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Preferences in Farmland Eco-Compensation Methods: A Case Study of Wuhan, China

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Abstract: Successful farmland eco-compensation projects need to reflect the heterogeneous preferences both from suppliers and beneficiaries. This paper tries to answer this question by investigating both citizen and farmer preferences for different farmland eco-compensation methods in Wuhan, China, and explore some of the socio-demographic characteristics that contribute to their preferences. Based on the data of 288 citizens and 331 farmers, the multinomial logit model was employed to analyze their preferences for the four farmland eco-compensation methods (monetary compensation, in-kind compensation, technology compensation and policy compensation), respectively. The results show that: (1) Monetary compensation is the most welcomed farmland eco-compensation method among both citizens and farmers. (2) Despite farmers and citizens both putting a high value on monetary compensation methods, citizens are more likely to provide compensation methods that can help farmers improve their living standards in a sustainable method (in-kind compensation, technology compensation and policy compensation). Farmers are less likely to choose the in-kind compensation method. (3) The preference for farmland eco-compensation systems of farmers and citizens are influenced by different socio-demographic characteristics. The results can help the government to design more aimed farmland eco-compensation methods for farmers with different socio-demographic characteristics.

Keywords: heterogeneous preference; multinomial logit model; citizens and farmers; socio-demographic characteristics

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1. Introduction

The farmland ecosystem is one of the most essential ecosystems in the world [1]. It is regarded primarily as a source of provisioning services, providing humans with agricultural products, bio-energy, landscape facilities and animal habitats [2,3]. However, the farmland ecosystem is fragile and vulnerable to damage under the influence of external factors, resulting in soil erosion, decline of soil fertility, land salinization, biodiversity reduction and other phenomena [4], which affect food security, human health and even have an adverse effect on the global climate [5]. Therefore, many countries are implementing farmland protection programs that can decrease farmland loss. However, the implementation of compulsory measures has resulted in the loss of economic interests of the protectors of farmland resources and the injustice between providers and beneficiaries of farmland ecology services [3]. China has experienced rapid urbanization processes since the "reform and open" policy started in 1978. Millions of acres of farmland are converted into urban land every year, which brings a huge threat to the central government on farmland management due to its fundamental role in providing non-market goods and services [6]. The provision typically has an impact on the well-being of the whole society but reduce farmer incomes [6,7], since they are compulsorily asked to take measures to protect their farmland by the government, which limits the farmers' right to use farmland resources and makes them suffer economic losses in the process of urbanization [8]. Those protection measures may lead to injustice; for example, some environmental protection measures may restrict the legitimate rights of the residents and the district [9], such as the economic interests and the development opportunities, resulting in uneven welfare among stakeholders. As a result, farmers' enthusiasm for protecting their farmland will decrease, which will ultimately affect national food security and social stability.

Eco-compensation is a way to readjust economic costs and benefits among different stakeholders to maintain social equity [10], which could internalize environmental costs and strengthen the protection of the ecological environment [11]. In developed countries and regions, eco-compensation, which is usually called Payment for Ecosystem or Payment for Environment Service, has been regarded as an important measure to promote green agricultural production [12,13]. As a new environmental economic policy to coordinate the regional economic development and farmland protection, farmland eco-compensation is essential to establish an incentive distribution relationship and risk-sharing relationship among various stakeholders by adjusting the land benefits. It has received significant attention and has become one of the important ways for many countries to protect farmland, farmers' interests and ecological agricultural environments over recent years [14]. Agri-environmental Policies and the Conservation Reserve Program in the US [15,16], Environmentally Sensitive Areas [17–19], the Nitrate of Special Scientific Interest [20] in the EU and the Countryside Stewardship Scheme of the UK [21] are all explorations of farmland eco-compensation and have received widespread attention. Specifically, the Conservation Reserve Program in the US is defined as annual payments and a cost-sharing structure to allow producers to retire and restore environmentally sensitive farmlands [16], which can improve the quality and environmental performance of their farmland. Environmentally Sensitive Areas play a central role in European agri-environmental policy [17]. The member states of the European Community establish ecological zones for areas with significant environmental values and provide financial support to local farmers who protect the agri-environment [18] so as to maintain a balance between the environment and the local social and economic development. In the UK, the Countryside Stewardship Scheme is supported by financial incentives aimed to pay for positive environmental change in the countryside. In China, the government has also implemented farmland eco-compensation plans to achieve the balance between farmland protection and economic development [22]. The practice of returning farmland to forest and grassland, since the last century, is the first large-scale eco-compensation action undertaken in China [23]. The government provides free grain and money subsidies to farmers who return farmland to forests every year [24]. In 2008, the Third Plenary Session of the 17th CPC Central Committee explicitly proposed to "delimit permanent basic farmland and establish a protection and compensation mechanism". In 2013, the Report of the Third Plenary Session of the 18th CPC Central Committee proposed to implement the system of paid-use of resources and ecological compensation and promote the establishment of ecological compensation systems. The farmland eco-compensation system is increasingly reflected in national policies. At present, China is implementing farmland ecological protection projects such as returning farmland to forest, returning farmland to lakes and natural forest protection projects [25]. In addition to policies and projects developed and implemented at the national level, some pioneering regions have gradually begun piloting their own region-specific farmland eco-compensation policies since 2008. For example, Chengdu set up the Farmland Protection Fund in 2008. Taking different types and qualities of farmland as the standard grants a certain amount of funds to farmers who protect the farmland as their pension insurance subsidies [26]. The eco-compensation fund management method, formulated by Suzhou, compensates grass-roots government and local farmers through government financial transfer payments. It focuses on the eco-compensation of basic farmland, important ecological wetlands, water sources and ecological public welfare forests [27]. There are also eco-compensation measures for basic farmland in Guangzhou, Foshan, Shanghai and other cities.

Current research on farmland eco-compensation mainly focuses on theoretical analysis and system construction, measurement of farmland eco-compensation quotas and the analysis of farmers' willingness to participate in farmland eco-compensation. Reed [28] explored adjusting agri-environmental plans through discussion with land stakeholders to obtain higher returns on ecosystem services from the farmland and better subsidize the farmers. Tamara [29] studied the influence of psychological characteristics on the willingness to pay for farmland ecological services with high natural value in the Mediterranean. Page [30] studied farmers in New South Wales, Australia, and summarized the factors that hinder them from participating in conservation methods as scheme and farmer factors. Villanueva [31] employed a choice experiment to evaluate farmer preference for AES and found that there was high heterogeneity among farmers at different levels. Ma et al. [32] explored the necessity of farmland eco-compensation from the perspective of optimal allocation of land resources and also tried to establish a basic theoretical framework of farmland eco-compensation accounting. Wang et al. [33] analyzed the regional differences of farmland eco-compensation in Chengdu, Sichuan Province, and discussed the effect of different external environments on the farmers' willingness to participate in farmland protection. From the perspective of farmers' differentiation, Yang et al. [34] explored the influencing factors of farmer preference for farmland eco-compensation methods. Based on the survey data from Jingshan County, Hubei Province, Yu et al. [35] quantified the amount of farmland eco-compensation quota under the consideration of the willingness of farmers to adopt environmentally-friendly farming methods. Zhang et al. [36] estimated the eco-compensation standard of nitrogen non-point pollution in Yixing City, and the results show that eco-compensation may decrease dosages of nitrogen fertilizer.

Despite well-documented research on the criteria of eco-compensation [7,19,23,32–43], research concentrating on the preferences of farmland eco-compensation methods is relatively rare, especially when both the supplying and demanding perspectives are taken into consideration. In the existing research, farmers are the main body of study on farmland eco-compensation preferences because they are the direct participants in farmland ecological protection activities and the providers of farmland ecological services. There are not many studies on the preferences of farmland eco-compensation by citizens as suppliers. Citizens are the beneficiaries of ecological services and the providers of funds for farmland eco-compensation. Policy-makers in the farmland management area need to understand stakeholder preferences. An appropriate farmland ecological pattern is not only fundamentally important to improving the efficiency of farmland eco-compensation programs but can also improve supplier willingness to contribute to farmland protection and help beneficiaries get what they want in return [38]. All of this can help decision-makers design a more flexible farmland eco-compensation pattern. In particular, despite the pioneering implementation of farmland ecological compensation projects in Chengdu, Suzhou, the farmland eco-compensation project for Wuhan is still in fierce debate, which makes it of fundamental importance to investigate the stakeholder's preferences in advance. Compared with making improvements after the policy is implemented, the consideration of supplier and beneficiary preferences beforehand will significantly improve the efficiency and satisfaction of farmland eco-compensation programs. We hope that the results may be helpful for the government to formulate a more reasonable and effective farmland eco-compensation system and to promote the enthusiasm of citizens and farmers to protect the ecological aspects of the farmland environment. In addition, the selection of compensation methods is core to the successful implementation of eco-compensation programs [44]. The ecological compensation classification system varies with the goals of the research [45,46]. According to the type of natural resources, the ecological compensation can be divided into ecological compensation for forest, grassland, marine, wetlands and agricultural lands. According to the operating mechanism, the methods of ecological compensation can be divided into "Command and Control" and "Market-Based" instruments. The methods of ecological compensation can be divided into monetary, in-kind, technology and policy compensations [47,48]. In this paper, we want to explore the best compensation method for farmers, so the last classification system is adopted.

Therefore, employing the data obtained from the face-to-face questionnaire survey, the effects of some socio-demographic characteristics on citizen and farmer preferences of four farmland eco-compensation methods were explored in this study. This research attempts to provide insights into the establishment of future farmland eco-compensation programs in Wuhan, China. There are five sections in this article. The Methods and Materials are organized in Section 2, and Section 3 is the Empirical Results. The Discussion is presented in Section 4, and Section 5 focuses on the Conclusion.

2. Methods and Materials

2.1. Methodology

Previous studies have employed logit models to analyze whether respondents favor one specific farmland eco-compensation method or not [49]. When estimating the impacts of background variables on the probability of belonging to one of many methods, the standard practice is to estimate a separate logit model for each of the compensation methods [50]. The major drawback of this is, however, that the estimated probabilities do not necessarily add up to 100%. This is unsuitable when the farmland eco-compensation methods are described in the form of multinomial variables [51,52]. In this paper, four alternative methods (monetary compensation, in-kind compensation, technology compensation and policy compensation) are presented to both citizens and farmers for them to choose one as their favorite.

To overcome this problem, a different modeling strategy was adopted, and the multinomial logit model was employed. The use of a multinomial logit model made it possible to examine the impacts of background characteristics on groups within a unified modeling framework [53]. This model was particularly useful in the present study since respondents' selections are mutually exclusive and exhaustive, i.e., once the probabilities for three of the methods are estimated, the fourth level is predetermined.

In order to write down the likelihood function, the dependent variable (the selection of farmland eco-compensation method) was defined as $Y = j$ ($j = 1, \ldots, 4$, let $j = 1$ denote monetary compensation, $j = 2$ indicate in-kind compensation, $j = 3$ indicate technology compensation, and $j = 4$ represent policy compensation). By defining the indicator variable d_{ij}, which equals 1 when the ith individual is observed in the jth group, the log-likelihood function for N observations is described as follows [54]:

$$In\ L = \sum_{\mathrm{j}} \sum_{i} d_{ij} \ln \Pr(y_i = j) \tag{1}$$

The probability that an individual is observed to belong to one of the four groups is given by:

$$\Pr(y_i = j) = \frac{\exp(\beta_j x_t)}{1 + \sum \beta_j x_t} \tag{2}$$

and:

$$\Pr(y_i = 1) + \Pr(y_i = 2) + \Pr(y_i = 3) + \Pr(y_i = 4) = 1 \tag{3}$$

To form a complete model, the elements of the vector x_t were also defined; it consists of the background characteristics included in the model. When expressed in terms of odds, which are also called marginal effects, the coefficients in the MNL (multinomial logit) model can be interpreted as changes in probability, i.e., the effect of a unit increase in an explanatory variable on the probability of belonging to a certain group. This odd can be written as:

$$\phi_{m/n}(x_t) = \frac{\Pr(y_i = m)}{\Pr(y_i = n)} = \frac{\exp(\beta_m x_t)}{\exp(\beta_n x_t)} = \exp(\beta_m - \beta_n)x_t, m, n \in j, m \neq n \tag{4}$$

2.2. Study Area

As the largest city in central China, Wuhan is located at the intersection of the Yangtze River and its largest tributary, the Han River, and has 7 central districts and 6 rural districts. Wuhan is one of the two pilot cities for the construction of the energy-saving and environmentally-friendly society of China. The city covers an area of approximately 850,000 hectares, and 250,000 hectares of them are farmland. However, indisputably, the farmland in Wuhan has decreased dramatically over the past decade, leading to a serious decline in local food production and ecological services. People may also have concerns about the fertility of farmland in terms of food security and quality due to the excessive use of pesticides and chemical fertilizers. All the above have brought a challenge for local farmland management.

2.3. Data

Data of citizens and farmers were collected separately. The contents of the questionnaire for citizens and farmers were exactly the same. Background information of the study was given to the respondents so that everyone had a basic understanding of the issues involved with the problem of farmland and compensation policies. Then, their preferences for farmland eco-compensation methods and their socio-demographic characteristics were investigated in the last two parts of the questionnaire.

Respondents were surveyed by 13 trained enumerators between December 2019 and January 2020. According to the distribution area of farmland, the number of rural citizens, geographic location and socio-economic development in each region of Wuhan, the enumerators collected data on farmers in the Jiangxia District, Huangpi District and Caidian District. Four to five townships in each district were randomly chosen, and then 25–30 householders were randomly selected from each township for investigation. Due to the existence of farmers who refused to accept the survey, and invalid questionnaires, only 331 valid questionnaires were collected from farmers. The city survey was conducted by random sampling, and numerators conducted face-to-face interviews in the central district of Wuhan. The central district is mainly divided into three important areas, which are Wuchang, Hankou and Hanyang. Five parks or commercial streets with a large number of people were randomly selected in each area, and the enumerators conducted face-to-face interviews with citizens willing to be interviewed. Approximately 20 citizens were interviewed in each place. After eliminating the invalid questionnaires, 288 valid questionnaires of citizens were obtained. A total of 288 citizens and 331 farmers were surveyed in Wuhan, China.

3. Empirical Results

Generally speaking, monetary compensation is the most common and direct method of compensation. This means that the consumers and beneficiaries of ecological services and products pay money to the providers, thereby compensating them for the losses suffered in protecting the ecological environment. Usually, monetary compensation is operated by the central government, which transfers the cash to the farmer's account directly from a special fund. Compared with other compensation methods, monetary compensation has the advantages of simplicity, directness and convenient operation. In-kind compensation refers to the provision of material, labor, land and other production and living factors to compensate the indemnified, such as providing farmers with furniture, seeds, chemical fertilizer and machinery, to enhance their production capacity and ability to obtain economic benefits. This method of compensation can protect farmers' basic life and maintain the local social order. The grain subsidy in China's policy of returning farmland to forest belongs to this method. Technology compensation, which is also called intellectual compensation, refers to the free technical guidance and service consulting to ecological service and product providers. This method can improve farmers' technical level, management level and organizational ability, as well as cultivate technical and management talents to improve farmers' lives in the future. Policy compensation is generally divided into two types. One type involves local governments making use of their policy-making privileges to formulate innovative policies suitable for local conditions to promote social and economic development. The other type is that local governments directly compensate farmers by giving policy supports such as tax reduction policies, thereby improving their production and living standards.

3.1. Empirical Results of Citizens

3.1.1. Analysis of Citizens' Preference

As one of the main providers of farmland eco-compensation, citizens' preferences of farmland eco-compensation methods reflect their willingness to pay for the foundation. Therefore, the comprehensive study of citizens' preferences may assist local decision-makers in designing a more reasonable eco-compensation mechanism. Their preferences for different farmland eco-compensation methods are presented in Figure 1.

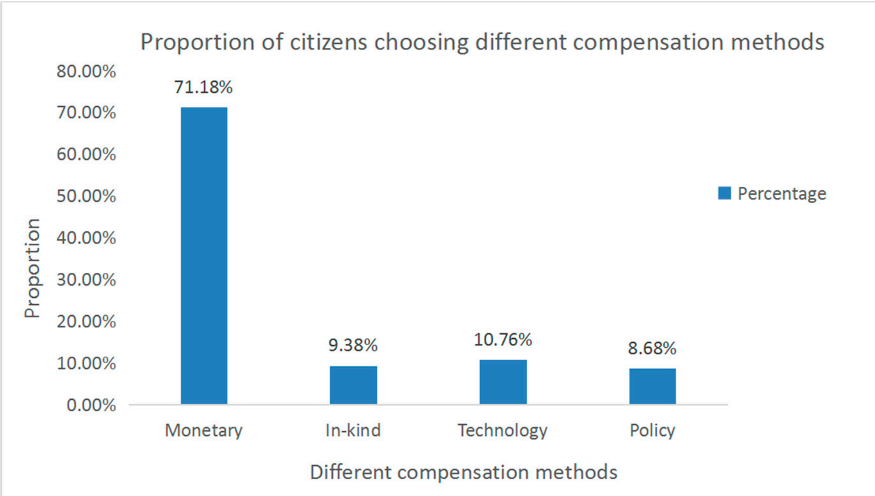

Figure 1. Citizens' preferences for different farmland eco-compensation methods. Developed based on questionnaire surveys.

According to the statistical result of the samples, 205 of 288 citizens preferred the monetary method for farmland eco-compensation, and their preferences for the other three methods were roughly the same. The reasons can be explained from the following aspects:

(1) Rent-seeking or corruption can be avoided if farmland eco-compensation is implemented in a monetary way and farmers can choose how to use the money. Compensation money can be directly compensated to farmers, avoiding transmission through governments at all levels, and reducing the opportunity for the government to use the power to intervene and embezzle. Citizens may be supportive of letting farmers have more choices in their production and life by providing money.

(2) Citizens' private time will be occupied if they choose the non-monetary compensation method, which makes them less likely to choose those methods. Moreover, the citizens were more likely to provide compensation methods that could help farmers improve their living standards in a sustainable way (in-kind and technological compensation methods). Citizens put a higher value on technological compensation because citizens' education levels were typically higher than that of farmers, which made the technological compensation method easier to accept by citizens rather than farmers.

3.1.2. Socio-Demographic Characteristics of Citizens

In the survey, citizens were presented with attitude and socio-demographic characteristic questions. Each respondent was presented with the following questions and asked to answer on a 5-point Likert scale according to their degree of agreement: "Do you hold the opinion that the water quality is important in your life?", "Have you realized that the farmland fertility/air quality is decreasing fast?". Citizens' socio-demographic characteristics are reported in Table 1, which includes their age, income and whether they are household owners or not.

Table 1. Variable definition for citizen questionnaires.

Variables	Definition	Value	Mean Value
Water	The degree of importance of water quality	5-point Likert Scale	4.1707
Fertility	The degree of importance of decreasing farmland fertility	5-point Likert Scale	3.7042
Air	The decreasing degree of air quality	5-point Likert Scale	4.1303
Income	Monthly income of the respondent	1000 Yuan	9.238
Holder	Whether the respondent is a household owner or not	1/0	0.3713
Age	The age of the respondent	Year	32.6703

Source: Developed by the authors based on the questionnaire surveys.

Table 1 shows that the average score of respondents who hold the opinion that water quality was important was larger than four, which is the same as respondents who believed air quality was declining. The average score for the decreasing degree of farmland fertility was 3.7042. It is also indicated that 37.13 percent of the respondents are household owners. Moreover, the average age of the respondents is 33, with an average income of 9238 Yuan monthly.

3.1.3. Econometric Results of MNL Model on Citizens

The STATA 12 mlogit command was employed to analyze the probability of respondents to select four different farmland eco-compensation methods and the factors contributing to their choices. In the estimation of the MNL model, the preference of one type of farmland eco-compensation method should be taken as the comparison group for the other three eco-compensation methods. In this article, the monetary compensation method was set as the comparison group. The estimated coefficient of variables represents the effect of those variables on the preference level of other farmland eco-compensation methods compared with the comparison group [54,55]. When the estimated coefficient of the variable is positive, it indicates that the selected variable has a positive effect on the preference of this eco-compensation method compared with the monetary compensation method as the compensation group. When the estimated coefficient of the variable is negative, it shows that the selected variable has a negative effect on the preference of this farmland eco-compensation method compared with the comparison group. After running the model, we found the Log-likelihood ratio = −218.1205, Pseudo R^2 = 0.1139 and P = 0.0000. It also showed that the model had a good fit [56]. With the monetary compensation method as the comparison group, the possibilities of the other three compensation methods, as well as the effect of significant socio-demographic characteristics on their choice, could be obtained. Our results are shown in Table 2.

The interpretation of the MNL model is complicated, so only the statistically significant variables were reported. In general, $P < 0.1$ indicates that the independent variable has a significant effect on the dependent variable. According to Table 1, with the monetary compensation as the comparison group, older respondents who had realized the decline in farmland fertility, and were household owners, were more likely to choose the in-kind and technology methods. For older respondents, it appears that they believed the in-kind and technology methods could help farmers in a direct and practical way. They also appear to have believed that practical methods could directly solve the decline in farmland fertility. Moreover, citizens with higher income also favored the in-kind compensation method compared with the monetary compensation method, which can be explained as they believed farmers could benefit directly from this method without realizing the possibility of the rent-seeking phenomenon by the government or foundation. On the contrary, citizens with less income were more likely to choose the policy compensation method compared with the monetary compensation method since they did not need to pay any cost for this way of compensation. In addition, citizens' income had no obvious effect on their selection of policy compensation methods.

Table 2. Results of MNL model on citizen questionnaire results.

Method	Coef.	Odds Ratio	Std.Err.	z	P > z
In-kind					
Water	−0.4101	0.6636	0.2367	−1.73	0.083
Fertility	1.0992	3.0017	0.3125	3.52	0.000
Air	−0.7371	0.4785	0.2271	−3.25	0.001
Income	0.0001	1.0001	0.0000	3.05	0.002
Holder	1.2556	3.5099	0.6226	2.02	0.044
Age	0.0430	1.0439	0.0176	2.44	0.015
_cons	−5.8107	0.0030	1.7461	−3.33	0.001
Technology					
Water	−0.3381	0.7131	0.2055	−1.65	0.100
Fertility	0.3513	1.4210	0.2426	1.45	0.148
Air	−0.1371	0.8719	0.2073	−0.66	0.508
Income	0.0000	1.0000	0.0000	0.84	0.399
Holder	0.9828	2.6718	0.5414	1.82	0.069
Age	0.0569	1.0585	0.0149	3.81	0.000
_cons	−4.9958	0.0068	1.5880	-3.15	0.002
Policy					
Water	0.3244	1.3833	0.2827	1.15	0.251
Fertility	−0.1302	0.8779	0.2665	−0.49	0.625
Air	−0.0152	0.9849	0.2372	−0.06	0.949
Income	−0.0001	0.9999	0.0001	−1.91	0.056
Holder	0.4720	1.6031	0.6552	0.72	0.471
Age	−0.0047	0.9954	0.0233	−0.20	0.842
_cons	−2.7975	0.0610	2.1091	−1.33	0.185

Note: Outcome Way = monetary is the comparison group. Contents of the above table (Coef., model coefficient; Std. Err., standard error; z, z-value.) were created by STATA 12. And "_cons" is the constant term.

Specifically, compared with the monetary compensation group, the importance of water and the coefficient of air quality decline in the in-kind compensation group were −0.4101 and −0.7371, respectively. We calculated that these two variables reduced the probability of choosing the in-kind compensation method compared with monetary compensation by 34 and 52 percentage points. Compared with the comparison group, the citizens' cognition degree on the decline of farmland fertility, whether household owner, income, and age all increased the probability of selecting the in-kind compensation method.

For the technology compensation group, the coefficient for the importance of water was −0.3381. This variable decreased the likelihood of choosing the technology compensation group by 29 percentage points compared with the comparison group. The citizens' age and household ownership had a significant positive effect on their preference for selecting the technology compensation method, which increased the probabilities by 167 and 6 percentage points compared with the monetary compensation group, respectively.

In regard to the group of policy compensation, citizens' income had a significant effect on their selection, although the possibility was only decreased by one percentage point compared with the monetary compensation group.

In summary, the citizens' cognition of the declining situation of farmland fertility, age, income and household ownership had a positive effect on the selection of the in-kind compensation group. However, citizens' cognition of the importance of water quality and the declining situation of air quality decreased the probability of choosing in-kind compensation. Citizens' age and income had positive effects on their selection of the technology compensation method, but their cognition of the importance of water quality decreased the possibility of belonging to this group. In addition, citizens' income had a slight negative impact on their choice of policy compensation method.

3.2. Empirical Results of Farmers

3.2.1. Analysis of Farmers' Preference

Compared with citizens, farmers were the beneficiaries of farmland eco-compensation. Their preferences for different farmland eco-compensation methods can provide a basis for the possible application of the farmland eco-compensation foundation. Therefore, understanding farmers' preferences may help local governments to design a more welcomed farmland eco-compensation mechanism. Their preferences for different farmland eco-compensation methods are presented in Figure 2.

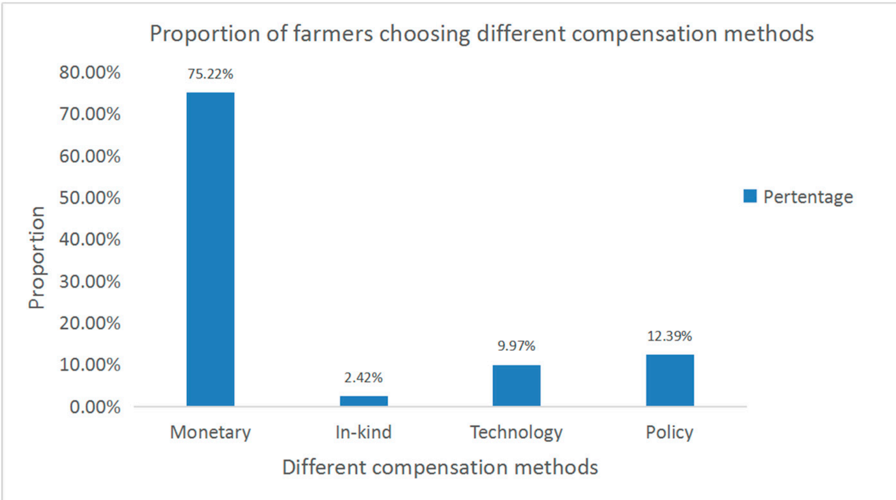

Figure 2. Farmers' preferences for different farmland eco-compensation methods. Developed based on the farmer's questionnaire surveys.

According to the statistical result of the samples, 249 of 331 (75.22%) farmers preferred to accept the farmland eco-compensation in a monetary way. The reasons accounting for this can be explained by the following aspects:

(1) Monetary compensation is the most favored compensation method due to its simplicity, directness and being less likely to be corrupted by the relevant department. Monetary compensation also gives farmers more choices. After the compensation funds are distributed to the farmers, the control will be completely owned by the farmers. Farmers can purchase materials and agricultural machinery according to their actual needs and make the best use of the compensation.

(2) Farmers appear to hope that the local government can take some measures on preferential policies, such as reducing the taxes on the farmer-owned property.

(3) They also appear to desire to learn about new technologies and improve their income in the long term. However, there are still many farmers who do not appear to realize the advantages and importance of professional training. Instead, they believe that participating in training takes up time and has no significant effect on current family income. In addition to the lack of farmers' own comprehension, the government also has improper considerations. For example, the training is not integrated with the local condition, and targeted training cannot be conducted according to farmers in different situations. These are likely reasons that made technology compensation less popular among farmers.

(4) Farmers strongly disliked the in-kind compensation because it may easily lead to rent-seeking. In the process of distributing and receiving materials, it is inevitable that there will be losses and reductions in materials. Moreover, there are a large number of farmers in the region, which makes it is difficult to meet all their needs simultaneously. Different farmers have different needs for agricultural materials, and the materials provided by compensation are probably not what the farmers need or want. For this reason, farmers are less likely to choose the in-kind compensation method. In the

long run, technical compensation can help farmers learn advanced technologies and have new survival skills even after losing their farmland.

3.2.2. Socio-Demographic Characteristics of Farmers

Similar to the citizens, the farmers' attitudes and socio-demographic characteristics were also investigated in the paper. The respondents were asked these two questions: "Have you ever participated in farmland protection activities?" and "Do you support farmland protection activities?". In addition, farmers' socio-demographic characteristics, including gender, age and annual family income, were also obtained in the investigation.

Table 3 shows that few respondents have ever participated in farmland protection activities, but 96.07 percent of them support this kind of activity. As for the socio-demographic characteristics, 57.44 percent of the farmers were male, the average age of respondents was 51 and the average family income was 21,168 Yuan annually.

Table 3. Variable definition for farmer's questionnaires.

Variables	Description	Value	Mean Value
Participation	Whether the farmer has participated in farmland protection activity or not	1/0	0.0579
Support	Whether the farmer support farmland protection activities or not	1/0	0.9607
Gender	The gender of the farmer, male = 1, otherwise = 0	1/0	0.5744
Age	The age of the farmer	Year	50.6021
Income	Annual income of the respondent's family	1000 Yuan	21.1684

Source: Developed by the authors based on the farmer's questionnaire surveys.

3.2.3. Econometric Results of MNL Model on Farmers

For the farmers, factors that had a significant effect on their selections are presented in the following section. The STATA 12 program was also employed to analyze the probability of farmers selecting one of four farmland eco-compensation methods and the factors contributing to their choices. From the analysis, it can be seen that the Log-likelihood = −235.0892, Pseudo R^2 = 0.0001 and P = 0.0000. With the monetary compensation method as the comparison group, the possibilities of choosing the other three methods and the effect of significant socio-demographic characteristics on farmers' choices could be obtained. Results are shown in Table 4.

According to Table 4, with the monetary compensation method as the comparison group, farmers who have participated in farmland protection activities were more likely to choose the in-kind compensation and technology compensation. As farmers' cognition of sustainable development increases, they are more inclined to obtain eco-compensation methods that can improve their own quality of life and promote environmental protection, such as technical training, policy support and project support. In addition, farmers' support of farmland protection activities made them less likely to choose in-kind compensation methods compared with the monetary compensation method, as farmers who supported the farmland protection activity are more inclined to choose the monetary compensation directly. Moreover, male farmers were more likely to choose the technology and policy compensation methods compared with the monetary compensation because they were all household owners and made decisions for the sake of the whole family in the long term. Older farmers had a decreased possibility of selecting the technology compensation method compared with the monetary compensation method. It can be explained as older farmers were unlikely to choose the technology way due to their unfamiliarity with it.

Table 4. Results for MNL model on farmers' questionnaire answers.

Method	Coef.	Odds Ratio	Std.Err.	z	P > z
In-kind					
Participation	2.2727	9.7055	0.9212	2.47	0.014
Support	−2.3839	0.0922	1.2592	−1.89	0.058
Gender	0.4211	1.5236	0.7949	0.53	0.596
Age	0.0020	1.0020	0.0302	0.06	0.948
Income	0.0000	1.0000	0.0000	1.31	0.191
_cons	−2.6928	0.0677	2.0483	−1.31	0.189
Technology					
Participation	1.2965	3.6563	0.6220	2.08	0.037
Support	12.7647	349,657.7158	1025.8440	0.01	0.990
Gender	1.0223	2.7795	0.4441	2.30	0.021
Age	−0.0380	0.9627	0.0157	−2.43	0.015
Income	0.0000	1.0000	0.0000	1.80	0.071
_cons	−14.3556	0.0000	1025.8440	−0.01	0.989
Policy					
Participation	−0.2628	0.7689	0.8347	−0.31	0.753
Support	13.1710	524,914.1477	896.1392	0.01	0.988
Gender	0.8208	2.2723	0.3756	2.19	0.029
Age	−0.0492	0.9520	0.0143	−3.44	0.001
Income	0.0000	1.0000	0.0000	−0.61	0.542
_cons	−12.8554	0.0000	896.1396	−0.01	0.989

Note: Outcome way == monetary is the comparison group. Contents of the above table (Coef., model coefficient; Std. Err., standard error; z, z-value.) were taken by STATA 12. And "_cons" is the constant term.

The coefficient for participation in farmland protection activities of in-kind compensation was 2.2727. It had a strong upward effect on the likelihood of belonging to the in-kind compensation group by 870 percentage points compared with the monetary compensation method. The coefficient of supporting farmland protection activities was −2.3839, which decreased the probability of choosing the in-kind compensation method by 91 percentage points compared with the monetary compensation method.

The coefficients for gender and participation of farmland protection activity of the technology compensation group were 1.0223 and 1.2965. Compared with the monetary way, those variables increased the probabilities of selecting technology compensation by over 178 and 165 percentage points. However, as farmers increase in age by one year, their possibility of choosing technology compensation method decreases by four percentage points compared with the comparison group.

For the group of policy compensation, the coefficient of gender was 0.8208. According to the odds, male farmers increased the possibility of choosing the policy compensation method by 127 percentage points compared with the comparison group. The coefficient of age was −0.0492, which represented that when farmers grow older by one year, the possibility of choosing the policy compensation method will decrease by four percentage points compared with the comparison group.

In summary, for farmers in Wuhan, monetary compensation was the most popular farmland eco-compensation method among the four compensation methods, and the second was the policy compensation method. Compared with the monetary compensation method, the factors of farmers' participation in farmland protection activities had a positive effect on choosing the in-kind compensation method, but farmers' support of the farmland protection activities negatively influenced the choice of this method. Farmers' gender, income and participation in farmland protection activities had a positive impact on their selection of technology compensation. However, those who support farmland protection activities are less likely to choose this method compared with monetary compensation. Finally, citizens' gender also had a positive effect on their selection of policy compensation, while their age decreased the probability of selecting this method.

4. Discussion

In the process of China's economic development, the government should pay attention to three rural issues, that is, rural areas, agriculture and farmers; they should gradually realize the need for transformation and upgrading of agriculture [57], and promote the transformation from traditional agricultural methods to green agriculture. In order to achieve green agricultural development and promote industrial transformations, it is necessary to take agricultural ecological compensation systems as the guarantee. The purpose of the farmland ecological compensation system is to develop the economy without harming the economic interests of farmland holders [58]. Therefore, our study explores the preferences of citizens and farmers in Wuhan for different farmland eco-compensation methods and some of the socio-demographic characteristics that contribute to their preferences.

The comparisons between the results of this study and those of other authors are made on the following two aspects: stakeholders' preference for different eco-compensation methods and the influencing factors related to farmland eco-compensation. The results of our paper are similar to those of Xu et al.'s [59] study. They investigated the WTP (willingness to pay) and WTA (willingness to accept) of residents in the upstream and downstream of Liaohe River Basin and found that beneficiaries and contributors of water resource protection both preferred monetary compensation. Su et al. [60] surveyed farmers in Zhangye and obtained monetary compensation and policy compensation as the preferred farmland eco-compensation method for most farmers, which is also similar to our results. The difference is that the number of farmers in Zhangye who choose technology compensation is the least. This may be because Zhangye is a fifth-tier city in China, and the emphasis on and promotion of technology compensation is not as good as that of Wuhan. The research results of Yang et al. [34] and Yin et al. [61] also showed that farmers mainly preferred monetary compensation. Different from the results of this study, in Shi et al.'s [62] research on agricultural eco-compensation in the upstream Erhai Basin, local farmers preferred to accept technology compensation. This indicates that farmers' preferences for eco-compensation may vary with different regions and cultures.

From the perspective of influencing factors related to farmland eco-compensation, citizens' and farmers' willingness and preferences for farmland protection and eco-compensation are affected by the external environment and their own factors [29,30,33]. Positive external factors such as safeguarding environmental factors and policy factors [33] often have a positive effect on the willingness to participate, while negative external factors, such as government uncertainty and low payment [30], will increase the concerns about farmers' participation in farmland protection and ecological compensation. In their studies, the personal factors affecting farmers' participation and preference include farmers' age and gender, which is also consistent with our research results. Sardaro et al. [63] conducted a study on the willingness of ecological compensation for wind farms construction in Italian farmland and found that the preference of farmland owners for compensation methods is affected by their own socio-economic characteristics such as gender, age and education level. Affected by external and personal factors, Villanueva et al. [31] revealed that farmers' preference for AES (agri-environmental schemes) was highly heterogeneous.

Although the farmland eco-compensation methods have been continuously explored in accordance with the local social and economic development, monetary compensation is still the main compensation method. The imperfect ecological compensation mechanism makes some citizens and farmers unable to provide or receive compensation in their preferred way. In this study, monetary compensation was undoubtedly the most preferred method of farmland ecological compensation methods among both citizens and farmers in Wuhan, but it is also quite necessary to satisfy the stakeholders during the implementation of farmland ecological compensation. Therefore, discussion and research on other compensation methods are also quite necessary. With the continuous advancement of the ecological civilization construction and the overall well-off process, people's happiness and satisfaction have become one of the priorities of the government's work. Farmland ecological compensation is one essential part of the ecological civilization society construction, so the investigation and study of different compensation methods are of great significance. Citizens are the most important beneficiary group of farmland ecological services [37]. In previous research, citizens have been neglected as another stakeholder of farmland eco-compensation. The research on their preferences can help the government to formulate compensation policies and provide suggestions. Despite more than 70% of citizens wanting monetary support, the preferences of the rest of the citizens should also be taken into consideration to improve the efficiency of farmland ecological compensation. Farmers are the dominant provider of farmland ecosystem services and products, and they are the main receiver of farmland eco-compensation [64]. Their preferences for farmland eco-compensation have become the key to the successful implementation of relevant policies. More than 70% of farmers prefer monetary compensation, but the preferences of the rest should also be taken into consideration to encourage the farmers' enthusiasm to protect the farmland environment. At present, the way of farmland eco-compensation in China is far from perfect, and monetary compensation is still the main way in most areas, which satisfies the preferences of most citizens and farmers. However, other citizens and farmers who prefer in-kind compensation, technology compensation or policy compensation could not be well satisfied. According to citizens and farmers of different regions, different age groups and different incomes, other compensation methods should be set up to meet the preferences and needs of more people, and compensation standards should be improved to promote rural revitalization and the further construction of an all-around well-off society.

It is undeniable that this paper has limitations. Affected by data collection, there are certain limitations in choosing variables that affect respondents' preferences for different farmland eco-compensation methods. Factors in more aspects and more in-depth levels will be studied in our future research. Secondly, China's farmland eco-compensation system is not very mature, and the specific measures in various regions are also different. This paper only takes the farmland eco-compensation in a broad sense as the content of the questionnaire and does not elaborate on the specific way of it in Wuhan. The specific details of the ecological compensation system in Wuhan will be further discussed in future research. Finally, our study area, Wuhan, is a relatively developed area, which can only provide policy implications with similar development levels when studying the choices of citizens and farmers.

5. Conclusions and Policy Implications

5.1. Conclusions

This study analyzes the preferences of both citizens and farmers for four farmland eco- compensation methods and their influencing factors based on face-to-face survey data collected in Wuhan, China. The results reveal that monetary compensation was the most welcomed compensation method both by farmers and citizens, which should be taken into consideration when designing the farmland eco-compensation methods. Compared with citizens, the proportion of farmers that favored the policy compensation method was slightly higher. This can be explained as a considerable amount of farmers selecting this compensation method when the tax on individual households could be reduced or exempted. The preferences for farmland eco-compensation methods of farmers and citizens are influenced by different socio-demographic characteristics. For citizens in Wuhan, cognition of the importance of water quality, the declining situation of farmland fertility, the declining air quality, income, household ownership and age had impacts on the preferences of farmland eco-compensation methods. For farmers in Wuhan, their choices for different farmland eco-compensation methods were affected by the participation of farmland protection activities, their support of farmland protection activities, gender, age and income.

5.2. Policy Implications

This paper has important theoretical and practical significance for the future formulation of farmland eco-compensation methods in Wuhan and other similar areas. It may provide a new perspective for the follow-up study of farmland eco-compensation and empirical evidence for future farmland eco-compensation policy frameworks.

(1) As the beneficiaries of farmland eco-compensation, farmers should strengthen their independent participation in farmland protection, improve the utilization efficiency of compensation, seize the opportunity to learn advanced agricultural technology, pay attention to agricultural policies and finally improve their life satisfaction and family income. As free recipients of farmland ecological services and products, citizens should actively participate in farmland protection and eco-compensation and supervise government policy formulation and management. These methods could avoid government failures and promote the transparent and efficient operation of eco-compensation policies. For citizens, the government should strengthen policy publicity on the importance of farmland in ensuring food security, maintaining biodiversity and promoting environmental improvement, showing society that farmland has essential ecological service value and improve the enthusiasm of the public to participate in farmland protection and compensation.

(2) For the government, despite monetary compensation being the main method of compensation, a diversified form of compensation should also coexist. When formulating compensation policies, it can be learned from the practices of the Chengdu Cultivated Land Protection Fund and provide the compensation funds in the form of farmers' pension subsidies. In the follow-up management, there is a certain need to improve the supporting system of eco-compensation. It is necessary to establish an eco-compensation supervision mechanism, avoid rent-seeking and corruption and provide institutional guarantees for the eco-compensation mechanism of farmland to promote its effective and efficient implementation. Particularly, an eco-compensation policy evaluation mechanism should be established to dynamically evaluate the implementation of farmland eco-compensation and timely adjust and optimize it according to farmers' needs and the actual implementation of compensation policy.

(3) When making decisions, the decision-makers of farmland management need to fully consider who the beneficiaries of eco-compensation are and who provide eco-compensation, and understand the preferences of different stakeholders. It can not only mobilize the enthusiasm of farmers for protecting the ecological environment of farmland and improving their living standards but also for citizens to participate in eco-compensation projects, which is helpful for government departments to raise compensation funds. In addition, farmland eco-compensation should be based on local conditions, fully considering the heterogeneity of farmers, and different compensation strategies should be formulated for different groups in different regions so as to improve the incentive effects of policies.

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