Article

Does Non-Farm Employment Promote Farmland Abandonment of Resettled Households? Evidence from Shaanxi, China

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Abstract: The de-agrarianisation of the labor force in the poverty alleviation resettlement (PAR) inevitably influences households' farmland management and farmland abandonment in the relocated areas. Drawing on survey data from 1079 households in Shaanxi, China, this study uses the Heckman two-stage model to empirically examine the relationship between non-farm employment and farmland abandonment in relocated areas. Additionally, it explores heterogeneity by considering the quantity and spatial distribution of non-farm employment, as well as the moderating effect of the withdrawal of rural homesteads (WRH). The results show that: (1) non-farm employment significantly promotes both behavioral and scale of farmland abandonment, with the magnitude of this impact varying based on the quantity of non-farm employment; (2) Heterogeneity analyses show that areas with non-farm employment exert a noteworthy positive effect on farmland abandonment. On average, farmers engaged in non-farm employment outside the county (NEO) exhibit a higher marginal effect on both behavioral and scale aspects of farmland abandonment compared to those engaged in non-farm employment within the county (NEI). Furthermore, only when the number of NEI reaches 3 does the probability and scale of farmland abandonment surpass those of NEO; (3) Mechanism analysis sheds light on the role of WRH, indicating that the cultivation of land in WRH weakens the promotion of farmland abandonment by non-farm employment, particularly in the NEI group. Conversely, the duration of WRH strengthens the contributions of non-farm employment to farmland abandonment, and this effect is concentrated in the NEO group. These findings underscore the importance of actively cultivating and introducing new types of agricultural management entities, promoting the moderate-scale operation of farmland, and encouraging the recultivation of withdrawn rural homesteads as strategies to curb farmland abandonment.

Keywords: non-farm employment; farmland abandonment; withdrawal from rural homesteads; poverty alleviation resettlement; urban resettlement

1. Introduction

Resettlement and relocation programs have been widely implemented by governments as strategic measures to achieve regional development and environmental objectives [1,2]. China's state-led poverty alleviation resettlement (PAR) stands as the flagship initiative of the targeted poverty alleviation (TPA). Its primary objective is to resettle rural poor populations living in inhabitable environments where rural livelihoods cannot be maintained to centralized resettlement sites with better facilities and convenient locations [3–5]. By 2020, more than 9.6 million poor rural people from mountainous, desert, remote, or soil-eroded areas in 22 provinces and 1400 counties had relocated to newly established centralized resettlement communities. Approximately 5 million of these resettled individuals transitioned from rural villages to towns or cities (urban resettlement mode) [4,5]. Thus, urban resettlement has increasingly emerged as the predominant type of rural poverty alleviation [6].

In the context of urban resettlement, resettled households are provided with housing and access to medical and educational resources. However, securing stable non-farm employment is a pivotal factor for poverty alleviation and livelihood stabilization among resettled households [7,8]. This consideration has also become the top priority for the follow-up support of PAR [9]. In practice, local governments actively implement a variety of support measures to foster employment within resettlement communities. These efforts include employment services, tax incentives for community factories, and public welfare positions (gardening, security, etc.) [5,10]. A commitment has been made to ensure that at least one member of each resettled household secures employment. By June 2022, the employment scale of resettled individuals lifted out of poverty reached 4.594 million, of which 34,000 employment assistance workshops attracted 433,000 people out of poverty. The trend of non-farm employment for resettled labor is expected to continue, involving both NEI (i.e., farmers engaged in non-farm employment within the county) and NEO (i.e., farmers engaged in non-farm employment outside the county) [11]. This aligns with the mobility pattern of Chinese migrant workers, where the overall number of migrant workers has increased, and the scale of NEI has steadily risen [12]. According to the 2021 Migrant Workers Monitoring Survey Report, by the end of 2021, China had a total of 293 million migrant workers, with approximately 120 million employed within the counties. This corresponds to China's strategy of county-based urbanization and nearby urbanization [11]. Changes in non-farm employment will inevitably affect agricultural production and the allocation of farmland resources, potentially leading to the abandonment of marginal farmland [2,13,14]. Hence, given the prevailing non-farm employment of resettled households, the debate on whether non-farm employment by resettled households inevitably leads to farmland abandonment and the impact of non-farm employment variations on farmland abandonment requires further discussion in the academic community [15,16].

Exploring the influencing factors of farmland abandonment has garnered substantial academic attention. Most scholars suggest that the migration of agricultural laborers is the primary cause of farmland abandonment [14,17,18]. However, research findings regarding the impact of non-farm employment on farmland abandonment are not uniformly aligned. Two main perspectives have emerged: One viewpoint affirms that non-farm employment facilitates farmland abandonment. For example, He et al. found that the probability of farmland abandonment increases as the number of non-farm laborers rises, and that abandonment occurs first on farmland that is far from home, with poor soil quality and irrigation conditions [15]. Xu et al.'s study revealed that farm households' part-time and off-farm labor migration significantly contributes to their farmland abandonment [18]. The second viewpoint posits a nonlinear relationship between non-farm employment and farmland abandonment. According to Deng et al.'s analysis of the 2014 China Labor Force Dynamics Survey, there is an inverted U-shaped relationship between non-farm employment and the behavior and scale of farmland abandonment, with turning points at 46.00% and 44.5% non-farm employment, respectively, and this suggests that non-farm employment does not inevitably lead to farmland abandonment [16].

Following the institutional arrangement of "one rural household owns one piece of land for house construction," resettled households are required to systematically withdraw from their idle rural homestead after settling into their resettlement house. This withdrawal of rural homesteads (WRH) refers to farmers voluntarily relinquishing their idle rural homesteads or giving up their usage rights under the guidance of local government or rural collective economic organizations, receiving funds or new houses as compensation in return [19,20]. By the end of 2020, over 1 million mu of rural homesteads in relocated areas had been withdrawn and transformed into farmland or greenery. The orderly withdrawal and transformation of rural homesteads effectively address constraints on urban land indexes for construction, PAR funding shortages, and the insufficient motivation of resettled households to withdraw their rural homesteads [21,22]. This initiative positively impacts the utilization of farmland by resettled households. Firstly, WRH affects farmers' farmland management, leading to changes in agricultural production conditions, challenges in

storing agricultural machinery and products, extended farming radius, and diminished recultivation farmland quality, resulting in reduced agricultural production efficiency [23]. Secondly, WRH affects farmland transfers, increasing the inconvenience of farming and encouraging resettled households to transfer out of their farmland [24]. Thirdly, WRH impacts farmers' willingness to withdraw farmland. According to an empirical study by Li et al. [25], farmers withdrawing from rural homesteads are more likely to withdraw their contracted land to obtain citizenship. While existing research has explored the effects of WRH on different farmland disposal behaviors, a notable gap exists in examining the impact on farmland abandonment behavior. Scholars have found that the transformation of withdrawn rural homesteads is not only a logically connected process with WRH but is also a crucial factor influencing the effectiveness of rural homestead reform. The transformation can be categorized into four types according to the land's functional changes: recultivation and greenery, enhancing functions (e.g., for industrial development, etc.), converting to state-owned construction land, and leaving it unused [26]. Disparities in the transformation of withdrawn rural homesteads will change farmers' agricultural production conditions. With the duration of WRH, rational farmers will flexibly adapt their farmland use strategies to the changing production conditions and gradually resume their normal agricultural production activities [23].

Existing studies have examined the effects of non-farm employment on farmland abandonment and the impact of WRH on farmland use, providing valuable insights for this study. However, further investigation still needs to be done to gain a deeper understanding of the topic. Firstly, existing research on the impact of non-farm employment on farmland abandonment presents inconsistencies, with many studies treating non-farm employment as a homogeneous whole and neglecting the heterogeneous effects stemming from spatial distribution and quantity variations in the non-farm labor force. Differences in geographic areas or numbers of non-farm employment may modify the agricultural factor allocation behavior of rural migrant workers, consequently influencing farmland abandonment. Second, although existing research on WRH has yielded numerous insightful findings on the rural human-land relationship [27], the structure and function of rural homesteads [28], and influencing factors of the WRH [19,20,29,30], there remains a notable gap in addressing the withdrawal and transformation of rural homesteads, particularly in examining the interconnection between the withdrawal and transformation of rural homesteads and farmland abandonment in rural households. Considering widespread non-farm employment, this study employs Heckman's two-stage model and a moderating effect model to explore the relationship between non-farm employment, WRH, and farmland abandonment using data from urban resettled households in Shaanxi, China. It helps to understand the formation mechanism of farmland abandonment in resettled households for PAR, provides a scientific basis for refining farmland use policies in the relocation areas, and enriches research on the factors influencing farmland abandonment in underdeveloped regions.

The rest of this paper is organized as follows: Section 2 introduces the theoretical analysis and proposes the corresponding hypotheses. Section 3 provides a description of the study area, data sources, and methods. The results are illustrated in Section 4, while a discussion is provided in Section 5. Section 6 presents the conclusions.

2. Theoretical Analysis and Research Hypotheses

2.1. The Impact of Non-Farm Employment on Farmland Abandonment

During the 13th Five-Year Plan, the urban resettlement of PAR successfully facilitated the spatial transfer of resettled households, enhancing their non-farm employment opportunities. This trend in de-agrarianisation among resettled laborers is anticipated to persist, propelled by ongoing support from follow-up assistance policies and higher relative returns. To optimize families' welfare, resettled households will strategically reallocate their labor distribution between the agricultural and non-agricultural sectors and across various non-farm employment areas based on the diverse factor endowments of the family members. The reallocation of rural labor resources in resettled households may

affect farmland abandonment by influencing factor allocation behaviors, such as the time invested in farming, the scale of their family's farmland operation, and the capital invested in agricultural production (see Figure 1).
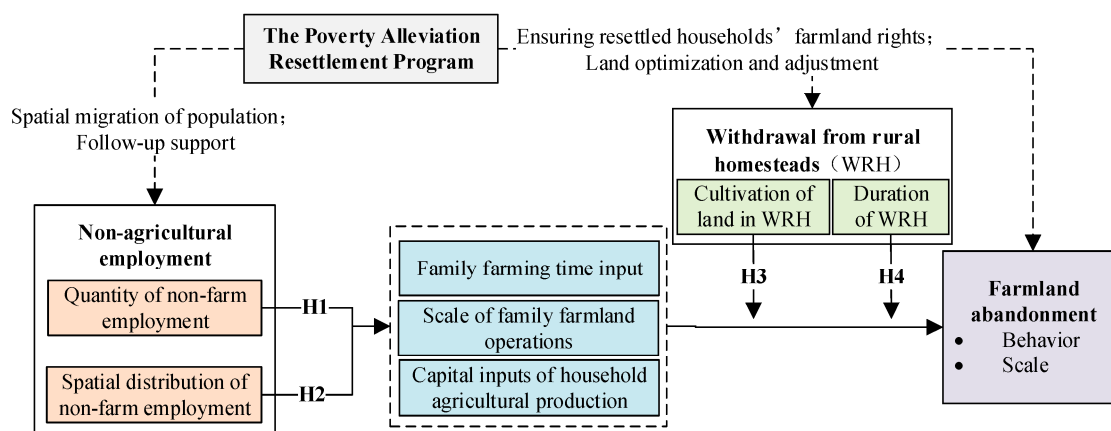

Figure 1. Theoretical analysis framework.

Firstly, farming time is a crucial factor. The loss of labor time in agriculture is the main driver of farmland abandonment [14,17,18]. Engagement in higher-return non-farm sectors often demands a greater investment of time and energy, which may crowd out farming time, leading to a reduction in the intensity of farmland use and an increase in the probability of farmland abandonment [17]. However, the geographical dislocation caused by PAR has resulted in resettled households being mostly engaged in the secondary and tertiary industries [31], leading to a partial loss of labor force in agriculture, even if they realize NEI. In comparison to NEO, NEI groups with higher convenience in terms of time and space for part-time business activities are less likely to abandon farmland [32]. Second, the scale of farmland has a distinct impact. Farmers tend to choose farmland scales that match their available labor force as rational individuals [33]. As a significant driver of farmland abandonment from the factor allocation perspective, an increase in non-farm employment introduces additional constraints on the farming labor force of resettled households. Farmers are thus forced to reduce the scale of their farmland operations. Compared with NEI, the NEO labor force is constrained by space and time, leading to a considerable loss of agricultural labor and reducing its corresponding family farmland operation scale. For farmland beyond the moderate scale, resettled households opt to transfer their contracted farmland freely or rent it to friends and family. Nevertheless, due to the inadequate farmland transfer market in the relocation area, the possibility of farmland abandonment increases. Third, the capital input of agricultural production also plays an important role. Compared to the NEI labor force, the NEO labor force can expand the boundaries of rural household income constraints by obtaining higher wages. On the one hand, increased household income can boost the input of agricultural production factors, such as fertilizers, pesticides, and mechanization services [34]. This offsets the negative effects of the loss of farming labor, which in turn may restrain farmland abandonment. On the other hand, it could also alternatively prompt resettled households to allocate more labor towards the non-farm sector, further reducing the input of agricultural production factors [35]. This can lead to decreased land use intensity or even abandonment. Consequently, the following research hypotheses are put forward:

H1: *Non-farm employment has a significant positive effect on farmland abandonment.*

H2: *The impact of non-farm employment on farmland abandonment differs significantly by non-farm employment area.*

2.2. The Moderating Effect of WRH

Farmers congregate around agricultural production and management to form a rural village, and rural homesteads provide agricultural production support functions. Both farmland and rural homesteads are the foundation for village formation and are intrinsically relevant [36]. The implementation of WRH in the relocation area significantly influences resettled households' farmland abandonment behavior by changing the agricultural production conditions, non-farm employment opportunity costs, and employment choices faced by rural households. According to the theory of rural household behavior, rational farmers who are aiming to maximize their household's utility and minimize risk will reallocate their labor resources between the agricultural and non-farm sectors based on changes to agricultural production conditions and the opportunity cost of non-farm employment, which in turn may affect their farmland abandonment behavior. Based on this, there may be an interaction between non-farm employment, WRH, and resettled households' farmland abandonment (see Figure 1).

Initially, the coordinated promotion of PAR and rural homestead withdrawal led most resettled households to realize centralized living and community management, expand their farming radius, increase the cost of agricultural production, and strengthen the separation between urban resettled households and their rural land [23]. The dearth of agricultural labor in resettled households may result in persistent farmland abandonment or its transfer, especially when their labor force is shifted to the non-agricultural sector for employment. With the increase in non-farm employment, agricultural labor input is reduced, the area of productive farmland for farm households is subsequently reduced, and the abandonment of farmland increases [37]. Conversely, the cultivation of land in WRH can potentially increase resettled households' farmland operation scale and potentially boost their farming income. Nevertheless, it may also crowd out rural households' non-farm employment time [33], and then reduce the scale of farmland abandonment. On the other hand, most of the resettled households with a shorter period of rural homestead withdrawal moved their families to the county. Although relocated labor can enter the non-farm employment sector, the stability of non-farm employment is insufficient, and the function of farmland security still plays a critical role in reducing the livelihood risk of resettled households, and these households are unlikely to abandon their farmland. For households that have been relocated for a longer period and have been employed and settled in towns and cities, gradually becoming integrated into urban life [38], the more non-farm employment or the more stable the non-farm employment is, the less dependent the rural household is on the economic and social security functions of farmland, and thus they are more likely to abandon their farmland. Based on these considerations, the following hypotheses are proposed:

H3: *The cultivation of land in WRH weakens the impact of non-farm employment on farmland abandonment.*

H4: *The duration of WRH strengthens the impact of non-farm employment on farmland abandonment.*

3. Data and Methods

3.1. Study Area and Data Collection

During the 13th Five-Year Plan, relocation areas for PAR were mostly concentrated in remote, rocky mountainous areas, geologically disaster-prone areas, hilly and plateau areas, and ecologically fragile areas in central and western China [39]. The natural environment and regional development policy restrictions have increased regional poverty. The implementation of PAR is one of the most effective strategies to solve regional poverty. Shaanxi is one of the provinces with the largest scale of resettlement households in PAR, resettling approximately 249,000 poor households, with 168,000 of them in towns or cities (see Figure 2). The urban resettlement model not only improves the employment environment for resettled households but also affects their agricultural production conditions.

Based on resource endowment and economic development characteristics, Shaanxi is divided into three distinct regions from north to south: Northern Shaanxi, Guanzhong, and Southern Shaanxi [40] (see Figure 2b). Northern Shaanxi, located in the center of the Loess Plateau, includes Yulin and Yan'an. The land is wide but thin, characterized by severe soil erosion covering 3.41 million hectares [40]. In contrast, Guanzhong features flat terrain, fertile soil, convenient irrigation, and a long history of cultivation. It stands out as the most populated, conveniently located, and economically developed area in Shaanxi, including Xi'an, Tongchuan, Baoji, Xianyang, and Weinan. Due to its location in the Qinba mountainous region, southern Shaanxi experiences common natural disasters and has fragmented and relatively infertile farmland. Consequently, PAR has been more widely implemented in this region, accounting for half of the total number of people resettled. According to the statistical data, the GDP structure of Northern Shaanxi, Guanzhong, and Southern Shaanxi in 2022 was 26.78:60.78:12.44, the farmland structure was 40.19:20.39:19.32 [41], and the population distribution of relocated households in PAR during the 13th Five-Year Plan was 14.08:26.08:59.84 [42]. The significant spatial distribution heterogeneity of demography, economic development, and farmland resources in Shaanxi Province leads to different agricultural production and non-farm employment conditions for rural households in different areas, subsequently influencing their farmland abandonment.
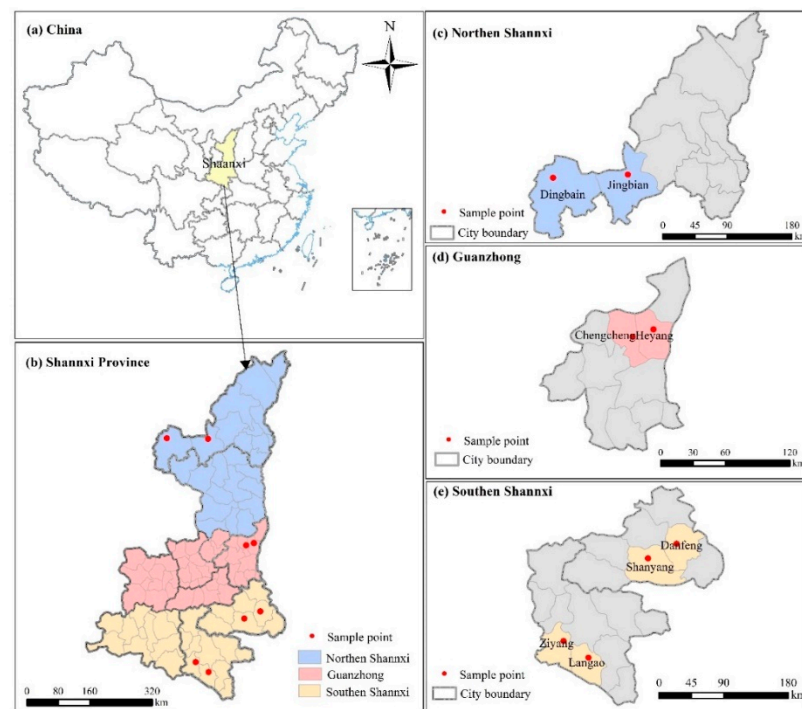

Figure 2. The map of study areas.

The data used in this study primarily comes from a field survey conducted by our research group in July and September 2021 on urban resettled households from PAR in Shaanxi, China. A stratified random sampling method was employed to ensure the representativeness of the samples. First, according to the scale of the PAR and the pre-survey situation in the three regions of Shaanxi province, 8 counties with significant-scale resettlement were selected: Dingbian County and Jingbian County in northern Shaanxi (see Figure 2c), Changchang County and Heyang County in central Shaanxi (see Figure 2d), and Ziyang County, Langao County, Danfeng County, and Shanyang County in southern Shaanxi(see Figure 2d, the basic geographic information (administrative division data) from the National Centre for Basic Geographic Information, http://ngcc.sbsm.gov.cn, accessed on 12 November 2023). This ensures that the sample captures regional heterogeneity in terms of geography. Second, considering the size of the resettled community, time of

resettlement, and participation of resettled households in WRH and farmland transfer, the research group initially selected 1–2 urban resettled communities in each county [43]. Finally, urban resettled households were randomly selected from each resettlement community for face-to-face questionnaire surveys. The study area's location is shown in Figure 2.

Before commencing the formal survey, a pre-survey was conducted in early June 2021 in Weinan, Shangluo, and Ankang, Shaanxi, to test the questionnaire and understand the differences in PAR implementation on the ground [5]. Based on this pre-survey, the final questionnaire was developed through frequent discussions and modifications with experts and scholars. The questionnaire covered family members' characteristics, employment, income, farmland utilization, withdrawal of rural homesteads, knowledge of farmland property rights, and follow-up support measures. Each survey interview, conducted by specially trained investigators, lasted approximately 60 min and took place mostly in the farmers' new homes. Most survey respondents were the heads of households or their spouses from urban resettled households who were familiar with their household situation. A total of 1302 questionnaires were distributed, of which 1285 were completed. After excluding incomplete data related to landless or rural homestead farmers who had not withdrawn, 1079 valid questionnaires were entered into the model analysis, with a sample validity rate of 83.97%. Additionally, the sample consisted of 231, 177, and 671 resettled household samples from Northern Shaanxi, Guanzhong, and Southern Shaanxi, respectively. The regional distribution of the sample aligns with the proportion of relocation scales in the three regions outlined in the "Implementation Plan for Poverty Alleviation Resettlement in Shaanxi Province during the 13th Five-Year Plan" [42].

3.2. Variables Specification

(1) Dependent variable: farmland abandonment. This study draws on the study of Xu et al. [44], using farmland abandonment behavior and its scale as indicators of farmland abandonment. The paper focuses specifically on explicit farmland abandonment, i.e., the abandonment emphasizes the termination of the state of farmland use and management, and the degradation of farmland facilities to the extent that they are difficult to reuse, accompanied by the process of natural vegetation restoration [45]. The scale of farmland abandonment is mainly derived from resettled households' subjective reports.

(2) Independent variables: non-farm employment. Drawing on Lu's study [17], the quantity of non-farm employment was selected as an indicator to measure the degree of non-farm employment in households. Following existing studies [37], non-farm employment in this paper is defined as family members aged between 15 and 64 who can work and are engaged in production and business activities across all industries other than agriculture and also excludes the unemployed group. Thereafter, the non-farm employment of resettled households is classified into NEI and NEO, depending on whether their employment area is within the county [11]. Specifically, if the labor force is employed within the county, it is classified as NEI; otherwise, it is classified as NEO. China's PAR follow-up support emphasizes "expanding employment channels and promoting local employment" for the relocated labor. Local governments assist relocated farmers in finding employment locally by attracting industrial projects to the resettlement area, developing community factories, and developing public welfare positions, which is one of the coordinated methods to promote follow-up support for PAR and county-based urbanization [11].

(3) Moderating variables: the cultivation of land in WRH and the duration of WRH. Statistics show that in 2021, 100% of the resettled households under PAR in Shaanxi Province withdrew from their rural homesteads (Data source: http://www.shaanxi.gov.cn/xw/sxyw/202103/t20210316_2156515_wap.html?ivk_sa=1024320u, access on 12 December 2022). Here, this study focuses on the cultivation of land in WRH and the duration of WRH, which were measured by the question "What is the use of your household's rural homestead after withdrawal?" with response options of (1) reculti-

vation, (2) re-greening, (3) not yet used, idle, and (4) others. Additionally, respondents were asked to provide the years they had withdrawn from their homesteads. In general, about 41% of the urban resettled households chose to recultivate their rural homesteads, with an average duration of WRH for the sample households being 1.759 years.

(4) Control variables. Based on existing research, this research selected 12 control variables from the characteristics of the household head, family, relocation, and farmland. Household head characteristics are mainly selected from the age and education level of household heads [15,37]; family characteristics include household size, dependency ratio, and household income [32,37]; relocation characteristics include time of relocation and farming radius [13]; and farmland characteristics include farmland size, farmland transfer, perception of contracted ownership, and perceived security of farmland rights [13,17]. The definition and descriptive statistics of each variable are shown in Table 1.

Table 1. Variable Selection and descriptive statistics.

Variables	Variable Descriptions	Mean	SD
Farmland abandonment behavior	Whether the resettled households have farmland abandonment? 1 Yes; 0 No	0.369	0.483
Farmland abandonment scale	Actual area of farmland abandoned by resettled households (mu)	3.570	8.797
Non-farm Employment	The number of laborers in resettled households with nonfarm employment	1.453	0.911
NEI	Number of non-farm laborers with employment areas in and within the county	0.480	0.660
NEO	Number of nonfarm labor force with employment areas outside the county	0.973	0.907
Cultivation of land in WRH	Whether or not the withdrawal rural homestead was re-cultivated? 1 Yes; 0 No.	0.410	0.492
Duration of WRH	By 2021, the year of rural homestead withdrawal	1.759	0.758
Age	The household head's age (year)	53.834	12.193
Educational	The household head's education status: 1 No education; 2 Primary schools; 3 Middle schools; 4 High schools; 5 Colleges and above	2.324	0.841
Household size	Number of family members	4.361	1.292
Dependency ratio	The ratio of the number of dependents (number of family members over 65 and under 15 years of age) to the total number of persons in the household	0.317	0.235
Household income	Total household income (in logarithmic form)	10.291	1.346
Relocation time	By 2021, the year of relocation (year)	2.158	0.736
Farming radius	Distance from the resettlement house to the largest parcel (kilometers, in its logarithmic form)	3.230	0.846
Farmland size	Total area of farmland area being operated (mu)	15.942	21.75
Farmland transfer	Experience of farmland transfer: 1 Yes; 0 No.	0.264	0.441
Perception of contracted ownership	Whether the perception of contracted land ownership is correct: 1 Yes; 0 No.	0.057	0.231
Perceived security of farmland rights	After relocation, are you worried that your household's contracted land rights will be lost or damaged? 1 Very worried; 2 Somewhat worried; 3 Indifferent; 4 Not worried; 5 Not worried at all	2.740	1.400

3.3. Model Selection

A preliminary investigation into the relationship between non-farm employment and farmland abandonment was conducted using a simple OLS regression model. The findings revealed a positive correlation: as the number of resettled farmers engaged in off-farm employment increased, so did the extent of farmland abandonment. However, the use of an OLS regression model is flawed due to its inability to capture self-selection [46]. To solve the possible self-selection issue, a two-step procedure developed by Heckman was applied to examine the decision to abandon farmland and determine the factors affecting the scale of farmland abandonment among households that have abandoned their farmland [46–48]. In the first stage, a probit model was employed to analyze the farmland abandonment behavior of resettled households by using all the observed data. Probit estimation is performed to construct the inverse Mills ratio (IMR), serving as an explanatory variable in the estimation of farmland abandonment scale to correct for sample selectivity bias. The selection model is specified as follows:

$$Z_i^* = \alpha_0 + \alpha_1 X_{1i} + \alpha_2 X_{2i} + \alpha_3 X_{3i} + \varepsilon_i \begin{cases} 1, & \text{If } Z_i^* > 0 \\ 0, & \text{If } Z_i^* \leq 0 \end{cases} \tag{1}$$

Here, Z_i^* represents the latent variable of the i household's farmland abandonment behavior. If the household chooses to abandon farmland ($Z_i^* > 0$), then $Z_i = 1$; otherwise, $Z_i = 0$. X_{1i} is the non-farm employment of the household, and X_{2i} includes control variables such as age, education, farmland size, relocation time, and so on (see Table 1). And X_{3i} is the identified variable. It should be noted that the Heckman model requires at least one factor influencing the likelihood of farmland abandonment but having no direct impact on migrants' farmland abandonment scale. To meet this requirement, we introduced the regional variable (1 Southern Shaanxi; 2 Guanzhong; 3 Northern Shaanxi) as an identify variable. α_0 is the intercept, α_1, α_2, and α_3 are the parameters to be estimated, and ε_i is the stochastic disturbance. The probit procedure estimated the farmland abandonment behavior of the resettled households. The first stage allows us to calculate the IMR. Subsequently, the OLS model is estimated for the samples that have abandoned their farmland (i.e., samples with $Z_i = 1$). In this model, independent variables excluded family, relocation, and farmland characteristics of the resettled households but included the IMR from the first stage. The farmland abandonment scale model can be represented as:

$$Y_i = \beta_0 + \beta_1 Z_i + \beta_2 X_{2i} + \beta_3 IMR + \mu_i \begin{cases} \text{Observable, If } Z_i = 1 \\ \text{Unobservable, If } Z_i = 0 \end{cases} \tag{2}$$

Here, Y_i refers to the scale of farmland abandonment, a continuous variable. Z_i are the explanatory variables, including X_{1i} affecting the scale of farmland abandonment among resettled households. β_0 is the intercept; β_1, β_2, and β_3 are the parameters to be estimated; and μ_i is the stochastic disturbance. If the coefficient β_3 passes the significance test, it indicates that there is a self-selection bias in the sample of resettled households, making the Heckman two-stage estimation method suitable for analysis.

4. Results

4.1. Descriptive Statistics

As shown in Table 1, there are 398 samples with farmland abandonment behavior among the 1079 samples, which is 36.886%. This proportion is higher than that of Europe (15.1%) [49], China (18.19%) [50], and Nepal (23.9%) [51], and the higher rate of farmland abandonment in the relocation area needs to attract the attention of related governmental departments and academics. Simultaneously, a group comparative analysis was conducted using the mean value of non-farm employment to assess farmland abandonment behavior and scale. In other words, a resettled household is classified as having a "high" non-farm employment rate if it is above the sample mean, and conversely, as having a "low" non-farm employment rate if it is below the mean. As can be seen from Table 2, the proportion and

scale of farmland abandonment among resettled households with low non-farm employment rates (especially low rates of NEO) are lower, and this group should be one of the key groups in curbing farmland abandonment in relocation areas. Specifically, the probability and scale of farmland abandonment of high non-farm employment rate households (0.405, 4.580 mu) are significantly higher than those of low non-farm employment rate households (0.335, 2.620 mu), with NEO playing a particularly significant role. In addition, resettled households with a high rate of NEI also show a significantly greater likelihood and scale of farmland abandonment than those with a low rate of NEI (4.167 mu > 2.866 mu). This suggests that non-farm employment may contribute to farmland abandonment and that there may be differences in the impact of farmland abandonment across different non-farm employment regions.

Table 2. Descriptive analysis of farmland abandonment.

Variable	Non-Farm Employment Rate			The Rate of NEI			The Rate of NEO		
	High	Low	Difference	High	Low	Difference	High	Low	Difference
Farmland abandonment behavior	0.405	0.335	−2.414 **	0.360	0.380	0.685	0.415	0.321	−3.210 ***
Farmland abandonment scale	4.580	2.620	−3.680 ***	4.167	2.866	−2.425 **	4.091	3.041	−1.962 **

Notes: ** and *** indicate the level of significance of 5% and 1%, respectively.

4.2. Benchmark Analysis

Table 3 presents the results of the benchmark regression. Models 1 and 2 employ the OLS and Heckman models, respectively, to analyze the overall impact of non-farm employment on farmland abandonment. Models 3 and 4 further investigate the influence of different numbers of non-farm employees on farmland abandonment. The baseline regression results show that both the IMR of Models 2 and 4 is significantly positive at the 1% level, suggesting a sample selection problem in resettled households' farmland abandonment, which the Heckman two-stage model appropriately addresses.

Table 3. Effect of non-farm employment on resettled household's farmland abandonment.

	(1) OLS Farmland Abandonment Scale dy/dx	(2) Heckman Farmland Abandonment Behavior dy/dx	(2) Heckman Farmland Abandonment Scale dy/dx	(3) OLS Farmland Abandonment Scale dy/dx	(4) Heckman Farmland Abandonment Behavior dy/dx	(4) Heckman Farmland Abandonment Scale dy/dx
Non-farm employment	0.908 ***	0.062 ***	2.560 ***			
	(0.271)	(0.019)	(0.763)			
Non-farm employment: reference with group 0						
No. of 1 employee				0.662	0.050	3.056 **
				(0.762)	(0.049)	(1.514)
No. of 2 employees				1.556 *	0.101 *	5.972 ***
				(0.834)	(0.056)	(1.940)
No. of 3 employees				2.932 ***	0.152 **	8.123 ***
				(1.115)	(0.073)	(2.690)
No. of 4 employees				2.837 ***	0.327 ***	10.263 ***
				(1.095)	(0.103)	(3.178)
Age	−0.055 **	−0.004 ***	−0.100 **	−0.056 **	−0.004 ***	−0.096 **
	(0.022)	(0.001)	(0.046)	(0.022)	(0.001)	(0.046)
Education	−0.676 ***	−0.050 ***	−1.635 **	−0.695 ***	−0.049 ***	−1.615 ***
	(0.261)	(0.017)	(0.633)	(0.263)	(0.017)	(0.623)
Household size	−0.433 *	−0.032 ***	−1.379 ***	−0.423 *	−0.032 ***	−1.372 ***
	(0.222)	(0.012)	(0.412)	(0.226)	(0.012)	(0.411)

Table 3. *Cont.*

	(1) OLS Farmland Abandonment Scale dy/dx	(2) Heckman Farmland Abandonment Behavior dy/dx	Farmland Abandonment Scale dy/dx	(3) OLS Farmland Abandonment Scale dy/dx	(4) Heckman Farmland Abandonment Behavior dy/dx	Farmland Abandonment Scale dy/dx
Dependency ratio	6.056 ***	0.333 ***	13.509 ***	6.060 ***	0.328 ***	13.632 ***
	(1.316)	(0.066)	(3.792)	(1.310)	(0.066)	(3.729)
Household income	−0.277 *	−0.023 *	−0.512 **	−0.261 *	−0.021 *	−0.590 **
	(0.143)	(0.011)	(0.258)	(0.146)	(0.012)	(0.272)
Relocation time	−0.578	−0.047 **	−0.696	−0.586	−0.046 **	−0.746
	(0.483)	(0.022)	(1.088)	(0.481)	(0.022)	(1.091)
Farming radius	0.881 ***	0.063 ***	2.522 ***	0.873 ***	0.064 ***	2.513 ***
	(0.277)	(0.017)	(0.608)	(0.276)	(0.017)	(0.596)
Farmland size	0.216 ***	0.005 ***	0.390 ***	0.216 ***	0.005 ***	0.391 ***
	(0.033)	(0.001)	(0.049)	(0.033)	(0.001)	(0.050)
Farmland transfer	−2.036 ***	−0.153 ***	−5.833 ***	−2.031 ***	−0.154 ***	−5.689 ***
	(0.514)	(0.032)	(1.773)	(0.517)	(0.032)	(1.732)
Perception of contracted ownership	−1.650	−0.100 *	−7.930 **	−1.670	−0.098 *	−8.028 **
	(1.037)	(0.062)	(3.722)	(1.037)	(0.062)	(3.750)
Perceived security of farmland rights	0.222	0.008	0.523 *	0.218	0.008	0.515 *
	(0.160)	(0.010)	(0.283)	(0.160)	(0.010)	(0.288)
Identity variable: region		−0.125 ***			−0.126 ***	
		(0.023)			(0.023)	
IMR			11.315 ***			11.319 ***
			(3.322)			(3.272)
N	1079	1079	398	1079	1079	398
R²	0.339	0.108	0.632	0.340	0.109	0.634
Wald test (Prod > χ²)		324.64 (0.000)			327.62 (0.000)	

Notes: (1) *, **, and *** indicate the level of significance of 10%, 5%, and 1%, respectively. (2) dy/dx is the average marginal effect of variables.

First, through a comparison of OLS and Heckman's two-stage regression (Models 1 and 2, Models 3 and 4), it is found that non-farm employment significantly promotes both the behavior and scale of resettled households' farmland abandonment, and Hypothesis 1 is verified. This finding is consistent with our expected results and the findings of previous studies by Xie et al. [37], Lu [17], and Xu et al. [18]. Specifically, the marginal effect of non-farm employment on farmland abandonment behavior and scale is 0.062 and 2.560 mu, respectively, significant at the 1% level. This suggests that the increase in non-farm employment encourages resettled households to allocate more labor to non-farm employment due to the income effect, and reduces household agricultural labor time and the scale of farmland operations by the substitution effect. This, in turn, leads to an increase in the behavior and scale of farmland abandonment [17,33,35]. Furthermore, the comparison between Model 1 and Model 2 reveals that, after solving the self-selection problem, the marginal effect of non-farm employment on resettled households' farmland abandonment scale becomes larger, increasing from 0.908 mu to 2.560 mu.

Second, the impact of non-farm employment on farmland abandonment varies with the number of non-farm employees, which is consistent with the findings of Lu [17]. Models 3–4 show that a higher number of non-farm laborers in the household increases the likelihood and scale of farmland abandonment. Especially, with 2, 3, and 4 non-farm employees in the household, the probability of farmland abandonment behavior increases by 0.101, 0.152, and 0.327, respectively, all statistically significant at the 10% level, with corresponding increases in scale by 0.051 and 0.175. When the number of non-farm laborers in the household is 1, 2, 3, and 4, the scale of farmland abandonment increases by 3.056 mu, 5.972 mu, 8.123 mu, and 10.263 mu, respectively. All of these increases are significant at the 5% level. The increase in farmland abandonment is 2.916 mu, 2.151 mu,

and 2.140 mu, respectively. Notably, as the number of non-farm laborers in the family increases, there is a gradual growth in the probability of farmland abandonment behavior, while the scale of farmland abandonment decreases. This study provides additional evidence supporting a positive relationship between non-farm employment and farmland abandonment, enriching existing research considering the number of non-farm employees.

In addition, control variables such as age, education, household size, household income, dependency ratio, and farmland size have a significant effect on farmland abandonment, which is consistent with the findings of Xie et al. [37] and Xu et al. [44]. Farmland transfer has a significant negative effect on the behavior and scale of farmland abandonment, which is consistent with the findings of Wang et al. [52] and Li et al. [13]. This also indicates that improving the farmland transfer market in the relocation areas and promoting farmland transfer is still an effective approach to curbing farmland abandonment.

4.3. Endogeneity Tests and Robustness Tests

To ensure the robustness of the empirical findings, this study employs two methods for robustness testing. Firstly, the instrumental variable method is utilized to address endogeneity bias. Given the possible interaction between non-farm employment and farmland abandonment, based on the research of Xie et al. [37] and Xu et al. [44], this study employs an instrumental variable, "the average number of non-farm employment of other farmers in the same resettlement community," to solve the possible endogeneity problem in the model. As shown in Table 4, the Wald test values of Model 1 and Model 2 are above the empirical value of 10, indicating that there is no weak instrumental variable problem and that non-farm employment has a significant positive impact on farmland abandonment, which demonstrates that the benchmark regression results are robust. Secondly, an alternative approach involves the replacement of independent variables. Referring to the study of Xu et al. [18,44], the independent variables are replaced by the proportion of non-farm labor to total household labor. As evidenced by Model 3 in Table 4, the empirical results are consistent with the benchmark regression results, further indicating that they are robust and reliable.

Table 4. Endogeneity test and robustness tests.

	(1) IV-Probit Model		(2) IV-Tobit Model		(3) Heckman Model	
	Non-Farm Employment	Farmland Abandonment Behavior	Non-Farm Employment	Farmland Abandonment Scale	Farmland Abandonment Behavior	Farmland Abandonment Scale
	The First Stage Coef.	The Second Stage Coef.	The First Stage Coef.	The Second Stage Coef.	Coef.	Coef.
Non-farm employment		1.377 ***		37.163 ***		
		(0.056)		(14.153)		
Instrument variable	0.417 ***		0.417 ***			
	(0.141)		(0.141)			
The proportion of non-farm labor to the total household labor					0.005 ***	0.087 ***
					(0.001)	(0.021)
Region					−0.387 ***	
					(0.073)	
IMR						11.459 ***
						(3.245)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−2.444 ***	2.685 ***	−2.444 ***	66.326 **	0.933 **	−5.482 ***
	(0.342)	(0.372)	(0.342)	(26.746)	(0.473)	(3.951)
Wald test		1235.48 ***		96.19 ***		292.33 ***
Wald test of exogeneity (chi^2)		21.74 ***		14.39 ***		/
R^2		/		/	0.105 ***	0.620 ***
N		1079		1079	1047	383

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

4.4. Heterogeneity Analysis

To test hypothesis 2, with reference to existing studies [11], non-farm employment is subdivided into NEI and NEO according to whether the resettled labor's employment area is inside the county. The estimation results are shown in Table 5.

Table 5. Results of heterogeneity analysis by the non-farm employment areas.

	(1) Heckman Model		(2) Heckman Model	
	Farmland Abandonment Behavior	Farmland Abandonment Scale	Farmland Abandonment Behavior	Farmland Abandonment Scale
	dy/dx	dy/dx	dy/dx	dy/dx
NEI	0.057 **	1.992 **		
	(0.026)	(0.934)		
NEO	0.064 ***	2.983 ***		
	(0.020)	(0.718)		
NEI: reference with group 0				
No. of 1 employee			0.037	2.133 *
			(0.035)	(1.194)
No. of 2 employees			0.105	5.484 **
			(0.067)	(2.212)
No. of 3 employees			0.406 ***	10.297 *
			(0.132)	(5.651)
NEO: reference with group 0				
No. of 1 employee			0.071 *	5.466 ***
			(0.037)	(1.296)
No. of 2 employees			0.132 ***	7.256 ***
			(0.050)	(1.763)
No. of 3 employees			0.168 **	9.395 ***
			(0.076)	(2.147)
No. of 4 employees			0.288 *	12.007 ***
			(0.157)	(3.112)
Control variables	Yes	Yes	Yes	Yes
Region	−0.123 ***		−0.125 ***	
	(0.023)		(0.024)	
IMR		12.221 ***		13.139 ***
		(3.274)		(3.251)
N	1079	398	1079	398
R^2	0.108	0.633	0.111	0.640
Wald test (Prod > χ^2)	302.76(0.000)		273.15(0.000)	

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

(1) There are positive and statistically significant effects of different non-farm employment areas on both the behavior and scale of farmland abandonment. The marginal effect of NEO on farmland abandonment behavior and scale is higher on average than that of NEI. These conclusions confirm Hypothesis 2, consistent with the expected results and Zhuang et al.'s research [32]. As can be seen from Model 1, the marginal effect of NEO on farmland abandonment behavior and scale (0.064, 2.983 mu) is greater than that of NEI (0.057, 1.992 mu). The findings of this study enhance the understanding of the varied effects of different non-farm employment areas on farm-

land abandonment, contributing to the enrichment of research on factors influencing farmland abandonment.

(2) The marginal effect of non-farm employment in different areas on farmland abandonment behavior and scale varies according to the number of laborers employed. First, with regards to the marginal effect of farmland abandonment behavior, the probability of abandoning farmland in the relocated household increases with the number of NEO. When 1, 2, 3, and 4 members of the household achieve NEO, the marginal effect of farmland abandonment behavior is 0.071, 0.132, 0.168, and 0.288, respectively. However, the effect of NEI on farmland abandonment behavior has a certain threshold, but the degree of effect is greater. Only when 3 persons in the household realize NEI, NEI has a significant positive effect on farmland abandonment behavior, with a marginal effect of 0.406, which is much greater than that of NEO. Second, in terms of the marginal effect of the scale of farmland abandonment. According to the results of Model 2, when there are 1, 2, or 3 NEI laborers in the family, the scale of farmland abandonment increases by 2.133 mu, 5.484 mu, and 10.297 mu, respectively, increasing to 3.351 mu and 4.813 mu. When a resettled household has 1, 2, 3, and 4 NEO laborers, the scale of farmland abandonment increases by 5.466 mu, 7.256 mu, 9.395 mu, and 12.007 mu, with increases of 1.790 mu, 2.139 mu, and 2.612 mu, respectively. It can be observed that when the number of non-farm employees is two or less, the impact of NEO on the scale of farmland abandonment is greater. Conversely, when the number of non-farm employees is three, the impact of NEI is higher.

4.5. Mechanism Analysis

To examine hypotheses 3 and 4, we followed Lu et al.'s [17] research and introduced interaction terms between the moderating variables and independent variables into the existing model to further explore the role of recultivation and the duration of rural homestead withdrawal in the relationship between non-farm employment and farmland abandonment.

Among the 1079 resettled households, 40.964% chose to re-cultivate, 15.477% to reforest, 40.964% to idle, and 2.595% to convert their land to other uses. Cultivating the land in WRH can increase the farmland operation area for the resettled households to some extent, improve agricultural income, and then curb farmland abandonment. The results from Model 1 and Model 2 in Table 6 prove this point: the interaction term between non-farm employment and cultivation of land in WRH is negatively significant at the 5% level, indicating that the cultivation of land in WRH weakens the contribution of non-farm employment to the probability of their behavior and scale of farmland abandonment, and has a stronger negative impact on the NEI labor force. This is in support of Hypothesis 3 and also in line with the expectations of this paper and the study by Hong et al. [33].

In the study area, the duration of WRH is concentrated, with 90.269% of the sampled households experiencing a rural homestead withdrawal period of 1 to 2 years. The longer the withdrawal period, the higher the likelihood that they successfully integrate into their new environment post-relocation. This integration allows them to achieve more stable non-farm employment, reducing their reliance on the production and security functions of their contracted farmland. This, in turn, leads to a higher probability of farmland abandonment. As shown in Table 6, Model 3 and Model 4 reveal that the interaction term between non-farm employment and the duration of WRH is positively significant at the 5% level, indicating that the duration of WRH strengthens the promotional effect of non-farm employment on farmland abandonment behavior, and this effect is concentrated in the NEO. Thus, Hypothesis 4 is confirmed, aligning with the expected findings. In summary, the above results further enrich and extend the research on the impacts of the withdrawal and transformation of rural homesteads.

Table 6. Effect of non-farm employment and WRH on resettled households' farmland abandonment.

	(1) Heckman Model		(2) Heckman Model		(3) Heckman Model		(4) Heckman Model	
	Farmland Abandonment Behavior	Farmland Abandonment Scale	Farmland Abandonment Behavior	Farmland Abandonment Scale	Farmland Abandonment Behavior	Farmland Abandonment Scale	Farmland Abandonment Behavior	Farmland Abandonment Scale
	coef.	coef.	coef.	coef.	coef.	coef.	coef.	coef.
Non-farm employment	0.222 ***	3.034 ***			0.060	2.023 **		
	(0.061)	(0.809)			(0.083)	(0.913)		
NEI			0.248 ***	2.992 ***			0.078	1.740
			(0.088)	(1.012)			(0.130)	(1.369)
NEO			0.208 ***	3.138 ***			0.033	1.833
			(0.066)	(0.908)			(0.107)	(1.254)
Non-farm employment * cultivation of land in WRH	−0.098 **	−2.157 ***						
	(0.049)	(0.575)						
NEI * cultivation of land in WRH			−0.202 *	−3.905 ***				
			(0.111)	(1.325)				
NEO * cultivation of land in WRH			−0.055	−1.497 **				
			(0.064)	(0.744)				
Non-farm employment * duration of WRH					0.069 **	0.232		
					(0.033)	(0.291)		
NEI * duration of WRH							0.046	0.079
							(0.055)	(0.500)
NEO * duration of WRH							0.091 *	0.595
							(0.051)	(0.590)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region	−0.396 ***		−0.398 ***		−0.401 ***		−0.394 ***	
	(0.071)		(0.074)		(0.072)		(0.074)	
Constant	1.234 ***	−4.310	1.233 ***	−4.384	1.287 ***	−3.189	1.276 ***	−3.307
	(0.477)	(5.188)	(0.477)	(5.271)	(0.478)	(5.252)	(0.478)	(5.419)
IMR		10.341 ***		10.824 ***	10.432 ***		11.317 ***	
		(2.933)		(3.073)	(2.962)		(3.193)	
N		1079		1079		1079		1079

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

5. Discussion

Based on the survey data of resettled households in northwest China, this study analyzes farmland abandonment characteristics and employs econometric models to explore the relationships between non-farm employment, WRH, and farmland abandonment behavior and scale. Compared to previous studies, our study makes the following marginal contributions: Firstly, our study empirically analyzes and clarifies that non-farm employment promotes farmland abandonment and pays attention to the differential impact of the number of non-farm employees using first-hand survey data from resettled households. Secondly, this study further divides non-farm employment into NEI and NEO, exploring the impact of differences in the spatial distribution of non-farm employment in rural households on farmland abandonment. Finally, this study quantitatively examines the moderating effect of the recultivation and duration of WRH. The study enriches the literature on the changes in farmland management behavior during urbanization in developing regions or countries, emphasizing the need for inclusive management involving various stakeholders, such as land managers, resettled households, and staff of human resources and social security departments, in decision-making for policy development addressing farmland abandonment. It contributes to the improvement of targeted governance policies for farmland abandonment, promoting rural revitalization, and food security in China and other developing countries.

Compared with existing studies, there were some similarities and significant differences in the conclusions drawn in this study. For example, previous studies have shown that for household laborer migration, nonfarm employment contributes to farmland abandonment [17,18,37], but fewer scholars have mentioned that the number of household members engaged in non-farm employment is significantly different in rural households. Lu found that with every 1% increase in the number of 1, 2, 3, or more household migrant

laborers, the average probability of rural households' farmland abandonment increases by 2.9%, 5.0%, and 7.8%, respectively [17]. Our study proves that when there are 2, 3, and 4 non-farm employees in a resettled household, the probability of farmland abandonment behavior increases by 0.101, 0.152, and 0.327, respectively, and the scale of farmland abandonment increases by 5.972 mu, 8.123 mu, and 10.263 mu, respectively. This is consistent with the findings of Lu [17], but there is a difference in the degree of farmland abandonment caused by the different numbers of non-farm jobs. One possible explanation is that, on the one hand, our study focuses on the relocation areas of PAR, which are mostly geologically hazardous and ecologically fragile areas with impoverished soil, which in turn leads to farmland being more prone to abandonment. On the other hand, compared with the common agricultural transfer population, PAR insists on relocating on a household basis, and the loss of the labor force in agriculture is more thorough.

In addition, it is noteworthy that this study finds that the marginal effect of NEO on farmland abandonment behavior and scale is larger than NEI, except when the number of NEI reaches 3. This specific threshold has not been explored previously. We think that NEI has the temporal and spatial conditions to engage in part-time farming compared with NEO. They are usually able to ensure seasonal labor demand for agricultural production, meet capital inputs for agricultural production, and are thus able to operate larger-scale farmland, thereby reducing abandonment.

Orderly withdrawal and recultivation of WRH have become an effective measure in addressing funding and land challenges in PAR [21,53], playing a crucial role in enhancing farmland utilization, ecological protection, and the civilization of urban resettled households [22,38]. Our study has proven that the cultivation of land in WRH significantly reduces the impact of non-farm employment on both the behavior and scale of farmland abandonment, especially in the NEI group. The duration of WRH also significantly improves the promotion of non-farm employment on farmland abandonment behavior, with a concentrated effect observed in the NEO group. One possible explanation is that PAR required farmers to voluntarily participate, move to new housing, demolish old homesteads, and personally recultivate the land [21]. Households that have withdrawn and recultivated their rural homesteads experience an increase in actual farmland area, making returns to scale more likely and thereby reducing the probability and scale of farmland abandonment. Conversely, households that have not recultivated their withdrawn rural homesteads are more likely to undertake extensive operations or even abandon their farmland due to the inconvenience of agricultural production conditions. Similarly, if urban resettled households have withdrawn from their rural homesteads for an extended period, their lifestyles and livelihoods may have shifted towards non-agriculture [22], making them more likely to abandon their farmland. This reaffirms the positive significance of the withdrawal and transformation of rural homesteads in improving farmland utilization and ecological protection. Additionally, future research can conduct a comprehensive analysis of how WRH influences the relationship between non-farm employment and farmland abandonment through a multi-case comparative approach, considering diverse regional topography and economic development levels.

Farmland abandonment is a widespread phenomenon globally, and each country has implemented policies to address it. For example, countries in Central and Eastern Europe have proposed land reform programs (e.g., land consolidation, land banking) and various instruments to support rural land market development, aiming to reduce property fragmentation and, eventually, abandonment [54,55]. Similarly, in addressing farmland abandonment, the Japanese government, which is similar to our small rural households, has implemented preventive measures in three aspects: solving the problem of who will cultivate the farmland through direct agricultural subsidy policies and farmland intermediate management careers; addressing the problem of whether the farmland can be cultivated through farmland reclamation careers and wild animal damage prevention; and tackling the problem of how to cultivate the farmland through high-value-added agriculture strategies and agriculture-welfare collaboration policies [56]. Additionally, our

field research in Tianbao village, Baihe county, Ankang, reveals a positive role in curbing farmland abandonment in the region through the cultivation of agricultural enterprises and active participation in farmland transfer [57]. These foreign and domestic governance practices provide valuable insights for establishing effective mechanisms to curb farmland abandonment.

There are some limitations to address in future studies. For example, this study focuses on the urban resettled households in Shaanxi province, which differ from other types of immigrants in terms of non-farm employment opportunities, farming costs, and so on. These differences influence decisions related to farmland abandonment. Therefore, these findings may hold theoretical significance for similar research groups, and their universality still needs verification in the future. Future research should extend the scope to include various research objects (e.g., agricultural resettled households, non-relocated households, ecological migrants, and other types of agriculture transfer populations). Through comparative analysis, a better understanding of abandoned farmland across different types of migrants can be achieved. On the other hand, the study's data are derived from a household survey, providing relatively comprehensive and accurate information. However, rural households often utilize diversified farmland disposal methods based on differences in farmland resource endowment on different plots. Moreover, the precision of the household survey data for plot-scale research and analysis is relatively inadequate. Therefore, future research could consider combining rural household survey data with remote sensing data to expand the research on the dynamic characteristics of rural households' farmland abandonment at the plot scale. In addition, our findings are based on a large-scale questionnaire survey (like He et al. [15] and Tang et al. [58]), and issues such as the demand for farmland systems and the deep-rooted causes of farmland abandonment require more detailed, in-depth qualitative information for analysis. In the future, we can collect more comprehensive information on the disposal of resettled households' farmland and explore the mechanism of resettled households' farmland abandonment and the implementation effect of related governance policies more deeply through typical case studies to compensate for the shortcomings of quantitative research.

6. Conclusions

Drawing on field survey data from 1079 urban resettled households in Shaanxi Province, this study provides an empirical analysis of the relationship between non-farm employment and farmland abandonment after the implementation of PAR and further explores the heterogeneous effects of the area and number of resettled households' non-farm employment, as well as the moderating effects of WRH. The results show that: (1) non-farm employment contributes to both behavior and scale of resettled households' farmland abandonment, and the impact varies by the number of non-farm employment. Specifically, as the number of non-farm employees increases, the growth rate of the probability of farmland abandonment behavior accelerates, but the growth rate of the farmland abandonment scale gradually decreases. The findings are robust through endogeneity tests and robustness tests. (2) Heterogeneity analysis found that the marginal effect of NEO on both behavior and scale of farmland abandonment is higher than that of NEI on average. Further research found that only when the number of NEI reaches 3, do the probability and scale of farmland abandonment surpass those of NEO. (3) Mechanism analysis found that the cultivation of land in WRH significantly reduces the impact of non-farm employment on farmland abandonment behavior and scale, especially in the NEI group. Additionally, the duration of WRH significantly improves the promotion of non-farm employment on farmland abandonment behavior, and the effect is concentrated in the group of NEO.

Our findings offer some policy recommendations to curb the problem of farmland abandonment in the relocation area for PAR. Firstly, to solve the problem of farmland abandonment caused by the shortage of agricultural labor, it is necessary to actively cultivate and introduce new agricultural management entities and new professional farmers. In light of the trend of non-farm employment among resettled households, agricultural operators

in relocation areas should particularly target urban resettled households who have reculti-vated their withdrawn homesteads, with low rates of non-farm employment, especially with fewer than two NEI laborers. This strategy can solve the problem of "Who will farm the land?" and promote sustainable agriculture. At the same time, it is actively developing agricultural socialization services for smallholder farmers to reduce the input of the agri-cultural labor force, thereby mitigating the impact of non-farm employment on farmland abandonment. Secondly, the government should actively promote moderate operation scales of agricultural farmland in relocated areas through resource coordination, policy formulation, and improvement. For example, concerning the farmland with favorable production conditions and its surrounding withdrawn homesteads, the government should actively organize land consolidation, high-standard farmland, and other projects to achieve contiguous concentration of farmland; in addition, local governments should gradually establish a system for the paid withdrawal of farmland and improve the farmland transfer platform in relocated areas, which can help resettled households with large numbers of non-farm laborers (especially NEO) to transfer out their farmland and further gradually realize the relative concentration of arable land rights. Finally, attaching importance to the transformation of rural homesteads and actively improving the quality of farmland through recultivation is crucial. Based on the moderating effect of WRH, local governments should encourage resettled households to re-cultivate their rural homesteads. This can be achieved through implementing some supporting policies, such as increasing subsidies for the recultivation of WRH and encouraging resettled households who have withdrawn from their rural homestead for a long time to transfer their farmland through withdrawals or transfers.

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