The Empirical Research of Rural Health Inequalities in Human Capital and Poverty*

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Abstract:

Based on the health of human capital theory and theory of regional differences, this paper study the regional differences in rural areas from a health perspective of human capital. In this paper, it showed that the incidence of poverty, health and a negative correlation between better health, the possibility of occurrence of poverty smaller by the simple OLS model, Probit model and Logit model of China's rural health human capital inequality on the poverty impact of empirical analysis.

Key Words: Regional gap, Human capital, Health human capital, Inequality in health

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1. INTRODUCTION

Since the reform and opening up, China's national economy has developed rapidly, and per capita income increased rapidly. But at the same time, the income Gini coefficient is a growing trend, from 0.32 in 1980 to 0.458 in 2008, surpassed the universally accepted warning line 0.40 standards. Poverty and the enlargement of the income gap can affect the economic development and social stability. The massive research indicated that the human capital investment will be beneficial to increase the resident marginal revenue, and improve the residents' income level. But the studies on the human capital mainly focus on the education human capital. The paper mainly studies another important component of the human capital—the health human capital and its income effect. Residents' health state is an important target which reflects a country's and regional economic development level, the overall quality of the residents and the level of the society medical care.

The countryside residents' nutrition and health condition affect the opportunities of entering the labor market and the labor productivity, influence household income level immediately and also influence the macro economic growth indirectly. The influence of the insufficiency of the health human capital investment on the countryside areas' economic level is outstanding. The countryside residents face not only few medical services, the poor medical service level, but also bear high medical service spending , the rural residents are more prone to the influence of "being into poverty by illness".

Poverty is the basic question of social development, the world bank pointed out: Poverty is not only refers to the income level is low, but also includes education poverty, health poverty, as well as the vulnerability of facing with the risk and so on. Health poverty is mainly refers to the situation of the poor are low to the availability of the health service and the health facilities, no money to treatment, and these are caused by personal income lever is low, the imperfection of medical security provided by society (Xulianying, Zhangzhizhong, Hezhizhong, 2003). The influence of the state of health on poverty mainly reflects on the following several aspects: First, diseases will directly influence the invalid's labor time and the intensity of labor, reduce the individual labor efficiency, reduce economic income. At the same time, other members of the family will reduce labor time to take care of the patients, and it will produce the adverse effect on the whole family's economic income. In addition, the high cost of health care and disease treatment will reduce the family's other investment: for example, children's education investment, production equipment investment, and affect the future economic gain.

Table I. The condition of poverty of the rural residents

Index	2000	2004	2005	2006	2007	2008
Poor standard (Yuan/people)	625	668	683	693	785	1196
The population of poverty (ten thousands)	3209	2610	2365	2148	1479	4007
Poverty rate (%)	3.5	2.8	2.5	2.3	1.6	4.2

Zhangchewei use Chinese rural poverty data to study the influence of nutrition and health on the labor productivity. The results show that nutritional intake and disease affect the farmers' labor productivity significantly. A calorie capacity increase 1% every time, the crop production's income will increase 0.75%; The time for being unable to work because of illness increase one month, the crop production's income will reduce 2300 Yuan. Weizhong use the 1993 China health and nutrition survey data to analyze the influence of health on labor supply, wage rate and the salary income. The study showed that health significantly affects the labor participation and non-agricultural employment, but the influence on wage is not significant. Liugongen, Fuzhenghong(2004) through the Chinese health and nutrition survey data to set up the individual income production function, the study showed that the health human capital is the important factor of influence per capita income; Compared with the urban population, rural population health and the economic return is bigger; Compared with men, women health and the economic return is bigger.

2. DATA SOURCES AND STATISTICAL DESCRIPTION

2.1 Data sources

This paper uses the survey of Chinese population, economic, health and nutrition, which was carried by the American north Carolina university and Chinese Health and Nutrition Survey-CHNS. This sample range includes the seven year (1989, 1991, 1993, 1997, 2000, 2004, 2006)，and conducts longitudinal survey about nine provinces which are along the east coasts, central and the west of out country (Heilongjiang, Liaoning, Henan, Shandong, Jiangsu, Hubei, Hunan, Guangxi and Guizhong). The content includes relevant community foundation, basic family situation, food and other supplies price, dietary structure, work and income, sanitation medical service, the body function and health information. This paper studies the health of the influence of human capital poverty, uses 6 new 2006 China health and nutrition survey data, and distinguishes the eastern coastal area, the central region, the central region, the western region, respectively use self-rated health status (SHE) and body mass index (BMI) to analyze the influence of rural residents health status on labor supply and income, and through Logit and Probit model to analyze the relationship of health and poverty rate. Because most of the population who are under age 18 still make nine-year compulsory education, and all or majority of expenses still be supplied by their parents; The old people who are over age 60, their lives rely mainly on the savings or by their children and government, the two parts of the crowed have no meaning to the study, so solid sample selection scope is from 18 to 60 years old. The rural residents who are studies by this paper are especially refer to those who live in rural area and the first professional for farmers, fisher men, hunter, Remove the observation value which lack of health, income level, education level and other important variables, the total sample size is 1123, sample distribution as below.

Table II. Sample distribution

Regions	Number of samples	Percentage (%)	Male (%)	Percentage (%)	People who have health insurance	Coverage (%)
Liaoning	126	11.2	53	42.1	97	77.0
Jiangsu	95	8.5	35	36.8	85	89.5
Shandong	82	7.3	51	62.2	52	63.4
East	303	27.0	139	45.9	234	77.2
Heilongjiang	190	16.9	346	182.1	530	278.9
Henan	170	15.1	96	56.5	38	22.4
Hubei	114	10.2	69	60.5	81	71.1
Hunan	88	7.8	41	46.6	3	3.4
Central	562	50.0	320	56.9	244	43.4
Guizhou	118	10.5	73	61.9	48	40.7
Guangxi	140	12.5	68	48.6	62	44.3
West	258	23.0	141	54.7	110	42.6
Total	1123	100.0	600	53.4	588	52.4

2.2 Relevant variables explanation

This paper uses EVIEWS 6.0 version statistical software to process the 2006 CHNS data. Table III is the statistical information of the total sample and regions of observation, the mean variables, standard deviation, maximum, minimum and so on. In the study of the influence of our country rural health human capital on poverty, the main index include employment rate, income, education level, health level, age and so on, below carries on the detailed explanation to these variables.

In the definition of income variable, this paper divided income into labor income and non-labor income. For rural residents, it is very hard to distinguish one person's contribution to household income, so this paper will use per capita household income as income index. Labor income includes the family's fruit and vegetable garden income, family's farm income, family's fishery income, a second career income and other cash income, non-cash income (convert into cash). Non-labor income includes ancillary revenue(only child subsidy, gas electricity gas subsidy，etc), cash income(difficult allowance, disability subsidy, welfare, the cash which is given by children of the non-family members, parents and relatives, etc) and gift income(the gifts which is given by the children of non-family members, parents, relatives, etc). This paper uses years working hours 19 as "labor participation" index. From the table III, the total sample's labor income mean was 2128.79 Yuan, in the eastern and western labor income was an average of 2271.75 Yuan and 2271.60 Yuan, and far higher than the western region of 1645.47 Yuan. The central region subsidies, cash and gifts income of the mean value index was 281.83 Yuan, accounting for about 60% of other areas. The gross income of the eastern region, the central region, the western region were respectively 2733.01 Yuan, 2555.43 Yuan and 2094.12 Yuan,

the western region was inferior to the central region about 640 Yuan. The maximum gross income was 110425 Yuan, it is 4.13 times of central region that maximum gross income is 26700 Yuan. In the years working time index, the western area's annual average working time is 1268.33 hours, higher than 257.99 hours of eastern area, equivalent to 1.56 times of central area's 811.45 hours. The disparately phases difference between maximum and minimum gross income disparity is due to a few rural residents' income become higher which is caused by the second job, and a few low health residents or other reasons' residents (such as the age or disabled)live on subsidies, relieves and savings. This does not include non-labor income and non-accounting income, so this data difference does not mean absolute difference between rich and poor.

In the china nutrition health survey (CHNS), the self-evaluation health (SEH) index divided health into four levels: Excellent, Good, Fair, poor. Residents self-evaluation health (SEH) subjective strong, and the real health status may exist for the gap, but Kaplan and Camacho (1983) study showed that self-evaluation health (SEH) reflect that personal main health information can make a good forecast of incidence and mortality. So this paper select self-evaluation health (SEH) and body mass index (BMI) as a main index which measure health. Self-health index is from 1(Poor) to 4 (Excellent), the higher the score and the better health. From the table III, the Midwest self-evaluation health status slightly higher than other areas, and each region's BMI index is similar.

In the Grossman health model theory, the relationship of health human capital and education is positively related. CHNS questionnaire divided "Formal education fixed number of year" into four stages, and give a certain value for each stage, ranging from 00 to 36 (00 said no formal education, 36 said master degree or above). This article transformed this partition value into the serial number, in the sample, each area's education fixed number of year is similar; all are between from 7.6 to 7.9, equivalent to the level of middle school second grade. The western region's education fixed number of year is 2.68 years which is slightly lower than other areas.

Table III. The basic statistical characteristics of variables

Index	Sample	Mean	Standard deviation	Max	Min	Median
Labor income (Yuan /year)	Total sample	2128.79	4825.35	110425.00	16.67	1012.50
	East	2271.75	4639.04	49108.33	25.00	1000.00
	Central	2273.60	5580.32	110425.00	32.00	1185.50
	West	1645.47	2817.61	26700.00	16.67	845.00
Ancillary revenue, cash income and gift income (Yuan / year)	Total sample	368.57	1180.25	21500.00	0.00	0.00
	East	461.26	1203.46	11000.00	0.00	0.00
	Central	281.83	1201.52	21500.00	0.00	0.00
	West	448.64	1088.47	7500.00	0.00	25.00

Total income (Yuan/ year)	Total sample	2497.36	5063.44	110425.00	20.00	1217.00
	East	2733.01	4924.60	49191.67	25.00	1316.67
	Central	2555.43	5751.39	110425.00	50.00	1333.33
	West	2094.12	3290.21	26700.00	20.00	950.00
Working time (Hours/year)	Total sample	970.08	727.81	6048.00	12.00	784.00
	East	1010.34	734.69	3360.00	36.00	784.00
	Central	811.45	648.71	4032.00	12.00	700.00
	West	1268.33	780.65	6048.00	12.00	1200.00
Family size	Total sample	4.02	1.47	10.00	1.00	4.00
	East	3.74	1.50	9.00	1.00	4.00
	Central	3.95	1.38	9.00	1.00	4.00
	West	4.52	1.50	10.00	1.00	4.00
Age (years)	Total sample	42.75	9.13	60.00	18.00	42.00
	East	44.54	9.13	60.00	19.00	44.00
	Central	41.85	9.68	60.00	18.00	41.00
	West	42.62	10.68	60.00	18.00	42.00
Years of education (years)	Total sample	7.77	2.09	15.00	5.00	9.00
	East	7.75	2.05	15.00	5.00	8.00
	Central	7.83	2.06	15.00	5.00	9.00
	West	7.68	2.18	15.00	5.00	8.00
SEH	Total sample	2.18	0.73	4.00	1.00	2.00
	East	2.24	0.69	4.00	1.00	2.00
	Central	2.07	0.76	4.00	1.00	2.00
	West	2.36	0.66	4.00	1.00	2.00
BMI (Kg/m^2)	Total sample	23.26	5.89	151.49	15.75	22.58
	East	23.98	4.51	56.46	15.75	23.24
	Central	23.60	7.30	151.49	16.67	22.66
	West	21.67	2.70	34.08	16.65	21.33

2.3 Analysis of the frame of theory and model

The theoretical frame model comes from the wage equation proposed by the American economy Mincer (1972). Mincer thought that the income of the employee was completely decided by the human capital level and personal characteristics of the employees. Namely;

$$Ln(W) = f(H, u)$$

In the Equation, W is human capital return variable, H is human capital variable, U is laborer's personal characteristic. Human capital variable H includes laborer's education level, training, health, etc. This paper uses the health status and education level as human capital variable, and takes income and labor time as human capital return variable, and through the Mincer equation

to analyze the influence of health human capital on labor productivity. In addition to health and education variables, there are some factors which affect labor productivity, such as laborers' gender, age, occupation, living areas, the family size, etc. Because all samples of this paper are farmers, so omit the professional variable, and put other observation factor into the wage equation. In addition, put some non-observed factors (personal social relation, behavior characteristic, the habit of the life, etc) into the random error μ. So the model of income and production is:

$$Ln(W) = f(Health, Age, Edu, Gender, Size, Area, Single, u) \qquad \text{(a)}$$

The equation's specific form:

$$Ln(W) = \alpha + \beta_1 Health + \beta_2 Age + \beta_3 Edu + \beta_4 Gender + \beta_5 Size + \beta_6 Area + \beta_7 Single + u \qquad \text{(b)}$$

W is income index (Y_1 means the family's per capita labor income, Income means the family's per capita income, Hour means labor time every year).

In the estimation of this model which carries the ordinary least squares (OLS), still have the following problems:

First, it is the relationship between the income and the health. In the model, we assume that health is the income's exogenous variable, this is abhorrent with the Grossman health demand model. From the above analysis, we know that both personal income level and income level of surrounding people affect the health. The study which was carried by Smith in 1999 showed that the income of the health was mainly influenced by long-term income level, and the influence of short-term income is not obvious. This data's source is the income and health level in the same period of 2006. Therefore, income health effect is lighter.

Second, it is the relationship of age, education, health and income. The analysis shows that laborer age, education and health condition are associated, and form the multiple linear in the model a. In dealing with this problem, we can use two kinds of methods. First, introduce age virtual variable. Virtual variable can reduce the influence of the continuous age variable on health status and income; control the endogenous of age and related variables. Specifically, use the residents whose age are between 18 and 30 as a reference group, define three virtual variables $Age1$, $Age2$, $Age3$ ($Age1 = 1$ says 31~40, $Age2 = 1$ says 41~50, $Age3 = 1$ says 51~60) instead of the continuous age variable. Another method is to join the interactive items into the model. We can solve the question that the influence of age change on income and health through the interactive variables of health and age, and also for a given health condition, we can analyze the influence of age on income. This paper chooses the second method. Join interactive items to the model.

In addition, design other qualitative variables which affect laborers' income such as gender, region as virtual variables. In this paper, we take the male as a benchmark, and define gender virtual variable Gender ($Gender = 1$ says men). In the factors of region, we use the east coastal

area as the reference group, define two regional virtual variables $Area_1$, $Area_2$ ($Area_1 = 1$ says the central area, $Area_2 = 1$ says the western region).

The establishment of measurement model as follows:

$$Ln(W) = \alpha + \beta_1 BMI + \beta_2 BMI_2 + \beta_3 Age + \beta_4 Age^2 + \beta_5 BMI \times Age + \beta_6 Edu + \beta_7 BMI \times Edu + \beta_9 Gender + \beta_{10} Size + \beta_{11} Area_1 + \beta_{12} Area_2 + \beta_{13} Single + \mu \quad \text{(c)}$$

Note that in the Chinese nutrition health survey (CHNS), it divided health into four levels: Excellent, Good, Fair, Poor, respectively use digital 4, 3, 2, 1 to say four kinds of health status which from the best to the worst. Here, 1, 2, 3, 4 respectively means four different health status, rather than continuous variable, so when use SHE to measure health index, this paper takes the worst health(Poor) as a benchmark, defines three self-evaluation health virtual variables which are independent each other SEH_2, SEH_3, SEH_4 ($SEH_2 = 1$ says that health condition is Fair, $SEH_3 = 1$ says that health condition is Good, $SEH_4 = 1$ says that health condition is Excellent), and the measurement model as follows:

$$Ln(W) = \alpha + \beta_1 SEH_2 + \beta_2 SEH_3 + \beta_3 SEH_4 + \beta_4 Age + \beta_5 Age^2 + \beta_6 SEH_2 \times Age + \beta_7 SEH_3 \times Age + \beta_8 SEH_4 \times Age + \beta_9 Edu + \beta_{10} SEH_2 \times Edu + \beta_{11} SEH_3 \times Edu + B_{12} SEH_4 \times Edu + B_{13} Age \times Edu + B_{14} Gender + \beta_{15} Siz + B_{16} Area_1 + B_{17} Area_2 + B_{18} Single + \mu \quad \text{(d)}$$

Table Ⅳ. The variable name and the Definition

Variable	Definition
Human capital return:	
Y_1	Per capita household labor income (Yuan / year)
Y_2	Household per capita non-labor income (including grants, cash, gift income, Yuan / year)
Income	Represents the total income, the sum of the value Y_1 and Y_2 (Yuan / year)
Hour	Working hours (hours / year)
Personal Health:	
SEH_2	If the self-rated health variables " Medium " value of 1, otherwise 0
SEH_3	If the self-rated health variable as "good" value of 1, otherwise 0
SEH_4	If the self-rated health variable as "excellent" value of 1, otherwise 0
BMI	Body mass index (kg / m^2)
Personal characteristics:	
Edu	Years of education (years)
Age	Age
$Edu \times Age$	Years of education and age interaction term

$SEH_i \times Age$	Self-rated health and age interaction term
$SEH_i \times Edu$	Self-rated health interaction term with years of education
$BMI \times Age$	Body mass index and age interaction term
$Geder$	If gender is "male", the value is 1, otherwise 0
$Single$	If "Married" is 1, otherwise 0
Family characteristics:	
$Size$	Family Size
$Area_1$	If it is the central provinces (autonomous regions) is 1, otherwise 0
$Area_2$	If it is the western provinces (autonomous regions) is 1, otherwise 0

3. THE EMPIRICAL ANALYSIS

3.1 Simple OLS model analysis

3.1.1 The OLS evaluation of the total sample

Put the labor income Y_1 (Yuan/year), the total revenue (Yuan/year), and labor time Hour (hour/year) into model c. Get the following three models.

$$Ln(Y_1) = \alpha + \beta_1 BMI + \beta_2 BMI_2 + \beta_3 Age + \beta_4 Age^2 + \beta_5 BMI \times Age + \beta_6 Edu + \beta_7 BMI \times Edu + \beta_8 Age \times Edu + \beta_9 Genger + \beta_{10} Size + \beta_{11} Area_1 + \beta_{12} Area_2 + \beta_{13} Single + \mu \quad (1)$$

$$Ln(Income) = \alpha + \beta_1 BMI + \beta_2 BMI_2 + \beta_3 Age + \beta_4 Age^2 + \beta_5 BMI \times Age + \beta_6 Edu + \beta_7 BMI \times Edu + \beta_8 Age \times Edu + \beta_9 Genger + \beta_{10} Size + \beta_{11} Area_1 + \beta_{12} Area_2 + \beta_{13} Single + \mu \quad (2)$$

$$Ln(Hour) = \alpha + \beta_1 BMI + \beta_2 BMI_2 + \beta_3 Age + \beta_4 Age^2 + \beta_5 BMI \times Age + \beta_6 Edu + \beta_7 BMI \times Edu + \beta_8 Age \times Edu + \beta_9 Genger + \beta_{10} Size + \beta_{11} Area_1 + \beta_{12} Area_2 + \beta_{13} Single + \mu \quad (3)$$

For the least squares estimate respectively, n=1123, R_2 is 0.107, 0.116, 0.089 respectively, and the regression results are as follows:

Table Ⅴ. BMI OLS estimates of health indicators

Independent variables	Y1 (1)	Income (2)	Hour (3)
BMI	-0.046	-0.030	-0.008
	(0.048)	(0.046)	(0.040)
$BMI \times BMI$	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
Age	0.005	-0.007	0.090***
	(0.039)	(0.038)	(0.033)
$Age \times Age$	0.000	0.000	-0.001***
	(0.000)	(0.000)	(0.000)

$BMI \times Age$	0.001	0.001	0.000
	(0.001)	(0.001)	(0.001)
Edu	0.050	0.172**	-0.037
	(0.105)	(0.101)	(0.088)
$BMI \times Edu$	0.000	-0.004	-0.003
	(0.003)	(0.003)	(0.003)
$Age \times Edu$	-0.001	-0.002	0.002**
	(0.002)	(0.002)	(0.001)
Gender	0.415***	0.346***	0.064
	(0.070)	(0.068)	(0.059)
Size	-0.189***	-0.213***	0.027
	(0.024)	(0.023)	(0.020)
$Area_1$	0.140**	0.048	-0.331***
	(0.081)	(0.078)	(0.068)
$Area_2$	-0.158	-0.144	0.222***
	(0.099)	(0.095)	(0.082)
Single	-0.102	-0.153	0.018
	(0.153)	(0.148)	(0.128)

The regression result shows that after controlling the factors of age, education, family scale, region and marital condition, etc, the BMI's indexes are all negative in the three models, but through the statistic we don not see that it has significant effects on the income and labor time.

In the model 1, in the statistics the factors of gender, the family size and region are significant. Under the control of other factors, the men's incomes are higher than the women's by 41.5%, the family population increases one person every time, and personal income reduces 18.9%, which is consistent with previous research. Relative to the residents who live in the eastern region, the influence of the middle area on the residents' labor income is significantly positive, the central areas' residents' personal income is 14% higher than the eastern region, and the western areas' residents' income is less than the eastern areas' by 15.8%. In the model 2 which uses Income as revenue variable, after controlling other factors, the relationship between the total income and education level is positively related. Increase a year education level every time, income will increase 17.2%. Similar with the 1 model's result, in the statistic, the influence of the family scale on income is significant. The situation in which other factors are the same, men's income is 34.6% higher than women's, the family population increases one person every time, and the personal income reduces 21.3%. The result of model 3 shows that in the statistic the age and the square of age are significant, and coefficients are 0.09 and 0.001 respectively. It shows that the age of the rural residents whose age is between 18 and 60 increase one year ,and their labor time increase 9%. The square coefficient of age is negative, it indicates that as the growth of the age, labor time rate is negative, the graph of the influence of the age on labor time is parabola form. These conclusions and daily experience are in agreement. Below, we

measure the influence of SEH on income and labor time. Put labor time Y_1 (Yuan/year), Income (Yuan/year) and labor time Hour (hour/year) into model d, and get the following three specific formula.

$$Ln(Y_1) = \alpha + \beta_1 SEH_2 + \beta_2 SEH_3 + \beta_3 SEH_4 + \beta_4 Age + \beta_5 Age^2 + \beta_6 SEH_2 \times Age + \beta_7 SEH_3 \times Age + \beta_8 SEH_4 \times Age + \beta_9 Edu + \beta_{10} SEH_2 \times Edu + \beta_{11} SEH_3 \times Edu + \beta_{12} SEH_4 \times Edu + \beta_{13} Age \times Edu + \beta_{14} Gender + \beta_{15} Size + \beta_{16} Area_1 + \beta_{17} Area_2 + \beta_{18} Single + \mu \quad (4)$$

$$Ln(Income) = \alpha + \beta_1 SEH_2 + \beta_2 SEH_3 + \beta_3 SEH_4 + \beta_4 Age + \beta_5 Age^2 + \beta_6 SEH_2 \times Age + \beta_7 SEH_3 \times Age + \beta_8 SEH_4 \times Age + \beta_9 Edu + \beta_{10} SEH_2 \times Edu + \beta_{11} SEH_3 \times Edu + \beta_{12} SEH_4 \times Edu + \beta_{13} Age \times Edu + \beta_{14} Gender + \beta_{15} Size + \beta_{16} Area_1 + \beta_{17} Area_2 + \beta_{18} Single + \mu \quad (5)$$

$$Ln(Hour) = \alpha + \beta_1 SEH_2 + \beta_2 SEH_3 + \beta_3 SEH_4 + \beta_4 Age + \beta_5 Age^2 + \beta_6 SEH_2 \times Age + \beta_7 SEH_3 \times Age + \beta_8 SEH_4 \times Age + \beta_9 Edu + \beta_{10} SEH_2 \times Edu + \beta_{11} SEH_3 \times Edu + \beta_{12} SEH_4 \times Edu + \beta_{13} Age \times Edu + \beta_{14} Gender + \beta_{15} Size + \beta_{16} Area_1 + \beta_{17} Area_2 + \beta_{18} Single + \mu \quad (6)$$

N is 1123, R_2 is 0.116, 0.122 and 0.097 respectively.

Table Ⅵ. SEH OLS estimates of health indicators

Independent variables	Y_1	*Income*	*Hour*
	(4)	(5)	(6)
SEH_2	-0.231	0.054	-0.590
	(0.583)	(0.565)	(0.488)
SEH_3	-0.776	-0.666	-0.103
	(0.695)	(0.674)	(0.582)
SEH_4	-1.305	-1.505	-1.740
	(1.278)	(1.239)	(1.070)
Age	0.036	0.029	0.079***
	(0.035)	(0.034)	(0.029)
$Age \times Age$	0.000	0.000	-0.001***
	(0.000)	(0.000)	(0.000)
$SEH_2 \times Age$	0.003	0.000	0.017**
	(0.010)	(0.010)	(0.009)
$SEH_3 \times Age$	0.000	0.002	0.010
	(0.012)	(0.012)	(0.010)
$SEH_4 \times Age$	0.018	0.021	0.042***
	(0.021)	(0.020)	(0.017)
Edu	0.080	0.128	-0.121**
	(0.087)	(0.084)	(0.073)
$SEH_2 \times Edu$	-0.001	-0.019	0.011
	(0.049)	(0.047)	(0.041)

$SEH_3 \times Edu$	0.076	0.052	-0.015
	(0.055)	(0.054)	(0.046)
$SEH_4 \times Edu$	0.003	0.025	0.020
	(0.101)	(0.098)	(0.085)
$Age \times Edu$	-0.003	-0.003**	0.003**
	(0.002)	(0.002)	(0.001)
Gender	0.395***	0.330***	0.077
	(0.070)	(0.068)	(0.059)
Size	-0.189***	-0.214***	0.026
	(0.024)	(0.023)	(0.020)
$Area_1$	0.130	0.043	-0.317
	(0.081)	(0.078)	(0.068)
$Area_2$	-0.134	-0.121	0.225***
	(0.097)	(0.094)	(0.081)
Single	-0.086	-0.139	0.018
	(0.153)	(0.149)	(0.128)

The estimate result which takes SEH as a measure health index is similar with the BMI index's estimate result. After controlling other factors, the influence coefficient of age is 0.079, age increase one year every time, and the labor time increase 7.9%. The coefficient of the square of age is -0.001， it shows that the influence of age increase on the labor time increase is negative, and the graph is parabolic. In the model 4 and 5, the coefficient of the gender factor is positive, and it shows that under controlling of other factors, men's labor income is higher than women's by 39.5%, and men's total income is 33% higher than women's. The family scale factor in the statistic is significant, its coefficient is -0.189 and -0.214 respectively. Family population increases one person, family per capita labor income reduces 18.9%, and the total income reduces 21.4%, it is the same with the analysis result of the model 3. In the model 6, the coefficient of education level is negative, personal education increase one year every time, the labor time reduces 12.1%, and its reason may lie in the particularity of this paper's sample.

Different from a lot of study results, the relationship between health index, income and labor time is not significant, the coefficient of the health index is negative. The reason of causing the result mainly lies in: First, the income of this paper is mainly fruit and vegetable garden income , agricultural income and fishery income ,and family cultivated land area and fishery scale is relatively fixed. Furthermore, this paper's personal income is the simple per capita income which accords to the number of family members, and can not show the personal labor contribution accurately. This also is the shortage of this paper.

3.1.2 The OLS estimation of three zones

In the evaluation of income production function model of the three areas, just removing area variable from model 2 and 5, and estimating three zones separately. Models are as follows:

$$Ln(Income) = \alpha + \beta_1 BMI + \beta_2 BMI_2 + \beta_3 Age + \beta_4 Age^2 + \beta_5 BMI \times Age + \beta_6 Edu + \beta_7 BMI \times Edu + \beta_8 Age \times Edu + \beta_9 Gender + \beta_{10} Size + \beta_{11} Single + \mu \quad (e)$$

$$Ln(Income) = \alpha + \beta_1 BMI + \beta_2 BMI_2 + \beta_3 Age + \beta_4 Age^2 + \beta_5 BMI \times Age + \beta_6 Edu + \beta_7 BMI \times Edu + \beta_8 Age \times Edu + \beta_9 Edu + \beta_{10} SEH_2 \times Edu + \beta_{11} SEH_3 \times Edu + \beta_{12} SEH_4 \times Edu + \beta_{13} Age \times Edu + \beta_{14} Gender + \beta_{15} Size + \beta_{16} Single + \mu \quad (f)$$

Through the analysis of the OLS model of the three areas, we found that the analysis result is basically same with the total sample's estimated result. Under the condition in which other factors are the same, the higher education level, the higher income. The analysis results of two models both show: after controlling other factors, men's income is higher than women's income, as the number of the family members increase, the income decrease. The result of the eastern area's model f shows that age and the square of age are statistically significant with income. The coefficient of the age is positive, the coefficient of the square of age is negative, namely the age of the western region increase each unit, and personal income will increase 15.6%, as the age increases, the income variation rate decreases.

Table Ⅶ. BMI health indicators of the three zones OLS estimates

	Eastern Region	Central Region	Western Region
R_2	0.135	0.104	0.130
n	303	561	257
BMI	-0.055	-0.012	-0.079
	(0.125)	(0.061)	(0.292)
$BMI \times BMI$	0.000	0.000	0.003
	(0.001)	(0.000)	(0.006)
Age	0.077	-0.017	-0.051
	(0.087)	(0.053)	(0.085)
$Age \times Age$	-0.001	0.000	0.001**
	(0.001)	(0.000)	(0.001)
$BMI \times Age$	0.001	0.002	-0.001
	(0.002)	(0.001)	(0.003)
Edu	-0.042	0.203	0.141
	(0.291)	(0.124)	(0.324)
$BMI \times Edu$	0.006	-0.006**	-0.002
	(0.008)	(0.003)	(0.014)
$Age \times Edu$	-0.003	-0.001	-0.003
	(0.004)	(0.002)	(0.003)
$Gender$	0.372***	0.325***	0.343***
	(0.140)	(0.089)	(0.156)
$Size$	-0.248***	-0.178***	-0.250***
	(0.047)	(0.031)	(0.051)
$Single$	-0.023	-0.120	-0.209

	(0.306)	(0.226)	(0.279)

Table Ⅷ. Three areas of health indicators SEH OLS estimates

	Eastern Region	Central Region	Western Region
R_2	0.157	0.114	0.148
n	303	561	257
SEH_2	-0.847	-0.232	1.463
	(1.495)	(0.646)	(1.945)
SEH_3	-3.370***	-0.754	1.405
	(1.650)	(0.889)	(2.043)
SEH_4	-2.784	-1.870	-2.173
	(2.563)	(1.690)	(3.419)
Age	0.156**	0.030	-0.058
	(0.080)	(0.049)	(0.074)
$Age \times Age$	-0.001**	0.000	0.001**
	(0.001)	(0.000)	(0.001)
$SEH_2 \times Age$	-0.012	0.012	-0.031
	(0.025)	(0.012)	(0.039)
$SEH_3 \times Age$	0.025	-0.001	-0.033
	(0.029)	(0.015)	(0.040)
$SEH_4 \times Age$	0.026	0.034	-0.003
	(0.051)	(0.027)	(0.051)
Edu	0.061	0.151	0.137
	(0.237)	(0.109)	(0.201)
$SEH_2 \times Edu$	0.137	-0.043	-0.040
	(0.130)	(0.053)	(0.163)
$SEH_3 \times Edu$	0.232**	0.096	-0.047
	(0.138)	(0.070)	(0.169)
$SEH_4 \times Edu$	0.185	-0.003	0.180
	(0.232)	(0.121)	(0.293)
$Age \times Edu$	-0.005	-0.003	-0.003
	(0.005)	(0.002)	(0.003)
$Gender$	0.400***	0.316***	0.313**
	(0.141)	(0.090)	(0.159)
$Size$	-0.252***	-0.184***	-0.251***
	(0.048)	(0.032)	(0.051)
$Single$	-0.025	-0.115	-0.137
	(0.310)	(0.228)	(0.284)

3.2 The analysis of the Probit model and the Logit model

The above is the least-square estimation of the relationship of health, income and labor time, this section analyze the relationship between health and the poverty incidence rate.

Data sources are same with the above, it is 2006 data of CHN. According to the 2007 Chinese statistical yearbook, Our country's rural absolute poverty line in 2006 is 693 Yuan/year, this paper takes poverty line as a benchmark, and defines virtual variable Poverty, when the year income is below 693 Yuan, its value is 1, otherwise it is 0. For the evaluation of the binary form's response variable, this paper use Probit model and Logit model to analyze. Assure the personal poverty is affected by the factors of age, gender, marital status, the family size education level and region, etc. we take health index BMI as, estimate equation is as follows:

$$P(Poverty=1|X)=\Phi(\alpha+\beta_1 BMI+\beta_2 Age+\beta_3 Age^2+\beta_4 Edu+\beta_5 Gender+\beta_6 Size+\beta_7 Single)$$

$Poverty$ is virtual variable, $Poverty$, $P(Poverty=1|X)$ says the probability of poverty that residents began, the meaning of other variables is the same with above. The estimated result is as follows:

Table Ⅸ. Probit model analysis

Variable	Total	East	Central	West
Obs	1123	303	561	257
Obs with $Poverty=0$	798	215	420	161
Obs with $Poverty=1$	325	88	141	96
McFadden R_2	0.055	0.068	0.052	0.057
BMI	-0.014	0.009	-0.022	-0.044
	(0.010)	(0.017)	(0.016)	(0.032)
Age	0.042	0.005	0.054	0.078
	(0.034)	(0.066)	(0.052)	(0.065)
$Age\times Age$	-0.001	0.000	-0.001	-0.001
	(0.000)	(0.001)	(0.001)	(0.001)
Edu	0.010	0.033	-0.024	0.050
	(0.020)	(0.039)	(0.030)	(0.038)
$Gender$	-0.277	-0.321	-0.236	-0.284
	(0.084)	(0.166)	(0.124)	(0.172)
$Size$	0.202	0.224	0.195	0.173
	(0.029)	(0.055)	(0.044)	(0.056)
$Single$	-0.047	-0.176	0.009	-0.139
	(0.194)	(0.390)	(0.326)	(0.322)

Table Ⅹ. Logit model analysis

Variable	Total	East	Central	West
Obs	1123	303	561	257
Obs with $Poverty = 0$	798	215	420	161
Obs with $Poverty = 1$	325	88	141	96
McFadden R_2	0.054	0.068	0.052	0.057
BMI	-0.023	0.016	-0.037	-0.072
	(0.017)	(0.028)	(0.028)	(0.051)
Age	0.076	-0.003	0.110	0.137
	(0.057)	(0.109)	(0.092)	(0.111)
$Age \times Age$	-0.001	0.000	-0.002	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)
Edu	0.020	0.061	-0.041	0.085
	(0.033)	(0.066)	(0.052)	(0.062)
Gender	-0.473	-0.568	-0.402	-0.480
	(0.142)	(0.283)	(0.210)	(0.281)
Size	0.333	0.366	0.333	0.282
	(0.048)	(0.093)	(0.075)	(0.095)
Single	-0.093	-0.350	0.060	-0.251
	(0.337)	(0.702)	(0.570)	(0.545)

Because the form of Probit model and the form of Logit model are different, the result of table Ⅸand the result of table Ⅹ have a large discrepancy. In order to make a facilitate comparison , we adjust the model coefficients according to the method of Wood Richie 《the modern view of econometrics introductory》.After the adjustment, the coefficients of the two models are basically the same (table XI , table XII). The relationship between BMI value and poverty rate is negative, the better the health, the less probability the poverty happen. In the total sample, BMI value increases each unit, the poverty rate reduces by 0.6%. The BMI of the central region and the western region increases each unit, the likelihood of happened poverty reduces by 0.9% and 1.8%, the influence of the western region on poverty is significant, the coefficient is six times as large as eastern area's coefficient. Therefore, to improve the level of health human capital is the effective way to solve poverty. In the same condition, age increase each unit, the poverty rate will be raised by 2% or so. The coefficient of the central region is smaller, about 0.2%, the age of the western resident increase each unit, the likelihood of poverty will increase by 3.4%. The coefficient of the square of age is almost zero; it shows that the influence of the age's factor on the poverty rate is very stable. The coefficient of the gender variable is negative;

it shows that women are more prone to poverty than men. Similar with the above analysis, family members increase a person each time, the incidence rate of poverty will increase by 8%. Married family's poverty rate is lower than the unmarried or divorced family's poverty rate.

Table XI. Adjusted Probit Model Analysis

Adjusted Probit value				
Variable	Total	East	Central	West
BMI	-0.006	0.003	-0.009	-0.018
	(0.004)	(0.007)	(0.007)	(0.013)
Age	0.017	0.002	0.021	0.031
	(0.013)	(0.026)	(0.021)	(0.026)
Age×*Age*	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Edu	0.004	0.013	-0.010	0.020
	(0.008)	(0.016)	(0.012)	(0.015)
Gender	-0.111	-0.128	-0.094	-0.114
	(0.034)	(0.067)	(0.050)	(0.069)
Size	0.081	0.089	0.078	0.069
	(0.011)	(0.022)	(0.018)	(0.023)
Single	-0.019	-0.070	0.004	-0.055
	(0.078)	(0.156)	(0.131)	(0.129)

Table XII. Adjusted Logit Model Analysis

Adjusted Probit value				
Variable	Total	East	Central	West
Age	0.019	-0.001	0.027	0.034
	(0.014)	(0.027)	(0.023)	(0.028)
Age×*Age*	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Edu	0.005	0.015	-0.010	0.021
	(0.008)	(0.016)	(0.013)	(0.016)
Gender	-0.118	-0.142	-0.100	-0.120
	(0.035)	(0.071)	(0.053)	(0.070)
Size	0.083	0.092	0.083	0.071
	(0.012)	(0.023)	(0.019)	(0.024)
Single	-0.023	-0.087	0.015	-0.063
	(0.084)	(0.176)	(0.143)	(0.136)

4. FORTH THE MAIN CONCLUSION OF EMPIRICAL RESEARCH

The article based on the theory of Ming harp wage equation to set up healthy production function. Our country's rural health influenced on the income, labor time and poverty rate analysis by the least squares method OLS model, Probit model and the Logit model. Sample is the last Chinese nutrition and health survey CHNS2006's section data. There nine provinces (autonomous regions) of the coast, in the central and west are all include in the sample. Questionnaire contained various information as community basic condition, family condition, personal diet structure, work, income, health facilities medical services and health condition. We can draw this conclusion by the empirical analysis.

First, BMI and poverty rate are negative correlation relationship in the Probit model and the Logit model. In all samples BMI increase each unit reducing by 0.6% the poverty rate. In the central and west area BMI increase each unit the possibility of poverty rate will reduce 0.9% and 1.8%, the health condition influence poor is observably in the west the coefficient is 6 times of east. Visible one of the effective methods to solve poverty is improve the health level of human capital.

Next, gender, family scale, level of education are impact income, labor time and poverty rate statistically significant under the same other factors. The results said, man's income is 30% higher than woman's; family member number increase each one reducing personal income 20%, increasing poverty rate 8%. Labor time increase 9%, poverty rate 2% as age increase each unit. Education level and total income are positively relate, after controlling other factors. One additional year educated income will increase 17.2%. These results are the same with most research results.

Third, by estimate the three area use OLS model Probit model and Logtit model, we found the result of analysis nearly the same as the estimate of sample. Compared with east inhabitant the central the labor income significant positive correlation, the inhabitant personal income is 14% higher the central then the east, 15.8% lower the east then the west. The influence statistically significant of the age and the age square in the east. In the east the age increase each unit personal income will increase 15.6%, the rate of increase reduce by the age raise. In the west the age increase each unit the possible of poverty rate will increase 3.4%. The higher education level the higher income, as the same other factor.

Last, in the OLS model based on the same age, education ,gender, family scale, area, Marital status, country inhabitant's health index influence income and labor time statistics not significant. The results may like these first, the income in the article is family orchard or garden income, farmer and fish income, however, square of family cultivated land and fish scale are relatively fixed. What else personal income in the article is simple average among family member, can't exactly show personal labor contribution. What are the deficiencies of the research.

5. CONCLUSION AND POLICY RECOMMENDATIONS

This article's study is the different of rural regional in our country by the angle of healthy human capital. In general the nine province's inhabitant which in the article have different state of health and health service condition. After comparison we can draw the conclusion that Jiangsu and Shandong province have higher rural inhabitant's healthy human capital but Guizhou and Guangxi province are lower; the three area have difference either. East is higher than west. What we found by analysis the factor of rural health demand model is as healthy capital marginal productivity diminishing the rate of health allowance for depreciation with a median age go up the customer's health demand reduce but demand of medical treatment raise; after the cost of medical treatment rise the customer's health demand reduce income and medical insurance will increase customer's demand of health. The positive analysis in fifth chapter said that gender, family scale and education level have effect significant statistically to rural inhabitant's labor income; BMI is negative correlation with poverty rate; man's income more than woman the more family member the less income when other factor are the same; in the same condition the income in the west is 15.8% lower than east, age rise each unit the poverty rate rise 3.4% in the west.

Labor productivity and the chance to get in the labor market are affected by rural inhabitant's nutrition and health condition what directly influence family income level. Several advices was put forward to control difference expend between city and country and low poverty rate in this article from health human capital.

First, government should pay more attention to teach rural inhabitant to knowledge of medical and health aspects enhance consciousness on investment health. The conclusion said that life styles like smoking drinking indiscipline life and mental condition will influence personal health. Youngsters' mental level and physical quality in a certain extent depends on dietary form what influence labor force in the future. Teach rural inhabitant give up there unhealthy eating habit and life styles put up good habits by propagandize healthy knowledge and prevention knowledge. Health investment theory should be popularized to improve health of human capital investment. Could let residents recognize that health not only a kind of consumer goods but a kind of investment, what can extend life length, increase labor time, improve family income. Correct medical consciousness as regular physical examination, catch earlier condition, instant to doctor should be guide.

Second, to increase investment to health service as rural technical personnel and sanitation. Our country rural health service popularity is low. Chinese health statistics yearbook survey result said every thousand population health care and health workers in part of remote areas are one-tenth less than city. Some factors restricting raise of the rural health level such as poor medical condition, aging medical equipment, less of health workers, generally low service technical level. Rural medical service agencies should be increase the same time corresponding healths personnel must be allocate. Government should strengthen personnel management, regularly education, raises technical level, cultivate qualified medical talents.

Third, rural cooperative medical system be perfect cooperative medical coverage been expand. These years medical service prices have grow, rural health costs 19 Yuan per person in 1990 in 20 years raised 19 times to 246 Yuan in 2008, the speed faster than rural personal income. Because price of medical service rise many families being into poverty by illness. Part of medical expenses been assume by rural cooperative medical system reduce influence from medical service price change to health needs. Rural medical cooperative system been implementation, rural cooperative medical insurance the system of send salary combining our characteristics find measures for the implementation what suit for our area, expending coverage and achieve universal insurance.

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