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Participation Preferences Regarding Domestic Waste Management in Rural China: Influences of Institutional Trust and Household Differentiation

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Broad and sustainable public participation are the basis of successful domestic waste management (DWM). However, households' participation preferences have not been fully analyzed; the current study addresses this gap. Using data from a survey of Chinese rural households, we applied multinomial logit models to explain how institutional trust influenced rural households' participation preferences in DWM under household differentiation. The results show that institutional trust and household differentiation have a significant impact on households' participation preferences. Specifically, institutional trust promotes households' preferences for labor and capital and capital only participation methods. Household participation method preferences differ based on households' characteristics. However, lower–differentiation households with lower–educated members, more permanent residents, and fewer migrated members preferred labor only, followed by labor and capital and capital only methods, while higher–differentiation households preferred not to participate. Given the disappointing performance of implemented policies in enhancing the participation of households thus far, it may be time to cultivate household's trust in institutions and explore differentiated participation methods such as labor and capital, capital only, and labor only.

Key words: domestic waste management, institutional trust, multinomial logistic regression, participation methods, participation preferences

INTRODUCTION

It is extremely challenging for governments worldwide to successfully manage domestic waste in rural areas, particularly in developing countries. China is the largest developing country and 45% of its rural population produced 300 million tons of domestic waste in 2017, becoming the primary source of rural pollution. In recent years, the Chinese government has issued several official documents mobilizing rural households—as producers of rural domestic waste and beneficiaries of rural household waste management—to actively participate in the centralized management of rural domestic waste pollution. However, owing to the regionality, strong externalities and public property, rural domestic waste management (DWM) is inevitably accompanied by the lack of public participation. The government supply model is difficult to target the public demand (Jomehpour and Behzad, 2020; Matsumoto, 2020; Sabet and Khaksar, 2020). Therefore, encouraging rural households to participate in DWM has become a key issue in achieving environmental sustainability (Han *et al*., 2019; Wu and Liu, 2019; Banerjee and Sarkhel, 2020, Drimili *et al*., 2020).

Theoretically, rural households' participation in environmental governance is an autonomous decision–making behavior constrained by the institutional framework. However, the degree of households' trust in the system is determined by execution quality and the effectiveness of related policies (Sabet and Khaksar, 2020). As an essential prerequisite and the foundation for cooperation, trust determines the depth and breadth of the corresponding parties' cooperation and participation in processes (Drimili *et al*., 2020). However, research on the behavioral economics paradigm found that institutional trust neither promotes nor inhibits individuals' waste management practices (Matsumoto, 2020). Therefore, there has been no consensus regarding the role of institutional trust in promoting rural household participation. Empirical research has proven that rural households with high institutional trust are more likely to participate in environmental governance through monetary investment (Sabet and Khaksar, 2020). However, the impact of institutional trust appears to be significantly different among various types of households. This difference was demonstrated by another study, where institutional trust significantly impacted whether low–income, lower–educated rural households were willing to pay to recycle agricultural waste; nonetheless, it had little effect on that of high–income, highly educated households (He *et al*., 2015). Scholars have explored the relationship between rural households' differentiation and participation in environmental governance by monetary contributions (Yin *et al*., 2020). However, the influence of household differentiation and institutional factors on the preferences for participation in DWM is still unclear.

The institutional design of households' participation in environmental governance only provides the institutional environment, and whether rural households recognize this institutional design is vital to determining its implementation effectiveness (Drimili *et al*., 2020; Sabet

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and Khaksar, 2020). As a quasi–public good, rural DWM is mainly provided by local governments and rural communities and supplemented by households through monetary contributions. However, previous studies have shown that not all rural households have the enthusiasm and willingness to pay for DWM, and those who are willing to pay can only make small monetary contributions (Han *et al*., 2019; Tang *et al*., 2020). Instead of monetary contributions to environmental services, some rural residents prefer to *pay* with labor (Han *et al*. 2019). In political practice, the household participation system of DWM in rural areas has faced widespread resistance due to its disconnect with rural society and the actual needs of households, leading to lack of willingness to participate, difficulty collecting corresponding fees, and a low fee–collection ratio (Han *et al*., 2019). These phenomena reflect the difficulties in local government policy implementation and the necessity and arduousness of rural DWM system reform.

To fill the above gaps, it is necessary to explore whether institutional trust can increase the preference of rural households to pay for DWM and whether other options exist to encourage their participation in the process. Meanwhile, under the rapid socio–economic development process, rural households face increasing differentiation in China. Hence, another aspect worth exploring is whether there are significant differences in the participation preferences of households with varied differentiation characteristics concerning DWM. These questions remain unanswered by current research. Therefore, this study investigated the influence of institutional trust and household differentiation on households' participation preferences in DWM in the context of urbanization, using rural household survey data from Shaanxi Province, China. The information garnered from this study can be used to promote household participation in waste management in the rural areas of China and other developing countries.

HYPOTHESES

In this study, institutional trust and the differentiation of rural households are incorporated into the analysis framework to examine their influences on the preferred participation method in DWM.

Institutional Trust and Participation Methods

The trust–cooperation theory argues that trust both promotes cooperation and serves as its basis. Contrary to interpersonal trust, which is based on an emotional connection between individuals, institutional trust is a non–interpersonal relationship that relies on legal, political, and other institutional environments (He *et al*., 2018; He *et al*., 2020). As society progressed, institutional trust emerged as an important mechanism, providing *soft* regulatory standards when shaping rural society. In that sense, trust effectively suppressed opportunistic behaviors, such as free–riding, and zero–sum games, such as the prisoner's dilemma (San Martín Gutiérrez, 2013; Hartmann and Herb, 2014). The higher the household trust in a DWM institution, the better the expected effect, and the more households are willing to pay for domestic waste treatment (Drimili *et al*., 2020).

Thus, the first hypothesis states:

H1: *Institutional trust promotes rural households' awareness and expectations of the effectiveness of DWM, thereby promoting households' preference to participate in the system through capital investment (over no participation).*

Differentiation of Rural Households and Participation Methods

Sustainable DWM requires considerable labor and financial resources. Generally, it is a common practice to charge households to treat their domestic waste (Pandebesie *et al*., 2019). However, with the progress of urbanization and the differentiation of rural households, rural households' participation in environmental governance is differentiated. Households with highly educated members, fewer permanent residents, and more migrated members (that rely primarily on the income of household members working in cities and towns) identify less with and have a lower attachment to the rural village where they reside (Pandebesie *et al*., 2019). These higher–differentiation households benefit less from environmental improvement and are expected to be less willing to participate in environmental management (Meng *et al*., 2019). In contrast, for traditional households with a low degree of differentiation, the central and local governments' implementation and reinforcement of the rural revitalization strategy, renovation of the rural residential environment, and construction and promotion of the ecological civilization propaganda and policies in recent years have improved and strengthened their environmental awareness and demand for a better life (Wang *et al*., 2019; Al Ahad *et al*., 2020; Li *et al*., 2021). Thus, they are more willing to change the domestic waste pollution situation. However, given that traditional rural households have abundant labor capital and minimal opportunity costs to contribute labor, they are likely to be more inclined to invest labor over capital.

Therefore, the second hypothesis states:

H2: *Rural households with highly educated members, fewer permanent residents, and increased dependence on the income of migrated members are unlikely to participate in DWM, while households with low differentiation are more willing to participate by contributing labor.*

MATERIALS AND METHODS

Data Source

To investigate rural households' preferred participation methods in China, we conducted a case study in Shaanxi Province, a western agricultural area with a population of over 30 million, 46% of whom live in rural areas. Data used in the analysis were random questionnaires completed through direct face–to–face interviews from July to August 2019 with a pretest survey conducted in June 2019. Well–trained interviewers con-

ducted the survey, and only one individual per household was targeted to complete our questionnaire. Considering the research purposes, operability, and funding constraints, four Counties/district were randomly selected, 600 households were approached and managed to complete 592 interviews for a 98.7% response rate.

Dependent variable

Most empirical studies regard labor or capital as the primary methods of public participation in environmental governance (Yuan and Yabe, 2014a; Yuan and Yabe, 2014b; Yuan *et al*., 2015; Han *et al*., 2019; Pandebesie *et al*., 2019). However, these studies seldom consider the substitution preferences of individuals between labor and capital. Therefore, this study divided participants into four categories: *neither labor nor capital* (*no participation*), *labor only, capital only*, and *labor and capital*. These categories were used as the dependent variables, and they were assigned values of 0, 1, 2, and 3, respectively. For any choice, j=1, 2,..., J ; the multinomial logistic regression model was expressed as follows:

$$Ln = \left[\frac{P(y=j|x)}{P(y=J|x)}\right] = \beta_0 + \beta_1 D_i + \sum_{k=2}^{k} \beta_k x_{ik}, \quad (1)$$

where $P(y=j|x)$ represents the conditional probability of the ith household's preference for the jth participation method. The core independent variable (D_i) is a dummy variable that measures whether the ith household has trust in the system; β_1 symbolizes the political effect of institutional trust; x_{ik} signifies the control variable, including the kth influential factor (e.g., personal and village characteristics); and β_k is the regression coefficient.

Independent Variables

Referring to the literature review and based on the context of the research framework, the researchers divided the factors affecting household participation in DWM into institutional trust, household differentiation (index of household characteristics), individual characteristics, and regional characteristics. Detailed explanations of the variables are as follows.

Institutional Trust

According to previous researchers (He *et al*., 2015; Tang *et al*., 2020), trust in village cadres can be used as a proxy variable for institutional trust. The grassroots cadres usually act as agents of the government and as representatives of the residents. These agents assume the responsibility of conveying government policies to the villagers, assisting in implementing specific measures, and communicating the viewpoints and expectations of the villagers to the relevant government departments. Therefore, in this study, household trust in village cadres was used to measure institutional trust. Households with greater trust in their village cadres were more willing to accept their guidance, engage in the environmental reconstruction of the village, and participate in DWM through monetary contributions.

Household Characteristics

Household characteristic variables included the highest education received by any household member, number of permanent residents in the household, and primary source of household income. These variables determine the socio–economic conditions of rural households (Chen, 2019; Delcea *et al*., 2020; Setiawan, 2020). Households with higher economic status are more inclined to avoid rural inhabitation and less likely to identify themselves with the village or form an emotional attachment to the village. As a result, they are unlikely to participate in DWM in rural areas. However, households with varying differentiation characteristics make different choices in terms of labor only, capital only, or labor and capital.

Household Differentiation Index based on Household Characteristics

Under the rapid socio–economic development process, rural households are faced with increasing differentiation in China. Previous studies have classified rural households from various perspectives, for example, income–based (Ellis and Freeman, 2004; Nielsen *et al*., 2013), land–based (Walelign *et al*., 2017; Chang and Liu, 2018), or other index–based (Yin *et al*., 2020; Zhang *et al*., 2020; Liu *et al*., 2021). However, a comprehensive evaluation of rural households' differentiation has not been discussed. In the present study, we defined *Chinese traditional rural households* as a population group that lives in rural areas and is traditionally less educated than its urban counterparts, with most of its income generated through small–scale agricultural production. Therefore, an index was constructed to measure the degree of rural household differentiation based on three variables: highest education received by any household member, number of members permanently residing in the area (permanent residents), and the degree to which the primary household's income is dependent on migrated employment. The detailed calculation of the index is as follows:

$$ID_i = 100 * \sum_{i=1}^{k} x_{ik} / k, \quad (2)$$

where ID_i represents the differentiation index of the ith household. x_{ik} is a dummy variable representing the characteristics of the ith household and includes whether the highest education received by any household member is above senior high school, whether the number of people permanently residing in the rural area is less than or equal to four, and whether the income of any migrated member is the primary source of household income (0 = no, and 1 = yes). The larger the value of ID_i, the higher the household's differentiation.

Personal and Regional Characteristics

Most empirical studies on this subject considered age as a variable. Older rural residents have more physical and economic limitations and low education level, and they lack adequate environmental awareness; thus, they are more unwilling to participate in DWM (Han *et*

al., 2019). Gender also influences individual preferences. Females are more closely engaged with waste management at the household level and better understand waste management (Babaei *et al*., 2015; Mukherji *et al*., 2016). However, due to their lower income, female residents are more inclined to participate in DWM through labor contributions. In this study, the head of the households' age, gender, and marital status were used to represent the personal characteristics of the household in question. Moreover, to control the influence of regional variance, region was included in the model as a control variable.

The operational definitions and assigned values of the abovementioned variables are presented in Table 1. The table shows that 65% of the respondents expressed trust in their village cadres, reflecting their overall degree of institutional trust. The average highest education received by any household member was senior high school; 49% of the households relied on the income of migrated members; the mean permanent resident per household was three to four people; the average age of the respondents was approximately 50 years old; 48% of the respondents were male, and 52% were female; additionally, 91% of the respondents were married.

RESULTS AND DISCUSSION

Actual Participation Methods vs. Preferred Participation Methods

Table 2 shows the actual and expressed participation method preferences of the 592 investigated households. The table shows that 55.4% participated in DWM, while 93.1% reported a willingness to participate. Among the participants who expressed a willingness to participate, 62.0% expressed a preference for the labor and capital method, which is nearly 57% higher than the proportion of households that reported participating through this method. Additionally, 20.9% preferred the capital only method, approximately 20% lower than the proportion of households that reported participating using this method. Furthermore, 10.1% preferred the labor only method, approximately 10% higher than the proportion of households that reported participating through this method. Finally, 6.9% preferred not to participate, which is 35% lower than the proportion of households that reported not participating in waste man-

Table 1. Variables and Descriptive Statistics

Variables	Levels and coding	Mean	SD
Dependent Variable			
Preferred participation method	0 = no participation, 1 = labor only, 2 = capital only, 3 = labor and capital	2.38	0.93
Core Independent Variables			
Institutional trust	0 = not trust, 1 = trust	0.65	0.48
Household differentiation index	calculated based on Formula (2)	0.57	0.26
Household Characteristics			
Highest education received by household members	1 = primary school or lower, 2 = junior high school, 3 = senior high school, 4 = higher than senior high school	3.26	0.93
Number of permanent residents	actual number	3.65	1.73
Main income from migrated members	0 = no, 1 = yes	0.49	0.50
Personal Features			
Age	actual age	50.36	15.94
Gender	0 = female, 1 = male	0.48	0.50
Marital status	0 = others, 1 = married	0.91	0.29
Dummy Variable of Region (Control: Yangling District)			
Chengcheng County	0 = others, 1 = Chengcheng County	0.17	0.38
Dali County	0 = others, 1 = Dali County	0.38	0.49
Taibai County	0 = others, 1 = Taibai County	0.21	0.41

Table 2. Actual vs. Preferred Participation Methods

Actual participation methods	Preferred participation methods									
	No participation		Labor only		Capital only		Labor and capital		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
No participation	26	10.4	44	17.6	34	13.6	146	58.4	250	100
Labor only	0	0.0	2	20.0	1	10.0	7	70.0	10	100
Capital only	13	4.5	14	4.9	86	29.9	175	60.8	288	100
Labor and capital	0	0.0	0	0.0	2	6.7	28	93.3	30	100
Unknown	2	14.3	0	0.0	1	7.1	11	78.6	14	100
Total	41	6.9	60	10.1	124	20.9	367	62.0	592	100

agement. These results showed that although the actual participation ratio was low, households' willingness to participate was generally high; moreover, a clear discrepancy existed between households' actual and reported participation method preferences.

Differences in Preferred Participation Method According to Household Characteristics

Table 3 shows that among households with high institutional trust, the proportion that preferred the labor and capital contribution method was 64.2%. The proportion that preferred capital only was 22.3%; these proportions were 6.4% and 3.9% higher than those of households without institutional trust, respectively. The proportion that preferred either the labor only or no participation method represented only 8.0% and 5.4% of the sample, respectively; these proportions were 6.1% and 4.3% lower than those of households without institutional trust, respectively.

Among households where members received an education higher than senior high school, 63.2% preferred the labor and capital method, 19.8% preferred capital only, and 8.8% and 8.2% preferred labor only and no participation, respectively. However, among the households where members received a senior high school or lower education, 60.6%, 22.3%, 11.7%, and 5.5% chose labor and capital, capital only, labor only, and not to participate, respectively. Among the households whose primary income originated from migrated household members, 18.3% preferred the capital only method (5.1% lower than the households that do not rely on the income of migrated members), and 9.3% preferred not to participate (4.7% higher than the households that do not rely on the income of migrated members). However, no significant differences were found in the preferences for the labor only and labor and capital methods between the two groups. Among households with permanent residents equal to or greater than five, 67% of the sample households preferred the labor and capital method, which is 7.4% higher than the preference of households with fewer permanent residents for this method. Additionally, 13.1% preferred labor only, which is 4.4% higher than the corresponding proportion of households with fewer permanent residents, and 14.7% preferred capital only and 5.2% preferred not to participate, which are 9.2% and 2.5% lower, respectively, when compared with households with fewer permanent residents.

In Dali County, the proportion of households that preferred the labor and capital method was 69.3%, and only 2.7% preferred not to participate. While the proportion of households that preferred the labor and capital method in Taibai County, Yangling District, and Chengcheng County were 59.8%, 59.4%, and 52.0%, respectively. Further, the proportion of households that preferred not to participate in these Counties and district were 11.5%, 9.1%, and 7.8%, respectively. These findings reveal that households in Dali County were more willing to participate in the process, particularly through the labor and capital method.

These results indicate that the majority of investigated households preferred the labor and capital and capital only methods. Households with higher institutional trust, whose members received higher than senior high school education, who have fewer than five permanent residents, and whose primary income did not come from migrated members preferred the capital only and labor and capital participation methods. Households whose primary income came from migrated members, whose members received senior high school or less education, and who had little institutional trust preferred to participate through labor only.

Regression Results

The dependent variable in this study was the preference for a participation method. The four options (no participation, labor only, capital only, and labor and capital) were independent, mutually exclusive, and were not nested. The Hausman test was used to examine the independence of irrelevant alternatives assumption, and the results showed that the null hypothesis was

Table 3. Differences in Preferred Participation Methods by Household Characteristics

Category	Levels	No participation		Labor only		Capital only		Labor and capital		Total	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Institutional trust	trust	21	5.4	31	8.0	86	22.3	248	64.2	386	100
	not trust	20	9.7	29	14.1	38	18.4	119	57.8	206	100
Highest education received by household members	≤ senior high school	15	5.5	32	11.7	61	22.3	166	60.6	274	100
	≤ senior high school	26	8.2	28	8.8	63	19.8	201	63.2	318	100
Number of permanent residents	≤ 4 people	31	7.7	35	8.7	96	23.9	239	59.6	401	100
	≥ 5 people	10	5.2	25	13.1	28	14.7	128	67.0	191	100
Main income from migrated members	yes	27	9.3	31	10.7	53	18.3	178	61.6	289	100
	no	14	4.6	29	9.6	71	23.4	189	62.4	303	100
County/district	Chengcheng	8	7.8	3	2.9	38	37.3	53	52.0	102	100
	Dali	6	2.7	12	5.3	51	22.7	156	69.3	225	100
	Taibai	14	11.5	18	14.8	17	13.9	73	59.8	122	100
	Yangling	13	9.1	27	18.9	18	12.6	85	59.4	143	100
Total		41	6.9	60	10.1	124	20.9	367	62.0	592	100

accepted; hence, multinomial logistic regression could be employed.

Regression Results of the Baseline Model

Before the regression analysis, the variance inflation factor (VIF) was used to diagnose the variables' collinearity. As a rule of thumb, a VIF value that exceeds five or ten indicates a problematic amount of collinearity (James *et al*., 2013; Bruce *et al*., 2017). The analysis results confirmed that the VIF of all variables was less than three; hence, they could be considered independent. Next, the households that were unwilling to participate in DWM were used as the control group, and SPSS 24.0 was utilized to perform the maximum likelihood estimation. Regression 1 included the core independent variable of institutional trust as well as household and personal characteristics. The result of –2 times the log–likelihood ratio for the model was 1,092.008 (pseudo–R^2 = 0.085). Considering the likely impact of regional differences on the regression results, the region was introduced into Regression 2. The –2 times the log likelihood ratio dropped to 1,071.721, and the pseudo–R^2 rose to 0.161, indicating that the model's independent power increased following the introduction of the region. In addition, the regression models revealed that changes in the parameter estimation and significance level of institutional trust were not significant; hence, it can be initially inferred that the results of Regression 2 were robust. The detailed results are as follows.

The influence of institutional trust on the preference for a participation method was found to be positive for the capital only ($p < 0.1$) and labor and capital ($p < 0.05$) methods; however, its effect on household preference for the labor only method was not significant. These findings suggest that households with high institutional trust were more inclined to prefer the labor and capital participation method, followed by capital only. A likely explanation is that households with high institutional trust are more likely to demonstrate reciprocal behavior in collective actions; hence, participation through labor and capital is more conducive to the success of collective action (He *et al*., 2018; He *et al*., 2020).

Regarding the influence of household characteristics on the preference for a participation method, all three household characteristic variables had a significant effect, indicating that household characteristics played a leading role in influencing participation preferences. The highest education received ($p < 0.05$) and the number of permanent residents ($p < 0.1$) negatively affected the preference for the labor only option, indicating that, controlling for other factors, the higher the highest education received or the fewer the permanent residents in the household, the less likely it is for the household to be willing to participate in DWM. However, studies found that education can enhance social responsibility and improve participation (Rahji and Oloruntoba, 2009; De Feo and De Gisi, 2010; Triguero *et al*., 2016). In contrast, households with less–educated members and households proportionally composed of more permanent residents preferred participating through labor only. The primary sources of income negatively impacted the preferences for the labor only and labor and capital methods ($p < 0.05$), which could explain the negative relationship between income and participation decisions (Ferrara and Missios, 2005; Barr and Gilg, 2007). These findings suggest that households that rely on migrated members for their income generally preferred not to participate. Alternatively, households that did not rely on the income of migrated members were more inclined to adopt a labor only or labor and capital method.

Among personal and regional characteristics, age had a significant negative effect on the willingness to participate through the labor only ($p < 0.05$), capital only ($p < 0.1$), and labor and capital ($p < 0.01$) methods, indicating that older residents were unlikely to participate, as shown by Rahji and Oloruntoba (2009) and Han *et al*. (2019). Gender had no significant influence on the choice of the participation method, which is inconsistent with Han *et al*. (2019). These results could be because the state's promotion of DWM, introduced due to the emergence of domestic waste pollution in rural areas, resulted in no noticeable difference in male and female residents' awareness. Marital status negatively influenced the preference for the labor only and capital only methods ($p < 0.01$). Residing in Chengcheng County also negatively impacted the labor only preference and had a positive effect on the capital only method, whereas residing in Dali County positively impacted the capital only ($p < 0.01$) and labor and capital ($p < 0.05$) methods. Signs of the coefficients for residing in Taibai County were all negative; however, the results were not statistically significant. The results showed that compared to Yangling District, residing in Chengcheng County had a significant negative effect on households' participation preference for labor only and a positive effect on their participation preference for capital only. However, living in Dali County had a significant positive effect on participation preference for the labor only and labor and capital methods. This result could be because Dali County and Chengcheng County specialize in agricultural production and have access to abundant labor resources. A relatively high proportion of residents in these counties engages in cash crop cultivation, and labor opportunity costs are high. Therefore, residents are more willing to participate through the capital only and labor and capital methods.

Detailed results of the regression analysis are presented in Table 4.

Robustness Test

To examine the robustness of the regression results, we introduced a multinomial probit model. The results (Table 5) show that when controlling for other independent variables, the proportion of households with high institutional trust that preferred the capital only and labor and capital methods was higher than those without institutional trust; however, the differences in households that preferred labor only are not significant. These results are generally consistent with the results illustrated in Table 4. In addition, despite controlling for

Table 4. Regression Results of the Multinomial Logistic Regression

Variables	Regression 1			Regression 2		
	Labor only	Capital only	Labor and capital	Labor only	Capital only	Labor and capital
Institutional trust	0.116	0.850**	0.819**	0.061	0.750*	0.732**
	(0.416)	(0.377)	(0.343)	(0.422)	(0.385)	(0.349)
Highest education received by household members	–0.886**	–0.543	–0.505	–0.985**	–0.510	–0.489
	(0.428)	(0.382)	(0.354)	(0.438)	(0.391)	(0.362)
Number of permanent residents	–0.995**	–0.107	–0.614	–0.884*	–0.244	–0.610
	(0.472)	(0.444)	(0.403)	(0.488)	(0.465)	(0.421)
Main income from migrated members	–0.952**	–1.124***	–1.073***	–1.139**	–0.674	–0.813**
	(0.446)	(0.400)	(0.372)	(0.474)	(0.428)	(0.397)
Age	–0.034**	–0.024	–0.036***	–0.034**	–0.027*	–0.037***
	(0.017)	(0.016)	(0.014)	(0.017)	(0.016)	(0.014)
Gender	0.149	0.079	–0.110	0.251	–0.095	–0.216
	(0.418)	(0.373)	(0.344)	(0.427)	(0.383)	(0.352)
Marital status	–14.676***	–15.202***	–15.276	–14.657***	–15.149***	–15.211
	(0.655)	(0.491)	(0.000)	(0.666)	(0.497)	(0.000)
Chengcheng County				–1.933**	1.126*	0.048
				(0.802)	(0.581)	(0.533)
Dali County				–0.378	1.642***	1.248**
				(0.637)	(0.591)	(0.541)
Taibai County				–0.611	–0.182	–0.276
				(0.524)	(0.537)	(0.449)
Constant	18.414***	18.023***	20.200***	18.925***	17.404***	19.871***
	(1.16)	(1.064)	(0.976)	(1.240)	(1.147)	(1.046)
–2 Loglikelihood		1,092.008			1,071.721	
Likelihood ratio value (P>chi^2)		52.497 (0.000)			103.985 (0.000)	
Pseudo R^2		0.085			0.161	

Notes: *The values in brackets are standard errors; *, **, and *** indicate significance at 0.1, 0.05, and 0.01, respectively; N = 592.*

Table 5. Results of the Multinomial Probit Model

Variables	Regression 3			Regression 4		
	Labor only	Capital only	Labor and capital	Labor only	Capital only	Labor and capital
Institutional trust	0.010	0.479**	0.450**	0.001	0.478*	0.486**
	(0.245)	(0.230)	(0.212)	(0.268)	(0.249)	(0.231)
Other variables		Uncontrolled			Controlled	
Constant	0.236	0.418**	1.318***	12.664***	11.940***	13.584***
	(0.183)	(0.177)	(0.162)	(0.766)	(0.811)	(0.774)
–2 Loglikelihood		1,222.368			676.981	
Likelihood ratio value (P > chi^2)		(0.019)			(0.000)	
Pseudo R^2		0.073			0.323	

Notes: *The values in brackets are standard errors; *, **, and *** indicate significance at 0.1, 0.05, and 0.01, respectively; N = 592.*

other variables, the estimation results and significance levels of the core independent variable did not change significantly.

Generally, the physical fitness and income levels of adults aged 60 and older tend to decline. Therefore, when promoting environmental governance, the working–age population should be the primary target (He *et al*., 2015). To further examine the influence of sample selection on the estimation results' robustness, respondents older than the Chinese retirement age, namely female respondents aged 55 and over and male respondents aged 60 and over, were excluded from the analysis. After controlling for personal, household, and regional characteristics, a re–estimation was conducted (Table 6). The results of Regressions 5 and 6 showed that when the elderly sample was excluded, regardless of whether other variables were controlled or not, institutional trust had a significant positive effect on the choice of capital only and labor and capital methods; however, the effect of institutional trust on the preference for the labor only method was not statistically significant. These findings reveal that institutional trust significantly

increases rural households' preference to participate in DWM and that the overall results of Regression 2 were robust.

Estimation Results Considering the Impact of Household Differentiation

To further examine the influence of the rural household differentiation degree on the choice of participation method, the household differentiation index was added to the model, based on Formula (1). Additionally, the three household characteristic variables that comprised the household differentiation index were excluded. The regression results are presented in Table 7.

Table 7 reveals that regardless of whether other variables are controlled for, institutional trust significantly impacted the preference for the capital only and labor and capital methods and had no effect on the preference for the labor only method. These findings echo the results of Regression 2 and further demonstrate the robustness of the previous analysis.

The differentiation index is an important reason for the differences in households' participation method preferences. Specifically, the index negatively impacted the preference for the labor only, capital only, and labor and capital methods, indicating that lower–differentiation households were more willing to participate. These results could be because, during the urbanization process, family members' educational background, number of permanent residents, and source of household income affected the way residents identify with and form an emotional attachment to their rural living environment, subsequently affecting their participation preferences regarding DWM.

CONCLUSIONS

The survey results from households in Shaanxi Province, China suggested that the proportion of households that did not participate and the proportions that participated by contributing labor only, capital only, and labor and capital were 6.9%, 10.1%, 20.9%, and 61.9%, respectively. The influence of institutional trust on the preference for labor only participation was not significant; however, its impact on household preference for capital only and labor and capital participation were significant ($p < 0.05$). Moreover, there are significant differences in the preferences of participation modes among households with different degrees of differentiation. However, with the acceleration of urbanization, higher–differentiation households that are gradually leaving rural areas are becoming more unlikely to participate; of those lower–differentiation households that are

Table 6. Regression Results of the Multinomial Logistic Regression (Excluding Older Population Samples)

Variables	Regression 5			Regression 6		
	Labor only	Capital only	Labor and capital	Labor only	Capital only	Labor and capital
Institutional trust	0.272	1.127**	0.959**	0.331	1.267**	1.113**
	(0.532)	(0.505)	(0.454)	(0.566)	(0.543)	(0.491)
Other variables		Uncontrolled			Controlled	
Constant	0.526	0.526	1.912***	20.140***	19.160***	21.458***
	(0.350)	(0.350)	(0.297)	(1.985)	(1.947)	(1.860)
–2 Loglikelihood		818.682			662.981	
Likelihood ratio value (P > chi^2)		12.133 (0.007)			73.218 (0.000)	
Pseudo R^2		0.027			0.175	

Notes: *The values in brackets are standard errors; *, **, and *** indicate significance at 0.1, 0.05, and 0.01, respectively; N = 445.*

Table 7. Regression Results Considering the Impact of Household Differentiation

Variables	Regression 7			Regression 8		
	Labor only	Capital only	Labor and capital	Labor only	Capital only	Labor and capital
Institutional trust	–0.029	0.741**	0.655**	0.064	0.749*	0.737**
	(0.409)	(0.370)	(0.334)	(0.422)	(0.384)	(0.349)
Household differentiation index	–2.436***	–1.674**	–1.805***	–3.040***	–1.510*	–1.908***
	(0.809)	(0.723)	(0.668)	(0.871)	(0.780)	(0.727)
Other variables		Uncontrolled			Controlled	
Constant	1.867***	1.709***	2.927***	18.882***	17.356***	19.858***
	(0.591)	(0.554)	(0.512)	(1.233)	(1.140)	(1.039)
–2 Loglikelihood		1,057.773			980.513	
Likelihood ratio value (P > chi^2)		19.883 (0.011)			102.045 (0.000)	
Pseudo R^2		0.003			0.158	

Notes: *The values in brackets are standard errors; *, **, and *** indicate significance at 0.1, 0.05, and 0.01, respectively; N = 592.*

willing to participate, their highest preference was for labor only, followed by the labor and capital and capital only methods.

The following political implications can be drawn from this study's results to promote rural household participation in DWM and further enable centralized improvement of rural communities: First, the corresponding departments should establish a systematic mechanism, supported by policies and regulations as well as central and local governments, to stimulate rural household participation in DWM. Participation methods should be subsequently formulated, improved, and refined in accordance with the needs of different households so that each household has the option to participate through their desired method, facilitating more widespread execution of regulation and policy. Second, the government should improve the selection, training, and assessment systems of the grassroots cadres. In turn, this will improve their overall quality and professional capabilities, disclose the financial status of village committees, and utilize a range of rural communication channels, such as village broadcasts, village leader presentations, and information exchange, to provide rural households with more access to information about DWM. On the village level, related activities should be organized to demonstrate village leaders' capabilities, enhance their connection to local households, stimulate trust, cultivate a trust–based environment, elevate pre–existing trust, and promote the progression of pilot projects. Third, the corresponding departments should encourage rural households to participate in DWM directly or indirectly while guiding them toward shifting from passive participation to active participation, fully mobilizing enthusiasm and enhancing waste management education in the process. The goal of such policies and practices is to cultivate a fuller sense of accountability and responsibility, create an environment that encourages conscious participation in policy while minimizing policy resistance, promote institutional trust, and stimulate household willingness to participate in and contribute to environmental governance to achieve autonomous governance of waste management at the village level. Finally, broader measures that corresponding government departments could implement may enhance villagers' sense of belonging and community cohesion, encouraging and supporting migrant workers to return to their hometowns, attracting a backflow of young migrant workers, organizing public activities, and expanding rural social networks. These measures will help develop residents' sense of attachment, appreciation, and identity toward their corresponding villages and promote awareness of waste management participation, effectively preventing free–riding behaviors in social reform.

Although this study revealed insight into rural households' preferred participation method of DWM, it should be noted that the relationship between the length of labor participation and the level of payment was not identified. Moreover, the data used were obtained from randomly selected counties/districts of Shaanxi Province. Thus, future studies should increase the sample size and include more counties and provinces to obtain a more representative sample of the population.

AUTHOR CONTRIBUTIONS

Y. L. Yuan designed the study, analyzed the data, wrote and modified the manuscript and provided financial and data support. Z. Y. Chen participated in the written of the study. M. Yabe participated in the design of the study, supervised and modified the work and provided financial support. Y. Ma modified the study. R. Kong supervised the work. All authors assisted in editing of the manuscript and approved the final version.

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