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Development of Off-farm Employment and its Determinants in Rural China

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This study investigates the long-term trends of labor allocation in rural households of China from the late 1980s until the mid-2010s, and examines the determinants of their off-farm employment in 2002 and 2013 using the nationally representative household survey (CHIP). The estimated results indicate that working status of whether a person is employed showed the coefficients on age and education have an inverse-U-shaped relationship with employment probability for both years. The estimated results of the Tobit model of off-farm workdays as a percentage share of total workdays show that female labor was more strongly influenced by household characteristics and political networks than male labor in 2002, but no clear gender gaps were observed in 2013. This appears mainly due to the relative scarcity of off-farm employment in the early 2000s; therefore, women tended to take charge of domestic work such as child care and agricultural production. With the increase of off-farm work and the liberalization of grain marketing, the division of labor between genders has become less apparent.

Keywords: rural inequality, labor allocation, China, off-farm work

JEL classification: J22, J71, N35, O15

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This study investigates the long-term trends of labor allocation in rural households of China from the late 1980s until the mid-2010s, and examines the determinants of their off-farm employment in 2002 and 2013 using the nationally representative household survey (CHIP). The estimated results indicate that working status of whether a person is employed showed the coefficients on age and education have an inverse-U-shaped relationship with employment probability for both years. The estimated results of the Tobit model of off-farm workdays as a percentage share of total workdays show that female labor was more strongly influenced by household characteristics and political networks than male labor in 2002, but no clear gender gaps were observed in 2013. This appears mainly due to the relative scarcity of off-farm employment in the early 2000s; therefore, women tended to take charge of domestic work such as child care and agricultural production. With the increase of off-farm work and the liberalization of grain marketing, the division of labor between genders has become less apparent.

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1. Introduction

Migration and off-farm employment are promising tools for rural households who suffer from a serious deficiency of production means to improve their standard of living. Off-farm employment also helps to make rural farmers less vulnerable to agricultural risk, achieving consumption smoothing through remittance (Stark 1984, Lucas and Stark 1985). In China, a household registration system was introduced in early 1950s to separate the "agricultural population" (*nongye hukou*) from the "nonagricultural population" (*fei nongye hukou*) and make them stay in their own areas. The migration of people classified as the "agricultural population" to urban areas was strictly restricted, and the Chinese government introduced a direct control mechanism for agricultural production and marketing to ensure equitable distribution of food among consumers in urban areas (Dong and Putterman 2002, Zhong 2004, Asuyama and Yamaguchi 2014).

However, since the implementation of the reform and opening-up policy in the late 1970s, the Household Responsibility System for agricultural production was introduced in rural China to improve incentives for crop cultivation. Rural households were released from the control of collective farming and granted autonomy over their agricultural production and marketing, resulting in improved production incentives (McMillan et al. 1989, Lin 1992). In accordance with this, off-farm employment by rural workers on their own initiative was officially approved, and the restrictions on temporary migration from rural to urban areas have been relaxed since the mid-1980s. The rapid growth of township and village enterprises (TVEs) and manufacturing enterprises in urban areas has offered huge opportunities for the rural labor force to engage in off-farm employment in rural and urban areas.

In particular, since the beginning of the 1990s, the intensification of the reform and opening-up policy by Xiaoping Deng facilitated huge investment by overseas and domestic enterprises, achieving more than 10% annual GDP real growth for nearly 20 years. Since this time, the amount of migrant labor has been increasing, and a survey on this labor by the National Bureau of Statistics (NBS) of China (http://www.stats.gov.cn) showed that the number of rural laborers who had migrated from their registered townships for more than six months reached 169 million people in 2015, accounting for about 37% of total rural labor in China. In recent years, a shortage of physical laborers in rural areas has become evident mainly in coastal areas, such as Shenzhen and Guangzhou, which has pushed up the wages for these workers. This has spawned debate in the recent literature about whether the Chinese economy has passed the Lewis turning point.[1]

There are many studies addressing off-farm employment and migration in China. Zhao (1999a) and Zhao (1999b) examined the determinants of migration and off-farm work

[1] A special issue on the Lewis turning point in China was published by the *China Economic Journal* (Vol. 3, No. 2, 2010), and the results of a symposium on this topic will be published in the *China Economic Review*.

focusing on household/personal characteristics and institutional constraints such as land arraignments and local taxation. Yang (1997) investigated the allocative efficiency of labor allocation between farm and off-farm work by using an educational index, and showed that the highest household schooling contributed to the most to farm allocative efficiency. Extending the framework, Yang (2004) focused on farmers' responses to factors (labor and capital) of market liberalization between 1986 and 1995 to evaluate the contribution of schooling to labor reallocation from agricultural to nonagricultural activities.

Wang et al. (2007) used panel data from Zhejiang to analyze time allocation of hired and off-farm supplied labor by rural households, suggesting that the rural labor market was functioning imperfectly. Using the same dataset, Glauben et al. (2008) classified rural households into four different groups according to the types of labor market participation to examine household and regional characteristics affecting decisions. Brosig et al. (2009) investigated the dynamics of rural households' labor market participation to evaluate the frequency of transition between full-time and part-time farming, suggesting lock-in effects in off-farm employment.

The relationships between the land rental market and off-farm employment have also been examined in previous studies. Benjamin and Brandt (2002) analyzed the effect of administrative land reallocation and unevenly developed off-farm labor markets on farm efficiency, and proposed that inefficiency in labor allocation is alleviated by administrative land reallocation and development of the off-farm labor market. Kimira et al. (2011) also empirically suggested that higher off-farm wage rates increase off-farm employment opportunities inducing a more active land rental market. Jia and Petrick (2014) proposed a theoretical linkage between farmland fragmentation and off-farm labor supply and testify the hypothesis by using household panel data, indicating that farmland fragmentation led to significantly lower labor productivity for agriculture. The effects of off-farm employment on the land rental market have also been examined. Kung (2002) used a two-stage instrumental variable regression to show that households actively participating in off-farm employment are less likely to rent farmland.

The present paper analyzes the decisions around labor supply and time allocation for off-farm employment by using nationally representative China Household Income Project (CHIP) survey data. CHIP has conducted five rounds of household surveys in 1988, 1995, 2002, 2007, and 2013, and the survey data include comprehensive coverage of household income and labor allocation. The surveys were carried out as part of a collaboration of international researchers to investigate income inequality in China with assistance from the NBS. The surveys covered approximately 10,000 rural households in every round resampled from NBS's survey data (Li, Sato and Sicular eds. 2013, http://www.ciidbnu.org/chip/). The

survey database covers rural households over a 25-year period from 1988 to 2013, which is a period of rapid and prolonged change in labor allocation of rural households.

The structure of this article is as follows. Section 2 presents an overview of income inequality and decomposes total income inequality into its agricultural and off-farm incomes to capture the structural changes. In addition, we show the general trends in employment status and off-farm employment of rural workers. Section 3 identifies the determinants of employment status and off-farm employment ratio by estimating the Probit and Tobit models for the 2002 and 2013 datasets. Section 4 concludes and describes the policy implications for improving labor allocation in rural China.

2. Trend in income inequality and labor allocation from the late 1980s to 2013

2.1. Change in income level and income inequality

First, the long-term trends of rural household income and income inequality are summarized to examine the contribution of off-farm employment. Table 1 shows the average per capita rural household real income in the five rounds of CHIP surveys.[2] The annual average growth rate of income was relatively low from 1988 to 2002, stagnating at 2–3%. Since then, the income growth rates have accelerated considerably and reached 7.6% from 2002 to 2007 and 13.2% from 2007 to 2013.

According to the official rural household survey by NBS, real income annual growth rates were 3.0% for 1988–1995, 4.0% for 1995–2002, and 8.7% for 2002–2007, slightly larger than those of CHIPs. In contrast, the annual growth rate of NBS for 2007–2013 was 9.3%, higher than those for previous periods, but substantially lower than that for CHIP. The major factor in the gap for 2007–2013 is the imputed rent for owner-occupied housing, which is not accounted for in the NBS rural household income (Hoken and Sato 2016). The percentage shares of imputed income for CHIP 2007 and 2013 were 9.6% and 16.6%, respectively; thus, the rapid increase in imputed rent appears to increase the gap in income growth rate between CHIP and NBS.

The long-term trend in income inequality measured by the Gini coefficient is also shown in Table 1. A considerable rise in Gini coefficient was observed between 1988 and 1995, increasing from 0.323 in 1988 to 0.387 in 1995. The coefficients remained similar, at 0.370

[2] Our definition of rural household income is consistent with the definition used for official CHIP, as described in Hoken and Sato (2016). However, we have adjusted the definitions to allow a comparison of rural income across the various survey rounds.

in 2002 and dropping slightly to 0.355 in 2007. In accordance with the substantial growth of real income from 2007 to 2013, the coefficient rose again and reached 0.398 in 2013, the highest of all rounds. The pattern of income inequality is consistent with that of the NBS official rural household survey (Department of Household Surveys of NBS 2014).[3] These results suggest that substantial changes occurred in the early 1990s and in the late 2000s to decrease the income gap among rural households.

Table 1 Trend in rural household income

	Income per capita		Gini coefficient
	Real income (yuan)	Annual growth rate (%)	
1988	2,778		0.323
1995	3,453	3.2	0.387
2002	4,015	2.2	0.370
2007	5,797	7.6	0.355
2013	12,166	13.2	0.398

Source: Author's estimates from CHIP surveys.

Note: (1) We use the purchasing power parity index for rural households in provinces estimated in Brandt and Holz (2006) and extend it to 2013 by using the official consumer price index (CPI) for rural areas. Income per capita is deflated by rural CPI (2013 = 100). Rural CPI is from the *China Statistical Yearbook* (various issues).
(2) Whole rural household observations (not including migrant households) are used to estimate income per capita and Gini coefficient. Regional weights are calculated based on the share of provincial agricultural population to regional ones.

2.2. Composition of income and its contribution to income inequality

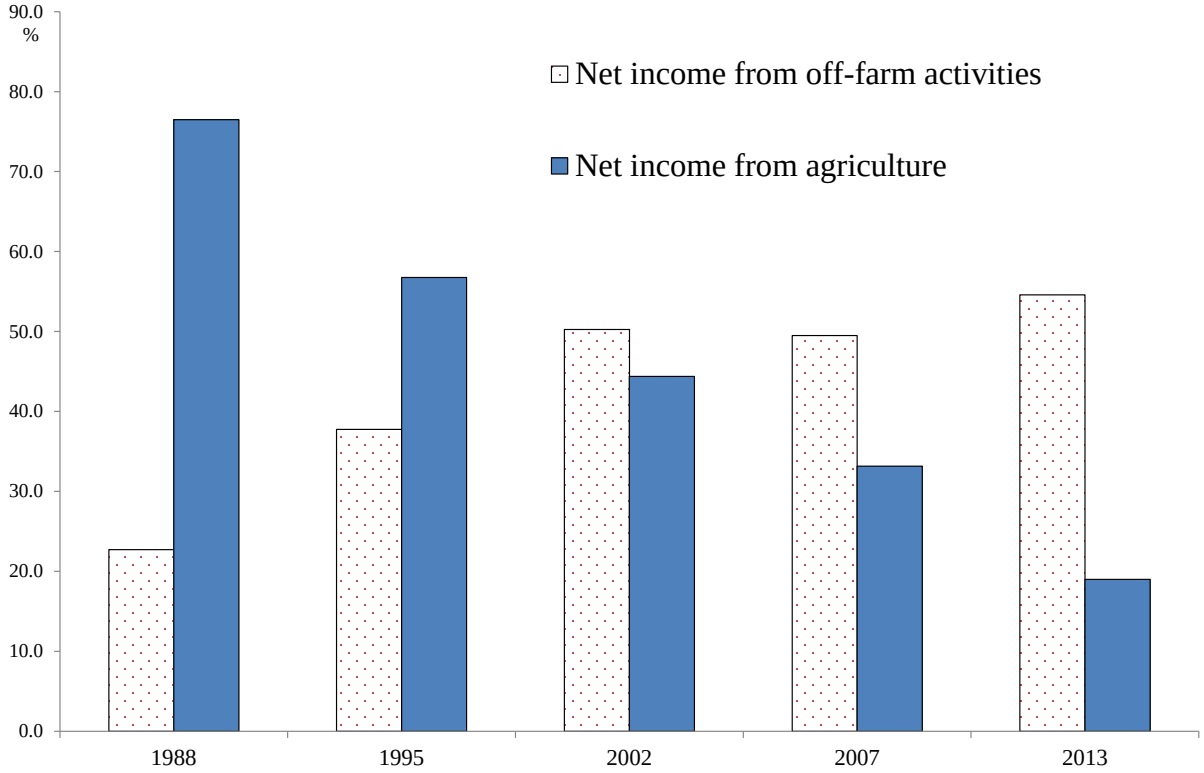
The long-term changes in income inequality are reflected in the shifts of income composition for rural households. To examine the structure of income composition and its contribution to income inequality, we disaggregate rural household income according to income sources. We separate household income into the following five components: net income from agriculture, net income from off-farm activities (net income from nonagricultural self-employment/business and wage earnings including remittances), asset income, imputed rental income from owner-occupied housing, and net transfer payments. To clarify the effects

[3] The Gini coefficient for the NBS survey exhibited a continuous rise from the 1980s to the 1990s, and subsequently, it has remained at a relatively high level since the early 2000s and reached 0.387 in 2012. Due to the revision of sampling design for household surveys, the official data on the Gini coefficient for rural household have not been published since 2013.

of labor allocation by rural households, we concentrate on the first two components (net income from agriculture and off-farm activities) to summarize the contributions to income.[4]

Figure 1 shows net incomes from agriculture and off-farm activities as a percentage share of the total income per capita. The shares of agricultural income decreased continuously from 76.5% in 1988 to 56.8% in 1995 and 44.4% in 2002. In contrast, the shares of net income from off-farm activities increased gradually from 22.7% in 1988 to 37.8% in 1995 and 50.3% in 2002. A substantial change in income composition occurred between 2007 and 2013. The shares of agricultural net income continued to decrease to 19.0% in 2013, whereas the shares of off-farm net income stagnated at approximately 50%. This is mainly due to the upsurge in imputed rent from owned housing, increasing from 9.6% in 2007 to 15.6% in 2013, although the amounts of off-farm net income approximately tripled, from 2,269 yuan in 2007 to 6,541 yuan in 2013.

Figure 1 Percentage shares of major income components of total income



Source: Author's estimates from CHIP surveys.

Note: Net income from off-farm activities is defined as the sum of net income from nonagricultural self-employment/business and wage earnings including remittances.

[4] Hoken and Sato (2016) investigate long-tern changes in the distribution of rural income and examine the contributions of each income component on income inequality by using the five CHIP surveys.

In accordance with the growth of off-farm income, the contributions to income inequality increased continuously during the period. We use the Gini decomposition method proposed by Lerman et al. (1985) and Stark et al. (1986) to investigate the contribution of each income component to per capita income inequality. The results show that the contribution of off-farm net income to total income inequality jumped from 36.0% in 1988 to 56.4% in 1995 and reached 65.6% in 2002. In contrast, the contributions of agricultural net income declined substantially from 57.4% in 1988 to 35.4% in 1995 and 27.4% in 2002.

Since then, although the contributions of off-farm income remained around 60% in 2007 and 2013, which were slightly higher than those of income shares, the contributions of agricultural income continued to drop from 22.6% in 2007 to 11.9% in 2013, lower than the shares of income composition. During 2002–2013, off-farm opportunities, including migrant jobs, continued to expand and spread more widely; hence, easy access to off-farm jobs mitigated the disparity effects of wage earnings. However, as shown in Zhang (2001) and Li (2001), the development of rural industries, such as TVEs, was still geographically unbalanced, and opportunities to obtain off-farm occupations were limited until the early 2000s. Therefore, rural households located in developed areas appear to benefit from wage income more than others did, accelerating income inequality among rural households.

2.3. Characteristics of employed status

The long-term shifts of income composition from agriculture to off-farm activities appear to be intimately related to labor allocation among rural households. To examine the changes in labor allocation for rural households, we summarize the features of labor supply by rural households. The percentage shares of working-age people who are employed or self-employed (not including full-time housework) are shown in Table 2. In calculating the employment rate, the observations were restricted people aged between 15 and 69, and self-employment was regarded as labor participation, whereas full-time household work was not.[5]

The percentage shares of employed people dropped considerably from 93.5% in 1988 to 81.5% in 1995 and 75.4% in 2002. The major factor that reduced the shares was the increase in school enrollment rate during this period. The students enrolled in school as a percentage share of the total labor force was only 1.4% in 1988, and the share increased to 7.7% in 1995 and 10.2% in 2002.[6] In addition, the increase in full-time household workers also contributed to the decrease in employment rates during the period; the percentage shares increased from 3.4% in 1988 to 5.9% in 1995 and 8.9% in 2002.

[5] The CHIP surveys gather employment/study status for all household members at the end of the surveyed year. Therefore, the question item in CHIP surveys is different from an ordinal item, which uses labor force participation as officially defined by ILO.

[6] No substantial gaps are observed for the shares of school-enrolled students between genders. The estimated results indicate that the percentage share jumped from 1988 and 1995, and has remained at 7–11% for both genders since then.

Table 2 Employment status for working population

Unit: %

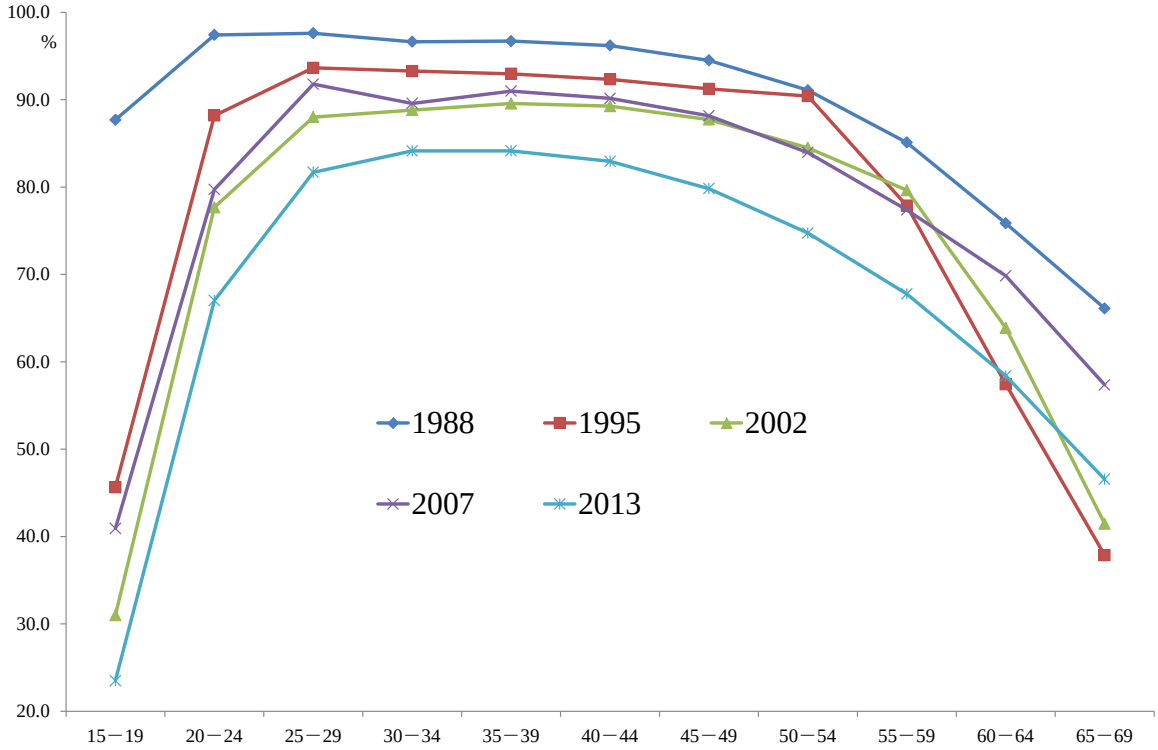
	Employed	Male	Female	Enrolled at school	Full-time household work	Retired	Unemployed or laid-off	Long-term sick leave	Other
1988	93.5	96.3	86.9	1.4	3.4	0.3	0.0	0.5	0.9
1995	81.5	85.6	75.1	7.7	5.9	0.3	0.2	1.1	3.2
2002	75.4	79.7	66.2	10.2	8.7	0.4	1.9	0.8	2.6
2007	79.2	84.5	69.1	8.1	8.9	0.5	0.9	1.3	1.1
2013	70.8	78.4	58.1	7.9	12.9	0.7	1.5	1.1	5.0

Source: Author's estimates from CHIP surveys.
Note: The observations were restricted to people aged between 15 and 69.

Although the employment rate jumped to 79.2% in 2007, the rate decreased considerably to 70.8% in 2013. Engagement in full-time household work appears to be a major factor in reducing the employment rates between 2007 and 2013. The percentage share of people engaged in full-time household work jumped from 8.9% in 2007 to 12.9% in 2013. The increase in the share of full-time household work is clearer when we disaggregate the employment status into genders. Namely, the percentage shares of full-time household work for females jumped from 6.2% in 1988 to 10.4% in 1995, and since then, the share has remained high at approximately 14% during the 2000s and it reached 18.5% in 2013. Compared with females, the share of full-time household work for males was much lower, accounting for just 0.5% in 1988 and 1.2% in 1995, although the share increased to 3.4% in 2007 and 6.4% in 2013.

Employment rates vary considerably among age groups. Thus, we show employment rates by age group for the working age population in Figure 2. The employment rate for the lowest age group (15–19) decreased drastically from 87.7% in 1988 to 45.6% in 1995, and reached 23.5% in 2013. This is mainly due to the dramatic increase in school enrollment. For middle-aged group (20–59), the employment rates also decreased continuously from 1988 to 2007, and declined substantially in 2013. The major factor in the reduction between 2007 and 2013 was the increase in full-time household workers for both genders. However, the employment rates started to decline for people in their late 40s onward for all CHIP rounds, and the rates of decline were clear in 2002 and 2007.

Figure 2 Percentage shares of people who are employed by age group



Source: Author's estimates from CHIP surveys.

2.4. Classification of off-farm participation

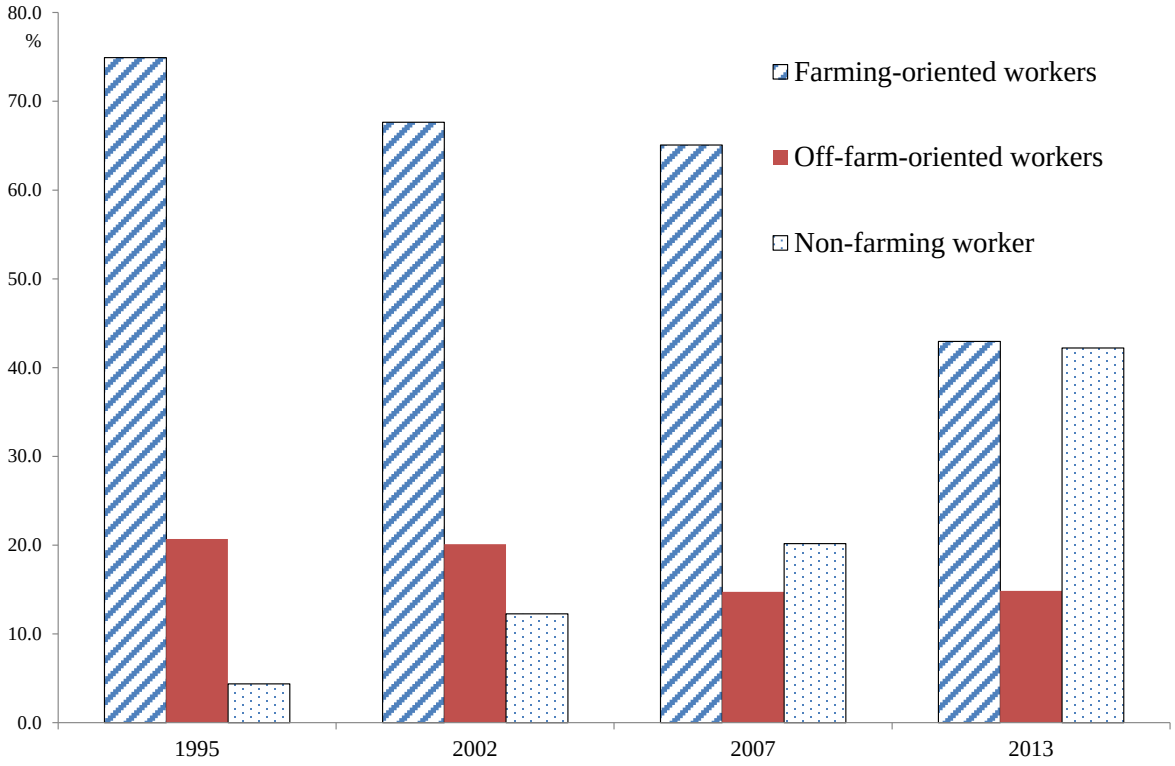
The household registration system was introduced in the early 1950s in China to separate the "agricultural population" from the "nonagricultural population" and keep people in their own areas. Therefore, "agricultural population" does not necessarily indicate a person's occupational status; it indicates their registration status. Although the system still prevents rural farmers from staying in urban areas permanently as urban residents, the restrictions on temporary migration from rural to urban areas tends have been relaxed since the early 1980s. In addition, the development of rural industries and the manufacturing sector in urban areas facilitated off-farm employment of the rural population.

Therefore, we divided the employed population into three groups according to the workdays they engage in off-farm occupations. We defined "farming-oriented workers" as people that spend more than half their total workdays as farming days, "non-farming workers" as people who do not engage in farming, and "off-farm-oriented workers" as people who do not fit into the other two groups. Due to lack of workday data for CHIP 1988, we used four rounds of CHIP data to divide the employment observations.

Figure 3 shows the percentage shares of workforce by off-farm participation pattern. The share of farming-oriented workers decreased gradually from 74.9% in 1995 to 65.1% in 2007, and then dropped substantially in 2013 reaching 43.0%. In contrast, the share of non-farming workers in rural households was low in 1995, accounting for only 4.4%, and it

increased steadily to 12.2% in 2002, 20.2% in 2007, and jumped to 42.2% in 2013. The percentage shares of off-farming-oriented workers remained around 15–21% during the same period. These results indicate that the withdrawal from farm production continues to expand gradually and the speed has increased since 2007.

Figure 3 Percentage shares of the off-farm participation pattern



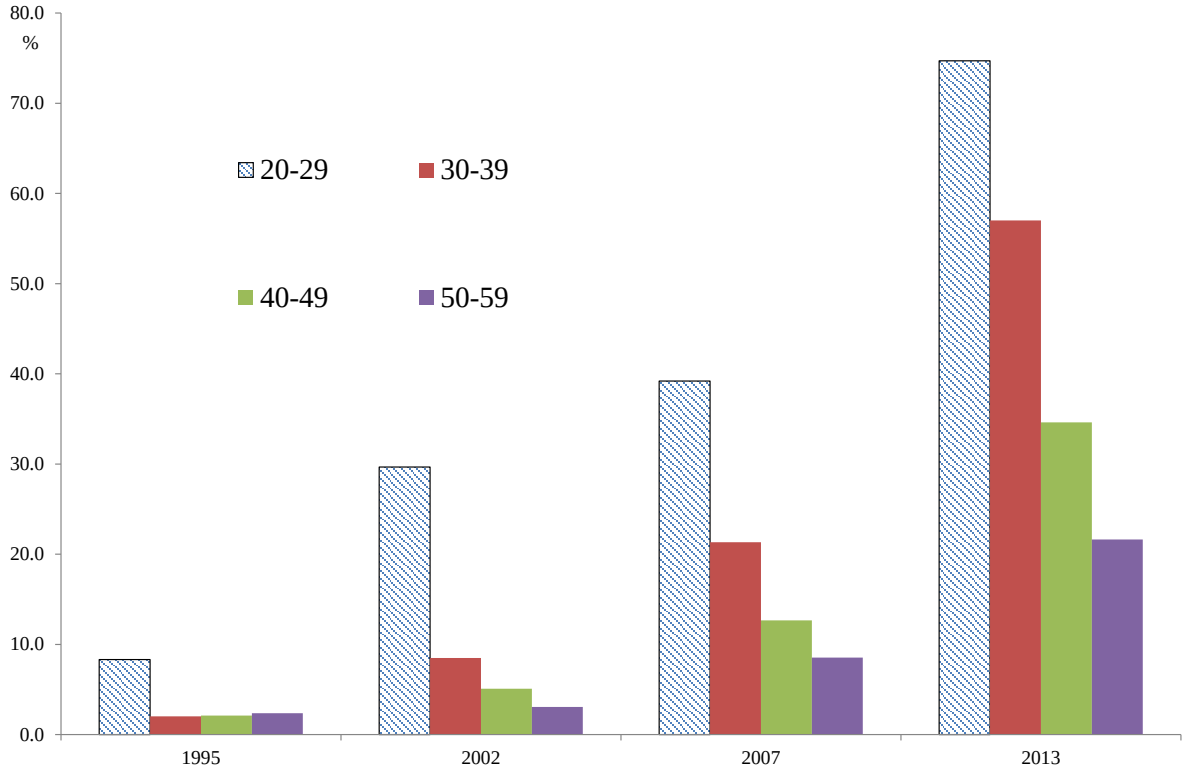
Source: Author's estimates from CHIP surveys.

Note: Farming-oriented workers indicate people spend more than half their total workdays as farming days. Non-farming workers are people who do not engage in farming. Off-farming-oriented workers are people who do not belong to the other two groups.

When workers are divided into age groups (Figure 4), striking differences in off-farm participation patterns were observed among the age groups. The percentage share of off-farm workers for the 20–29 age group was the highest and continued to increase during the period. The percentage share for the 20–29 age group increased from 8.3% in 1995 to 29.1% in 2002 and 39.2% in 2007, and then jumped considerably to 74.7% in 2013. The shares of off-farm workers have increased continuously from 1995 to 2013 for all age groups, including the 50–59 age group (Figure 4). The share for the 50–59 age group remained low, accounting for only 2.4% in 1995 and 3.1% in 2002. Since then, the share increased to 8.5% in 2007 and to 21.6% in 2013. These outcomes indicate that off-farm employment has been more prevalent for younger age groups and has become dominant since the late 2000s, and that the trend has

spread gradually even to older age groups.[7]

Figure 4 Percentage shares of off-farm workers by age group



Source: Author's estimates from CHIP surveys.
Note: Non-farming workers are people who do not engage in farming.

[7] When individual data were categorized into household data, the percentage shares of off-farm households decreased considerably, constituting only 0.9% in 1995 and 1.4% in 2002. However, reflecting the expansion of off-farm opportunities the share of off-farm households increased to 8.1% in 2007 and 28.0% in 2013. The disparities in the shares between individual and household data are mainly attributed to the division of labor among household members. Namely, sons and daughters tend to participate in off-farm occupations located in more developed eastern areas, whereas either or both parents are likely to engage in farming.

3. Determinants of off-farm participation by rural workers

3.1. Estimation framework

Off-farm employment has spread with the development of the Chinese economy, but employment opportunities are not equally distributed among rural households. Therefore, whether a person obtains stable off-farm employment appears to be major factor in increasing income inequality in rural China. To examine the determinants in obtaining off-farm employment, several kinds of estimation approaches have been used in previous studies, such as a Probit model of whether a worker participates in off-farm employment, and a multi-nominal logit model of whether a worker is categorized into different off-farm work groups. However, to measure the extent of people employed in off-farm jobs more precisely, it would be appropriate to use continuous data on work status, such as the total off-farm workdays and the percentage share of off-farm participation days, although these data were clamped above and below. Therefore, we estimated the Tobit model to examine the determinants of off-farm employment. The estimation model is specified as

$$L_i = \alpha + \beta_1 T_h + \beta_2 M_h + X_i c + \sum_k \gamma_k V_{kh} + \varepsilon_i , \qquad (1)$$

where L_i is the percentage share of workdays engaged in off-farm occupations to total workdays for individual i, T_h is the total area of farmland used for agricultural production for household h, M_h is the total amount of agricultural capital, X_j is a vector of individual characteristics that affect work participation, V_{kj} represents the geographical features of villages (flat, hilly, and mountainous land), and ε_i is an *i.i.d.* error term. The parameters to be estimated are α, β_1, β_2, γ, and vector c. As apparent from the definition, L_i is distributed between 0 and 1; therefore, the two-limit Tobit procedure is used to control selection bias.

The employment rates decreased gradually with the survey rounds, especially for younger and older age groups. In addition, there were considerable differences between male and female employment rate and employment status. To identify the determinants of factors that affect employment, a Probit model of whether a person is employed (including self-employment) was also estimated by gender by using almost the same independent variables with a Tobit estimation, except for incorporating health index. Owing to the relatively small number of observations for CHIP 1995 and 2007, we used two rounds of CHIP (2002 and 2013) to compare the determinants of off-farm engagement between the rounds.

Table 3 Descriptive statistics for estimation data

	2002							2013						
	Total		Male		Female		*t* -value	Total		Male		Female		*t* -value
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	
Employment dummy	0.767	0.423	0.807	0.395	0.722	0.448	15.88***	0.614	0.487	0.667	0.471	0.554	0.497	17.52***
Percentage share of off-farm workday in total workday	0.308	0.397	0.385	0.396	0.211	0.377	30.16***	0.499	0.456	0.588	0.433	0.388	0.460	28.50***
Total workdays	252.4	117.0	259.4	117.1	243.7	116.2	9.20***	180.2	139.8	196.7	138.0	161.7	139.4	18.94***
Workdays for agriculture	165.9	127.1	149.7	120.2	186.0	132.6	-19.70***	81.7	115.2	75.5	111.1	88.7	119.3	-8.60***
Workdays for off-farm employment	86.6	118.7	109.8	121.2	57.6	108.7	30.68***	98.5	129.0	121.2	131.3	73.0	121.3	28.53***
Age	36.3	14.2	36.7	14.6	35.8	13.9	4.61***	38.8	18.7	38.5	18.8	39.1	18.6	-2.38**
Years of education	7.181	2.797	7.757	2.493	6.538	2.972	34.93***	7.272	3.474	7.651	3.232	6.845	3.682	17.52***
Minority dummy (1: minority, 0: non-minority)	0.134	0.341	0.136	0.343	0.132	0.339	0.89	0.084	0.277	0.082	0.275	0.086	0.281	-1.11
Health index (1: bad; 2: relatively bad; 3: normal; 4: relatively good; 5: good)	4.027	0.738	4.071	0.726	3.978	0.748	9.83***	3.974	0.903	4.009	0.890	3.935	0.916	6.12***
Total cultivated farmland (mu)	7.629	7.133	7.610	7.123	7.651	7.144	-0.46	5.976	6.111	5.998	6.112	5.950	6.111	0.59
Total amount of agricultural capital (yuan)	2,490	3,081	2,473	3,056	2,508	3,110	-0.88	5,827	12,094	5,875	12,092	5,773	12,096	0.64
Total number of work-age population within household	2.773	1.295	2.785	1.299	2.761	1.292	1.41	2.961	1.145	2.958	1.147	2.964	1.144	-0.37
Child dummy (1 if member under 5 years old within household; 0 otherwise)	0.156	0.363	0.152	0.359	0.161	0.368	-2.01**	0.185	0.388	0.174	0.379	0.196	0.397	-4.25**
Old age dummy (1 if member over 70 years old within household; 0 otherwise)	0.113	0.316	0.111	0.315	0.115	0.318	-0.79	0.165	0.372	0.164	0.370	0.167	0.373	-0.70
Male dummy (1: male, 0: female)	0.527	0.499						0.529	0.499					
Cadre dummy (1: cadre, 0: otherwise)	0.135	0.342	0.189	0.391	0.075	0.264	26.33***	0.020	0.140	0.029	0.168	0.010	0.099	10.22***
CCP dummy (1: ccp member, 0: otherwise)	0.067	0.251	0.112	0.315	0.018	0.131	30.01***	0.048	0.214	0.073	0.261	0.020	0.139	18.89***
Housing demolition dummy (1: have experience of housing demolition., 0: non)								0.037	0.190	0.037	0.188	0.038	0.192	-0.55
Farmland expropriation dummy (1: expropriated, 0: non)								0.097	0.296	0.096	0.295	0.098	0.297	-0.37

Notes: *** significant at the 1% level, ** at the 5% level, and * at the 10% level.

Table 4 Estimation results for labor participation (Probit)

	2002									2013								
	Total			Male			Female			Total			Male			Female		
	Coef.	*dy/dx*	*z*	Coef.	*dy/dx*	*z*	Coef.	*dy/dx*	*z*	Coef.	*dy/dx*	*z*	Coef.	*dy/dx*	*z*	Coef.	*dy/dx*	*z*
Age	0.353	0.064	69.61 ***	0.419	0.044	51.55 ***	0.326	0.081	46.04 ***	0.241	0.093	69.50 ***	0.272	0.097	53.47 ***	0.209	0.084	43.53 ***
Age * Age	-0.004	-0.001	-64.58 ***	-0.005	-0.001	-47.72 ***	-0.004	-0.001	-43.71 ***	-0.003	-0.001	-64.95 ***	-0.003	-0.001	-50.15 ***	-0.002	-0.001	-40.57 ***
Education	0.189	0.034	13.21 ***	0.243	0.026	8.98 ***	0.098	0.025	5.32 ***	0.055	0.021	5.50 ***	0.093	0.033	5.32 ***	0.033	0.013	2.66 ***
Education * Education	-0.014	-0.003	-14.55 ***	-0.018	-0.002	-10.77 ***	-0.009	-0.002	-6.48 ***	-0.003	-0.001	-5.01 ***	-0.006	-0.002	-5.74 ***	-0.002	-0.001	-2.00 **
Minority dummy	0.034	0.006	0.87	-0.065	-0.007	-1.08	0.096	0.023	1.74 *	0.056	0.021	1.40	0.036	0.013	0.61	0.077	0.030	1.42
Health index	0.173	0.031	10.37 ***	0.227	0.024	8.78 ***	0.123	0.031	5.38 ***	0.152	0.059	12.18 ***	0.180	0.064	9.77 ***	0.135	0.054	7.83 ***
Cultivated farmland	-0.013	-0.002	-7.12 ***	-0.007	-0.001	-2.49 **	-0.016	-0.004	-6.68 ***	-0.008	-0.003	-4.29 ***	-0.013	-0.005	-4.78 ***	-0.004	-0.002	-1.62
Agricultural capital	0.000	0.000	-4.62 ***	0.000	0.000	-1.54	0.000	0.000	-4.85 ***	0.000	0.000	-2.95 ***	0.000	0.000	-3.17 ***	0.000	0.000	-1.10
Work-age population	0.884	0.160	66.34 ***	0.874	0.092	43.54 ***	0.957	0.239	49.77 ***	0.270	0.104	27.76 ***	0.286	0.102	19.63 ***	0.259	0.103	19.51 ***
Child dummy	-0.214	-0.042	-6.13 ***	-0.225	-0.027	-3.94 ***	-0.311	-0.085	-6.77 ***	-0.140	-0.055	-5.07 ***	-0.003	-0.001	-0.07	-0.255	-0.101	-6.99 ***
Old age dummy	0.024	0.004	0.63	-0.036	-0.004	-0.6	0.101	0.024	1.92 *	-0.156	-0.061	-5.17 ***	-0.254	-0.094	-5.75 ***	-0.079	-0.032	-1.90 *
Male dummy	0.493	0.091	19.14 ***							0.488	0.188	22.84 ***						
Cadre dummy	0.227	0.037	5.47 ***	0.127	0.013	2.19 **	0.132	0.031	2.08 **	0.073	0.028	0.88	0.091	0.032	0.89	0.008	0.003	0.05
CCP dummy	0.343	0.051	5.32 ***	0.093	0.009	1.23	0.465	0.091	3.29 ***	0.124	0.047	2.27 **	0.103	0.036	1.58	0.142	0.056	1.33
Geographic dummy (hilly)	-0.093	-0.017	-3.25 ***	0.005	0.001	0.12	-0.159	-0.041	-4.12 ***	-0.105	-0.041	-3.91 ***	-0.083	-0.030	-2.06 **	-0.127	-0.051	-3.49 ***
Geographic dummy (mountainous)	-0.048	-0.009	-1.44	0.038	0.004	0.74	-0.116	-0.030	-2.58 ***	-0.088	-0.034	-3.20 ***	-0.073	-0.026	-1.78 *	-0.106	-0.042	-2.83 ***
Central region	0.041	0.007	1.36	0.082	0.008	1.71 *	-0.020	-0.005	-0.51	0.088	0.034	3.54 ***	0.159	0.056	4.27 ***	0.031	0.013	0.93
Western region	0.101	0.018	3.04 ***	-0.021	-0.002	-0.41	0.180	0.044	3.95 ***	0.215	0.082	7.18 ***	0.137	0.048	3.09 ***	0.280	0.111	6.81 ***
Housing demolition dummy										-0.188	-0.074	-3.52 ***	-0.154	-0.057	-1.90 **	-0.214	-0.085	-2.99 ***
Farmland expropriation dummy										-0.153	-0.060	-4.37 ***	-0.145	-0.053	-2.78 ***	-0.157	-0.063	-3.30 ***
Intercept	-9.076		-61.41 ***	-10.335		-42.25 ***	-7.837		-40.13 ***	-5.746		-57.13 ***	-6.070		-39.90 ***	-4.957		-36.33 ***
Number of observations	24,560			12,954			11,606			22,594			11,959			10,635		
Log Likelihood	-6,884			-2,792			-3,768			-9,633			-4,234			-5,292		
LR χ^2	12,913			7,122			6,190			10,868			6,745			4,034		
Pseudo R^2	0.484			0.561			0.451			0.361			0.443			0.276		

Note: *** significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level.

Table 5 Estimation results for off-farm workday ratio (Tobit)

	2002						2013					
	Total		Male		Female		Total		Male		Female	
	Coef.	*t* -value	Coef.	*t* -value	Coef.	*t* -value	Coef.	*t* -value	Coef.	*t* -value	Coef.	*t* -value
Age	-0.024	-9.38 ***	0.006	2.34 **	-0.070	-11.06 ***	0.013	6.50 ***	0.021	10.17 ***	0.003	0.61
Age * Age	0.000	2.16 **	0.000	-7.22 ***	0.001	5.83 ***	0.000	-16.56 ***	0.000	-18.22 ***	0.000	-6.90 ***
Education	0.036	4.57 ***	0.014	1.44	0.012	0.77	0.045	8.79 ***	0.032	4.83 ***	0.048	5.22 ***
Education * Education	0.000	0.58	0.001	1.43	0.003	2.95 ***	-0.001	-2.22 **	-0.001	-1.87 *	0.000	0.14
Minority dummy	-0.205	-11.61 ***	-0.155	-8.42 ***	-0.339	-7.93 ***	-0.067	-3.81 ***	-0.079	-4.12 ***	-0.057	-1.64
Health index	0.017	2.20 **	0.026	3.14 ***	-0.019	-1.02	0.043	7.49 **	0.042	6.61 ***	0.046	3.96 ***
Cultivated farmland	-0.021	-22.79 ***	-0.018	-18.86 **	-0.033	-13.99 ***	-0.024	-28.15 ***	-0.021	-23.69 ***	-0.029	-16.53 ***
Agricultural capital	0.000	-10.32 ***	0.000	-8.42 ***	0.000	-6.53 ***	0.000	-14.19 ***	0.000	-12.34 ***	0.000	-7.46 ***
Work-age population	-0.024	-5.11 ***	-0.041	-8.29 ***	0.025	2.18 **	0.021	4.93 ***	0.012	2.62 ***	0.033	3.80 ***
Child dummy	-0.037	-2.64 ***	0.018	1.19	-0.184	-5.57 ***	-0.075	-6.55 ***	-0.026	-2.08 **	-0.176	-7.54 ***
Old age dummy	0.018	1.14	0.006	0.36	0.046	1.25	0.038	2.87 ***	0.021	1.44	0.071	2.71 ***
Male dummy	0.432	37.14 ***					0.321	34.63 ***				
Cadre dummy	0.092	5.93 ***	0.061	3.97 ***	0.125	2.89 ***	0.028	0.95	0.003	0.11	0.089	1.10
CCP dummy	0.114	5.73 ***	0.087	4.73 ***	0.173	2.18 **	0.046	2.21 ***	0.018	0.93	0.153	2.42 **
Geographic dummy (hilly)	0.051	4.13 ***	0.044	3.30 ***	0.049	1.76 *	-0.030	-2.65 ***	-0.029	-2.28 **	-0.032	-1.38
Geographic dummy (mountainous)	-0.025	-1.73 *	-0.015	-0.99	-0.077	-2.26 **	-0.091	-7.71 ***	-0.067	-5.14 ***	-0.143	-5.97 ***
Central region	-0.141	-10.87 ***	-0.092	-6.56 ***	-0.293	-10.01 ***	-0.030	-2.80 ***	-0.005	-0.41	-0.078	-3.72 ***
Western region	-0.216	-15.19 ***	-0.169	-11.05 ***	-0.340	-10.59 ***	-0.193	-14.91 ***	-0.163	-11.38 ***	-0.261	-10.07 ***
Housing demolition dummy							0.055	2.35 **	0.077	2.97 ***	0.013	0.28
Farmland expropriation dummy							0.101	6.72 ***	0.057	3.39 ***	0.183	6.27 ***
Intercept	0.600	8.45 ***	0.498	6.33 ***	1.685	10.41 ***	0.121	2.17 **	0.331	5.42 ***	0.381	3.31 ***
Sigma	0.607		0.522		0.798		0.514		0.438		0.642	
Number of observations	18,514		10,365		8,149		16,272		9,015		7,257	
Log likelihood	-13,612		-7,976		-5,051		-11,817		-6,004		-5,354	
LR χ^2	5,664		2,299		2,231		8,578		4,439		3,394	
Pseudo R^2	0.172		0.126		0.181		0.266		0.270		0.241	

Note: *** significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level.

3.2. Descriptive statistics

Descriptive statistics of the variables used for the estimations are shown in Table 3. Considerable gaps were observed for total workdays between 2002 and 2013. Namely, the average total workday in 2002 was 252.4 days, substantially larger than 180.2 days in 2013. This was mainly due to the decrease in average workdays for agriculture from 165.9 days in 2002 to 81.7 days in 2013. Compared with this, the average workdays for off-farm employment remained almost constant (85–100 days) between the periods. The labor participation rate in 2013 was 61.4%, notably lower than that in 2002 of 76.7%, whereas off-farm days as a percentage share of total workdays in 2013 was 49.9%, considerably larger than that in 2002 of 30.8%. No obvious differences were observed in the other variables, except for total cultivated farmland and cadre dummies. Average values of both variables in 2013 were substantially lower than those in 2002.

Dividing the observations by gender showed higher engagement in off-farm work for

males. The average workdays for off-farm employment for males were 109.8 days in 2002 and 121.2 days in 2013, significantly larger than those for females in both years. In contrast, average workdays for agriculture for males were 149.7 days in 2002 and 75.5 days in 2013, which were significantly fewer than those for females. The off-farm workdays as a percentage share of total workdays between 2002 and 2013 increased from 38.5% to 58.8% for males and from 21.1% to 38.8% for females. These results indicate that off-farm employment became more prevalent from 2002 and 2013, although the chances of being employed in off-farm occupations were higher for the male labor force.

In addition, there were significant differences between males and females for some variables such as years of education and dummy variables for cadre and Chinese Communist Party (CCP) members for both years. Males had higher average years of education than females, whereas the percentage shares of people who were cadre and CCP members for males were 18.9% and 11.2% in 2002, 2.9% and 7.3% in 2013, respectively, which were significantly larger than those for females. Considering these differences in the basic features of labor force, we examined the determinants of labor participation and off-farm employment for the rural labor force.

3.3. Estimation results for labor participation

Table 4 shows the results of the Probit model of whether a person is employed. The estimated results were generally consistent between 2002 and 2013 for major variables such as age, years of education, and household features. The coefficients for age and age squared showed significant positive and negative signs, respectively, indicating that the probability of employment and age of household head had an inverse-U-shaped relationship, with the peak of the age curve at approximately 43 years old for both rounds. The coefficients on education also showed an inverse-U-shaped relationship with employment probability for all cases.

With regard to other personal attributes, the health index coefficients showed significant positive signs for all cases, whereas the coefficients of the minority dummy tended to be positive but significant only for females in 2002. In contrast, the coefficients for cadre and CCP dummies were positively significant in 2002, especially for females. This result indicates that political networks tended to provide more favorable conditions for females to be employed in 2002. Furthermore, the coefficients of the number of working age members in a household showed significant positive signs for all cases. This outcome suggests supply-driven employment within households; the larger the household labor force is, the more a person tends to be employed. The marginal effect evaluated at the mean value of the working age population was the highest of the variables, indicating the substantial contribution of the working age population to the labor supply. In contrast, the coefficients of household

attributes, such as the size of the cultivated farmland and the amount of agricultural capital, showed negative signs, indicating that the larger (more) the size of cultivated farmland (agricultural capital), the lower the probability of employment.

People who live in hilly and mountainous areas tended to be less employed in 2013 compared with people who live in flat areas. In contrast, the coefficients of the Central and Western region dummies showed significant positive signs in both years, and the marginal effect of the Western region dummy was relatively high for females in 2013. These results indicate that disadvantageous geographic conditions prevent rural people from participating in economic activities, whereas people living in inland areas are more likely to participate in jobs. In addition, the coefficients of housing demolition and farmland expropriation for 2013 had significant negative effects on employment regardless of gender. This suggests that public intervention through compulsory housing demolition and farmland expropriation appears to suppress labor supply where the measures are targeted.

3.4. Estimation results for off-farm workday ratio

Table 5 summarizes the results of the Tobit model of off-farm workdays as a percentage share of total workdays. Compared with the results of the Probit model, there were clear differences in the coefficients between 2002 and 2013. The coefficients for age and age squared for 2002 had significant negative and positive signs, respectively, indicating a U-shaped relationship with the off-farm workday ratio, whereas those for 2013 showed an inverse-U-shaped relationship with the off-farm workday ratio. When observations were divided by gender, a significant U-shaped relationship was observed for females in 2002, suggesting that the younger females had larger shares of off-farm workdays. The results for education varied considerably between years and genders. A significant positive or inverse-U-shaped relationship was detected in 2013, whereas no clear pattern was observed for the subsample in 2002.

Favorable political status tended to increase the share of off-farm workdays significantly, and the effect was stronger in 2002. Specifically, the coefficients of the cadre and CCP dummies in 2002 showed significant positive signs for all cases, whereas the coefficient of only the CCP dummy was significant in 2013. These outcomes reflect long-term changes in local industrialization and off-farm opportunities. Due to the stagnation of TVEs since the end of the 1990s, people who were relatively young and in politically favorable positions had more opportunities to engage in off-farm occupations in 2002. With the rapid development of migration, opportunities for off-farm employment have continued to increase for people who are already in favorable circumstances and for a wider range of people.

In contrast to these personal attributes, the coefficients of the minority dummy and health index exhibited similar results for 2002 and 2013, showing significant negative and positive signs, respectively. These results imply that minority people face less favorable circumstances for working in off-farm jobs, whereas people in good health have an advantage in obtaining more stable off-farm occupations. In addition, the coefficients of the male dummy are positively significant in both years, indicating that males are more likely to engage in off-farm jobs.

Household attributes also play important roles in employment in off-farm occupations. The coefficients for cultivated farmland and agricultural capital show significant negative signs for all cases, suggesting that the people who possess abundant agricultural factors are less likely to engage in off-farm employment. The coefficients of child dummy were significantly negative for females in both years, and the numerical values for females were larger than those for males. This result indicates that the role of child rearing within households is more likely to be accepted by female, preventing them from engaging in off-farm jobs. The coefficients for the old people dummy were significantly positive only for females in 2013, indicating that having old people in households encourages females to engage in off-farm employment. Therefore, the characteristics of household structures are more heavily reflected in off-farm employment for females.

The coefficients of the working age population showed differences between the years, with a significant negative sign in 2002 and positive sign in 2013. This result suggests that the substitution of farm work for off-farm work among household labor was prevalent in 2002, whereas the restriction appeared to be reduced in 2013. This is probably because rural households were required to cultivate and sell specific varieties for state or private marketing agencies under the state procurement system of major grain until 2004 (Hoken, 2014). Thus, substitution of labor between agriculture and off-farm work was widespread in 2002, whereas off-farm work by females was supported by a large labor force in a household. With the liberalization of grain marketing since 2004, the obligation of rural households to cultivate and sell grain was reduced considerably. This trend can be confirmed by fewer workdays for agriculture shown in Table 3; average workdays for agriculture decreased drastically from 165.9 days in 2002 to 81.7 days in 2013.[8] Relaxation of labor supply restrictions through grain marketing liberalization has enabled workers to engage in off-farm work more frequently.

With regard to geographic and regional characteristics, people in disadvantageous areas were generally less likely to engage in off-farm jobs. The coefficients of hilly and

[8] The large reduction in average workday for agriculture also reflects the rapid upsurge of labor costs in urban and rural areas and substitution between labor and capital to reduce production costs (Wang et al. 2016).

mountainous dummies are significantly negative for all cases excluding hilly areas in 2002. In addition, people in the Central and Western regions worked significantly less frequently in off-farm jobs compared with people in the Eastern region, and the effects were clearer in the Western region. The coefficients of housing demolition and farmland expropriation in 2012 were significantly positive, suggesting that people who experienced housing demolition or farmland expropriation were more willing to engage in off-farm jobs. Combined with the results of the Probit estimations, housing demolition and farmland expropriation prevented the target groups from participating in the labor market; however, once they were employed, they engaged in off-farm jobs more intensively.

4. Conclusion

This study investigates the long-term trends of labor allocation in rural households from the late 1980s until the mid-2010s, and examines the determinants of their off-farm employment intensity using a nationally representative household survey in China. The results of this study are summarized as follows. First, a major factor in increasing income inequality in rural China has been off-farm net income since the middle of the 1990s, whereas the contribution of agricultural net income to total income and income inequality has declined continuously since 1988. This suggests that off-farm employment has acquired greater importance in rural households to improve their standard of living.

Second, the estimations from the 2002 and 2013 data of working status whether a person is employed showed that the coefficients on age and education had an inverse-U-shaped relationship with employment probability for both years. In addition, the marginal effect evaluated at the mean of the working age population was the highest of all variables, indicating supply-driven employment in rural households. The geographic characteristics where people live are a major factor affecting their work status; people in hilly and mountainous areas are less likely to participate in economic activities.

Third, estimated results of Tobit model of off-farm workdays as the percentage share of total workdays show that female labor was more strongly influenced by their household characteristics and political network than male labor in 2002, but no clear gender gaps were observed in the determinants of off-farm work in 2013. This appears to be mainly due to the scarcity of off-farm employment in the early 2000s; therefore, females tended to take charge of household work such as child care and agricultural production. With the increase in off-farm work and the liberalization of grain marketing, the division of labor between genders has become less distinct.

However, females still tend to take on more household work, such as child rearing,

leading to relatively lower intensity in their off-farm employment. In addition, disadvantageous geographic condition appears to be a major factor preventing people who live in hilly and mountainous areas from engaging in stable off-farm employment. Therefore, providing migrant and off-farm workers with appropriate nursery and educational services for their children by enterprises and local governments would be a promising measure to facilitate the participation of workers in stable off-farm work. Furthermore, policy support for people who live in geographically disadvantageous areas to offer opportunities for vocational training would be useful to improve their ability to engage in off-farm jobs.

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