To move or not to move: How farmers now living in flood storage areas of China decide whether to move out or to stay put

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Abstract
The living and production of large populations in flood storage areas (FSAs) is a common phenomenon in China. Such a situation inevitably produces a contradiction between flood potential and development, which may be solved by resettlement. Resettlement in FSAs with Chinese characteristics is an important means of flood risk management by the government. Based on a questionnaire survey, this paper analyses the factors influencing the resettlement decision-making process of farmer households' in FSAs using a logistic regression. The findings suggest that the location of the resettlement, resettlement subsidies, and rationality of the subsidy policy have the most significant positive effect. The government should take measures to encourage farmers to resettle, so as to accelerate resettlement progress.

KEYWORDS
China, decision-making process, flood storage area, influencing factors, resettlement decision

1 | INTRODUCTION

Flood disasters are among the world’s most frequent and most devastating types of disaster (IFRCRCS, 1998), claiming many lives every year (Dilley et al., 2005). The occurrence rates of floods, flood-induced mortality, and flood-affected populations have generally increased globally (Hu, Zhang, Shi, Chen, & Fang, 2018; Matczak, Lewandowski, Choryński, Szwed, & Kundzewicz, 2018). Asia, including China, has the highest flood frequency and flood mortality rate. Occurrences of flood disasters accounted for 43% of the global natural disasters during 1994–2013, affecting 2.5 billion people and causing 0.16 million deaths (CRED, 2015). The extent of flood disaster damage is enhanced by population growth, accelerating urbanisation processes, fast industrial development, and especially irrational land exploitation (Drogue et al., 2004). Serious flood occurs frequently in China. Flood flows are often diverted into designated FSAs that operate as additional floodplains. Reservoirs, embankments, and flood storage areas (FSAs) constitute a flood control engineering system. While reservoirs are the first line of defence for flood control, FSAs are known as the last measure for flood control. In most countries, FSAs are basically uninhabited, and the land in the area is mainly farmland, forest, or wetland; however, this is not the case in China. As China has a large population and few land resources, a large number of people live in FSAs. In normal flood years, FSA residents can live and produce normally. When a sudden flood comes, rivers overflow, and new areas must be opened up to store the excess water. Thus, FSAs begin to play the function of reservoirs, for
the temporary detention of excess water. At this point, residents in FSAs must be evacuated temporarily to make space for flooding. Two or three months later, the flood subsides, and the residents return to their devastated homes and begin to rebuild. This cycle has brought great losses to the lives and production of local residents, leading FSAs to become areas of concentrated rural poverty.

If the resettlement of an impoverished population due to climate change and ecological deterioration does not receive enough global attention, government intervention, and resource input, the consequences will be grave (Leckie, 2011). With the sudden occurrence of natural disasters, such as floods, hurricanes, and earthquakes, resettlement can represent an effective self-protection mechanism, avoid risks, and reduce losses (Boustan et al., 2012). Families tend to migrate from areas susceptible to environmental disasters to areas less affected by environmental disasters (Zelinsky, 1971). Natural disasters in a region may become an important motivation for resettlement (Slovic, 1987). When people cannot adapt to or mitigate the impacts of natural disasters, they may have no choice but to move out of disaster zones (IPCC, 2014). Resettlement is one of the most effective ways to address natural disasters (Artur & Hilhorst, 2014; Drabo & Mbaye, 2015; Pei, 2017). Resettlement, if managed well, is one of the best long-term strategies for disaster risk reduction, not only for saving lives but also for reducing the future response and recovery costs. Although the resettled households can avoid the threat of natural disasters and escape poverty, resettlement itself entails certain social risks (Cernea, 1997). If it is not properly planned or implemented, resettlement may not achieve the objectives but instead may bring new problems (De, 2006). As a number of studies have demonstrated, resettlement can increase social vulnerability, reduce the access to livelihood security, and, in some cases, expose people to new risks (Gaillard, 2008; Kelman & Mather, 2008; Oliver-Smith, 1991; Usamah & Haynes, 2012). Thus, the resettlement plan may be implemented only when other methods for disaster prevention and mitigation and poverty alleviation are ineffective or costlier than relocation (Chan, 1995a).

Anne, Brent, and Linda (2018) categorise resettlement motivated by three causes: climate change, natural hazards and natural disasters (i.e., floods, hurricanes, and earthquakes), and economic development (i.e., dam construction and natural resource extraction). They further identify five principles for resettlement in the context of climate change: proactiveness, communication and participation, permanence, compensation, and livelihood protection. The process of resettlement is complex. It is described as a “multidimensional, multifactor, multiactor, multiscalar, and multilevel” process that affects the resettled populations in different ways depending on their “vulnerabilities, capacities, positionings, and interests” (Vanclay, 2017). Through the analysis of 29 large dam projects, scholars have noted that the resettlement process is contentious (Kirchherr, Ahrenshop, & Charles, 2019). Compared with forced migration caused by natural disasters, voluntary migration is a positive diversification strategy (Boano et al., 2008; Kniveton et al., 2008), and preventive resettlement has the advantages of ensuring life safety, reducing property losses, reducing investment in disaster prevention facilities, and reducing the interruption of educational and medical services (Correa, 2011). By 2050, 200 million people around the world will have migrated due to environmental problems (Myers, 2002). Population resettlement caused by natural disasters has recently become a major problem in China (Pei, 2017). Chinese government wants people to leave FSAs permanently so that the areas can be used more frequently when serious flooding occurs: which will be likely to become more frequent with climate change.

Resettlement from FSAs refers to the permanent migration of residents now living in FSAs to move out of FSAs and represents resettlement induced by preventive flood disaster. Because resettlement is voluntary, farmer households have high subjective selectivity, and they decide autonomously whether to move or not. The total area of the 98 FSAs in China is approximately 34,000 km², and the total storage capacity is approximately 107 × 10⁹ m³. These areas are home to approximately 16 million people, cover nearly 1.73 × 10⁶ hm² of cultivated land, and produce approximately 110 billion yuan of GDP (Hou & Shen, 2010). Because of the specific national conditions of China, FSAs have the dual functions of storing excess floods and providing residential living space. Resettlement from FSAs would replace multiple temporary moves with a one-time permanent relocation. Resettlement can fundamentally solve the problem of flood control and ensure the safety of local residents’ lives and properties. The Huai River basin is a key part of the resettlement project of FSAs in China. After the Huai River floods of 2003 and 2007, implementation of the relocation project began, and 110,200 households and 393,100 people were relocated.¹ In the current stage of the project, the people living in unsafe areas of the FSAs are relocated under normal circumstances in what is called disaster-induced resettlement or preventive resettlement (He & Yan, 2014). Most of the relocation areas are FSAs with a high frequency of use. However, due to the low subsidy, the populations are not willing to move, and relocation is difficult to implement (Ma, Rong, & Liao, 2017). According to the relocation plan for FSAs in the Huai River basin, Anhui Province, 535,800 people still need to relocate. Resettlement from FSAs is
government-led voluntary relocation. As the main stakeholders involved in the resettlement, farmers in FSAs can decide independently whether to move and their decision will directly determine whether the resettlement project can be carried out smoothly.

In summary, numerous scholars have extensively studied the problems related to farmer households' resettlement. Resettlement willingness and influencing factors, such as individual characteristics, resettlement distance, and resettlement cost, have been discussed in detail, and corresponding countermeasures have been put forward. Some scholars have noticed that current family economic conditions restrict farmers’ ability to relocate, which is an important factor affecting the decision-making behind farmers’ resettlement (Li & Qin, 2015). These studies have laid an important theoretical foundation for this study. There are many studies concerning reservoir resettlement, dam resettlement, and ecological resettlement. Concerning the dimension of time, many studies examine the issue of resettlement and the postresettlement impacts. However, few are concerned with the decision-making migrants engage in before resettlement. Until now, there has not been a sufficiently comprehensive and systematic analysis of the decision-making process behind preventive resettlement, especially in the decision-making process behind farmer households' resettlement from FSAs. While this type of resettlement is commonly practiced in China, it is the subject of little academic research. To fill this gap, this paper performs two primary tasks. First, it conducts a literature review and a questionnaire survey to analyse the decision-making process. Second, it applies logistic regression analysis to analyse the factors that influence farmer households' resettlement decision-making. The results provide a theoretical reference for the practice of resettlement from FSAs in China and add new content to the international research on government flood risk management.

2 | THE DECISION-MAKING PROCESS BEHIND FARMER HOUSEHOLDS’ RESETTLEMENT FROM FSAS

According to Brown and Moore's decision-making model of population relocation, the resettlement decision of farmer households living in FSAs depends on flood pressure, government support, and the farmers’ expectations (Duan, 1998). Flood pressure refers to the probability of utilisation of the FSAs; if the FSAs have a high probability of utilisation, the flood pressure is high; otherwise, the flood pressure is low. This is the push factor associated with the original residence. When negative environmental pressure exceeds the pressure threshold (different individuals have different pressure thresholds), people will take measures to migrate (Wolpert, 1966). Government support refers to the government’s promotion of a smooth relocation process through rational planning of the resettlement population carrying capacity and the potential for economic development, provision of investment funds for infrastructure construction, issuance of resettlement grants, and implementation of measures and preferential policies to encourage farmers to relocate. Finally, based on a complete understanding of the resettlement policy and resettlement conditions, farmers form expectations of the living and production environment of the resettlement site.

Herbert Simon, an American decision management expert, thought that a decision is not only the action of selecting a plan from several alternatives but also the process of evaluating and choosing a plan. The process theory of population migration holds that the change from the desire to the act of resettlement is a long and complex process (Rossi, 1955). In the decision-making process of a farmer household, two types of individual factors, capacity and intention, can be considered (Siebert, Toogood, & Knierim, 2006). Migration is an effective strategy to counteract environmental pressures and shocks (Martin et al., 2014). However, in some cases, migration is not feasible, as only the richer families have the possibility of choosing to migrate (Chan, 1995b). The resettlement decision involves two stages: one is the choice of whether to relocate, and the other is the choice of where to relocate. The most important factors in deciding whether to relocate have been found to be wages and relocation costs (Bergen & Blomquist, 1992).

Thus, a model of farmer households' decision-making process concerning resettlement from FSAs is established (Figure 1), with the research by Lewis (1982) serving as a reference.

As shown in Figure 1, there are two decision points in the decision-making process of farmer households living in FSAs. At decision point one, whether the resettlement pressure in the FSA exceeds the pressure threshold is one of the key points in farmers’ resettlement decision-making. Resistance to relocation comes from the existing housing conditions, production conditions, personal characteristics, and family characteristics. Z represents the relocation resistance, P represents the flood pressure, F represents the government support, and MP represents the resettlement pressure in the FSA. Thus, MP = P + F − Z; when MP is below the pressure threshold, farmers will decide not to migrate, while when MP exceeds the pressure threshold, farmers will choose to migrate. This decision is a process. First, farmers form the motivation to migrate and begin collecting relevant information to gain...
a detailed understanding of the specific government policies and resettlement circumstances. The expected income and the relocation cost are initially established, and the expected net income of resettlement is estimated. At decision point two, whether net income is expected is the most important key point for farmers, as the key factor of resettlement is the net income after resettlement (Sheng, Liang, & Shi, 2009). Schultz (1990) originally proposed a theory concerning the costs and benefits of population resettlement, in which only when the expected return of resettlement is higher than the transfer cost will people decide to migrate. Therefore, the expected net income of farmers in FSAs will directly affect their decision-making behaviour. The expected net income is the expected profit minus the cost of relocation and is represented as $E$ in the model; then, only when $E > 0$ will farmers decide to relocate. The larger the $E$ value is, the greater the probability that farmers will choose to relocate; when $E < 0$, farmers prefer to temporarily withdraw before a flood, and not permanently relocate. In this case, if they migrate, there is a high probability that they will return to the FSA.

### MATERIALS AND METHODS

#### 3.1 Model building

A logistic model can be applied to measure the relationships between discrete variables. This study uses a logistic model to analyse the factors influencing the decision-making behaviour of farmers living in FSAs. The resettlement decision-making behaviour is regarded as a dependent variable, while individual characteristics, family characteristics, existing housing and production conditions, resettlement area and infrastructure, and government subsidy policy are independent variables.
According to the above analysis, this paper establishes a function for the decision-making behaviour and factors influencing farmer households’ resettlement, as follows:

\[ Y = F(\text{individual characteristics, family characteristics, existing housing and production conditions, resettlement sites and infrastructure} + \alpha) \]  

The influencing factors are divided into 17 independent variables. Thus, the regression for the decision-making process behind farmer households' resettlement can be expressed as

\[ Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \cdots + \beta_{17} x_{17}. \]  

The results of this study reveal two cases. When farmers choose “very willing” or “willing” to migrate, the value 1 is assigned, indicating that they choose to migrate. When farmers choose “indifferent,” “unwilling,” or “very unwilling,” the value 0 is assigned, indicating that they choose not to migrate. This conversion reduces the demand for a large sample size of the five variable regression model and improves the accuracy of the data analysis.

If the probability of \( Y = 1 \) is \( P \), the value range is \((0, 1)\). The corresponding logistic regression equation can be expressed as follows:

\[ \ln \left( \frac{P}{1-P} \right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \cdots + \beta_n x_n. \]  

Among them, \( P \) indicates the probability of choosing to migrate, and \( 1 - P \) is the probability of choosing not to migrate. \( \beta_0 \) is a constant term that represents the regression intercept, \( \beta_n \) represents the regression coefficient of the \( n \)th influencing factor, and \( x_n \) expresses the \( n \)th independent variable, or the \( n \)th influencing factor.

### 3.3 Investigation method and data sources

The research data come from an investigation in Chengxiu FSA in Huoqiu County, Anhui Province, which was carried out in October 2017. By means of in-depth interviews with cadres in villages and towns, the author learned about the actual situation of resettlement and the resettlement willingness of farmer households. Then, a pre-survey of 30 samples was conducted. The questionnaire was revised and improved with the opinions and suggestions of experts in resettlement studies. The formal questionnaire covers the five aspects of individual characteristics, family characteristics, existing housing and production conditions, resettlement area and infrastructure, and government subsidy policy. The factors that affect the decision-making of farmers’ resettlement were finally examined through in-depth analysis.

A formal survey was conducted in April 2018. A total of 367 questionnaires were randomly distributed in 15 villages, and 286 valid questionnaires were collected, yielding a response rate of 77.93%. Figure 2 shows the general situation of farmers’ willingness to move. The questionnaire is presented in Appendix.

Of the 18 FSAs currently found in Huaihe in Anhui Province, Chengxiu FSA was chosen for investigation for three reasons. First, the total number of population to be resettled in FSAs of Huaihe River basin is 6,446,000, and the population in urgent need of resettlement in Chengxiu FSA is 183,300. The latter accounted for nearly 30% of the former. Thus, it is urgent and representative to select Chengxiu FSA as the investigation site. Second, Chengxiu FSA is the largest FSA in the middle basin of the Huaihe River. Its frequency of use is 10–15 years, but it has not been used since 1991, not because it has not been needed, but because a large population that is difficult to resettle lives in the unsafe, low-lying areas. With the development of the economy, wealth is accumulated, transfer losses increase, and it becomes increasingly difficult to issue flood diversion orders and implement...
resettlement. Chengxihu is located in Huoqiu County, Anhui Province (Figure 3).

4 RESULTS AND DISCUSSION

Logistic regression analysis was performed on the 286 valid samples using SPSS21.0. In this model, the Cox & Snell $R^2$ and Nagelkerke $R^2$ values were 0.641 and 0.803, indicating that the model had very good fit. The detailed results are shown in Table 2.

### 4.1 The influence of household individual characteristics

The statistical results of householder individual characteristics show that all variables except for sex and current life satisfaction affect farmers’ resettlement decisions. First, since FSAs are found in poor and backward rural areas, the majority of householders are married men. A total of 92% of the samples were male householders. Second, people living in FSAs are generally under threat of floods for a long period, and their current life satisfaction is generally not high, with little variation across individuals. Third, since there were not enough sample data used in this study, the variables of sex and current life satisfaction are not shown by logistic regression and are considered “nonsignificant” variables.

The influence of householder age on the resettlement decision is significant at the 5% level, and its coefficient is negative, as expected. Generally, older householders have a lower ability to engage in nonagricultural employment, and therefore fewer opportunities for suitable jobs under the same conditions. Moreover, greater age indicates stronger attachment to the place of residence, lower adaptability, and greater reluctance to relocate to a new place. On the other hand, younger householders have a stronger desire to accept new things and greater ability to adapt to new environments; they are also physically

### TABLE 1 Logistic model variable description

| Explanatory variable                        | Variable symbol | Variable description | Expected application direction |
|---------------------------------------------|-----------------|----------------------|-------------------------------|
| Individual characteristics                  |                 |                      |                               |
| Age                                         | X1              | $<35 = 1, \geq 35–50 = 2, \geq 50–65 = 3, \geq 65 = 4$ | –                             |
| Sex                                         | X2              | Male = 1, female = 0  | +                             |
| Education level                             | X3              | Illiterate = 1, primary school = 2, junior high school = 3, high school and above = 4 | +                             |
| Nonagricultural work experience             | X4              | Yes = 1, no = 0      | +                             |
| Current life satisfaction                   | X5              | High = 1, low = 0    | –                             |
| Family characteristics                      |                 |                      |                               |
| Family size                                 | X6              | Continuous variable  | +                             |
| Family per capita income (10,000 yuan)      | X7              | $<1 = 1, \geq 1–3 = 2, \geq 3–5 = 3, \geq 5 = 4$ | +                             |
| Nonagricultural income proportion           | X8              | $<30\% = 1, \geq 30–50\% = 2, \geq 50–80\% = 3, \geq 80\% = 4$ | +                             |
| Whether having school-age children          | X9              | Yes = 1, no = 0      | +                             |
| Current housing and production conditions   |                 |                      |                               |
| Current housing satisfaction                | X10             | High = 1, low = 0    | –                             |
| Cultivated land area (mu)                   | X11             | $<2 = 1, \geq 2–5 = 2, \geq 5 = 3$ | –                             |
| Tillage radius (km)                         | X12             | $<1 = 1, \geq 1–3 = 2, \geq 3 = 3$ | –                             |
| Resettlement area and infrastructure        |                 |                      |                               |
| Resettlement position                       | X13             | Suburb = 1, centre town = 2, safety zone = 3 | +                             |
| Infrastructure                              | X14             | Good = 1, general = 2, bad = 3 | +                             |
| Teaching quality                            | X15             | Good = 1, general = 2, bad = 3 | +                             |
| Government subsidy policy                   |                 |                      |                               |
| Resettlement subsidy standard               | X16             | High = 1, low = 0    | +                             |
| Rationality of subsidy policy               | X17             | Rational = 1, irrational = 0 | +                             |
stronger and can more easily engage in nonagricultural work locally or outside the village, so their resettlement willingness will be higher.

The influence of education level on the resettlement decision is significant at the 5% level, indicating that less educated people are more reluctant to relocate, and the degree of education is positively correlated with the decision to relocate. The effects of age and education are consistent with the findings concerning reservoir and rural family migrants, indicating that there is no particularity in these individual characteristics of farmers in the FSAs.

The impact of the nonagricultural work experience variable on the resettlement decision is significant at the 5% level. With the acceleration of China’s urbanisation process, the number of rural young and middle-aged labourers entering cities has increased dramatically. The richer the employment experience is and the more
conducive it is to the cultivation of all aspects of a householder’s ability, the stronger the employability will be. At the same time, householders with nonagricultural work experience have broadened their horizons and think that the outer world is more spacious and have more opportunities. They find that it is more sensible to move out than to stay in FSAs. Therefore, householders who have nonagricultural work experience are more likely to decide to relocate.

### 4.2 The influence of family characteristics

The family size variable is significant at the 10% level, indicating that larger families are more likely to decide to relocate. This may be because larger families imply more crowded living space and greater willingness to relocate to change the situation. The regression coefficient of family income per capita is zero, and the occurrence ratio is 1, indicating that its influence on resettlement decision is irregular. The relationship between family income and the resettlement decision is not linear. If the average annual household income is high, the household can afford the relocation cost and therefore may easily decide to migrate. However, some families may have spent the majority of their income building a new house in their current location, and relocation would mean that the money was wasted. As a result, although the family’s per capita income is high, the likelihood of choosing to migrate is low. The variable for the proportion of nonagricultural income is significant at the 5% level; this finding indicates that the greater the ratio of nonagricultural income is, the less income depends on the land, and therefore, the greater the likelihood that farmers will choose to migrate. The variable for having

| Explanatory variable               | $B$    | Wald     | Sig.  | Exp($B$) |
|-----------------------------------|--------|----------|-------|----------|
| **Individual characteristics**    |        |          |       |          |
| X1 age                            | -0.561**| 3.126    | 0.047 | 0.571    |
| X2 sex                            | 1.374  | 0.802    | 0.815 | 3.951    |
| X3 education level                | 1.032**| 0.743    | 0.071 | 2.807    |
| X4 nonagricultural work experience| 0.873**| 1.491    | 0.019 | 2.394    |
| X5 current life satisfaction      | -0.735 | 4.239    | 0.203 | 0.480    |
| **Family characteristics**        |        |          |       |          |
| X6 family size                    | 0.493* | 2.627    | 0.072 | 1.637    |
| X7 family per capita income       | 0.000  | 0.000    | 0.617 | 1.000    |
| X8 nonagricultural income proportion| 0.643**| 2.744    | 0.038 | 1.902    |
| X9 whether having school-age children| 2.116**| 5.742    | 0.025 | 8.298    |
| **Current housing and production conditions** | | | | |
| X10 current housing satisfaction  | -5.364***| 7.116    | 0.003 | 0.005    |
| X11 cultivated land area         | -1.274***| 2.954    | 0.007 | 0.280    |
| X12 tillage radius               | -2.869**| 3.752    | 0.065 | 0.568    |
| **Resettlement area and infrastructure** | | | | |
| X13 resettlement position        | 3.586***| 12.563   | 0.002 | 36.089   |
| X14 infrastructure               | 0.734  | 1.645    | 0.278 | 2.083    |
| X15 teaching quality             | 0.469  | 3.843    | 0.435 | 1.598    |
| **Government subsidy policy**     |        |          |       |          |
| X16 resettlement subsidy standard| 1.346***| 5.379    | 0.003 | 3.842    |
| X17 rationality of subsidy policy| 2.748***| 7.541    | 0.001 | 15.611   |
| Constant                         | -1.571 | 2.636    | 0.000 |          |
| -2 log likelihood                | 71.047 |          |       |          |
| Cox & Snell $R^2$                | 0.641  |          |       |          |
| Nagelkerke $R^2$                 | 0.803  |          |       |          |

Note: ***, **, and * indicate significance at the 1, 5, and 10% levels, respectively.
school-age children is significant at the 5% level. Because the conditions of rural schools in FSA are much worse than those in towns or counties, farmers often rent houses in a town to obtain better education for their children. This shows that because of the importance of children’s education, having school-age children becomes an important factor in the decision to migrate out of FSAs, and thus, families with school-age children tend to migrate.

### 4.3 The influence of current housing and production conditions

The current housing satisfaction variable is significant at the 1% level, and the coefficient is negative, indicating that the more satisfied farmers are with their current housing, the less willing they are to relocate, and vice versa. 38% of the farmers’ houses are new, that is, new construction within the last 5 years; 48% of the farmers’ houses are over 5 years old; and 14% of the farmers’ houses are dangerous (of course, some farmers do not necessarily live in such houses for long). Under the condition that the resettlement subsidies are paid by households, 48% of the farmers living in new buildings will never want to relocate. Therefore, the value of the current housing satisfaction variable is inversely proportional to the decision-making behaviour of farmer households. The variable of cultivated land area is significant at the 1% level. China’s current land policy for cultivated land of different areas is rigid. Farmers in FSAs who have more arable land are less likely to choose resettlement, while those who have less arable land are more likely to choose resettlement. Tillage radius refers to the distance from the planned resettlement area to the fields the farmer cultivates, rather than the distance from the existing home to the fields he cultivates. The variable of tillage radius has significance at the 10% level; therefore, as the tillage radius increases, the difficulty of engaging in production and ensuring one’s livelihood increases. Tillage radius is one of the fundamental reasons why farmers decide against resettlement (Li, Wen, & Shen, 2010). The greater the tillage radius is, the lower the likelihood that farmers will decide to relocate.

### 4.4 The influence of the resettlement location and infrastructure

The location of the resettlement site is significant at the 1% level, and it has the largest coefficient of all variables, which indicates that the resettlement location is the most important factor in farmers’ resettlement decision. The better the location is, the more likely a farmer will choose to relocate. This finding supports Tang’s conclusion (Tang & Li, 2012), which is consistent with the saying “the man goes up to the high place, and the water flows down to the low place”. No one wants to move permanently to a location that is worse than the current residence. In contrast, the infrastructure and teaching quality variables are not significant. This may be because these two variables have certain fuzziness; the quality of infrastructure and teaching can be judged only after a household relocates. Therefore, infrastructure and teaching quality have no significant impact on farmers’ decision.

### 4.5 The influence of government subsidy policy

The variable for the resettlement subsidy standard is significant at the 1% level. This indicates that the higher the subsidy standard is, the more likely farmers will decide to relocate, while the lower the subsidy standard is, the less likely farmers will decide to relocate. The variable of resettlement subsidy is directly proportional to farmers’ decision-making behaviour. The rationality of the subsidy policy variable is significant at the 1% level, which indicates that the more reasonable the subsidy policy is, the more likely farmers will decide to relocate, while farmers are unlikely to relocate if the subsidy is unreasonable. The rationality of the subsidy policy variable is directly proportional to the farmer’s resettlement decision.

### 5 CONCLUSIONS

Based on a field survey, research data concerning 286 farmer households were collected, and a logistic model was applied to analyse the decision-making process and influencing factors behind the resettlement of farmer households’ living in FSAs. The following conclusions were drawn.

Individual characteristics, family characteristics, existing housing and production conditions, resettlement area and infrastructure, and government subsidy policies have a significant impact on the resettlement decision-making behaviour of farmer households in FSAs. Among these factors, nonagricultural work experience, education level, family size, proportion of nonagricultural income, presence of school-age children, resettlement location, resettlement subsidy and rationality of the resettlement subsidy have a positive influence on farmer households’ decision to relocate. The four factors of householder age, current housing satisfaction, cultivated land area, and
tillage radius have a negative impact on farmers’ decision to relocate. Annual average family income and household sex have no obvious influence on the decision-making behaviour of farmer households. In short, if the household is younger, more educated, has non-agricultural work experience and is optimistic about the expected income of resettlement; if the family size is larger, the proportion of nonagricultural income is larger, and there are school-age children; if the farmer is more dissatisfied with the existing housing, and the cultivated land area and tillage radius are smaller; if the resettlement area is better; or if the resettlement subsidy standard is higher, and the subsidy policy is more reasonable, the likelihood that farmers will decide to relocate is higher.

The location of the resettlement area is an important factor that is directly related to farmers’ decision to relocate in FSAs. According to the theory of population gradient transfer, there are two modes of rural population transfer: transfer to cities and towns or transfer from poor areas to better-off rural areas (Yan, Shi, & Yi, 2012). Farmers want to move to the suburbs or larger towns where the economy is prosperous and transportation is convenient. The minimum standard is that the resettlement sites cannot be economically behind and more inconvenient than the farmers’ current residence. In other words, the better the location and economy of the resettlement site is, the more likely farmers will decide to relocate.

The rationality of the standard of resettlement subsidy and the subsidy policy are important factors affecting farmers’ resettlement out of FSAs. For migrants, there is a reasonable level of compensation at which they will voluntarily relocate. When the compensation granted by resettlement improves their situation, voluntary resettlement can be achieved (Jackson & Sleigh, 2000). According to rational decision theory, if the government sets up a high-standard resettlement subsidy, farmers will expect higher income after relocation, and the likelihood that they will decide to relocate will be greater. In contrast, the lower the subsidy standard is, the less likely farmers are to relocate. As shown by the surveys, one of the issues of most importance to farmers is the amount of the resettlement subsidy for housing construction. It is true that all the potential resettlement farmers want the government to provide a higher resettlement subsidy, and the more money is offered, the more people will choose to move. This situation is characteristic of human greed. However, due to the special historical reasons for the formation of the FSAs in the Huaihe River basin, it is impossible for all the people in FSAs to move away. The resettlement subsidy cannot simply be increased. For potential resettlement farmers, there is a reasonable price subsidy standard that will satisfy most people and prompt their choice to migrate. Therefore, what the government needs to do is to find this reasonable standard through comprehensive research and demonstration. Whether the subsidy policy is reasonable is related to the specific interests of each household. For example, the policy may mimic that adopted for old city demolition; the value of compensation may be determined according to the value of the present housing and courtyard and not simply set at a flat rate.

In conclusion, resettlement in FSAs is an important means of flood risk management by the government. Compared with the resettlement activities carried out after flood disasters in the past, it is an innovation of government management function mode to actively relocate the unsafe masses to safe areas, which can avoid the huge social problems brought by resettlement after disasters. The implementation of resettlement in FSAs reflects the leap from the concept and strategy of “resettlement due to disasters” to “resettlement due to danger.” Farmer households’ resettlement decision depends on many individual factors, such as the householders’ level of knowledge, age and family size and general factors, such as the resettlement conditions, local flood pressure, and national relocation policy concerning FSAs. Therefore, flood resettlement policy propaganda and mobilisation should promote farmers to relocate.

Like all studies, this one has certain limitations. First, the specific factors influencing the resettlement decisions of farmers’ in FSAs require further refinement and improvement. Relocation problems need to be tested in practice. The research conclusions cannot be simply applied to all FSAs, and the results are not universally generalizable. Second, the research focuses mainly on the resettlement to nearby areas, such as nearby safety zones, villages and towns. The influencing factors of the resettlement decision for farmers who buy houses in more distant cities and towns are different, and this research does not consider this case. Third, good resettlement infrastructure, public services and human environment are undoubtedly attractive factors for farmers’ resettlement, but there is some ambiguity in the quality of resettlement infrastructure, as it can be judged only after farmers relocate. Thus, the impact of this indicator is worth further investigation. Future research should explore more extensive factors affecting the decision-making behind farmer households’ resettlement, examine the change in the decision-making of farmer households after resettlement and study the value of relocation for residents in FSAs.

Of course, many factors are involved in the decision-making process of farmer households living in FSAs. Whether to relocate is the first decision. Future research should investigate farmers’ decisions concerning, first,
whether the nuclear family or the extended family should relocate; second, where the household should relocate, either to rural or urban areas, and then to which particular location; third, whether to buy or rent a house in the resettlement area; and fourth, the source of livelihood after resettlement, whether it is farming or nonagricultural employment.

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ENDNOTE

1 Relocation plan for residents in Huai River FSAs and Huai River beach area of Anhui Province (Revision) (Anhui water gauge No. [2016] 57) [EB/OL]. [June 8, 2016]. http://www.ahsl.gov.cn/websites3/detail/5757d90fdd6f36b015000028.html

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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