

# Geography and Rural Household Income: A Village Level Study in Henan Province, China

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**Abstract:** This study uses the data from a sample survey conducted in April 2007 on 1 251 rural households in 11 villages of Henan Province, the largest less developed agricultural province in China, to examine how geography affects rural household income (RHI). The quantitative analysis indicates following results. 1) The significance of the traditional geographical factors reduces as RHI rank increases. 2) The landform does not affect the RHI significantly. The per capita income of rural household in a plain area is lower than that in a mountainous area. And 3) the capital endowment and status of non-farm economic activities contribute to the increase of RHI. But the probability and intensity of non-farm economic activities of rural households in urban outskirts villages are higher than that in non-urban outskirts villages. Based on the results, the paper further concludes that geography still plays a significant role in rural development, but it is changing over time. The agricultural resources (such as per capita arable land) significantly affect RHI with the relatively lower income level, while the geographical location shows a more significant impact on RHI with the relatively high income level. Along with economic development, the proximity replaces the traditional geographical factors such as landform and physical resources as the major determining factor in RHI.

**Keywords:** rural household income (RHI); geographical factor; village level study; Henan Province

## 1 Introduction

Rural development involves many factors, such as economic input, environmental modernization, ethnic politics, nation building, and personal motives (Webber, 2008). The status of rural household plays an important role in economic and social development of the rural regions in developing countries. Many scholars have made relevant researches on examining the factors that affect the increase of rural household income (RHI). The three aspects can be clarified in this focus, including the capital endowment, the structure of economic activity, and the macro-environment of rural household. The literatures on capital endowment and RHI have mainly discussed the impact of human capital, physical capital, and social capital on RHI. Gao and Yao (2006), using the panel data of 1 320 households from eight provinces covering 15 years, found that the main factors causing the difference of RHI are human capital rather

than material capital or land. Based on the statistical data from *China Statistical Yearbook* from 1983 to 2005, Guo and Chang (2007) indicated that the household education level positively affects RHI at a significant level, and the other important factor is the household migration investment. Jiang and Huang's (2006) research on 500 households randomly sampled in Yangzhou City of Jiangsu Province showed that human capital and social capital significantly affect the salary income of rural households.

The literature viewing from the perspective of structure of rural household economic activity mainly probed into how the farming structure (Liu and Wang, 2007) and the intensity of non-farm activities (like part-time jobs and migrant jobs) (He, 2003; Wang *et al.*, 2005; Wang *et al.*, 2006) influence RHI. And some researches indicated that RHI is mainly decided by their part-time and migrant job salaries (Xiang and Han, 2005).

From the view point of geography, mostly studies on

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RHI focus on the relationship between the development behaviors of the rural households and the geographical environment where they are located. The fact is that the economic behavior of rural households is greatly affected by different geographic factors, cultural types developed in traditional economic advancement, and environmental ideas formed under the influence of globalization and urbanization. All these factors have impacts on RHI (Li, 2005; Li and Shi, 2008). Li *et al.*'s (2008b) analyses on entire villages and towns of Henan Province showed that in less developed rural areas, such geographic factors as agricultural resources and landform exert a more significant influence on RHI; while in the better developed rural areas, it is the geographic location and the relating infrastructure that have a more evident impact on RHI. Through the research on the 1 000 rural households in five provinces, Meng and Wu (1998) believed that the regional difference in RHI is mostly caused by the degree of marketization of the region where the households are located, and the similar conclusion also reached by another research (Huang *et al.*, 2005). By analyzing the decisive cause of income difference in 766 rural households in nine villages of three provinces (Guangdong, Hubei and Yunnan), Wan and Zhou (2005) concluded that geography is still a significant cause of income difference, but its role is declining.

Theoretically, influences on RHI caused by geographic factors can be divided into direct influence and indirect influence. The former includes agricultural resources endowment like arable land and forests that may determine the intensity of farm activities. The latter includes household economic behavior. Nowadays, in the less developed farming areas of Central China, salary income from non-farm activities like part-time jobs and migrant jobs are the main source of RHI. The non-farm activities vary in intensity among villages and households partly owing to geographic factors like location. The rural households in suburban villages are involved more frequently in non-farm activities than their counterparts living in remote rural communities (Li *et al.*, 2008a). Besides, capital endowment for rural households like human capital also differs due to the geographic factors, thus leading to RHI difference in the rural regions (Zou and Zhang, 2006; Liu and Gao, 2004).

Researches on RHI and its influencing factors commonly assume that all the rural households are homogeneous. But in reality, each rural household differs from

others in many factors like capital and geographical environment, and these differences will further affect the household economic behavior and business outcome. Thus the questions coming up for further consideration include: Do the factors influencing RHI differ among rural households at different income levels? Is there any spatial and temporal difference in the intensity of each of the influencing factors? To what extent is the difference caused by geographic factors? In what way do the geographic factors work? Are there any rules to follow? By covering villages of different types and specifically focusing on the units of rural households, this paper attempts to establish a RHI model covering the rural household's capital endowment, business structure and geographical factors. We also will adopt the estimation method of Quartile Regression to analyze the features of the factors that influence RHI at different income levels.

## 2 Study Area and Methodology

### 2.1 Study area and data

Henan is a province with the largest population in China. In terms of agricultural production and rural population, the province ranks national top position. This makes the case significant in rural studies. We selected 11 representative villages (Fig. 1) in the province by taking into consideration of the landforms, transportation accessibility, land use types and economic development levels. With a random survey of 100–130 rural households in each of the 11 villages, we finally collected 1 251 questionnaires from rural households (Li and Shi, 2008).

### 2.2 Rural household income model

The paper hereby proposes a RHI model including three sets of variables: variables reflecting the rural household capital endowment (material capital, human capital and social capital), variables indicating the structure of rural household economic activity, and geographic variables showing rural household's development surroundings (per capita area of arable land and landform).

Among the capital endowment, material capital can be evaluated by rural household's productive fixed assets per capita. The human capital investment is quite a general description covering inputs in education, technical training, health, and laborer migration. In the present stage, school education is the core component of rural human capital, so educational investment can be

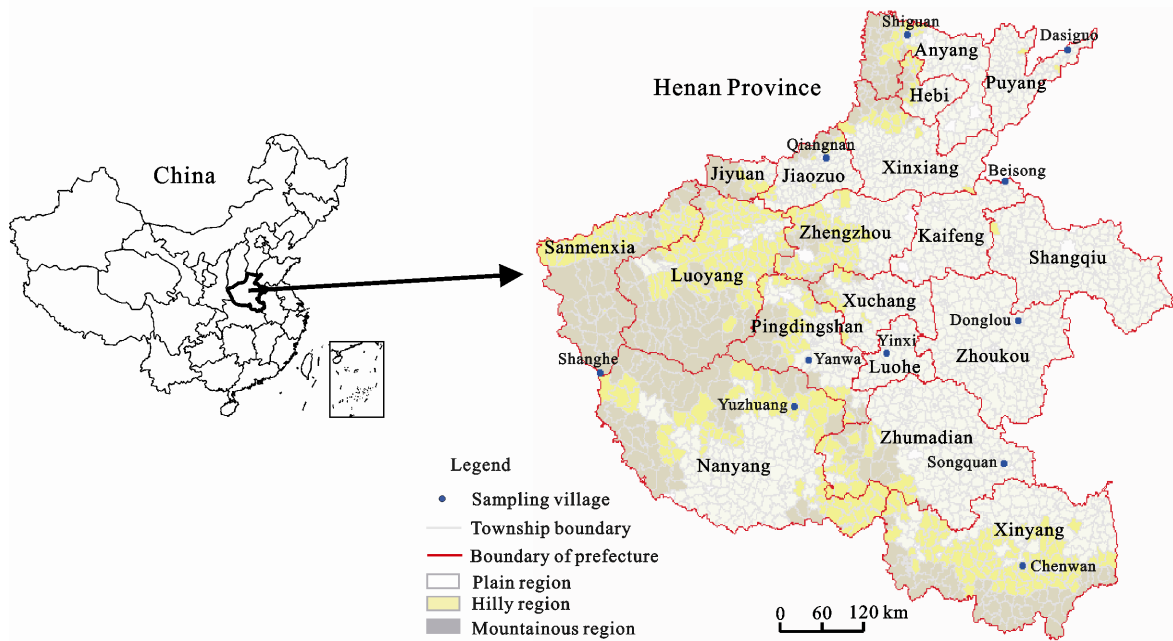


Fig. 1 Location sketch of 11 sampling villages in Henan Province

measured by laborers' average schooling. The rural household investment in laborer migration in the aspect of human capital has an increasing effect on the household's ability to acquire and handle information and it is indicated by the rural residents' average communication expense, and the factors influencing health mainly include food, clothing, dwelling environment, medical treatment and health care. Considering the fact that rural residents spend very little on health care unless it is for medical treatment, we will use the average meat expense to illustrate rural household investment in health, as the grocery expense, especially meat consuming level can better tell of rural household input in health. The social capital possessed by a rural household plays a key role in turning the various capital endowments into real business activities. So we count such social capital quantity in this paper by marking out if there is a village leader or government employee among the family members of a household.

The structure of economic activities for a rural household has a direct impact on its income. Generally, non-farm activities like part-time jobs or migrant jobs are the main cause to RHI difference. So the rural households' structure of economic activities is indicated by

the proportion of migrant workers among the family laborers, and by the proportion of time spent in doing part-time jobs among the stay-in family laborers<sup>①</sup>.

In terms of geographical factors, the paper here uses variables of landforms and per capita area of arable land. The landforms are divided into the mountainous (including the hilly) land and plains. To an extent, landform can briefly give a comprehensive description of the physical conditions a rural household is exposed to. For instance, the mountainous areas are rich in timber and minerals, whereas their counterparts in the plains often have advantages in farmland resources. The size of per capita area of arable land may determine the intensity of farming activities, thus directly affecting RHI. Besides, it can also exert indirect impacts on RHI by its influence on the non-farm activities of the rural households.

The computing model is defined as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 D_1 + \beta_6 X_5 + \beta_7 X_6 + \beta_8 X_7 + \beta_9 D_2 + e$$

where  $e$  refers to a random error item,  $\beta_0$  is a constant,  $\beta_i (i=1, 2, \dots, 9)$  represents the coefficients to be estimated for the explanatory variables (Table 1).

① For the convenience of analyzing the rural household family members engaged in economic activities other than the conventional agriculture, we termed those who stay away from home for less than three months as men going for part-time jobs and those over three months as men going for migrant jobs.

Table 1 Variables used in models and their definitions

	Variable	Definition
	$Y$	Per capita net rural household income (yuan (RMB)/person)
Material capital	$X_1$	Per capita productive fixed assets ( $\times 10^4$ yuan/person)
Human capital	$X_2$	Per capita communication expense (yuan/person)
Human capital	$X_3$	Per capita meat expense (yuan/person)
Human capital	$X_4$	Average schooling of family laborers (year/person)
Social capital	$D_1$	Fuzzy variable, 1 for a rural household family with a village leader or government employee, 0 for that without such an employee
Economic structure	$X_5$	Family members doing for migrant jobs/number of family laborers
Economic structure	$X_6$	Time spent by stay-in laborers in part-time jobs/total laboring time
Per capita arable land	$X_7$	Per capita area of arable land (mu/person) (1 ha = 15 mu)
Landform	$D_2$	Fuzzy variable, 1 for plains, 0 for other conditions

### 2.3 Quartile regression

The paper makes regression estimation of the RHI model parameters by using the technique of Quartile Regression (QR) so as to identify each of the factors that may have possible specific influence on the RHI. Compared with Ordinary Least Squares (OLS), the estimated result by the QR method hereby can indicate the marginal effect of a given quartile where the independent variables work on the dependent variables, thus better illustrating the whole distribution of the cause variables. It can also handle the problem of data heterogeneity (Wu and Ma, 2006). Thus on the one hand, the QR technique can help solve the problem of rural household heterogeneity, and on the other hand, it can help estimate the different impact and intensities of the various

factors on RHI of different income levels. In the empirical research, 0.10, 0.25, 0.50, 0.75 and 0.90 are the representative quartile figures regularly adopted in making the estimation.

The software Stata 9.0 and SPSS 12.0 were used to estimate the model from perspectives of QR and OLS respectively. The regression outcome is listed in Table 2. The estimation of result of OLS indicates that the regression results of all the variables, but the social capital ( $D_1$ ), are statistically significant. That proves that the variables are appropriately selected in the model. The QR results are the estimated results from the quartiles starting from the right to the left as 0.01, 0.10, 0.25, 0.50, 0.75, 0.90 and 0.99. The analysis made in this paper is mainly based on the QR results.

Table 2 Simulation results from model

	OLS	QR						
		0.99	0.90	0.75	0.50	0.25	0.10	0.01
$X_1$	0.010 (4.60)**	0.153 (11.10)**	0.084 (8.10)**	0.096 (11.60)**	0.090 (11.90)**	0.021 (4.60)**	0.028 (5.10)**	0.004 (1.40)
$X_2$	2.814 (8.30)**	3.204 (1.50)	5.309 (10.40)**	3.344 (9.10)**	2.852 (9.70)**	1.954 (6.40)**	1.249 (3.10)**	0.573 (1.50)
$X_3$	0.688 (1.80)*	11.116 (18.90)**	2.681 (6.30)**	2.609 (6.90)**	0.918 (2.70)**	0.428 (1.10)	0.032 (0.10)	0.533 (1.40)
$X_4$	158.115 (4.80)**	861.695 (3.80)**	347.293 (6.10)**	189.806 (4.70)**	111.679 (3.90)**	33.569 (1.30)	54.191 (1.80)*	-17.200 (-0.40)
$D_1$	167.947 (0.70)	193.331 (0.30)	621.304 (1.50)	683.312 (2.40)*	43.777 (0.20)	75.269 (0.40)	106.280 (0.50)	16.361 (0.10)
$X_5$	5116.867 (16.80)**	9242.032 (4.60)**	7335.056 (13.20)**	6630.042 (18.90)**	5341.726 (20.60)**	4172.048 (16.50)**	3141.787 (10.10)**	529.421 (0.90)
$X_6$	6590.889 (13.70)**	13274.530 (2.95)**	8883.979 (9.99)**	7362.249 (12.60)**	5352.160 (12.80)**	4670.591 (12.20)**	4139.699 (8.81)**	1764.895 (3.69)**
$X_7$	592.810 (8.60)**	63.783 (0.20)	626.994 (5.60)**	621.782 (7.90)**	530.033 (8.90)**	416.662 (8.20)**	403.380 (6.40)**	152.051 (1.90)*
$D_2$	-237.405 (-2.10)*	-808.333 (-1.15)	-239.688 (-1.14)	-204.666 (-1.50)	-360.305 (-3.70)**	-306.776 (-0.40)**	-260.313 (-2.50)*	-40.515 (-0.30)

Note: The numerical value in the bracket is the value of  $t$ , \*\* denotes significance at the level of 0.01, \* means significance at the level of 0.1, the ones without the marks of \*\* or \* indicate no statistic significance between the independent variables and dependent variables.

### 3 Results and Analyses

#### 3.1 Impact of capital endowments on RHI

(1) Human capital. The regression coefficients indicate that the higher the general RHI level goes, the more effect the various human capital exerts on the per capita RHI. But at the smaller quartiles, the correlation ratio is small or the significance level fails in statistical test in the relating modulus between RHI and the per capita communication expense, per capita meat expense and the average schooling of family laborers. In terms of the absolute quantity, human capital possessed by the rural households differs from one another. For example, the average schooling of the sampled rural household laborers is 7.42 years, those with per capita income ranking the top 20% has an average of 8.11 years, while those with per capita income dropping into the bottom 20% has an average of 7.14 years.

(2) Material capital. An obvious positive correlation is found between the per capita productive fixed assets and the RHI. The higher the quartiles, the closer the correlation, with an only exception at the quartile of 0.01. That can be interpreted as that the material capital has comparatively greater increasing effect on the RHI of the high-income households. Based on the regression

result, every  $10 \times 10^3$  yuan (RMB) of per capita productive fixed assets at the quartile of 0.99 can bring 5.54 times more RHI than that at the quartile of 0.1. But at the quartile of 0.01, the correlation between RHI and the material capital is hardly detectable.

(3) Social capital. The influence of village leaders and government employees on RHI is insignificant statistically. The rural households can obtain information and methods on how to get rich through wider social networks rather than just from the government.

The capital factors differ not only among the rural households, but also among villages exposed to different geographical conditions. We divide the villages surveyed into those in plains and in mountainous areas in consideration of the landforms. As the economic locations among villages in plains vary greatly, we further divide this category into the urban outskirts and the non-urban outskirts villages. The data in Table 3 indicate that rural households at urban outskirts stand advantageous in every capital factors when compared with their counterparts in the other geographical contexts. But of all, the rural households at non-urban outskirts villages in the plains stand the lowest in each of the capital factors. The per capita RHI is also in corresponding to the capital endowments.

Table 3 Rural household capital endowment and income from villages with different geographical factors (year/person)

Village type	Item	$Y$	$X_1$	$X_2$	$X_3$	$X_4$
In plain	Urban outskirts	3006	2064	130	199	8.0
	Non-urban outskirts	2147	896	91	181	7.4
In mountainous area		2798	1726	121	214	7.2

#### 3.2 Impact of structure of economic activity on RHI

(1) Migrant jobs. A positive correlation is shown significantly between the proportion of migrant workers in a household and the RHI at all quartiles except that of the 0.01. The higher the quartiles, the closer the correlation. Such a positive correlation at the fraction of 0.01 is statistically insignificant, which can be interpreted practically as that, due to illness and a shortage of laborers, the low-income rural households can spare fewer persons and time for migrant jobs. By examining the rural households ranked among the bottom a hundred, we have found that the proportion of migrant workers take up 14.7% of the family laborers (it is 33.3% in the whole samples). Their net income from farming is 62.6%, those from migrant jobs and part-time jobs take up 7.6% and 21.0% respectively, and that from other

sources is 6.2%. The analysis tells us that low-income rural households make money mainly from the less-profitable farm work and some odd part-time jobs.

(2) Part-time jobs. A significantly positive correlation is found between the time proportion spent by the stay-in rural household laborers on part-time jobs and the RHI at each of the major fractions, indicating the fact that part-time jobs help increase RHI of all income levels. But the help varies among households of different income levels. The higher the RHI goes, the closer the correlation.

#### 3.3 Impact of geographic factors on RHI

(1) Per capita area of arable land. An obvious positive correlation is found between the per capita area of arable land and the per capita net income of the rural

households at all the quartiles except the quartile of 0.99. That means per capita area of arable land can generally help the increase of RHI. But its effect on the high-income rural households is not so significant. In the rural households whose per capita incomes list on the top a hundred, the proportion of migrant workers takes up 42.7% of family laborers (it is 33.3% with the whole samples). The net income from migrant jobs and part-time jobs are 39.6% and 34.3%, respectively, and the income from other sources goes to 13.9%. So the high-income rural households mainly get their income from migrant jobs, part-time jobs, and other capital working activities, rather than cultivated farming.

(2) Landform. The impacts of landform on RHI are statistically insignificant at the extreme quartiles of 0.99, 0.01 and at the high quartiles of 0.90, 0.75. Such phenomenon can be explained in two aspects. For the high-income rural households, capital, market and information are the major factors affecting their income, while landform is turning into the less significant factor. But for the low-income rural households, the number of laborers and health conditions are the major factors. A shortage of laborers or troubling illness often prevent them from taking full advantage of the favorable landform, therefore, landform does not play a significant role in their income.

A significant negative correlation is shown at the quartiles of 0.5, 0.25, and 0.10, indicating that the favorable landform in the plains does not help the increase of RHI at these quartiles. The income structure<sup>①</sup> of the majority rural households can explain why that happens. For most rural households in the study villages, migrant and part-time job salaries are their main source of income, the other business or work is their secondary income source, and the income from farming only takes up a very small proportion of the total. As the households living in non-urban outskirts plain villages have to spend more time taking care of their farmland, the time they spent in non-farm activities is somewhat reduced. Although the rural households at urban outskirts villages spend a lot more time doing non-farm activities and their incomes are much higher than their counterparts in the mountainous villages, rural households of such economic locations only compose a small proportion. The majority rural households are living in non-urban out-

skirts villages.

As many geographic factors are related to the landform and location, we examine the geographic factors that affect RHI by probing into how the geographical locations affect the rural households' non-farm activities. In average, the income from migrant and part-time jobs takes up 81% of the total income of the rural households at the sampling villages. But the per capita income of the rural households in mountainous villages is higher than their counterparts living in non-urban outskirts plain villages. The reasons lie in the difference in the time they spend in doing the migrant and part-time jobs. Based on the data from the sampling villages, migrant workers of the mountainous villages spend 9.4 months annually doing migrant jobs, while their counterparts from the non-urban outskirts plain villages do 8.5 months per year. In consequence, when the former makes a per capita annual income of 5 667 yuan, the amount of the latter drops to 4 561 yuan. A comparative observation of the part-time jobs taken by the stay-in laborers and their annual income just tells the same story.

The villages in the plains can be divided into two types. Type one includes villages located at the outskirts of large cities, such as Yinxi Village in Luohe and Qiangnan Village in Jiaozuo. As there are strong needs for laborers in big cities and peasants living there have better ability to acquire information, the rural households make high income from migrant and part-time jobs. For the 283 laborers surveyed in Yinxi Village, 113 are migrant workers, of whom 58 work in Guangdong, 32 in the city proper of Luohe. The per capita annual salary income of these migrant workers goes to 7 272 yuan, ranking on top of all the sampling villages. The rural households surveyed in Qiangnan Village, close to the city proper of Jiaozuo, have a total of 259 laborers, of whom 90 are taking part-time jobs in the city proper of Jiaozuo, engaging in housekeeping, house fitting up, and transportation. Type two includes the non-urban outskirts villages that have comparatively poorer economic locations. Five sampling villages of this type are selected (Yinxi, Yanwa, Donglou, Dasiguo and Beisong). Their per capita RHI ranks the bottom five of the 11 sampling villages. Compared with the abovementioned two plain villages at the urban outskirts, migrant workers from those five villages are less in

① For the convenience of research and the consideration of the reality in the surveyed villages, farming, migrant jobs, part-time jobs, and others (such as the transferring incomes) are included in the RHI structure.

number, the time they spent doing migrant jobs is shorter, and their salary income is lower. The stay-in laborers of those villages take less part-time jobs and gain lower salaries. For instance, Beisong Village in Kaifeng has the lowest per capita income, its migrant workers take up 24.7% of the total laborers there, and the per capita annual income for migrant jobs is merely 3 277 yuan. Only 6.8% of the stay-in laborers take part-time jobs. They plant common crops like wheat and maize, which help little in raising RHI.

In general, the geographic advantages possessed by the plain villages lie in the advantageous farming conditions. But now farming is no longer the main source of rural household's income. As villages on farming and the households in these villages are large in number, and the urban outskirts villages are extremely few, it is understandable to see that the plain location shows an obvious negative impact on RHI at the quartiles of 0.50, 0.25, and 0.10.

#### 4 Conclusions

RHI at different income levels is affected by different factors, and the magnitude of impact of each factor also varies. Although the paper has adopted a same income function to analyze the factors that exert influence on RHI, we still can see that the influence of each factor differs in degree. Such difference may be mainly caused by the amount of material capital, human capital and social capital possessed by each rural household.

At the capital endowment level, material capital and human capital show a significant influence on the increase in RHI, but the increasing effect is stronger on the high-income rural households. As to the economic activity structure, the effects of part-time migrant jobs are also stronger on the high-income rural households. Comparatively, doing part-time jobs is a steady-going factor that helps to raise RHI of all the rural households at different income levels to some extent. But the impacts of the above mentioned social and economic factors on RHI differ among villages owing to geographical location. Rural households in urban outskirts villages are engaged more in migrant and part-time job activities than their counterparts living in the non-urban outskirts villages.

Geographical factors lead to RHI difference among villages. Geographical environment is embodied in many

factors. Owing to the differentiation and diversification of a single factor or the combination of multi-factors, the mechanism of geographical impact on RHI tends to be complicated: 1) the impact of traditional geographical factors (such as landform and arable land) on RHI is declining with the rising economic level. 2) The factors, such as economic locations, geographic proximity are playing an increasing role in affecting RHI. Such role is mainly seen in the indirect impacts on the non-farm activities performed by the rural households. Therefore, we can not jump to the simple conclusion that the impacts of geographical factors on RHI are declining. The fact is that such impacts of given geographic factors have changed in their magnitude and way.

The empirical research may be suggestive to the policy-making. Firstly, government should increase human capital investment in rural communities. By providing compulsory education, working skill training and health care, the rural laborers can increase their ability in non-farming jobs. Secondly, government should promote the construction of a public employment services system and create a good market environment for laborers to migrate across industries and across regions so as to help turn the rural households' capital endowments into real income. Thirdly, as geographic environment differs greatly among villages, which exerts different impacts on the rural household behaviors, we suggest that rural policies should be implemented specifically according to the type of geographical environment surrounding to each village. For example, when we try to assist the poverty-stricken rural households, the differentiated policies and measures should be taken according to the feature of these households. Only in this way, can we hope to get better results. Finally, since location and proximity are important to RHI, the establishment of rural township systems should be promoted in the less developed region. Not only towns attract many rural surplus laborers, but also can rural households be benefited from public services provided in nearby locations.

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