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How social integration affects the income of relocated households: evidence from China

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Ensuring the income of relocated households is of great theoretical and practical significance for improving their livelihoods and sustainable development. This article is based on micro survey data of relocated farmers in Sichuan Province, China, and analyzes the impact of social integration on the income level and structure of relocated farmers from both theoretical and empirical perspectives. The results show that: social integration has a significant positive effect on the household income level of relocated farmers, and the effect of social integration on household income decreases with the increase of income level. From the perspective of income structure, social integration improves the operating income, wage income and property income of relocated households, but the impact of social integration on transfer income is not obvious. Non-agricultural employment ability, information acquisition and life satisfaction are the mechanisms through which social integration affects household income. There are differences in the effect of social integration on household income among different groups of relocated farmers. Finally, according to the conclusion, the paper puts forward relevant countermeasures and suggestions to improve the level of social integration, improve the non-agricultural employment ability of relocated farmers, improve the quality of information acquisition and life satisfaction, and provide differentiated support for different groups.

KEYWORDS

social integration, household income, poverty alleviation relocation, mediating effect, level and structure

1 Introduction

Relocation for poverty alleviation is a special poverty alleviation project implemented for rural impoverished populations. By implementing relocation for rural impoverished populations in areas with poor living conditions, we can fundamentally improve their living and development environment, thereby achieving the goal of poverty alleviation and wealth creation for impoverished households in remote mountainous areas (Feng et al., 2022; Wu et al., 2023). By the end of 2020, China had realized comprehensive poverty eradication for the rural poor population, built 35,000 centralized resettlement areas, built more than 2.66 million resettlement housing units, and more than 9.6 million poor households have all moved to new homes (Hu et al., 2022). The completion of the relocation program has contributed to the development of a new home for the poor. The completion of the relocation program has made an important contribution to winning the battle against poverty and realizing the first 100-year goal, laid a solid foundation for solving regional poverty and promoting high-quality development of the poverty-stricken areas, and contributed Chinese wisdom and Chinese solutions to the cause of global poverty reduction (Feng Y. B. et al., 2024).

However, relocation for poverty alleviation as a complex social migration project, for the overall work of relocation, the relocation is only the first stage of the project (Huang et al.,

2020). Due to multiple factors such as fragile ecological environment, backward socio-economic development level and insufficient self-development ability of relocated farmers, the sustainable development of the subsequent livelihood of relocated farmers is still facing many challenges, with a high potential risk of returning to poverty for the relocated farmers, and difficulties in transforming their livelihood strategies, which makes it difficult to consolidate the results of poverty eradication (Bai et al., 2022; Liu et al., 2023). After “moving,” how to provide relocated households with stable follow-up measures to ensure that the relocated people can “gradually get rich” is of more practical significance (Liu et al., 2024). Ensuring the income of relocated households not only enhances their economic security, but also improves their livelihood capital and promotes sustainable development (Wang et al., 2022; Feng Q. et al., 2024).

Social integration is a process in which the differences between relocated farm households and local residents are gradually narrowed, and they are able to participate in economic, social and cultural life in an equal and comprehensive manner, gradually gaining recognition and a sense of belonging, and ultimately integrating with local residents (Fothergill et al., 2011; Tian et al., 2019). In recent years, academics have conducted extensive research around social integration, clarifying that the head-of-household characteristics, family characteristics, and relocation and resettlement characteristics of relocated households all affect social integration (Ma et al., 2023; Zhao et al., 2021; Li et al., 2022). Researchers usually consider social integration as an outcome variable, and the influences on social integration can be broadly categorized into two main groups: capital causation theory and non-capital causation theory, with human capital, social capital, institutional constraints, and cultural differences being the main factors affecting social integration (Mazza and Punzo, 2017; Zhang et al., 2023; Zhou et al., 2022), and these factors are closely related to livelihood changes.

A few scholars view social integration as a causal variable for certain integration consequences, and much of the current research on the consequences of social integration focuses on effects on settlement intentions, health, and employment (Fothergill et al., 2011; Wei and Gao, 2017). For example, Berry (1997) argued that social integration significantly and positively affects the mental health of immigrants, and that the extent of the effect varies across integration types, with immigrants adopting integration and segregation social integration strategies having better mental health outcomes (Fothergill et al., 2011). In addition, the family economic behavior of relocated farmers has also received more and more attention from scholars. Some scholars have found that social integration has a certain impact on the economic behavior of migrants, and that urban integration can significantly increase the household consumption of migrant workers and optimize the consumption structure (Lu and Zheng, 2016). Throughout the existing literature, most of the studies are centered on the influencing factors of social integration and the impact of social integration on the economic behavior of migrant workers, while there is less literature on the study of relocated household income from the perspective of social integration, especially the lack of in-depth analysis of the possible multiple intermediary mechanisms involved.

Based on the above background, this paper uses survey data from 610 relocated farmers in Sichuan Province, China, and uses OLS and Tobit models to empirically analyze the impact of social integration on the household income of relocated farmers from the dual perspectives of income level and income structure. The

multi-mediating effect model is introduced to analyze the specific action paths of non-agricultural employment, information acquisition and life satisfaction. In addition, the heterogeneity of the impact of social integration on household income is explored based on different livelihood strategies and different resettlement locations. Intended to increase the income of relocated households, promote their sustainable livelihoods, and provide theoretical support and practical reference for the effectiveness of the follow-up support for relocation.

2 Theoretical analysis and research hypotheses

2.1 The impact of social integration on the income level of relocated households

According to social capital theory, the relationships and trust that individuals build in social networks can provide resources and information (Cui et al., 2022). For relocated farmers, good social integration can enhance their social networks (Tuominen and Haanpää, 2022), provide more employment opportunities and market information, thereby increasing household income. Social integration is also closely related to the development of human capital (Xu et al., 2022). By integrating into the new environment, relocated farmers can gain access to training and skill upgrading opportunities, thereby increasing their employability and labor productivity (Cao et al., 2015). This ability to improve can directly contribute to the growth of household income. On this basis, the role of social capital is not limited to the individual level, but also affects the lives of relocated farmers through intergenerational transmission and social structure (Zhao et al., 2021). Social capital cannot only affect the economic conditions of the current generation of farmers, but also affect the education, employment and social integration level of the next generation through the intergenerational transmission mechanism. Social networks and the accumulation of trust facilitate the transfer of resources across generations, including financial support, information flow and social support, which can have a profound impact on children's education, employment choices and social status. In addition, the role of social capital involves changes in the social structure, especially in new communities after migration. The social capital accumulation of relocated farmers is not only the result of individual behavior, but also affected by community structure, public resource allocation and social policy (Zhang et al., 2022). Through mutual support and resource sharing among communities, relocated farmers can better integrate into the new environment, obtain more social support, and promote social integration. Therefore, the hypothesis is proposed:

H1: Social integration has a positive effect on the household income level of relocated farmers.

2.2 The impact of social integration on the income structure of relocated households

The income of relocated households consists of operating income, wage income, property income, and transfer income. Social integration can affect operating income by enhancing social capital.

The social capital theory holds that social networks and social relationships can provide resources, information, and support, all of which have a positive impact on business activities (Cao et al., 2015). For example, relocated farmers who integrate into the new community can utilize the local commercial network and resources to obtain market information, technical support, and cooperation opportunities, thereby increasing their operational income. Individual skills, knowledge and education levels have a significant impact on income, and after integrating into the new community, relocated farmers may have the opportunity to receive better vocational training and education, enhancing their employability and market competitiveness (Liu et al., 2023). Social integration helps relocated farmers accumulate various forms of capital, including financial and material capital. By participating in investments such as renting out houses and land to earn rent, participating in cooperative dividends, and earning interest income from funds, relocated farmers can increase their property income. Social integration enhances the social support network of relocated farmers, making it easier for them to receive social assistance and government subsidies, and increasing their transfer income (Cao et al., 2015). Based on this, the following research hypothesis is proposed:

H2: Social integration has a positive impact on different types of income of relocated farmers.

2.3 Analysis on the mechanism of social integration affecting the family income of relocated farmers

Human capital theory emphasizes the importance of an individual's knowledge, skills, and experience to economic output (Wu et al., 2022). Social integration helps farmers establish broader social networks, promote their access to more employment information and opportunities, and enhance their knowledge, skills, and labor productivity (Cui et al., 2022). These all belong to the category of human capital and directly affect economic income. Non-farm employment is usually accompanied by higher wages and more stable job opportunities (Huang et al., 2022). With the strengthening of social integration, relocated farmers can more easily enter the non-agricultural employment market, thereby increasing household

income. This process indicates that non-agricultural employment plays an important mediating role between social integration and household income, and this mediating effect is closely related to the improvement of human capital.

The information asymmetry theory states that access to and use of information has a significant impact on an individual's decision making (Mavlanova et al., 2012). The existence of information asymmetry often leads to inefficient decision-making and misallocation of resources, which can be significantly improved by social integration. Social integration enhances relocated farmers' access to information, enabling them to keep abreast of market dynamics, employment opportunities, and relevant policy information (Vancea and Boso, 2015). This access to information can help relocated farmers make better economic decisions and thus improve household income.

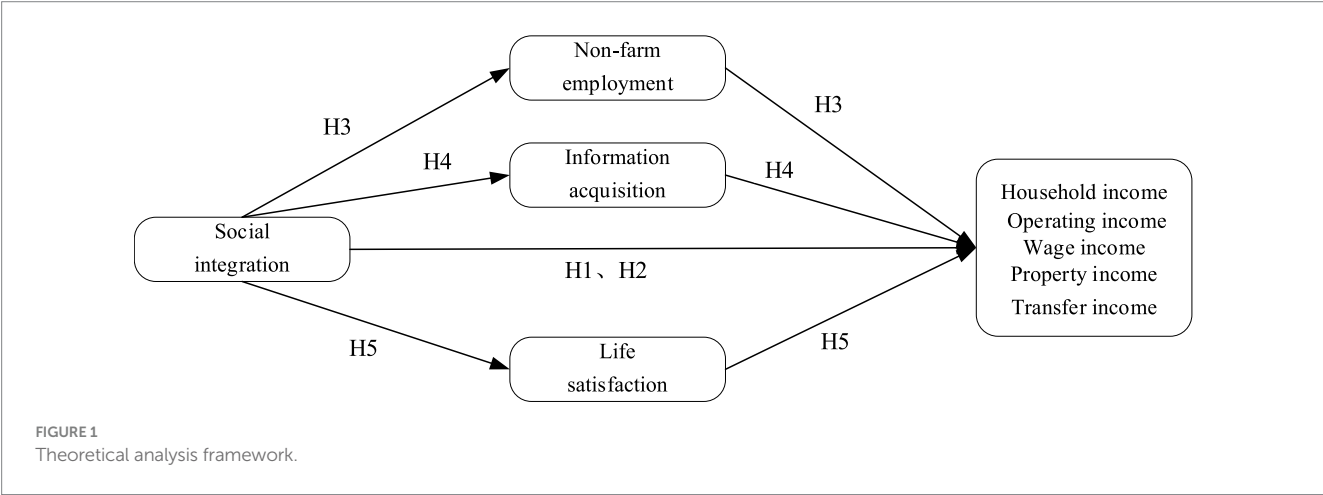
Life satisfaction reflects an individual's subjective assessment of his or her own life status, and an individual's life satisfaction affects his or her overall well-being and job performance (Ahn et al., 2023). Good social integration enables relocated farmers to feel a sense of belonging and support in the new environment, which in turn increases their life satisfaction (Piao et al., 2022). Positive emotional state and mental health promote better work performance and productivity (Walasek et al., 2019) which in turn affects household income. Synthesizing the above analysis, the following hypothesis is proposed:

H3: Non-farm employment mediates the effect of social integration on the household income of relocated farmers.

H4: Information acquisition mediates the effect of social integration on the household income of relocated farmers.

H5: Life satisfaction mediates the effect of social integration on household income of relocated farmers.

Based on the previous theoretical analysis, the theoretical analytical framework of social integration affecting relocated household income is constructed (Figure 1) to verify the mechanism of social integration affecting relocated farmers' income and the mediating effects of non-agricultural employment, information acquisitions and life satisfaction.



3 Materials and methods

3.1 Data sources

The data used in this paper are from the field research conducted by the research group from January to March 2024 in Liangshan Prefecture, Sichuan Province, on the theme of “social integration of farmers relocated to alleviate poverty through land resettlement.” In the survey, firstly, a typical survey was used to select five counties with more resettlement from the 17 counties (cities) in Liangshan Prefecture, and finally, Ganluo, Butao, Yuexi, Meigu, and Zhaojue counties were selected as the sample source counties. Secondly, the method of combining stratified sampling and random sampling was adopted, taking full consideration of the differences in the level of economic development of different regions and the types of characteristics of different relocated farmers, and, as far as possible, a variety of types of relocated farmer samples were selected to ensure that the research results were closer to the actuality. One to three resettlement districts were randomly selected from each county, and 50–80 research samples were selected from each resettlement district, and household surveys were carried out. A total of 661 questionnaires were recovered, and after eliminating invalid questionnaires, 610 valid questionnaires were finally obtained, with the validity rate reaching 92%.

3.2 Variable selection

3.2.1 Explained variables

The explained variables in this paper include total household income and its sub-income, including operating income, wage income, property income, and transfer income. Among them, operating income includes farming income and business income; Wage income refers to the total wage income of a family, including all income from work, employment, and retirement benefits; Property income includes rent from houses, land, and other sources, as well as dividends and interest income from cooperative investments; Transfer income refers to government subsidies and other transfer income such as donations from society, relatives, and friends. To alleviate the problem of heteroscedasticity in income variables, the above-mentioned types of income are analyzed quantitatively by adding 1 to the numerical value and taking the logarithmic form.

3.2.2 Core explanatory variables

The core explanatory variable in this paper is the social integration of relocated farmers, which is a comprehensive concept, and existing studies have not yet reached a unified consensus on the measurement dimensions of social integration. Referring to the relevant studies (Fothergill et al., 2011; Xu et al., 2024; Lin et al., 2017), this paper measures the social integration level of relocated farmers from four dimensions: economic integration, social interaction integration, cultural integration and psychological integration. Among them, economic integration includes four dimensions of employment status, income stability, income level, and consumption status; social integration includes four dimensions of participation in election activities, resettlement area activities, degree of mutual help and familiarity with local residents; cultural integration includes four dimensions of mastery of the

local language, funeral customs, marriage concepts, and diet and living; psychological integration includes three dimensions of identity, long-term residence, and discrimination. This paper adopts factor analysis to measure the level of social integration, and the KMO value is 0.794, the Bartlett is significant at 1% statistical level, and the cumulative variance contribution rate reaches 66.512%, indicating that it is suitable to adopt the factor analysis method.

3.2.3 Mechanism variables

The mediating variables in the paper include: (1) non-farm employment, expressed as the ratio of the number of non-farm employment in the household to the total labor force in the household. (2) Information acquisition: the subjective evaluation of whether the relocated farmers have good access to employment and other related information from the community, with 1–5 indicating “very poor” to “very good,” respectively. (3) Life Satisfaction: the subjective evaluation of the relocated farmers’ satisfaction with their current life, with 1–5 indicating “very dissatisfied” to “very satisfied,” respectively.

3.2.4 Control variables

The factors affecting the household income of relocated farm households are complex and diverse, and with reference to the practices of existing related studies, control variables are selected from three aspects: household head characteristics, family characteristics and resettlement characteristics (Ma et al., 2018; Zhang et al., 2022). Among them, household head characteristics include gender, age, education level, health status, and skill training; household characteristics include household size, burden ratio, proportion of labor force, and livelihood capital; and resettlement characteristics include distance from the place of relocation, resettlement location, and distance to the central town. The specific definitions and descriptive statistics of the main variables are detailed in Table 1.

3.3 Research methodology

3.3.1 Benchmark regression

Since the family income level and social integration in this paper are continuous variables, this paper uses OLS regression model to estimate the impact of social integration on the family income level of relocated farmers, and builds the following baseline regression model:

$$Y_i = \alpha + \alpha_1 X_i + \alpha_2 Control_i + \varepsilon_i \quad (1)$$

In Equation (1), the explained variable Y_i denotes the household income of relocated farmers, and the core explanatory variable X_i denotes the level of social integration of relocated farmers. The control variable $Control_i$ denotes the observable characteristics of the head of household, household characteristics and resettlement characteristics of the relocated farmers; ε_i is the random error term.

3.3.2 Tobit model

In reality, some relocated farmers may face some type of income zero situation, which will lead to left truncation of data when studying income. Ordinary regression models cannot effectively handle this situation, while Tobit models can simultaneously handle continuous income data and situations with zero income (Wang

TABLE 1 Description of variables and descriptive statistics.

Variable type	Variable name	Variable meaning and assignment	Mean value	Standard deviation
Explained variable	Household income	Sum of household operating income, wage income, property income and transfer income (log)	11.085	0.603
	Operating income	Operating income (log)	4.051	4.698
	Wage income	Wage income (log)	10.162	2.688
	Property income	Property income (log)	4.158	3.237
	Transfer income	Transfer income (log)	7.670	1.749
Core explanatory variable	Social integration	The factor analysis method measured	0	0.504
Mediating variable	Non-agricultural employment	Ratio of household nonfarm employment to total household labor force	0.580	0.312
	Information acquisition	Is there good access to relevant information from the community such as employment: very poor = 1, poor = 2, average = 3, good = 4, very good = 5	3.387	0.793
	Life satisfaction	Evaluation of current life satisfaction: very dissatisfied = 1, dissatisfied = 2, average = 3, satisfied = 4, very satisfied = 5	3.910	0.702
Control variable	Gender	Gender of head of household: male = 1, female = 0	0.818	0.386
	Age	Age of head of household (years)	47.383	13.136
	Educational level	Educational level of the head of household: below elementary school = 1, elementary school = 2, junior high school = 3, secondary or high school = 4, college and above = 5	1.849	0.745
	Health status	Physical health of the head of household: very unhealthy = 1, unhealthy = 2, average = 3, healthy = 4, very healthy = 5	3.926	0.736
	Skills training	Whether the head of household has participated in vocational skills training: yes = 1, no = 0	0.659	0.474
	Family size	Total household size (persons)	5.605	1.761
	Burden ratio	Ratio of elderly to children in total population	0.429	0.249
	Proportion of labor force	Number of household laborers/total household size	0.572	0.230
	Livelihood capital	Measured by the entropy method	2.228	0.391
	Distance from place of relocation	Distance between current place of residence and place of removal (km)	37.497	30.851
	Placement location	County resettlement = 1, township resettlement = 0	0.761	0.427
	Distance to center of town	Distance from current residence to central town (km)	2.224	1.503

et al., 2024). Therefore, this paper adopts Tobit model to analyze the impact of social integration on income structure, and the model is set as follows:

$$Y_{iq} = \alpha_0 + \sum_{h=1}^H \alpha_{hq} X_{hq} + \sum_{k=1}^k \alpha_{kq} \text{Control}_{kq} + \varepsilon_{iq} \quad (2)$$

In Equation (2), ρ represents a specific type of household income in the sample (operating income, wage income, property income and transfer income), λ_0 and λ_1 represent constant terms and regression coefficients respectively, X_n represents independent variables, and θ_n represents error terms.

3.3.3 Mediated effects regression

In order to accurately identify the intermediate transmission mechanisms of non-farm employment, information acquisition and life satisfaction in the impact of social integration on the household income of relocated farmers, this section adopts the Bootstrap method to construct a multiple parallel mediated effects model to test Hypotheses 2, 3, and 4. The mediation effect test method proposed by Wen and Ye (2014) is used to construct the following mediation effect model:

$$Y = \gamma_0 X_i + \gamma_1 \text{Control}_i + \sigma_{1i} \quad (3)$$

$$M_i = \delta_0 X_i + \delta_1 \text{Control}_i + \sigma_{2i} \quad (4)$$

$$Y_i = \lambda_1 X_i + \lambda_2 M_i + \lambda_3 \text{Control}_i + \sigma_{3i} \quad (5)$$

The coefficient γ_0 in Equation (3) is the total effect of social integration on the household income of relocated farmers; (4) The

coefficient δ_0 in Equation (4) is the effect of social integration on the mediating variable i that affects household income; The coefficient λ_2 in Equation (5) is the effect of the mediating variable i on the household income of relocated farmers, controlling for the effect of social integration; and the coefficient λ_1 is the direct effect of social integration on the household income of relocated farmers, controlling for the effect of mediating variables; $\sigma_{1i}, \sigma_{2i}, \sigma_{3i}$ is the random error term.

4 Results

4.1 Impact of social integration on the household income level of relocated farmers

In order to investigate the influence of social integration on family income level, this paper adopts the method of gradually adding variables. Specifically, from model (1) to model (4) in Table 2, social integration variables, household head characteristics variables, family characteristics variables and resettlement characteristics variables are gradually introduced, respectively. The estimated results in Table 2 show that the social integration variables in models (1) to (4) are at least significant at the 5% level, and the sign is positive. This indicates that social integration significantly promotes the improvement of household income level of relocated farmers, and the influence of social integration on household income is stable after gradually strengthening the constraints. The estimation results of model (4) show that social integration significantly increases the household income of relocated farmers after controlling the characteristics of household head, family and resettlement. When social integration increases by 1 unit, the household income level of relocated farmers increases by 0.359 units, and hypothesis 1 is verified.

TABLE 2 Baseline regression results of social integration on household income level of relocated farmer.

Variable name	Model (1)	Models (2)	Models (3)	Models (4)
Social integration	0.536*** (0.041)	0.480** (0.044)	0.335*** (0.048)	0.359*** (0.046)
Gender		0.210*** (0.060)	0.124** (0.052)	0.119** (0.051)
Age		0.002 (0.060)	0.001 (0.002)	0.001 (0.002)
Educational level		0.206 (0.156)	0.029 (0.032)	0.026 (0.032)
health status		0.046 (0.034)	0.012 (0.027)	0.012 (0.026)
Skills training		0.115** (0.052)	0.076 (0.047)	0.080* (0.046)
Family size			0.105*** (0.016)	0.098*** (0.015)
Burden ratio			0.060 (0.182)	0.084 (0.179)
Proportion of labor force			0.331 (0.201)	0.348* (0.195)
Livelihood capital			0.278*** (0.085)	0.335*** (0.086)
Distance from place of relocation				0.001 (0.001)
Placement location				0.205*** (0.045)
Distance to center of town				−0.005 (0.015)
Constant term	11.085*** (0.022)	10.470*** (0.218)	9.373*** (0.300)	9.121*** (0.308)
R ²	0.201	0.234	0.366	0.386
Observations	610	610	610	610

*, **, and *** indicate significant at the 10, 5, and 1% statistical levels, respectively; robust standard errors are in parentheses.

TABLE 3 Endogenous processing.

Variable name	Model (1)	Models (2)
	The first stage	The second stage
Social integration		0.964*** (0.158)
Average value of social integration of other relocated farmers in the same resettlement community	1.145*** (0.140)	
Duration of residence in new community after relocation	0.139*** (0.020)	
Control variable	Controlled	Controlled
Constant term	−1.304*** (0.227)	10.001*** (0.409)
Kleibergen-Paap rk LM	69.501 (0.000)	
Cragg-Donald Wald	39.952	
Hansen J	0.414 (0.120)	
Observations	610	610

*** indicate significant at the 1% statistical levels; robust standard errors are in parentheses.

In terms of the impact of control variables on the household income of relocated farmers, gender is significant at the 5% statistical level, and the coefficient estimate is 0.119, which indicates that the income-enhancing effect brought by men contribute 11.9% more to household income than women. Skills training has a significant positive impact on household income, making it of great policy significance for the government to increase vocational skills training for relocated farmers and guide them to non-farm employment. Family size is significant at the 1% statistical level, and the coefficient estimate is 0.098. For every additional member of the family, the total family income increases by 9.8%. This suggests that the larger the household size, the more potential labor force there is, and the more total household income is generated. The proportion of labor force significantly increases the level of income, when the proportion of household labor force increased by 10%, the total household income is increased by 3.5%, the larger number of labor force in the household means that more members can engage in economic activities and work, increasing the total income of the household. The impact of livelihood capital on household income is significantly positive, with total household income boosted by 33.5% for every one unit increase in livelihood capital, probably because having more and higher quality livelihood capital means that households have stronger productive capacity, employability, and risk resistance, which not only directly increases income, but also, through optimizing resource allocation, improving productive efficiency, and expanding the scope of economic activities, can indirectly contribute to the growth of household income (Wang et al., 2023; Zhao and Lan, 2023). The location of resettlement is significant at 1% statistical level, and the coefficient is 0.205, which indicates that the location of resettlement is one of the important factors affecting the household income of relocated farmers.

4.2 Endogeneity processing

When the benchmark regression model estimates the impact of social integration on the household income of relocated farmers, there may be endogeneity problems caused by factors such as mutual causation and missing variables. It is necessary to select appropriate instrumental variables to overcome the potential endogeneity problems. Drawing on Zhao et al. (2022) and Cui and Wang (2020),

the “mean value of social integration of other relocated farmers in the same resettlement community” and the “duration of residence in the new community after relocation” were selected as instrumental variables for social integration. Since the same community is an acquaintance society and the “peer effect” prevails, the social integration of relocated farmers will be affected by the mean value of social integration of other relocated farmers in the same community, which is in line with the principle of correlation of instrumental variables. At the same time, the social integration of other relocated households in the surrounding area will not directly affect the farmer income of the relocated household, and there is no inevitable connection between the two, which is in line with the requirement of exogeneity of instrumental variables. The longer the time of living in the new community after relocation, the more time and opportunity the family members have to establish contact with the residents of the new community, build a new social network, increase social capital, and thus improve the level of social integration. The length of residence in the new community after relocation mainly affects the process of family adaptation to the new community and the establishment of social networks, rather than directly determining the income level of the family. Therefore, the “duration of residence in the new community after relocation” also meets the requirements of relevance and exogeneity of instrumental variables.

The 2SLS results are shown in Table 3 for model (1) and model (2). From the results of the non-identification test, the Kleibergen-Paap rk LM statistic is 69.501, corresponding to a *p*-value of 0.000, rejecting the original hypothesis of “non-identification.” From the test of weak instrumental variables, the Cragg-Donald Wald statistic is 39.952, which is greater than the critical value of 19.93 at the 10% level of bias, rejecting the hypothesis of “the existence of weak instrumental variables.” In the over-identification test, the Hansen J statistic corresponds to a *p*-value greater than 0.1, which means that the original hypothesis of “all instrumental variables are exogenous” is accepted, and the instrumental variables meet the requirement of exogeneity. From the results of the second stage regression, after overcoming the potential endogeneity problem, the regression coefficient of social integration on the household income of relocated farmers is 0.964, which is significant at the 1% statistical level. Although the estimated coefficient is larger than that of the baseline regression, the sign and significance of the coefficient have not changed substantially. This indicates that the conclusion that the

TABLE 4 Robustness test.

Variable name	Model (1)	Models (2)	Models (3)	Models (4)	Models (5)
	0.25	0.50	0.75	Replace the explained variable	Shrinking tail method
Social integration	0.485*** (0.057)	0.453*** (0.044)	0.387*** (0.046)	0.338*** (0.046)	0.370*** (0.043)
Control variable	Controlled	Controlled	Controlled	Controlled	Controlled
Constant term	9.763*** (0.376)	9.916*** (0.284)	10.140*** (0.316)	8.634*** (0.298)	9.263*** (0.282)
R ²	0.275	0.230	0.178	0.284	0.401
Observations	610	610	610	610	610

*** indicate significant at the 1% statistical levels; robust standard errors are in parentheses.

TABLE 5 Estimation results of social integration on the income structure of relocated households.

Variable name	Model (1)	Models (2)	Models (3)	Models (4)
	Operating income	Wage income	Property income	Transfer income
Social integration	2.292** (1.019)	1.070*** (0.254)	2.547*** (0.471)	−0.210 (0.171)
Control variable	Controlled	Controlled	Controlled	Controlled
Constant term	−3.625 (5.574)	10.145*** (1.407)	2.542 (2.561)	7.620*** (0.944)
R ²	0.023	0.042	0.040	0.015
Observations	610	610	610	610

** and *** indicate significant at the 5, and 1% statistical levels, respectively; robust standard errors are in parentheses.

improvement of social integration level will increase the household income of relocated farmers is significant and robust.

4.3 Robustness tests

4.3.1 Quantile regression results and analysis

Due to the fact that the OLS regression model focuses on the mean value and the estimation results are easily affected by outliers, it is impossible to obtain the distribution pattern of the impact of social integration on the income of relocated households. Meanwhile, quantile regression is not affected by outliers of the explained variables, making its coefficient estimation more robust than OLS regression. Table 4 shows the quantile regression results for models (1) to (3). The results show that there is a significant positive effect of social integration on the household income of relocated farmers at all quantile points, which indicates that the improvement of the level of social integration has an important effect on the promotion of income increase of relocated farmers, and also verifies Hypothesis 1 once again. At the same time, by comparing the coefficients of social integration at all quantile points, it is found that the effect of social integration on the household income of relocated farmers gradually weakens with the increase of the quantile points, i.e., social integration has a better effect on the income increase of relocated farmers with low household incomes. Therefore, raising the level of social integration also helps to narrow the income gap and improve the unfavorable position of relocated farmers in income distribution (Lindstrand and Hånell, 2017).

4.3.2 Replace the explained variable

The total household income of relocated farmers is used to represent household income in the benchmark regression. Considering that the income level may be affected by the number of households, the practice

of Wang (2024) is used to measure the household income variable by using the per capita net income of relocated households, and the OLS regression is performed again, and the results are shown in model (4) of Table 4. The results show that social integration has a significant positive effect on household income level of relocated farmers, indicating that the baseline regression model estimates are robust.

4.3.3 Shrinking tail method

Although the distribution of household income of the sample relocated farmers itself is relatively average, there are still some relocated farmers whose income is too high or too low, in order to exclude the influence of extreme values, the relocated farmers with the highest and the lowest 1% income level in the sample are shrinking the tail treatment, and the empirical test is carried out again, and the results are shown in Table 4, model (5). As can be seen from model (5), the sign of the role of social integration on the household income level of relocated farmers has not changed, and remains significant at the 1% statistical level, indicating that the results of the benchmark regression are relatively robust.

4.4 The impact of social integration on the income structure of relocated households

Table 5 reports the estimation results of social integration on the income structure of relocated households using the Tobit model. The regression results of model (1) show that social integration has a positive impact on operating income, indicating that social integration has a significant positive effect on the operating income of relocated households. This may be because social integration helps relocated farmers establish connections with local residents, obtain more market information, technical knowledge, and business experience, thereby

TABLE 6 Results of multiple mediation effect analysis of the impact of social integration on the household income of relocated households.

Category of effect	Path relationship	Effect value	Standard error	95% confidence interval	
				Lower limit	Upper limit
Specific intermedation effects	Social integration → non-farm employment → household income	0.075	0.018	0.043	0.112
	Social integration → information acquisition → household income	0.071	0.017	0.039	0.108
	Social integration → life satisfaction → household income	0.101	0.021	0.060	0.143
Indirect effect	Social integration → multiple mediating effects → household income	0.246	0.034	0.182	0.314
Total effect	Social integration → household income	0.359	0.047	0.267	0.452
Direct effect	Social integration → household income	0.113	0.046	0.023	0.203

improving the efficiency and effectiveness of business activities. The coefficient of social integration in model (2) is 1.070, and it has passed the significance test at the 1% level, indicating that social integration has a significant positive impact on the wage income of relocated farmers. This may be because by integrating into the new social environment, relocated family members of farmers can more easily access local employment information, including job advertisements, business needs, etc., which helps them find suitable jobs. According to the regression results of model (3), social integration has a significant impact on property income, and the coefficient is positive, which is consistent with research hypothesis 2. On the contrary, the results of model (4) show that the social integration of relocated farmers has no effect on their transfer income, which is partially biased from hypothesis 2, indicating that the current level of social integration of relocated farmers in the research subjects is not significant enough to significantly promote the increase of family transfer income.

4.5 Analysis of the mechanism of social integration affecting the household income of relocated farmers

According to the results in Table 6, the coefficient of the total effect of social integration on household income is 0.359, and the lower limit is 0.267 and the upper limit is 0.452, and the range excludes 0, which indicates that the total effect of social integration on the household income of relocated farmers is significant. The test coefficient of the mediating effect of non-farm employment between social integration and household income is 0.075, and the lower limit is 0.043 and the upper limit is 0.112, the range does not include 0, indicating a significant intermediary effect. The test coefficient of the mediating effect of information acquisition between social integration and household income is 0.071 and the lower limit is 0.039 and the upper limit is 0.108. The range does not include 0, so the mediating effect is significant. The test coefficient for the mediating effect of life satisfaction between social integration and household income is 0.101 and has a lower bound of 0.060 and an upper bound of 0.143, which excludes 0 and has a significant mediating effect.

Table 6 presents not only the results of the tests of the path of influence, but also the results of the total indirect and direct effects. The total indirect effect is the overall mediating effect of the three variables of non-farm employment, information acquisition and life satisfaction between social integration and household income, with a coefficient of 0.246, a lower bound of 0.182 and an upper bound of 0.314, with confidence intervals that do not include 0, indicating that these three

mediating variables generally mediate between social integration and household income of relocated farm households. The direct effect of social integration on household income, i.e., the “net effect” of social integration itself on household income after controlling for the mediating effects of non-farm employment, information acquisition and life satisfaction. The results show that the coefficient of the direct effect is 0.113, with a lower confidence interval of 0.023 and an upper confidence interval of 0.203, which does not include zero, indicating that social integration itself has a significant contribution to household income. Therefore, social integration not only indirectly affects household income through mediating variables such as non-agricultural employment, information acquisition, and life satisfaction, but also directly has a significant positive impact on household income. Hypotheses 3, 4, and 5 have been validated.

4.6 Heterogeneity analysis

4.6.1 Heterogeneity analysis of livelihood strategies

There are differences in livelihood methods, income sources, and economic activities among relocated farmers with different livelihood strategies (Chen and Gan, 2024), resulting in the possibility of different degrees of impact of social integration on the household income of relocated farmers. Therefore, the sample relocated farmers were categorized into agricultural and part-time types and non-agricultural types for heterogeneity analysis based on the criterion of whether or not agricultural income was included in the total household income (Shang et al., 2023). As can be seen from columns (1) and (2) of Table 7, the models for both the agricultural and part-time types and non-agricultural types passed the significance test, and in terms of the size of the coefficients, the coefficients of the non-agricultural types are larger than those of the agricultural and part-time types. This indicates that social integration always positively affects the household income of relocated farmers in both agricultural and part-time types and non-agricultural types, and that the utility of social integration in affecting the household income of relocated farmers in non-agricultural types is greater than that of agricultural and part-time types. The reason is that non-agricultural relocated farmers need to rely on social networks to obtain employment information, business opportunities and other resources because they are engaged in non-agricultural activities. High social integration enables these farmers to build stronger social networks, which will provide them with more help and support in their employment and entrepreneurial processes, and ultimately increase their household incomes (Yang et al., 2020).

TABLE 7 Heterogeneity analysis: livelihood strategies and resettlement location.

Variable name	(1)	(2)	(3)	(4)
	Agricultural and part-time type	Non-agricultural	Township resettlement	Urban resettlement
Social integration	0.181** (0.088)	0.454*** (0.057)	0.585*** (0.089)	0.333*** (0.055)
Control variable	Controlled	Controlled	Controlled	Controlled
Constant term	8.640*** (0.647)	9.289*** (0.339)	8.237*** (0.659)	9.521*** (0.328)
R ²	0.404	0.402	0.498	0.380
Empirical P-value	0.003***		0.010**	
Observations	174	436	146	464

** and *** denote significant at the 5 and 1% statistical levels, respectively; robust standard errors are in parentheses; “empirical p-values” are used to test the significance of differences in the coefficients between groups and were obtained by self-sampling (Bootstrap) 1,000 times.

4.6.2 Heterogeneity analysis of resettlement locations

Relocated farmers in different resettlement areas differ in terms of geographic location, social services and employment opportunities, and the social integration and household income of relocated farmers in different resettlement areas may also differ significantly. Therefore, based on the differences in resettlement locations, the sample is divided into two categories of urban resettlement and township resettlement for heterogeneity analysis. Columns (3) and (4) of Table 7 report the results of the regression of heterogeneity of social integration on household income of relocated farmers in different resettlement locations. The results show the heterogeneity of the effect of social integration on the household income of relocated farmers in different resettlement locations. Compared with urban resettlement, the impact coefficient of township resettlement is significantly higher at 0.585, indicating that social integration has a greater effect on the household income of relocated farmers in township resettlement. The reason is that in township resettlement areas, community relations are usually closer and social capital is easier to accumulate, and township residents are more likely to have kinship or acquaintance relationships with each other, forming a stronger social network, and these close community relations help relocated farmers to integrate into the local society more quickly, and to obtain employment opportunities, economic support, and social resources through interpersonal relationships, thus increasing household income.

5 Discussion

Social integration is an important way to promote the income of relocated farmers. Specifically, social integration not only enhances the social network and trust relationships of relocated farmers, providing them with more employment opportunities and market information, thereby increasing their income levels, but also directly or indirectly promotes income growth through improving the proportion of non-agricultural employment, the quality of information acquisition, and life satisfaction. In fact, due to multiple factors such as fragile ecological environment, backward level of social and economic development and insufficient self-development ability of relocated farmers, the social integration of relocated farmers often faces obstacles (Lin et al., 2020; Xie et al., 2022). It is of great practical significance to explore the overall effect of social integration on the household income of relocated farmers and the influence

mechanism. The marginal contribution of the paper is mainly reflected in the following two points: Firstly, exploring the impact of social integration on the income of relocated farmers from both horizontal and structural perspectives, and based on multiple mediation effect tests, deeply exploring how social integration promotes the growth of income of relocated farmers through improving non-agricultural employment opportunities, information acquisition ability, and life satisfaction. Secondly, compared with previous studies that regarded relocated farmers as homogenous groups, this study conducted an in-depth analysis of the impact mechanism of social integration on household income of different types of relocated farmers from the perspective of heterogeneity of different livelihood strategies, resettlement locations and social integration, enriching the existing theoretical framework.

There are still some shortcomings in the paper. Firstly, the research area is mainly in Liangshan Prefecture, Sichuan Province, China, and further research and analysis are still needed to verify whether the research conclusions are applicable to other areas in China. Secondly, the data used in the paper are only cross-sectional data, which can hardly reflect the dynamic changes of social integration of relocated farmers. In future research, we should focus on the collection of panel data and explore the dynamic characteristics of the impact of social integration on the household income of relocated farmers from the time dimension.

6 Conclusion

This paper analyzes the impact of social integration on the family income level and income structure of relocated farmers by using the research data of relocated farmers in Liangshan, Sichuan Province, and the mechanism of social integration to increase the household income of relocated farmers through non-farm employment, information acquisition and life satisfaction was discussed, and further heterogeneity analysis was done. The results show that: From the perspective of income level, social integration significantly increases the household income of relocated farmers, and for every 1 unit increase in the level of social integration, the household income of relocated farmers increases by 35.9%. As the level of household income of relocated farmers increases, the effect of social integration on household income gradually decreases. From the perspective of income structure, social integration has increased the operational income, wage income, and property income of relocated households, but the

impact of social integration on transfer income is not significant. Multiple mediation analysis of social integration on household income finds that social integration contributes to the growth of household income of relocated farmers by increasing the proportion of non-agricultural employment, the quality of information access, and the satisfaction with life, and thus promotes the growth of household income of relocated farmers. Heterogeneity analysis finds that compared to the relocated farmers of the agricultural and part-time type and the urban resettlement, social integration has a greater utility in influencing the household income of relocated farmers of the non-agricultural type and township resettlement.

In summary, this paper proposes the following countermeasures: Firstly, improve the social integration of relocated farmers. The government and the community should actively carry out integration activities and regularly organize cultural exchanges and vocational skills training to help relocated farmers strengthen their ties with local residents and enhance their sense of social identity and support networks, thus further promoting the growth of family income.

Secondly, the ability of relocated farmers to engage in non-agricultural employment, the quality of their access to information and their satisfaction with their lives should be enhanced. It should strengthen vocational skills training for relocated farmers and increased support for non-agricultural industries; established a diversified information service platform to ensure that relocated farmers have timely access to market dynamics, policy information and information services on employment opportunities; and organized community activities to enhance their life satisfaction and sense of social participation.

Thirdly, provide differentiated support for different relocated farmer groups. For non-agricultural relocated farmers, the government should increase support for non-agricultural industries and provide more vocational training and entrepreneurship support policies. For relocated farmers in townships, in addition to strengthening social integration, it is also necessary to increase infrastructure construction and social service supply, improve the living conditions and employment opportunities of relocated farmers, promote their stable development in township society, and increase their economic income.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

CZ: Conceptualization, Data curation, Formal analysis, Methodology, Resources, Software, Writing – original draft, Writing – review & editing. MT: Data curation, Formal analysis,

Resources, Software, Supervision, Writing – original draft. CW: Conceptualization, Supervision, Writing – review & editing.

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Conflict of interest

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fsufs.2024.1520548/full#supplementary-material>

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