Households’ Willingness to Contribute to Irrigation Infrastructure in Rural China: The Role of Lineage and Outmigration

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Abstract: Rural areas worldwide are witnessing an increase in outmigration, which has led to an impact on irrigation infrastructure management. In many cases, governments in transition economies find it difficult to support small-scale irrigation infrastructure programs. This research aims to examine the extent to which the recent “lineage revival” in China to increase the importance of lineage networks can reduce the negative effects of outmigration in rural communities. Analyzing a rural community in Sichuan Province, the findings reveal that while there is no significant effect of outmigration on respondents’ willingness to contribute toward irrigation infrastructure, and while lineage networks can enhance this willingness, such networks also reduce participation if non-lineage members are among the beneficiaries. Finally, the study provides an understanding of how informal lineage networks may facilitate contribution to irrigation infrastructure.

Keywords: lineage; migration; irrigation infrastructure; rural community development

1. Introduction

In 2018, China’s agricultural water consumption was 369.3 billion cubic meters, accounting for 61.4% of the total water consumption, with surface water accounting for 82.3%, groundwater accounting for 16.2%, and rainfall accounting for 1.5% of this consumption. The effective irrigation area of farmland was 1.02 billion mu and the irrigation area accounted for 50% of the cultivated area which means irrigation is essential for agricultural production in China. To what extent can traditional informal institutions of lineage mitigate the effects of outmigration in rapidly changing rural communities, with regard to people’s willingness to contribute to irrigation infrastructure development? To examine this question, this article describes a case study in a Chinese rural community.

The rapid development of China’s urban areas has led to outmigration in rural communities [1–4]. According to the National Bureau of Statistics of China, the total number of peasant workers migrating from rural to urban environments in 2018 was 288.36 million, an increase of over 0.6% from the previous year, and nearly one-fifth of the total population of China [4]. Out-migrants were primarily young farmers leaving behind older people and women to become “the main agents of production and life in the villages” [3]. This large-scale outmigration of young men into cities has affected the collective management of households, village leadership, social capital, households’ sense of community, and their dependence on resources. Collective action is pivotal for natural resource management in Chinese rural communities [5,6], and in other developing countries, such as Nepal [7], Kenya [8], and Pakistan [9]. “Collective action occurs when a group of potential beneficiaries jointly provide and maintain physical, such as irrigation systems” [10]. Most of the government-led projects are large
projects [11], and therefore, while the government has invested heavily in irrigation infrastructures, e.g., the “take targeted measures to help people lift themselves out of poverty” policy [12], there is a gap between government provision and households’ demand for small-scale irrigation infrastructure, and it is unclear whether the larger investments have brought about the desired improvement in the lives of people in rural communities. Self-led initiatives by residents provide opportunities to fill this gap and create more sustainable, self-help forms of community development [13].

There have been different modes of irrigation infrastructure provision for collective action in rural communities in China over the last century. Before 1949, during the Qing Dynasty, state power did not reach the village level, so village-level order depended on etiquette, lineage, and village leaders [14]. Village leaders coordinated providing irrigation infrastructure by organizing peasants’ collective action. Village leaders had the power and authority to do this as they were responsible for the moral education of peasants, which entailed establishing the moral standards of the community. These standards, as well as a certain sense of belonging to the community, generated feelings of shame if a peasant did not participate in the collective action of rural public infrastructure provision or any other action for improving public welfare [15].

From 1958 to 1979, villages were part of a vertical and centralized political structure belonging to “people’s communes” that were responsible for economic production and village decision-making. A commune formed the lowest level of state administration and had, on average, approximately 20,000 members [16]. Two further levels, the “brigade” and the “team,” existed below the commune level. Peasant life traditionally revolved around groups of farmers (the team) that made up the brigade, which was at the village level (or the societal unit) of a lineage and was also part of a market zone that comprised more than a dozen villages (the commune). The brigade or village was responsible for overseeing infrastructure construction [17], while the team was responsible for the operation and maintenance of infrastructure (e.g., irrigation infrastructure). Hence, society was organized vertically, and political and economic organization reached down to the village level. With the introduction of the Household Responsibility System in 1979, this vertical organization came to an end, and every villager was rented out a piece of land for cultivation. However, the institutions from the previous period of collectivity continued to practice agriculture, particularly when it came to the provision of public goods [18].

Currently, the public administration in China is responsible for irrigation infrastructures, and village committees are “officially organs of self-governance” [19]. There are few formal regulations regarding village committees [17], and the management of small-scale irrigation infrastructure. The central government of China is responsible for the construction and management of large-scale irrigation infrastructures. Before 2006, the main source of funding for the management of small-scale irrigation infrastructures were agricultural taxes and fees. Local governments and village-level collective organizations (village committees) were still responsible for the management of small-scale irrigation infrastructure. The abolition of agricultural taxes cut off funding sources and weakened the role of local governments and grassroots organizations in the implementation of small irrigation-infrastructure management. As the formal administration is unable to manage small-scale irrigation infrastructure at the village level, lineage or religious organizations have taken on that role. In the context of village governance, lineage has become an important social network [20], through which the provision of public goods can be improved [21].

A lineage network is a collection of social relations among blood relatives of the same lineage stretching over a certain geographical area [22]. Lineage networks are an important traditional informal institution [23,24] affecting the management of irrigation infrastructure in rural communities. In China, these lineage networks and their institutions have recently been reformed to become more compatible with modernity [25]. As the state influence has weakened in rural communities, the “influence of lineage and popular village religions has re-emerged in some villages” [26]; however, scholarly opinion varies on how this development influences management of public goods [21,26–28] demonstrated that lineage contributes to the provision of public goods and collective action in rural communities in the context
of weak formal institutions. These findings are similar to the results of research in other countries where lineage is believed to have an impact on natural resource management. Beyene, for example, demonstrated how lineage-based customary institutions facilitate grazing-resource management in Ethiopia [29], and Brown and Lassoie illustrated how lineage network structures can affect democratic processes and community-based forest management in Cameroon [30].

Lineage members often engage in collective activities such as ancestral rituals, family meetings, and enacting and executing lineage rules [31]. Lineage is, however, also important to rural society because lineage elders are responsible for the reconciliation of disputes [21]. To this end, ancestral temples are important places of worship and conflict resolution. However, it is not just lineage elders who manage public tasks in a village; a temple committee has the authority to collect money for public purposes, which is why village cadres, that do not always have the resources to supply all the required public services, at times rely on lineage or temple groups to fund and manage public services [17]. “Single-lineage villages that actively practice lineage rituals ... or that contain an active village community council or temple association provide broad community networks that village officials can draw on for public services” [17]. Lineage is a mobilizing structure of collective action, which is more likely to occur in villages with strong lineage networks (monopolistic or oligopolistic structure) than in mixed-surname villages [32]. In addition, strong social capital based on lineage can facilitate sustainable governance and adaptive governance such as infrastructure provision through collective action in rural communities [33]. At the individual level, “villagers who participate actively in an annual cycle of lineage or religious activities involving the entire community are far more likely to respond to a call for voluntary contributions to pave a road or build a new village school” [17]. However, few quantitative researchers have investigated how far the lineage networks have influenced the provision and maintenance of irrigation infrastructure in rural China and whether outmigration has been affected by this. A subsequent question is whether a lineage network, as an institution, can still build a bond among people and motivate them to contribute toward the general economic development in the context of rural outmigration.

Outmigration is the result of modernization and urbanization; apart from this factor, another development in rural China is “lineage revival” [3,25]. “Lineage revival” has occurred in the context of the expanding tolerance of local authorities toward traditional culture, traditional lineage, and lineage networks, and, subsequently, these have played an increasingly important role in rural governance [3]; thus, lineage may encourage villagers to participate in rural governance.

While this research provides evidence that lineage networks influence the provision of irrigation infrastructure, Researchers could not confirm the influence of lineage networks on the provision of irrigation infrastructure, but rather, they argued that the level of economic development was a significant factor [34]. In more economically-developed villages, particularized trust, as embodied by lineage networks, becomes less powerful, and lineage is subsequently more influential in the provision of irrigation infrastructure. This finding supports the hypothesis that the modernization of rural China has weakened the influence of informal institutions such as lineage, partly because of the “new links between peoples and resources” [2], for example, from migration networks.

It is not known whether outmigration from rural communities or lineage networks, or both, influences the provision of irrigation infrastructure in rural communities of China. Researchers have thus far explored either the influence of outmigration on public goods provision [2,4] or the increasing influence of lineage networks on the provision of public goods [21,28,35]. However, as no research has been conducted to examine the impact of both, in this study, the influence and extent on both is studied and compared.

This research paper will briefly introduce the recent history of the governance of the commons in rural communities in China and the history of lineage networks as an important part of China’s rural communities. It will then introduce the model of the lineage network and the willingness of people to participate in collective action.
2. Materials and Methods

2.1. A Model of Willingness to Participate in Irrigation Infrastructure Provision

Lineage networks are assumed to play a role not only in connecting lineage members but also in determining how lineage translates into the willingness of individuals and households to participate in irrigation infrastructure provision. The focus of this research is the influence of lineage on households’ willingness to participate in the provision of small-scale irrigation infrastructure (WPPSI). At the same time, the impact of outmigration on household WPPSI is analyzed. Infrastructure is defined as the combination of physical facilities and systems used to provide public services [36], and infrastructure management encompasses all the activities that are performed to provide and maintain adequate infrastructure [37].

While outmigration and the level of economic development can be easily operationalized as quantitative variables, the operationalization of lineage is by no means straightforward. This problem begins with the definition of lineage, which, depending on the literature, can be rather broad. As lineage networks are the “primary informal institutions that regulate rural life” [5], lineage permeates the social structure of culture and power [23,24], and is deeply rooted in rural Chinese society, (i.e., political, economic, and religious views [38]. Moving away from these general definitions to one that looks specifically at the practice of lineage, five constituents of lineage networks in China become important. First, the core spirit of lineage in China is filial piety (Er Ya Shi Qin; Xiao Jing), that is, the younger generation should love, respect, and honor their parents [39], and love, respect, and honor all people. Second, lineage implies that members of lineage networks have a common ancestor (Bai Hutong·Zong Zu). Ancestral temples, a genealogy, and practicing to sacrifice are very important practices for lineage (Xiao Jing·Sang Qin). Third, lineage networks traditionally have a leader (Bai Hutong·Zong Zu); however, this is not a necessary condition in modern society. Fourth, lineage members share a surname (Bai Hutong·Zong Zu). Finally, a common cemetery is important to a lineage network (Xiao Jing·Sang Qin). Against this background, it becomes clear why research on lineage networks as fundamental informal institutions in rural China has used hands-on indicators for measuring their influence on rural society. For example, most researchers have used the physical presence of an ancestral temple [21,26,27,40] as “a symbolic space of the lineage” and a spiritual carrier [25,31], and therefore, as an indicator of a lineage network [40,41]. Researchers have also used genealogy as an indicator; genealogy is the embodiment of the spirit and solidarity of a lineage, which is difficult to measure directly [40,42]. This research will follow this tradition and employ the presence of an “ancestral temple” and of “genealogy,” or of both, to operationalize lineage.

As outlined above, “lineage revival” has occurred alongside large-scale outmigration, which has affected the provision of irrigation infrastructure. As people migrate to cities, the question arises as to whether and to what extent this migration will also affect lineage networks as informal institutions. To aid the study of this interrelation of lineage and outmigration on the provision and maintenance of irrigation infrastructure, a “strength of lineage network ties” (SLNT) measurement is proposed as an indicator. This indicator distinguishes whether a respondent is part of a lineage network of an ancestral temple or genealogy or is a member of a lineage network without a temple or genealogy. To measure outmigration, we considered whether the respondent lives in the village or outside the village, which is assumed to influence their WPPSI; that is, the WPPSI is presumed to be lower or less predictive if the respondent lives outside the village.

This model was applied to empirical research carried out among the Hakka, a Han ethno-linguistic group in the Sichuan Province. The Hakka, with a population of about 50 million, are distributed in 19 provinces in southern China and account for approximately 5% of the Chinese Han population—the largest ethnic group of China. While they are not considered an ethnic minority, they are still distinct from the Han Chinese people. The Hakka have experienced displacement throughout their history, and hence, have a strong sense of identity helping them maintain the traditional culture of the Hakka lineage networks over generations. This implies that Hakka communities have stronger levels of
cohesion compared to other Han communities. At the same time, Hakka lineage networks are a good representation of the broader Chinese traditional lineage networks and they are an ethnicity that is part of the Han ethnicity. Moreover, after the Cultural Revolution, minority protection policies have not been applied and therefore these policies have not interfered with the informal Hakka institutions. Subsequently, their lineage network has largely maintained their traditions over time. Against this background, a survey among the Hakka was deemed suitable for this research.

2.2. Research Design—Survey

The dataset is part of a survey that the authors carried out from August to September 2018. The research area was the city of Chengdu, in Jintang County, which is located in a humid subtropical climate affected by the monsoon. Due to the influence of terrain and rainfall distribution, the drought frequency in winter and spring is more than 90% and the drought frequency in summer is 77%. Small irrigation infrastructure is particularly important for agricultural production. Three communities surveyed had six small river dams, 511 small irrigation pools, 14 small electric pumping stations and 24.06 km of irrigation channels. The lack of management of these small irrigation infrastructures since 2006 has led to years of disrepair, and villagers had spontaneously intervened in their management. Jintang County is a Han area; however, in the sample, Hakka households account for 27.63% of the participants. According to the recommendation of experienced local government staff, three communities from three different townships: Zhugao Town, Tianbaozhai Village, Wufeng Town, Xiaofeng Village, and Pingqiao Twon Dayu Village, which are Hakka households, were selected. A total of 152 questionnaires were collected (one village produced 50 samples, and two villages produced 51 samples each). Sichuan is the second-largest province for outmigration workers and Chengdu is the capital of Sichuan. The research area was located at the edge of Chengdu, which not only inherits a good lineage culture and informal institutions but is also affected by outmigration of workers in the context of rapid urbanization. We compared sample data with national data (age, gender, and education level). The sample could represent plain areas, hilly areas, and suburban rural areas in southern China. First, the local community leaders for the proportion of Hakka households were interviewed, and then using the help of local rural leaders, the stratified random sampling method was used to sample a certain percentage of Hakka households and Han households. We divided the sample into two groups of Hakka and Han, and randomly sampled Hakka people in each village at a rate of 27.63%, and Han people at a rate of 72.37%. When the sampled Hakka households were not available, the nearest alternative household was used to complete the sampling.

The questionnaire included general questions about the household head (e.g., age, party membership, and place of residence), questions about the SLNT, and questions relating to the WPPSI. The survey also included questions about household resource endowment (social capital endowment, traffic location endowment, economic resource endowment, family labor including human capital, and family education) and natural capital (agricultural land endowment).

After the survey, the survey data were validated by township cadres, community cadres, and community elites as they understand the communities’ dynamics and would be able to comment upon the validity of the data. The sample covered two types of SLNT (79 households with ancestral temple or genealogy or both and 73 households without ancestral temple and genealogy) as well as households with different types of places of residence.

3. Results: Descriptive Statistics

While the questionnaire asked questions about the household, the respondents were mostly the head of the household or core family members of a household. Farmers completed the questionnaires by themselves but were accompanied by a researcher who provided further clarification; for example, regarding the options for the answers to ensure the validity of data entered. In total, 154 questionnaires were completed, and excluding the omitted questionnaires, the sample comprised a total of 152 valid questionnaires, with an effective response rate of 98.70%. From the valid data, 84.87% of the
respondents were male, and the age group that officially makes up the labor force, that is, between 20 and 60 years old, accounted for 89.47% of respondents. The household head’s education level was used as a proxy for the household’s education level, and 10.53% of the household heads had primary school education or less, 16.54% had graduated from junior middle school, technical secondary and high school degrees accounted for 21.05%, and 6.58% of the household heads had a college degree or an even higher educational degree. Household heads living in the village for less than 20 years accounted for only 9.21%; 44.74% of the household heads (i.e., 68 household heads) had been living in the village for 20 to 39 years; 53 respondents, that is, 34.87%, had been living in the village for 40 to 59 years; and 17 household heads had been living in the village for more than 60 years, accounting for 11.18%. Household heads who were party members accounted for 28.95% of the respondents (Table 1).

### Table 1. Descriptive statistics.

| Item                  | Category                        | Quantity | Percentage | Item                  | Category                        | Quantity | Percentage |
|-----------------------|---------------------------------|----------|------------|-----------------------|---------------------------------|----------|------------|
| Gender                | Male                             | 129      | 84.87      | Education level       | Primary school and below        | 32       | 21.05      |
|                       | Female                           | 23       | 15.13      |                       | Junior middle high school       | 58       | 38.16      |
| Age                   | Age 16–20                        | 1        | 0.6        |                       | Technical secondary/high school | 46       | 30.26      |
|                       | Age 21–40                        | 76       | 50         |                       | College                         | 14       | 9.21       |
|                       | Age 41–60                        | 60       | 39.47      |                       | Master/PhD                      | 2        | 1.32       |
|                       | Over the age of 60               | 15       | 9.8        | Period of living in village | Under 20 years               | 14       | 9.21       |
| Political status      | Party member                     | 44       | 28.95      |                       | 20–39 years                      | 68       | 44.74      |
|                       | Communist Youth League member    | 5        | 3.29       |                       | 40–59 years                      | 53       | 34.87      |
|                       | General public                   | 103      | 67.76      |                       | Over 60 years                    | 17       | 11.18      |
|                       | Living in village                | 122      | 80.26      | Household labor (number) | 0–1                              | 8        | 5.26       |
|                       | Living in cities and towns       | 30       | 19.74      |                       | 2–3                              | 116      | 76.32      |
|                       |                                  |          |            |                       | 4–7                              | 28       | 18.42      |
| Total number          | 152                              |          |            | Total number          | 152                              |          |            |

Note: In the survey, the male head of the household was chosen first. If the head of the household were an outmigration worker (not at home), the female head of the household was chosen to represent the household. Gender, age, and political status were the value for the respondents. Education level and period of living in village were the value for the head of the households. Living in cities and towns were the value for family members.

#### 3.1. Willingness to Participate in the Provision of Small-Scale Irrigation Infrastructures

In the questionnaire, a total of four statements [43] and a Likert scale of 1 to 5 were used to measure respondents’ WPPSI(y). The average of the values of the four statements was taken as the total value; that is, the ordinal variables of the Likert scale were converted into one continuous variable from 1 to 5. For a first overview of the WPPSI values, please see Table 2. In Table 2, the WPPSI values are divided into six categories, and the different independent variables, that is, SLNT, ethnicity, and place of residence, are presented. The value categories that received the highest percentage age of responses are highlighted. In the following section, the distribution of the WPPSI for each of the independent variables is briefly discussed.

### Table 2. Households’ willingness to participate in the provision of small-scale irrigation infrastructure (WPPSI) range description.

| Item                  | Category                        | 1  | 1 >, ≤ 2 | 2 >, ≤ 3 | 3 >, ≤ 4 | 4 >, ≤ 5 | 5  | Proportion |
|-----------------------|---------------------------------|----|----------|----------|----------|----------|----|------------|
|                       | SLNT                            |    |          |          |          |          |    |            |
|                       | With ancestral temple or genealogy * | 0  | 0        | 7.59     | 25.32    | 36.71    | 30.38 |            |
|                       | No ancestral temple or genealogy | 5.48 | 0        | 23.29    | 35.62    | 20.55    | 15.07 |            |
| Department of people  | Hakka                           | 0  | 0        | 6.82     | 27.27    | 56.82    | 9.09  |            |
|                       | Non-Hakka                       | 3.70 | 0        | 18.52    | 31.48    | 17.59    | 28.70 |            |
| Place of residence    | Village                         | 1.82 | 0        | 17.27    | 30.00    | 23.64    | 27.27 |            |
|                       | Cities and towns                | 4.76 | 0        | 9.52     | 30.95    | 42.86    | 11.90 |            |
| Total                 |                                 | 2.63 | 0        | 15.13    | 30.26    | 28.95    | 23.03 |            |

* All categories of lineage were selected the head of the households.
3.1.1. SLNT and WPPSI

SLNT has two dimensions: households had neither an ancestral temple nor a genealogy (referred to as “without” in the table), or households that had an ancestral temple or genealogy or both (referred to as “with” in Table 2). As illustrated with Table 2, the majority of households had strong lineage network ties (i.e., “with” in Table 2), and demonstrated WPPSI values between 4 and 5, that is, they expressed a strong or very strong willingness, as 67.09% of the households selected a value of more than 4. Households without (strong) lineage network ties are not as willing to contribute to the provision of irrigation infrastructure, and 63.77% expressed a willingness level less than 4.

3.1.2. Hakka People and WPPSI

Most Hakka respondents selected values higher than 3 for the WPPSI, which means “willing,” and among all the Hakka households 84.09% were either “willing” or “strongly willing” to contribute to irrigation infrastructure. Among the non-Hakka households, 18.52% expressed their willingness with a value higher than 2 and up to 3. This means that a considerable share of the non-Hakka respondents were unwilling (i.e., demonstrated a value of 2) or “neither willing nor unwilling” (i.e., demonstrated a value of 3). Nevertheless, 28.70% of the households selected the value 5, which indicates “perfectly willing.”

3.1.3. Place of Residence and WPPSI

In this research, the place of residence was the main reference for whether household members were migrant workers. Being a migrant worker was presumed to impact economic resource endowment. In the sample, 27.63% of the respondents lived in cities and towns, and, interestingly, 54.76% of the respondents “living in cities and towns” were “willing” or “more than willing (i.e., higher than 4) to contribute to irrigation infrastructure. Respondents living in the village did not display a higher willingness than people “living in cities and towns.” For example, 17.27% responded that, on average, they were neither willing nor unwilling. At the same time, 50.91% of the respondents were very willing to contribute to irrigation infrastructure compared with 54.79% of the respondents who were “living in cities and towns.”

3.1.4. Independent Variables Description

Other independent variables included the period of time the household head had lived in the village, political status, relationship with the villagers, income, house size, house structure, family labor force, distance from main road, education level, land area, and age.

The longer the period of time the household head had lived in the village, the more the resource endowment of households was concentrated in agricultural production and depended on agricultural production; thus the households were more willing to contribute to irrigation infrastructures. Political status of household heads and relationship with villagers were related to the social status of households and being a party member. Having a good relationship with the villagers meant higher social status in rural areas which made households more willing to live in rural areas and contribute to irrigation infrastructures. High-income households had more surplus funds beyond basic living which made them more willing to contribute to irrigation infrastructures. House size and structure were key factors of immovable property; large house size and high quality house structure were high-quality resources of households in rural areas which meant households were more willing to carry out agricultural production rather than becoming outmigration workers, and thus they were more willing to contribute to irrigation infrastructures. The total area of farmland of one household in rural China usually required one or two laborers to engage in agricultural production; households with more laborers were more likely to have surplus laborers to become outmigration workers which meant that they had more income and were more willing to contribute to irrigation infrastructures. Less distance from the main road helped reduce the cost of transporting and selling agricultural products which made households...
more willing to engage in agricultural production, and thus more willing to contribute to irrigation infrastructures. The higher the education level, the more willing the household was to contribute to irrigation infrastructures, because higher-education-level households understood that improving irrigation infrastructures could help increase crop yields. The larger the land area owned by households the more their income from agricultural production, thus the more willing they were to contribute to irrigation infrastructures. Finally, the younger their age, the stronger their willingness to change the existing production conditions in order to increase their income from agricultural production and more the more willing they were to contribute to irrigation infrastructures.

4. Results: Regression Analysis

For the regression analysis, two dependent variables were used. One dependent variable related to the full sample of households’ WPPSI and is referred to as WPPSI(y). As independent variables, SLNT (x1) and households’ resource endowment—agricultural land endowment, family labor endowment, economic resource endowment, social capital endowment, family education, and traffic location—were selected (x2 to x13) [44,45]. A Tobit model of the limited dependent variables was used to analyze the data. The definition and description of the variables are provided with Table 3.

Households’ WPPSI is the average of the values of the four Likert scale statements, and hence it is expressed in continuous values from 1 to 5, that is, as limited dependent variables. This is the reason a Tobit model of limited dependent variables was selected. The Tobit model is expressed as follows:

\[ y_i = \begin{cases} 
\beta^T X_i + e_i, & 1 \leq \beta^T X_i + e_i \leq 5 \\
0, & 1 > \beta^T X_i + e_i \text{ or } \beta^T X_i + e_i > 5 
\end{cases} \]

where WPPSI is expressed as \( Y_i \). The explanatory variables that impact the WPPSI are expressed as \( X_i \), \( \beta^T \) represents the \((k \times 1)\) dimension of the unknown parameter vector, and \( e_i \) represents the error term.

For the limited dependent variables, Tobit regression analysis was conducted using Stata14.0, and the results are as shown in Table 4. For this analysis, six different models were used: regressions for the SLNT type (Model 1), residence type (Model 2), Hakka ethnicity (Model 3), overall regression (Model 4), SLNT and residence type (Model 5), and SLNT type and the Hakka ethnicity (Model 6).

4.1. Regression Analysis for the Sample

Model 4 demonstrates the regression results of all the variables. Only lineage networks had a significant influence on the WPPSI. While the influence of lineage was positive, not living in cities and towns did not influence the WPPSI. Whether a respondent was Hakka or not, could not predict their WPPSI. Furthermore, respondents’ relationship with other villagers (variable x6) positively correlated with the WPPSI, which seems contradictory to the finding that the family labor force was negatively correlated with the respondent’s WPPSI (see variable x10). Having good relations with other villagers made households feel more positive about collective action, and thus relations with other villagers was a positive correlation.

In the following section, the variables that had a significant influence on the WPPSI independent of the model are presented, and then some of the particularities of the different models are discussed.
Table 3. Variables definitions and descriptions.

| Variable                      | Index                                                                 | Variable Definitions                                                                 | Means  | Standard Deviation | Minimum Value | Maximum Value |
|-------------------------------|-----------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------|-------------------|---------------|---------------|
| Dependent variable            | WPPSI sample of households’ WPPSI(y)                                  | The average continuous variable value of five-point Likert scale                     | 4.061  | 0.893             | 1             | 5             |
| Independent variable          | SLNT Head of households’ lineage with ancestral temple or genealogy  | Yes = 1, No = 0                                                                     | 0.519  | 0.501             | 0             | 1             |
| Social capital endowment      | Hakka (x3)                                                            | Yes = 1, No = 0                                                                     | 0.276  | 0.449             | 0             | 1             |
| Period the head of household  | living in the village (x4)                                             | Reported value of the respondents (year)                                            | 38.336 | 17.258            | 2             | 94            |
| political status (x5)          | Party members = 1 Communist Youth League members = 2 The masses = 3 Others = 4 | Good, very harmonious = 5, Well = 4, In general, neither good nor bad = 3, Poor relationship, not very good = 2 Very poor, large friction, hostile state = 1 | 2.408  | 0.930             | 1             | 4             |
| Relationship with the villager (x6) |                                                                 | 3.099  | 1.603             | 1             | 5             |
| Economic resources endowments | Income (x7)                                                           | Logarithmic (yuan/year household) respondents’ reported values                      | 47341.6| 114514.7          | 0             | 1015000       |
| House size (x8)               | Logarithmic (square meter) respondents’ reported values              | 193.449  | 130.004           | 0             | 810            |
| House structure (x9)          | Reinforced concrete structures = 5, Brick structure = 4, Wood and brick structure = 3, Stone/wood/cottage, adobe houses, shacks = 2, Others = 1 | 3.152  | 1.186             | 1             | 5             |
| Family labor endowments       | Family labor force (x10)                                              | Reported value of the respondents (number of people)                                | 2.730  | 1.196             | 1             | 7             |
| Traffic location endowment    | Distance from the main road (x11)                                    | Reported value of the respondents (kilometer)                                       | 2.391  | 3.509             | 0             | 20            |
| Family education endowments   | Education level of the head of household (x12)                       | Primary school and below = 1, Junior middle school = 2, Technical secondary/high school = 3, College = 4, Master/PhD = 5 | 2.322  | 0.987             | 1             | 5             |
| Agricultural land endowment   | Land area (x13)                                                      | Reported value of the respondents(mu)                                               | 2.946  | 2.371             | 0             | 11            |
| Individual characteristics    | Age (x14)                                                            | Reported value of the respondents(age)                                              | 41.281 | 13.314            | 16            | 94            |

Added up to an average of each index, calculated 1–5 continuous value; 1 represents "totally unwilling", 5 represents "perfectly willing"; the smaller the value the weaker will, the greater the value the stronger will.
was largely composed of people from the Hakka group. The influence of this sample on the results, therefore, needs further consideration.

against the respondent was willing to contribute to the provision of irrigation infrastructure. Against the background of the significant influence of lineage on the WPPSI (see Model 1), it may be concluded that if the respondent lived in a city, it did not have any influence on the degree to which households’ WPPSI, the results of Model 2 are particularly interesting. The regression results demonstrate that if the respondent lived in a city, it did not have any influence on the degree to which households “with an ancestral temple and genealogy” had a value that was 0.8065 higher than that of households without identifiable lineage ties. The WPPSI of households “with identifiable lineage ties” had a value that was 0.8065 higher than that of households without identifiable lineage ties.

Table 4. Regression results of Tobit model of limited dependent variables.

| Independent Variable | Dependent Variable: WPPSI |
|----------------------|--------------------------|
|                      | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 |
| With ancestral temple or genealogy (x1) | 0.8065 *** | 0.8852 *** | 0.8296 *** | 0.8649 *** |
|                      | (0.20069) | (0.23576) | (0.21104) | (0.23247) |
| Family members living in cities and towns (x2) | 0.0776 | -0.3340 | -0.1432 |
|                      | (0.28651) | (0.27701) | (0.27531) |
| Hakka (x3) | 0.3067 | -0.1544 | -0.1639 |
|                      | (0.00936) | (0.29473) | (0.29412) |
| Period the head of household living in the village (x4) | 0.0150 | 0.0161 | 0.0135 | 0.0138 | 0.0146 |
|                      | (0.00889) | (0.00975) | (0.00996) | (0.00923) | (0.00917) |
| Political status (x5) | 0.1251 | 0.1359 | 0.1310 | 0.1235 | 0.1223 | 0.1262 |
|                      | (0.11268) | (0.11935) | (0.11772) | (0.11336) | (0.11288) | (0.11319) |
| Relationship with community members (x6) | 0.1375 | 0.2046 * | 0.1915 * | 0.1494 *** | 0.1454 | 0.1423 |
|                      | (0.08403) | (0.09016) | (0.08819) | (0.08618) | (0.08546) | (0.08485) |
| Income (x7) | -3.16e-07 | 5.89e-08 | -1.3e-07 | -1.34e-07 | -2.11e-07 | -2.27e-07 |
|                      | (7.77e-07) | (8.51e-07) | (8.33e-07) | (8.18e-07) | (8.03e-07) | 7.95e-07 |
| House size (x8) | -0.0004 | -0.0009 | -0.0008 | -0.0004 | -0.0004 |
|                      | (0.00096) | (0.00102) | (0.00100) | (0.00097) | (0.00096) |
| House structure (x9) | -0.0797 | -0.1086 | -0.1197 | -0.0680 | -0.0759 | -0.0693 |
|                      | (0.10992) | (0.11539) | (0.11431) | (0.10934) | (0.10803) | (0.10929) |
| Family labor force (x10) | -0.2394 * | -0.1898 * | -0.2339 * | -0.2065 * | -0.2274 * | -0.2163 * |
|                      | (0.10332) | (0.11192) | (0.11680) | (0.11338) | (0.10581) | (0.11156) |
| Distance from the main road (x11) | -0.0487 | -0.0514 | -0.0479 | -0.0494 | -0.0479 | -0.0503 |
|                      | (0.02986) | (0.03181) | (0.03149) | (0.03014) | (0.02991) | (0.03009) |
| Education level of the head of household (x12) | 0.13346 | 0.14217 | 0.14166 | 0.13802 | 0.13542 | 0.13633 |
|                      | (0.13346) | (0.14217) | (0.14166) | (0.13802) | (0.13542) | (0.13633) |
| Land area (x13) | 0.0899 | 0.1262 | 0.1270 * | 0.0845 | 0.0874 | 0.0868 |
|                      | (0.06449) | (0.06852) | (0.06729) | (0.06530) | (0.06472) | (0.06511) |
| Age (x14) | -0.0071 | -0.0026 | -0.0052 | 0.0056 | -0.0067 | -0.0059 |
|                      | (0.01154) | (0.01223) | (0.01231) | (0.01179) | (0.01157) | (0.01176) |
| Constant term | 4.1267 *** | 3.8480 *** | 4.1365 *** | 3.9622 *** | 4.0944 *** | 3.9844 *** |
|                      | (0.76976) | (0.81293) | (0.84616) | (0.81530) | (0.77259) | (0.81361) |

Sample size 152 152 152 152 152 152

Note: ***, **, and * represent significance at the 1%, 5% and 10% levels, respectively.

Significant Results across Models

As illustrated with Table 5, four independent variables across the models had a significant impact on a respondent’s WPPSI. The fact that a good relationship with other villagers (x6) positively influenced the WPPSI was not a surprising finding, as indicated above. Research has demonstrated that the larger a household, the more labor it will set free to work outside of agriculture [46]. This interpretation is also consistent with the significant and negative influence of family labor force (x10) across the models. This result is closely related to (x2) because, in rural China where the average land area per household is limited, the number of people engaged in agricultural production is fixed. The more members a family has, the more the members that can engage in non-agricultural production as outmigration workers living in cities and towns (x2). If this understanding is correct, it can be verified by looking closely at the second model (see Table 4).

The results of Model 1 demonstrated that the strength of a lineage network ties had a very significant impact on a respondent’s WPPSI. The WPPSI of households “with an ancestral temple and genealogy” had a value that was 0.8065 higher than that of households without identifiable lineage ties.

Considering the overall question of how far outmigration or lineage revival will influence households’ WPPSI, the results of Model 2 are particularly interesting. The regression results demonstrate that if the respondent lived in a city, it did not have any influence on the degree to which the respondent was willing to contribute to the provision of irrigation infrastructure. Against the background of the significant influence of lineage on the WPPSI (see Model 1), it may be concluded that there was “lineage revival of the sample at hand”. However, as discussed above, the sample was largely composed of people from the Hakka group. The influence of this sample on the results, therefore, needs further consideration.
The results of Model 3 demonstrate that being a member of the Hakka people did not influence the WPPSI. The reason the Hakka people were not significant may be that the village we sampled is a community where the Hakkas and the Han people live together. The irrigation infrastructure provided by collective action is often for the irrigation infrastructure development of the whole village, and the Hakka people are more inclined to focus on the interests of their group. While the research question of this study was the extent to which outmigration might be more influential on the WPPSI than lineage, the results demonstrated that outmigration was not as important, but the preliminary conclusion was that the WPPSI might be more affected by either ethnicity or SLNT. Therefore, the regression was running again using “with ancestral temple or genealogy” \( (x_1) \) and “living in cities and towns” \( (x_2) \) together for the SLNT type and the residence type (Model 5), and for the SLNT type and the Hakka (Model 6) we ran the regression “with ancestral temple or genealogy” \( (x_1) \) and “Hakka” \( (x_3) \) together.

The regression results from Model 5 demonstrated that living in cities and towns is not significant. As mentioned above, therefore, lineage is a strong predictor for the WPPSI. However, living outside of the village did not influence the WPPSI. Hence, the results above can be refined to conclude that while lineage is a strong predictor for households’ WPPSI, outmigration had no impact on this willingness.

The results of Model 6 are to some extent surprising because, as outlined in the introduction, the Hakka are known for their sense of community and strong cohesion. This should have suggested that belonging to the Hakka group would also result in a higher WPPSI. Lineage networks and religious groups can, however, “spur factionalism within rural communities and ultimately jeopardize village governance because, by nature, they encourage social cleavage rather than unity” [3]. As our sample comprised 27.63% Hakka respondents and 72.37% non-Hakka respondents, it may be presumed that the villages where the respondents live will not be composed of only Hakka people. Therefore, the insignificant correlation between being Hakka and contributing to the provision of irrigation infrastructure might be explained by the historically strong SLNT, which may lead to members of the Hakka people being more inclined to help members of their own ethnicity, and not contribute much to irrigation infrastructure provision of a village comprising people of different ethnicities. This means that within this sample of households with strong lineage networks, the strong lineage ties might also lead to mechanisms of exclusion or evasion, that is, of Hakka people not being supportive of contributing to irrigation infrastructure in their village.

4.2. Robustness Test

To test the robustness of the regression results, the data were divided into six different groups for the Tobit regression. Models 1 and 2 were groups for place of residence (Model 1 was for the sample living in a village and Model 2 was for living in cities and towns), Models 3 and 4 were groups for political status (Model 3 was for the sample of Party members, including Youth League members, and Model 4 was for non-Party members), and Models 5 and 6 were groups for education level of the head (Model 5 was for education higher than technical secondary/high school and Model 6 was for education lower than technical secondary/high school; see Table 5). The estimation results of the robustness test are consistent with the regression results above, which means that endogeneity was controlled in our models. The appearance of lineage networks has a history of thousands of years, far older than the WPPSI, and hence, the reverse causality problem is not significant.
Table 5. Group regression results of Tobit model for robustness test.

| Independent Variable                                      | Model 1 Living in Villages | Model 2 Living in Cities and Towns | Model 3 Party Members | Model 4 Non-Party Members | Model 5 Higher Than Technical Secondary/High School | Model 6 Lower Than Technical Secondary/High School |
|-----------------------------------------------------------|----------------------------|------------------------------------|-----------------------|---------------------------|----------------------------------------------------|----------------------------------------------------|
| With ancestral temple or genealogy (x1)                  | 0.8269 **                  | 1.6526 **                          | 1.3841 **             | 0.8200 **                 | 0.9221 *                                           | 1.6111 ***                                         |
|                                                           | (0.26360)                 | (0.59067)                          | (0.25286)             | (0.41056)                 | (0.35253)                                          | (0.3538)                                           |
| Family members living in cities and towns (x2)            |                            |                                    |                       |                           |                                                    |                                                    |
|                                                           | −0.5341                   | −0.1537                            | 0.2554                | −0.4395                   | 1.0826 *                                           | −1.336 **                                          |
|                                                           | (0.37332)                 | (0.54805)                          | (0.66278)             | (0.29908)                 | (0.42649)                                          | (0.45379)                                          |
| Hakka (x3)                                                |                            |                                    |                       |                           |                                                    |                                                    |
|                                                           | 0.0070                    | 0.0570                             | −0.0008               | 0.0289 **                 | 0.0135                                             | 0.0164                                             |
|                                                           | (0.01179)                 | (0.02656)                          | (0.02132)             | (0.01041)                 | (0.01993)                                          | 0.01204                                            |
| Period the head of household living in the village (x4)   |                            |                                    |                       |                           |                                                    |                                                    |
|                                                           | 0.1265                    | 0.2004                             | −0.1049               | 0.1529                    |                                                    |                                                    |
|                                                           | (0.13719)                 | (0.21353)                          | (0.18351)             | (0.17193)                 |                                                    |                                                    |
| Political status (x5)                                     |                            |                                    |                       |                           |                                                    |                                                    |
|                                                           | 0.1439                    | 0.2502                             | 0.3402                | −0.0043                   | 0.0923                                             | 0.1405                                             |
|                                                           | (0.10365)                 | (0.25097)                          | (0.18116)             | (0.09564)                 | (0.15669)                                          | (0.10429)                                          |
| Relationship with community members (x6)                  |                            |                                    |                       |                           |                                                    |                                                    |
|                                                           | 0.642e-06                 | −7.95e-07                          | 6.38e-06              | −4.32e-08                 | −2.23e-06                                          | −2.98e-07                                          |
|                                                           | (5.61e-06)                | (8.33e-07)                         | (7.44e-06)            | (6.79e-07)                | (3.53e-06)                                          | 8.44e-07                                          |
| Income (x7)                                               |                            |                                    |                       |                           |                                                    |                                                    |
|                                                           | −0.0014                   | 0.0016                             | −0.0006               | 0.0007                    | −0.0014                                            | −0.0006                                            |
|                                                           | (0.00127)                 | (0.00212)                          | (0.00206)             | (0.00105)                 | (0.00169)                                          | 0.00130                                            |
| House size (x8)                                          |                            |                                    |                       |                           |                                                    |                                                    |
|                                                           | −0.0079                   | −0.1670                            | 0.2165                | −0.1784                   | −0.0357                                            | −0.0069                                            |
|                                                           | (0.13662)                 | (0.20278)                          | (0.25878)             | (0.10810)                 | (0.172880)                                         | 0.13835                                            |
| House structure (x9)                                     |                            |                                    |                       |                           |                                                    |                                                    |
|                                                           | −0.3014 *                 | 0.1465                             | −0.2982               | −0.1985                   | −0.2629                                            | −0.2196                                            |
|                                                           | (0.13480)                 | (0.23636)                          | (0.21056)             | (0.12176)                 | (0.23578)                                          | 0.13413                                            |
| Family labor force (x10)                                 |                            |                                    |                       |                           |                                                    |                                                    |
|                                                           | −0.0337                   | −0.1656 *                          | 0.0418                | −0.0581 *                 | −0.0063                                            | −0.0937 *                                          |
|                                                           | (0.03893)                 | (0.07362)                          | (0.07613)             | (0.02777)                 | (0.04898)                                          | 0.04267                                            |
| Distance from the main road (x11)                        |                            |                                    |                       |                           |                                                    |                                                    |
|                                                           | −0.2143                   | 0.0158                             | −0.4340               | −0.4845 **                |                                                    |                                                    |
|                                                           | (0.16726)                 | (0.31487)                          | (0.26426)             | (0.16359)                 |                                                    |                                                    |
| Education level of the head of household (x12)            |                            |                                    |                       |                           |                                                    |                                                    |
|                                                           | 0.1469                    | −0.1303                            | 0.1362                | 0.1523 *                  | 0.0898                                             | 0.0551                                             |
|                                                           | (0.07714)                 | (0.14307)                          | (0.13637)             | (0.06754)                 | (0.09826)                                          | 0.09065                                            |
| Land area (x13)                                          |                            |                                    |                       |                           |                                                    |                                                    |
|                                                           | 0.0016                    | −0.0175                            | −0.0089               | −0.02455 *                | 0.0097                                             | −0.0003                                            |
|                                                           | (0.01391)                 | (0.02794)                          | (0.02945)             | (0.01223)                 | (0.02663)                                          | 0.01456                                            |
| Age (x14)                                                |                            |                                    |                       |                           |                                                    |                                                    |
|                                                           | 3.9604 ***                | 0.9667                             | 2.7966                | 6.0492 ***                | 4.0359                                             | 2.6560 **                                          |
|                                                           | (0.92873)                 | (2.2273)                           | (1.52027)             | (1.04041)                 | (2.27554)                                          | (0.871713)                                         |
| Constant term                                            |                            |                                    |                       |                           |                                                    |                                                    |
|                                                           | 110                       | 42                                 | 48                    | 104                       | 62                                                 | 90                                                 |

Note: ***, **, and * represent significance at the 1%, 5% and 10% levels, respectively.
5. Conclusions

In the context of large-scale migration and lineage revival, this article investigated the extent to which lineage or outmigration impacts the willingness of households to contribute to providing irrigation infrastructure. This question is particularly relevant for rural communities in developing countries where public administration may not always be able to provide small-scale irrigation infrastructure.

The research demonstrates that there are no direct effects of outmigration on households’ willingness to provide irrigation infrastructure. However, the size of the labor force of a household had a significant negative effect on the WPPSI. These correlations can be explained by the labor force being allocated to work on tasks other than those that were agriculture-related, likely outside the village, and from this, it may be inferred that migration can have an indirect effect on the WPPSI.

The findings of the influence of lineage networks demonstrate a significant and strong effect on households’ WPPSI. Lineage networks can enhance communities and positively influence individuals’ WPPSI. Peng argues that informal lineage networks and institutions reduce the effectiveness of formal institutions [47]. This case study demonstrates that they can also increase the effect of formal institutions by promoting peasant participation and willingness for collective action. Therefore, these results provide a more nuanced picture of the effects of lineage networks and outmigration on households’ WPPSI.

As the sample was partly composed of Hakka people, further studies could analyze the role of Hakka people in the provision of irrigation infrastructure. While the results demonstrate that the Hakka people had no significant impact on the willingness to contribute to the provision of irrigation infrastructure, this result is surprising as it is inconsistent with the results of the fieldwork. The Hakka have a stronger sense of belonging to their lineage than other Han people, and they have stronger lineage networks. The strong ties within the Hakka lineage may have an impact on the willingness to contribute when beneficiaries outside of the lineage are involved, and this may account for the inconsistency described above. This means that informal institutions, such as lineage networks, can supplement formal institutions in the provision of irrigation infrastructure, but attention needs to be paid to the possible exclusion of those not part of the informal institutions.

Lineage networks of China are informal institutions that are entrenched in rural daily life, often “manifested only in daily interactions among members,” and at times visible in temples, temple associations, or genealogy [3]. This article has provided a quantitative account of the influence of lineage networks on the provision of irrigation infrastructure. However, this quantification grasped only some aspects of these complex informal institutions, and future research is necessary to develop a more complete picture.

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