3}$$

$$\begin{aligned} P(Willingness\ to\ Participate = 1|\boldsymbol{x_i}) = P\left(y_i^* > 0|\boldsymbol{x_i}\right) = P(\boldsymbol{x_i\theta} + e_i > 0|\boldsymbol{x_i}) \\ = P(e_i > -\boldsymbol{x_i\theta}|\boldsymbol{x_i}) = P\left(\tfrac{e_i}{\sigma} > -\tfrac{\boldsymbol{x_i\theta}}{\sigma}|\boldsymbol{x_i}\right) = 1 - \Phi\left(-\tfrac{\boldsymbol{x_i\theta}}{\sigma}\right) = \Phi\left(\tfrac{\boldsymbol{x_i\theta}}{\sigma}\right) \end{aligned}. \tag{4}$$

Hence, the probability density function of willingness to participate in wetland restoration estimation is characterized by

$$f(y|\boldsymbol{x}\,;\,\boldsymbol{\theta}) = \left[1 - \Phi\left(\frac{\boldsymbol{x_i\theta}}{\sigma}\right)\right]^{1[y=0]} \Phi\left(\frac{\boldsymbol{x_i\theta}}{\sigma}\right)^{1[y=1]}. \tag{5}$$

The associated log-likelihood function used for maximum likelihood estimation (MLE) is

$$l_i(y|\boldsymbol{x}) = 1[y = 0]log\left[1 - \Phi\left(\frac{\boldsymbol{x_i\theta}}{\sigma}\right)\right] + 1[y = 1]\Phi\left(\frac{\boldsymbol{x_i\theta}}{\sigma}\right). \tag{6}$$

4. Results and Discussion

The estimated results and marginal effects from the probit estimation are reported in Table 4. For a robustness check, we also estimated the logit and linear probability models (LPM), which all provide similar results. The discussion below is based on the probit model.

As shown in Table 1, previous studies show mixed results in the effects of demographic characteristics on farmers' participation decisions. For example, while Söderqvist [15] shows that age has no impact on wetland restoration decisions, Petrolia and Kim [23] find a positive impact, and Ghosh and Mondal [17] and Zhang et al. [20] find a negative impact. Our results also suggest that age has no significant influence on farmers' willingness to participate in wetland restoration in our sample. Similar to Ghosh and Mondal [17] and Zhang et al. [20], gender is also found to not affect farmers' willingness to participate. Consistent with most empirical results, education level (Education) plays an important role in farmers' participation decisions. Its coefficient is positive and statistically significant at the 1% level. The average marginal effect demonstrates that an individual farmer's willingness to participate will increase by 10.6 percentage points as his education attainment increases by one level. Farmers with higher education attainment have stronger environmental protection awareness and are also more receptive to new ideas. Therefore, these farmers tend to be more willing to participate in wetland restoration. In addition, farmers with higher education levels have more job opportunities in non-agricultural sectors than those with lower education levels, so they are more likely to participate in wetland restoration. According to our survey data, 73% of farmers with vocational school or higher education levels are willing to participate while only 32% of illiterate farmers are willing to participate in wetland restoration.

The number of available workers in the household (Manpower) seems to have no significant influence on farmers' participation decisions. However, whether or not the household has dependent(s) (Dependent) does significantly affect farmers' willingness to participate; the likelihood of participation for those households with dependents is 17 percentage points lower. Compared to households without dependents, farmers with dependents face more responsibilities and heavier economic burdens in supporting their families. Because participating in wetland restoration may be associated with loss of land or income, farmers with dependents tend to be more risk averse and less likely to participate in wetland restoration.

The positive coefficient of the migrant member factor (Migrant) suggests that households with migrant members are more likely to participate in wetland restoration than those without migrant members because they have less unemployment and an easier transition to non-agricultural sectors. The marginal effect shows willingness to participate in wetland restoration for farmer-households with migrant members will increase by 12 percentage points more than those without migrant members.

Previous results about the effect of farm size is also mixed, with a positive effect found by Kong et al. [9] and a negative effect found in work by Yu and Belcher [10] and Zhang et al. [20]. However, our results indicate that farm size does not affect farmers' willingness to participate in wetland restoration, with the sign of the farm size (Acreage) coefficient being positive but not statistically significant. Larger-scale farmers may be more willing to participate in wetland restoration because they have more land available for farming, thus restoring part of their farmland to wetlands would only partially affect their agricultural activities. Smaller-scale farmers may also be willing to participate because agricultural income may not be their dominant sources of income; that is, they receive less income from agricultural production than from non-cultivation activities. Hence, the empirical effect of farm size on an individual's willingness to participate is ambiguous and may largely depend on the heterogeneous farm sizes in the dataset representing the population.

Nonetheless, this insignificant result may also be attributable to the fact that variations in farm size are not fully reflected in our data because a categorical number is used to measure farm size.

Unlike Zhang et al. [20] and Kong et al. [21], we find that net household income (Net income) is negatively associated with farmers' participation in wetland restoration in China. The coefficient is negative and statistically significant at the 5% level. The marginal effect shows that an increase of 10,000 RMB (1 RMB ≈ 0.17 USD) in net household income decreases participation probability by three percentage points. This result differs from the positive impact reported by Ghosh and Mondal [17] and Petrolia and Kim [23]. This finding may be attributed to the fact that farmers with higher net household incomes tend to be non-cropping households and their main income sources are non-agricultural activities (the correlation between household net income and non-agricultural income is about 0.97). For relatively rich farmers, the marginal utility of holding additional farmland is much higher than the marginal utility of obtaining monetary compensation (which is often low) for wetland restoration, thus leading to less willingness to participate in wetland restoration.

It is interesting to note that being a crop farmer (Cropper) will significantly reduce a farmer's willingness to participate in wetland restoration by 27.7 percentage points. A crop farmer is defined as a farmer who is mainly engaged in crop production using cultivated land. As shown in Table 2, the variable Cropper is a binary variable that equals one if a farmer is a crop farmer and equals zero if a farmer is mainly engaged in non-agricultural activities or other agricultural activities such as animal production (i.e., livestock), aquaculture, or natural/wild fishing. This result clearly indicates a competitive relationship between crop production and wetland restoration because crop farmers' income will decrease sharply if they restore their farmland to wetlands. Dedah [19] found similar results that landowners engaged in farming activities are less likely to invest in wetland restoration.

The effect of distance to urban area (Distance) suggests that the probability of farmers' participation in wetland restoration decreases when farmers are farther away from urban areas due to less information about environmental protection from government outreach activities. As reported in Table 4, the probability of participating in wetland restoration will decrease by two percentage points as the distance to urban areas increases by 10 km.

We find that knowledge about government wetlands restoration policy (Policy knowledge) has no significant impact on farmers' willingness to participate. Given various issues in policy and policy enforcement in China, it is unsurprising to observe little impact of government restoration policies on farmers' willingness to participate for several reasons. First, governments in the Poyang Lake area lack a consistent policy across the region. Some administrative districts (townships and counties) offer land rental payments while others offer credit access from state-owned banks, subsidized loans, or vocational training to transition to non-agricultural jobs. Farmers may not consider non-monetary support (such as training) an attractive incentive compared to direct land rental payments. Second, there are no standard or valuation schemes in place at the national or provincial level. The current payments are mostly offered by local governments on an ad hoc basis and are often too low compared to agricultural income. For example, on average, farm-household income in Jiangxi Province was approximately \$1350/hectare (\$90/mu) in 2013 and \$1515/hectare (\$101/mu) in 2014. However, one administrative district offered about \$225/hectare (\$15/mu) per year for restored lands. Third, there exist various enforcement problems. In some cases, the restoration policies are not implemented due to ill-aligned local interests or budget constraints of local governments. In other cases, the restoration policies are poorly implemented or are enforced in highly controversial ways, such as forced relocation, that often create tensions and confrontations between farmers and enforcing agencies. All these issues could dampen farmers' beliefs in government policies and thus weaken the impact of the policies.

Although no significant impact of awareness of wetland's ecological benefits and values (Benefit knowledge) is found on farmers' willingness to participate, the benefits of conserving water is identified as significantly increasing farmers' willingness to participate by 14 percentage points. This is consistent with the findings of Kim and Petrolia [18] and Zhang et al. [20], both of which showed perceived benefits of wetland are positively associated with farmers' participation decisions. However, the perceived benefits of the other two wetland functions (i.e., controlling flood and drought and regulating climate) appear to not significantly impact farmers' participation decisions.

Our results may indicate a lag between farmers' recognition of wetland restoration and taking personal actions to restore wetlands. Farmers may have realized the importance as well as the benefits of wetland restoration through the process of witnessing wetland degradation and experiencing agricultural production disruptions. However, farmers may still hesitate when personal actions are required to restore wetlands, especially when participation in wetland restoration involves direct land loss and potential economic loss. Farmers tend to weigh personal needs and conditions when making such participation decisions.

5. Conclusions

This study provides in-depth insights into individual farmers' participation decisions in wetland restoration. Using survey data from a farm-household survey in the Poyang Lake area in China, our model suggests that farmers' education level and the number of household migrant members have a significant, positive influence on farmers' willingness to participate, while net household income and distance to urban areas have a negative impact on farmers' willingness to participate. These results suggest that individual and farm characteristics are important determinants of farmers' participation in wetland restoration.

Understanding farmers' decision processes is important for designing an effective and efficient wetland restoration program. As revealed in our analysis, farmers' supportive attitudes toward wetland restoration (e.g., recognizing the importance of wetland restoration and understanding government restoration polices) do not necessarily increase farmers' willingness to participate in wetland restoration when participation is directly linked to the loss of land or income. The decision to participate is rather a process of weighing personal and household needs and economic conditions. Hence, the government should introduce monetary incentives such as competitive compensation and bidding systems that would be budget efficient and effective in attracting enrollment.

Failure to elicit farmers' willingness to participate may indicate poor or ineffective government policies. The government should take concrete measures to ensure that their wetland restoration policies are consistently implemented at different government levels and across regions. The government should also make sure that policies are implemented properly. In particular, there should be appropriate and consistent land rental payment valuation schemes in place to avoid inconsistencies or arbitrariness when determining rental payments. Finally, it is important that the central and provincial governments work closely to make the program budget available, ideally at the provincial or central government level. Relying on local governments to cover wetland restoration costs could result in disincentives and inconsistencies that would hamper program implementation.

Our empirical results also show variations of willingness to participate in wetland restoration among farmers based on demographics and farm characteristics. This has important implications for designing targeted policy instruments to increase farmers' willingness to participate in wetland restoration in the Poyang Lake area. For example, households with migrant members are more likely to participate in wetland restoration. If the government created non-agricultural jobs for rural households, this could greatly increase farmers' incentives to take part in wetland restoration programs.

In addition, model results indicate that cropping farmers are less likely to participate in wetland restoration than non-croppers due to competing land use between farming activities and wetland restoration. To reduce this potential competition in land use, the government may consider providing both financial and technological support to promote non-cropping activities.

As farmers are less likely to participate in wetland restoration when they live farther away from urban areas, the government may also consider planning infrastructure investment in combination with wetland restoration to improve rural transportation and communications in the Poyang Lake area, which would help improve access to information and provide farmers with non-agricultural job opportunities, thus contributing to wetland restoration and protection.

Acknowledgments: This study is funded by the National Natural Science Foundation of China (No. 41261106 and No. 41361007), Social Science Foundation of China (No. 13&ZD160), Science and Technology Project of Department of Education of Jiangxi Province (No. GJJ12217), Social Science Foundation of Jiangxi Province (No. 11YJ36) and GANPO Outstanding Talents"555" Project.

Author Contributions: Honggen Zhu was the principal investigator (PI) of the grants and wrote the first draft. Zhengfei Guan revised the draft. Xuan Wei was invited to re-analyze the data and further revise and improve the paper. Zhengfei Guan finalized the manuscript.

Conflicts of Interest: The authors declare no conflict of interest. The founding sponsors had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, and in the decision to publish the results.

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