# The impact of health on the off-farm income of China's migrant workers

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**Abstract**: The purpose of this study is to empirically examine the impact of health on the off-farm income of China's migrant workers by the Heckman model. The dataset collected from the Research Center for Rural Economy, the Ministry of Agriculture of China between 2003 and 2007 was used in this paper. The results of both qualitative and quantitative analysis show that the health of flowing workers significantly influences their off-farm income. Flowing workers associated with a poor health condition earn less than those who are of good health, and the off-farm income gap due to the health condition widens year by year. In addition, poor health negatively impacts the off-farm participant decision for the China's rural residents. Therefore, more attention should be given to the health investment of migrant workers so as to improve their health and increase their off-farm income.

**Key words:** health, off-farm income, rural residents

The big income gap between urban dwellers and rural residents is one of the remarkable characteristics of China's dual economy. The annual income per capita for urban households in year 2010 was RMB 19109 Yuan (US $1 = RMB 6.3 Yuan), while the income per capita for rural households was RMB 5919 Yuan, only 31% out of that for urban households (National Bureau of Statistics of China 2011). For rural population, engaging in the off-farm work is an effective way to increase their income, thus bridgeing the urban-rural gap and building a harmonious society (Bowlus and Sicular 2003; Chen and Hamori 2009). However, in China, the government has been carrying out differentiated welfare policies in cities and in the country (Xie 2011). Most urban residents enjoy the salary corresponding to their length of service. They are entitled to a paid leave if they are unable to work because of illness. In contrast, while rural residents are taking part in off-farm work, they cannot enjoy these privileges. Obviously, when rural residents work in cities, most of them are involved in a heavy manual labor, which demands a better health condition. Therefore, studying the influence of health on the off-farm income of China's mobile workers is of a high significance for the government to formulate relevant social and economic policies in the era of the China's social transformation.

Health is an important component of human capital (Grossman 1972; Li and Huang, 2009). There is an abundant research literature on the health influence upon the labour market performance and most results demonstrate that health significantly contributes to the labour involvement and earnings. Some of the studies discover that the better an individual's health is, the higher pay the person gets (Strauss and Thomas 1998; Jones and Wildman 2008; Lu 2010). Better health conditions can increase the work efficiency and strengthen the labour's salary negotiation power. Furthermore, some studies find that labourers who are subject to health impact cannot adapt themselves to the working environment (Riphahn 1999; Pelkowski and Berger 2004; Pilar et al. 2010). The working time they can supply decreases and some of them have to withdraw from the labour market. Thomas et al. (2006) conducts a research on an Indonesian interference experiment on the health influence upon labour market. The result shows that the improvement of the residents' health increases the probability of the male residents'

involvement in work and their pay per hour, but for the females, the influence is not obvious.

Studies on the health effect on the China labour market are few and a controversy remains over the scarce published literature on the relationship between health and income. Several studies find that a good health condition contributes to the income of the Chinese urban and rural residents (Zhang 2003; Liu et al. 2004; Yuan 2009). However, some studies illustrate that in spite of the positive correlation between health and income, it is not significant statistically (Wei 2004; Li and Huang 2009; Cao and Wenwen 2010; Zhang 2011). At the same time, several researches test the health influence upon the labour involvement and they find that health is an important contributor to labuor involvement (Liu 2008; Cao and Wenwen 2010; Zhang 2011). Moreover, Xie (2011) finds that health has an obvious influence on the labour involvement of Chinese rural residents, but it has no effect on that of Chinese urban residents.

Although some studies examined the impact of health on the China labour market, there are several related issues that have not been solved yet. First, the problem of endogeneity between health and off-farm income still needs to be settled. These researches mostly employ the cross section data. There is an interactive influence between health and off-farm income, but the cross section data cannot discern whether it is health that influences the off-farm income or if it is the off-farm income that effects the health of rural residents. Since health and the off-farm income interact with each other, there exists the endogenous problem and the above literature concerned about China has not solved the problem. Second, the above researches mostly employ the samples from the China Health and Nutrition Survey (CHNS), and since there is only the household income but no personal income, they cannot give an exact estimate of the relationship between health and personal income, lacking the comparability of an empirical research. Third, the empirical research on health influence upon the income of migrant workers in China is still absent.

The overall goal of this study is to contribute to the ongoing assessment of the impact of health on the China's flowing workers' off-farm income. To meet the goal, this paper makes four contributions. First, by referring to the one-year-lagged health condition as the initial effect on their current year off-farm income, the endogenous problem between health and the off-farm income is thus solved. Second, almost no literature gives attention to the research on the health influence upon the China's rural residents' off-farm income and this paper will do that. Third, by using the Heckman two-step method to make the econometric estimation, the problem of the off-farm workers' self-selection is solved. Fourth, we adopted the data of large-scale surveys, which for the sample obtained are nationwide representative. This is the first paper that employs these data to study the relation between the health of migrant workers and their off-farm income, enriching the empirical research on the health influence upon the off-farm income of Chinese rural residents.

## DATA DESCRIPTION

The dataset adopted in this study was collected from the Research Center for Rural Economy, the Ministry of Agriculture of China. It spans five years from 2003 to 2007. The survey covers nine provinces in the East, the Center and the West of China. In the Eastern area, there are the Shandong, Zhejiang and Fujian Provinces. In the central area, there are the Shanxi, Henan and Hubei Provinces, and in the Western area, there are Gansu, Shaanxi and Sichuan Provinces. The provinces selected as samples make up one third of all China's provinces and the geographical distribution of the sample provinces is reasonable, and therefore a fairly representative. In each province, the counties are divided into categories of high income, middle income and low income according to their economic development. In the same way, villages are classified into high income villages, mid-

Table 1. Annual off-farm income difference of migrant workers of different health conditions unit: RMB Yuan

| One-year-lagged health condition | 2004 | 2005 | 2006 | 2007 | Total samples |
|---|---|---|---|---|---|
| Good | 4 822.63 | 5 397.90 | 6 485.98 | 8 686.19 | 6 391.54 |
| Poor | 3 291.67 | 3 875.90 | 4 397.43 | 6 321.67 | 4 414.52 |
| Income of the poor health lower than that of the good health | 1 530.96*** | 1 522.00*** | 2 088.55*** | 2 364.52*** | 1 977.02*** |
| Proportion of the income the poor health makes up that of the good health (%) | 68.25 | 71.80 | 67.80 | 72.78 | 69.07 |

***indicates *t*-test at 1% statistically significant level

dle income villages and low income villages. Finally, households are chosen by an equidistance random sampling approach. There are 26 922 rural residents in 6750 rural households investigated each year. To meet the purpose of this study, we choose such rural residents as our research samples, who are between the labour age of 16 to 65 and not students. As it is said in the first part, one of the main contributions of this paper is employing the one-year-lagged health condition as the initial influence factor of the rural residents' off-farm income. Therefore, this paper uses the health variable of year 2003–2006 as the corresponding years' lagged health variable and it uses the data 2004–2007 as the current year variable. Through data cleaning, there are 40 476 observations used in this study.

Table 2. Definitions and descriptive statistics of the main variables

| Variable | Definition | Observations | Mean | Standard deviation |
|---|---|---|---|---|
| Off-farm income | Annual off-farm income (RMB Yuan) | 15 270 | 5 709.378 | 10 470.700 |
| Health status | One-year-lagged health condition is equal to 1 if it is poor, is equal to o if it good | 40 560 | 0.430 | 0.495 |
| Gender | Male = 1, female = 0 | 40 665 | 0.527 | 0.499 |
| Age | Age in years | 40 676 | 42.216 | 12.534 |
| Education | Number of educational years | 38 565 | 6.798 | 2.762 |
| Vocational training | Having received job training is 1, otherwise 0 | 39 775 | 0.084 | 0.278 |
| Days of off-farm work | Annual off-farm working days (day) | 15 402 | 201.782 | 113.167 |
| Whether participating in off-farm work | Engaging in off-farm work is 1, otherwise 0 | 40 676 | 0.337 | 0.473 |
| Number of off-farm work member | Number of member engaging in off-farm work in a family (person) | 40 676 | 1.230 | 1.084 |
| Number of old people | Number of people above the age of 65 years in a family (person) | 40 676 | 0.194 | 0.472 |
| Number of children | Number of children under the age of 6(person) | 40 676 | 0.263 | 0.502 |
| Harvest cultivated land | One-year lagged actual harvest area of the cultivated land (Mu) | 40 676 | 8.685 | 7.081 |
| Suburb | Home located in the suburb is 1, otherwise 0 | 40 676 | 0.120 | 0.325 |
| Plain | Home located in plain is 1, otherwise 0 | 40 676 | 0.399 | 0.490 |
| Commercial catering services | Main income source of the interviewees from commercial catering services is 1,otherwise 0 | 38 838 | 0.076 | 0.265 |
| Agriculture | Main income source of the interviewees from farming is 1, otherwise 0 | 38 838 | 0.635 | 0.482 |
| Industry | Main income source of the interviewees from industry is 1, otherwise 0 | 38 838 | 0.104 | 0.305 |
| Building | Main income source of the interviewees from building is 1, otherwise 0 | 38 838 | 0.057 | 0.233 |
| Transportation | Main income source of the interviewees from transportation is 1, otherwise 0 | 38 838 | 0.026 | 0.160 |
| Others | Main income source of the interviewees from other industry is 1, otherwise 0 | 38 838 | 0.102 | 0.303 |
| Mobility 1 | Working place in other villages but within the same township is 1, otherwise 0 | 13 395 | 0.276 | 0.447 |
| Mobility 2 | Working place in a different township but within the same county is 1, otherwise 0 | 13 395 | 0.232 | 0.422 |
| Mobility 3 | Working place in a different county but within the same province is 1, otherwise 0 | 13 395 | 0.197 | 0.398 |
| Mobility 4 | Working place in other provinces is 1, otherwise 0 | 13 395 | 0.293 | 0.455 |
| Mobility 5 | Working place in other countries or areas is 1, otherwise 0 | 13 395 | 0.001 | 0.039 |
| Western region | Interviewees from the western region is 1, otherwise 0 | 40 676 | 0.374 | 0.484 |
| Central region | Interviewees from the central region is 1, otherwise 0 | 40 676 | 0.434 | 0.496 |
| Eastern region | Interviewees from the eastern region is 1, otherwise 0 | 40 676 | 0.192 | 0.394 |

Table 1 shows the off-farm income of rural residents by different health conditions. It illustrates that the off-farm income of migrant workers of poor health is distinctively lower than those of good health. The off-farm income of migrant workers of poor health is RMB 4415 Yuan, while the off-farm income of good healthworkers is RMB 6392 Yuan. The annual average off-farm income of flowing workers of poor health makes up only 69% of that of those in good health, with their absolute amount being RMB 1977 Yuan lower that the latter.

Viewed year by year, between 2004 and 2007, the annual off-farm income of migrant workers of poor health is lower than those of good health, with no exception. In 2004, the off-farm income of migrant workers of poor health is RMB 3292 Yuan while the off-farm income of those in good health is 4823, that is to say, the off-farm income of mobile workers associated with poor health makes up only 68% of those in good health. As known by the absolute amount, the off-farm income of migrant workers of poor health is by RMB 1531 Yuan lower than that of good health. According to Table 1, we learn that from 2004 to 2007, despite the rising tendency of both of the off-farm income of migrant workers in better/poor health, the income gap between the two groups is widening year after year, which demonstrates that poor health decreases the off-farm income of flowing workers distinctly.

As it is shown in Table 2, the samples of the group of poor health make up 43% of the total samples and the proportion of the samples of good health is 57%, namely, the proportion of poor health is lower than that of good health. In the study samples, the average annual off-farm income of the off-farm mobile worker is RMB 5709 Yuan, with the lowest being 31 Yuan, the highest 516 256. Then, 34% of the rural residents flow out to work, which is higher than the figure from the synchronic National Agriculture Survey (China National Statistics Bureau 2008), which is 25%. The annual average number of days of the off-farm work is 202 and the top number amounts to 365 days. Male samples are higher than the female samples. The former is 53% and the latter is 47%, which is in agreement with the general situation of the China's population structure – males are more numerous than females. The average age of the interviewees is 42, and their average schooling years are 7. Only 8.40% of the interviewees have received any vocational training, which shows that the majority of rural residents have no job training, a minus factor to their off-farm income. The average number of family members who flow out to work is 1.23, with the top number amounting to 6, the bottom being zero.

**Theoretical frame and econometric model**

The analysis of this study based on the theory of human capital. Mincer is one of the important founders of the human capital theory, who established and furthered the classic Mincerian Wage Equation (Mincer 1974, 1997). Mincer takes human capital as the key factor of improving the laborers' earning power. Education, training, mobility and health are important forms of the human capital investment. Health differs from the other three forms of human capital in the cumulative way because health conditions are vulnerable to the exogenous impact, which causes failing of health, not only lowering the labour productivity, but also decreasing the time of labour supply, which in turn reduces the labour income. Based on this, health makes the main variable of concern in this paper.

However, health interacts with the rural residents' decision to participate in the off-farm work and the off-farm income. Good health condition is likely to encourage rural residents to decide to take part in the off-farm work and to increase their off-farm income. Consequently,a higher off-farm income improves the health investment capacity of rural residents, contributing to their health. Thus it can be seen that there is the endogenous problem with health and the decision to join in the off-farm work and income. Following the study of Zhang (2011), this paper employs the one-year-lagged health condition of rural residents as the initial effect on their off-farm work participant decision and income, the endogenous problem between health and their decision to participate in the off-farm work and income is thus solved. In order to isolate the influence of health on the decision to participate in the off-farm work and income, this paper transferred the Mincerian wage equation to the following format:

$$\mathrm{Ln}Income_t = \alpha_0 + \alpha_1 Health_{t-1} + \alpha_2 \Pi_t + \varepsilon_t \qquad (1)$$

$Income_t$ in the above formula, is the annual income of migrant workers in $t$ year and the health condition is one-year time lagged. To be in agreement with the past literature, this paper uses the dichotomous variable of the self-reported health condition by rural interviewees as the health condition measurements. If the interviewees' self- reported health is poor, it is equal to 1. And if it is good, the health is equal to 0. $\Pi_t$ is the vector including the variables that influence the off-farm income of rural residents, such as their personal characteristics, family situation, job characteristics and the propensity of the region and the year. The $t$ stands for different years. The value

of the off-farm income calculated by logarithm is to avoid the non-normality distribution.

The value of the off-farm income in Formula 1 can be observed. However, the rural residents who participate in the off-farm work we surveyed are not always random selections among the total samples, so the study samples may cause deviated coefficient estimates of the measured results, namely the selective bias. In fact, since the biased estimate due to the self-selection of the survey samples is a frequent problem in the field investigation, Heckman (1979) proposes a two-step method to solve the problem and it has been used widely (Wei 2004; Cao and Wenwen 2010). First, the fact whether the rural resident participates in the off-farm work is the variable to be explained, and the Probit Model is used to estimate the probability of the rural resident to participate in the off-farm work. The explanatory variables in the Probit Model include the individual characteristic variables such as gender, age, education, health condition and the variables that only influence the decision to participate in the off-farm work, but not the effect on the off-farm income. For example, the number of family members, the number of children, the number of the old ones, the real harvest area of field, living in the suburb or living in the plain. There is a considerable difference between the labour markets in different regions of China. In order to control the regional differences in the socio-economic situation and their annual variation, regional and annual dummy variables are included in the model. As job characteristic variables, such as the number of working days, distance of mobility, only influence the off-farm income but not the decision to participate in the off-farm work, these variables are included in the wage formula instead of in the work decision-making formula. The standard Probit Model is as follows:

$$P(Working_t = 1) = F(Z_t) = \int_{-z}^{z} f(u_t)du_t \qquad (2)$$

$F(Z_t)$ in formula 2 is the cumulative distribution function. Because the amount of observations of study is sufficiently large, $U_t$ can be assumed as the normal distribution. Therefore, the probability $\hat{P}_t$ of rural residents' decision to participate in the off-farm work can be generated in formula (3). In formula (3), $\phi(\cdot)$ is the probability density function of the standard normal distribution. $U_t$ is a random variable with the mean zero and unit variance.

$$\hat{P}_t = \Phi(\hat{Z}_t) = \int_{-z}^{z} \varphi(u_t)du_t$$

$$= \int_{-z}^{z} (2\pi)^{-1/2} exp(-u_t^2/2)du_t \qquad (3)$$

Besides, the Inverse Mills Ratio (IMR) $\hat{\lambda}$ can be used as the correction parameter in the second stage econometric estimation in the Mincerian wage equation.

$$\hat{\lambda} = \begin{cases} \dfrac{\varphi(\hat{Z})}{\phi(\hat{Z})} & \text{if the individual engaging in off-farm work} \\ \dfrac{\varphi(\hat{Z})}{1-\phi(\hat{Z})} & \text{otherwise} \end{cases} \qquad (4)$$

In the above formula, $\varphi(\hat{Z})$ is the standard normal density function. If the coefficient value of $\hat{\lambda}$ is not statistically significant, the selective bias does not exist and the Ordinary Least Square (OLS) method can be used to estimate the model. If the coefficient value of $\hat{\lambda}$ is statistically significant, the selective bias will occur in this study. $\hat{\lambda}$ is treated as a new aggressor in equation (1) to correct the bias. The final econometric model (5) this study uses is generated.

$$\text{Ln}Income_t = \gamma_0 + \gamma_1 Health_{t-1} + \gamma_2 \Pi_t + \gamma_3 \hat{\lambda} + \eta_t \qquad (5)$$

The mean of each variable vector in formula (5) is the same as above. $\gamma_0$ to $\gamma_3$ are estimated coefficients. And $\eta_t$ is random error.

## EMPIRICAL RESULTS AND ANALYSIS

Table 3 is the results of health impacting the rural residents' participation in the off- work and the off-farm income examined by Heckman two-step method. The coefficient value of $\hat{\lambda}$ in the estimation results is 0.12, at 1% statistically significant level, showing that there is a serious self-selection problem with the survey samples. If we use the OLS method to estimate the equation, it will cause the deviated coefficient value. This paper adopts the Heckman two-step method to estimate the model, effectively avoids the selective bias in the results, so enhancing the reliability of the measurement results. The empirical analysis discovers that poor health condition not only decreases the probability of rural residents' participation in the off-farm work, but it also lowers their off-farm income significantly.

### Results from the Probit model

The variable of health is the focus of all variables in this research. The econometric results of the Probit model in Table 3 shows that the health coefficient is –0.04, indicating that the health condition not only decreases the probability of deciding to engage in the off-farm work, but such a result is significant at 1%

statistical level. The rural residents' decision for the off-farm work depends on their health self-selection, which means that the rural residents of good health, expecting that their health condition can meet the requirements of intensive physical work, tend to participate in the off-farm work. Rural residents of poor health, expecting that their health conditions are not fit for the high-demanding physical work, tend to stay and work in the villages (Yuan 2009). Thus it can be seen that the health condition plays an important role in the rural residents' decision to participate in the off-farm work. Poor health condition handicaps the rural residents' decision to be engaged in the off-farm work.

The regression result of the variable gender indicates that there is a difference in the particition in the off-farm work between males and females. Males are more inclined to take part in the off-farm

Table 3. Results of the impact of health on migrant workers' off-farm income (using Heckman two-step procedure)

| Variable | Wage equation | | Probit model | |
|---|---|---|---|---|
| | coefficient | standard deviation | coefficient | standard deviation |
| Gender | 0.327*** | 0.019 | 1.166*** | 0.020 |
| Age | 0.085*** | 0.004 | –0.011** | 0.005 |
| Age square | –0.001*** | 0.000 | –0.001*** | 0.000 |
| Education | 0.039*** | 0.012 | 0.104*** | 0.013 |
| Education square | –0.002*** | 0.001 | –0.004*** | 0.001 |
| Vocational training | 0.135*** | 0.023 | 0.084*** | 0.031 |
| Health condition | –0.045*** | 0.016 | –0.042** | 0.019 |
| Number of off-farm work member | | | 0.905*** | 0.010 |
| Number of old people | | | 0.111*** | 0.019 |
| Number of children | | | –0.299*** | 0.018 |
| Harvest cultivated land | | | –0.010*** | 0.001 |
| Suburb | | | 0.069** | 0.028 |
| Plain | | | 0.167*** | 0.019 |
| Days of off-farm works | 0.005*** | 0.000 | | |
| Occupations (control group: commercial catering services) | | | | |
| Agriculture | –0.229*** | 0.027 | | |
| Industry | 0.003 | 0.024 | | |
| Building | 0.071*** | 0.027 | | |
| Transportation | 0.232*** | 0.040 | | |
| Others | –0.074*** | 0.025 | | |
| Working place (control group: Mobility 1) | | | | |
| Mobility 2 | 0.091*** | 0.021 | | |
| Mobility 3 | 0.026 | 0.022 | | |
| Mobility 4 | 0.145*** | 0.022 | | |
| Mobility 5 | 0.838*** | 0.172 | | |
| Region dummy(control group: west) | | | | |
| Centre | 0.095*** | 0.016 | –0.190*** | 0.021 |
| East | 0.282*** | 0.021 | –0.157*** | 0.026 |
| Year dummy (control group: year 2004) | | | | |
| Year 2005 | 0.124*** | 0.020 | 0.061** | 0.025 |
| Year 2006 | 0.326*** | 0.020 | 0.095*** | 0.025 |
| Year 2007 | 0.532*** | 0.021 | 0.118*** | 0.026 |
| Constancy | 4.800*** | 0.099 | –1.409*** | 0.114 |
| Lambda | 0.117*** | 0.019 | | |

***, **and*respectively stands for 1%, 5% and 10% statistical significance

work than females. The reason is that most jobs the Chinese migrant workers are doing are heavy physical work in poor working conditions and the males are more likely to adapt themselves to the heavy physical work. The result of the variable education shows that education is significantly contributing to the migrant workers' decision to participate in the off-farm work. The length of formal education increases their willingness to make the decision to take part in the off-farm work. Education is one of the important forms of human capital, obtaining the corresponding educational investment revenue. The comparative interest of engaging in farming is lower, so that the education level positively influences the rural residents' decision to join in the off-farm work. The variable of job training shows that the experience of job training significantly contributes to their decision to be engaged in the off-farm work. Job training is an important mode of increasing human capital, enhancing the competitive power of rural residents in the off-farm labor market.

The more family members are engaged in the off-farm work in one household, the more inclined the family members are to participate in the off-farm work than if they are associated with no off-farm work. The family member who is already a migrant worker may pass on the employment messages to the other members in the family, which helps them to make the off-farm working decisions. The more old people there are in a family, the more likely are its members to decide to take part in the off-farm work. This is consistent with the fact that there have appeared a lot of empty nest families in China in the recent years, which shows that solving the problem of the old-age care in China is becoming increasingly important. The variable of one-year-lagged actual harvest acreage area shows that a small actual harvest cultivated land contributes to the rural residents' decision to do the off-farm work. Because of a crop failure caused by a natural disaster, the rural residents' income from crop farming decreases so that rural residents are under more pressure to look for the off-farm work. The result of the variable suburb indicates that rural residents living in the suburb have more propensities to participate in the off-farm work because they can get more employment information, thus increasing their chances of the off-farm working.

**Results from wage equation**

In Table 3, the coefficient value of the variable health in the wage equation is –0.045, and at 1% of the statistically significant level, showing that a poor health condition decreases the off-farm income of migrant workers. Health condition influences the off-farm income of rural residents in two ways. On the one hand, from the perspective of labour requirements, health condition is an important standard, so that an enterprise hirig employees tend to employ rural residents of good health whereas their counterparts of poor health are hard to find jobs (Zhu 2009). Rural residents of good health, whose individual labour productivity is higher and lowers the production cost of the enterprise, help to strengthen the market competitiveness of enterprises. In contrast, when rural residents are subject to the exogenous impact on health like sudden illness, their labour productivity will be reduced. In the labour market where the businesses have the employment freedom, they either fire the migrant workers of poor health, or keep them but lower their wage. Both results will decrease the off-farm income of rural residents of poor health.

On the other hand, from the perspective of labour supply, rural residents have the health self-selection mechanism when deciding to participate in the off-farm work. Rural residents who choose to be engaged in the off-farm work are mostly young adults, and they are in the best health condition of their life cycle. The majority of migrant workers do jobs of heavy physical labour, jobs in bad working condition and in constant mobility, which demand a good health. When rural residents enter the off-farm labour market, those of good health can adapt themselves to these jobs and they can take the positions. However, once their health becomes worse and they cannot meet the high health condition demanding jobs, they are compelled to adjust their labour supply so as to fit their inferior health condition (Pilar et al. 2010). The ways to adjust include reducing working hours or even withdrawing from the labour market, which will decrease the income of migrant workers dramatically.

As is shown in Table 4, there is a considerable difference in working time between migrant workers of good health and those of poor health, namely, the working time of migrant workers of poor health is obviously shorter than that of migrant workers of good health. It can be seen from all samples that the average annual working time of migrant workers of good health is 219 days, whereas that of migrant workers of poor health is 168 days, which shows the annual working time of migrant workers of poor health is by 60 days shorter than that of migrant workers of good health. Seen year by year from 2004 to 2007, the annual working time of migrant workers of poor health is lower than that of those of good health by a wide margin. In 2004, the annual working time of

Table 4. Difference of off-farm working days between migrant workers of good and poor health (unit: day)

| One-year-lagged health condition | 2004 | 2005 | 2006 | 2007 | Total samples |
|---|---|---|---|---|---|
| Good | 215.09 | 219.07 | 216.02 | 226.72 | 219.29 |
| Poor | 152.90 | 168.29 | 165.58 | 189.79 | 168.32 |
| Working days of the poor health less than those of the good health | 62.20*** | 50.78*** | 50.44*** | 36.93*** | 50.97*** |
| The proportion of working days the poor health make up that of the good health (%) | 71.08 | 76.82 | 76.65 | 83.71 | 76.76 |

***indicates *t*-test at 1% statistically significant level

migrant workers of poor health was 153 days, 62 days less than that of the migrant workers of good health, whose working time was 215 days. In 2007, the annual working time of migrant workers of poor health was 190 days, whereas that of migrant workers of good health was 227 days, 37 days less than the working time of the migrant workers of good health. With the annual variation, the difference in working time between the two groups of migrant workers is shrinking gradually. However, in 2007, the working time of migrant workers of poor health was still one month less than those of good health. Under the same wage rate, the result of a shorter working time is the fall of income. That is to say, different health conditions influence the income of migrant workers.

The results of the other variables are also worth attention. The result of the variable education shows that a better education level significantly increases the income of migrant workers. Education is one of the important means of increasing human capital. Better-educated rural residents can better understand and master the modern technology so that they can increase productivity and their earning power. The income of migrant workers who have experienced vocational training is significantly higher than that of their counterparts who have not received job training. With the fantastic development of science and technology and the intensity of international competition, the industrial structure and production technology are being constantly adjusted and upgraded, which requires not only a good health but also some professional skills of rural residents. Rural residents, who have received job training, master the production technology and can increase the productivity, bringing direct economic benefits. Job training has become an important way to enhance the competitiveness and production efficiency. Therefore, vocational training can improve the negotiation ability of rural residents in the labour market and increase their income. These results show that the human capital investment of rural residents receives a significant return.

The econometric result of the variable gender shows that the off-farm income is different between males and females. The income of male migrant workers is higher than of the female ones and such a result is statistically significant at the 1% level. The jobs that migrant workers are performing are of a high intensity and demand a good health condition, so male migrant workers are more adequate to these positions than the female ones and get a higher off-farm income. The result of the age variable indicates that the income increases with the age advancing. The older age means a relatively rich working experience, possessing better working skills, and it is expected to raise productivity. However, the coefficient value of the age square variable is a minus, showing that the off-farm income and age take on the characteristic of non-linearity. Compared with rural residents living in the country and mountain areas, those living in the suburb of cities or in plain areas earn more. Rural residents in these areas are relatively well informed of the employment messages, having more chances of employment and are getting a higher off-farm income. The econometric result of the variable working place shows that the distance of mobility positively correlates with the income of migrant workers. The farther they work away from home, the higher income they get. The income of migrant workers who work in other provinces is higher than that of those who work in the province where they live. In addition, there is a distinct regional difference as far as the migrant workers' income is concerned. Rural residents in the Eastern or Central district earn more than those in the Midwest. Rural residents in the Eastern district earn more than their counterparts in the Midwest when they are engaging in the off-farm work.

## CONCLUSIONS

This study empirically analyses the impact of health on the off-farm income of China's rural residents. A

large scale survey sample spanning the years 2003 to 2007 collected from the Research Center for Rural Economy, the Ministry of Agriculture of China was adopted. Using the Heckman two-step model, the problem of the selective bias arising from the self-selection of survey samples was solved. In addition, by referring to the one-year-lagged health condition of the rural residents as the initial effect on their current year off-farm income, the endogenous problem of the relation between health and their income is thus solved. So, the reliability of econometric results was improved. The results of both the qualitative and quantitative analysis all prove that the health condition of rural residents is in a positive correlation with their participating in the off-farm work and income. Poor health not only diminishes the possibility of rural residents deciding to be engaged in the off-farm work, but also significantly lowers the off-farm income. Rural residents of poor health earn only 70% of the off-farm income of those of good health and the gap of the health return is becoming bigger year by year. These results show that health plays a more and more important role in the off-farm labour market in China.

The above findings have significant implications for the policy-making. First, governments at all levels should invest more in the public health. In China, there are 80% of medical resources concentrated in urban areas, while they are scarce in the extensive rural areas, which is a negative factor in improving the health condition of rural residents. Though the government has invested more into the health care in rural areas recently, the medical facilities are outdated and the numbers of doctors and nurses are far from sufficient. Second, the enterprises should improve working conditions and strengthen the labour protection. They must create conditions for safe production and improve them constantly. They should offer the production safety training, carry out the labour protection measures and prevention measures for the occupational diseases. Meanwhile, the concerned government departments should urge enterprises to ensure the safety and hygiene of workplaces. Furthermore, rural residents should have a clear sense of health care and disease prevention because Chinese rural residents tend to pay attention to the disease treatment but ignore the disease prevention. If patients cannot receive treatment in the case of illness, the ailments will develop into serious diseases, which will not only harm the health of rural residents seriously but also increase their medical expenditure greatly. All in all, only if we strengthen the health care and disease prevention, improve health condition, we can increase the earning ability of migrant workers.

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