

# Analysis of the Relationship between Urban and Rural Women's Human Capital and Income Based on OLS Regression

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**Abstract**—This paper uses the data obtained from the 2013 Urban and Rural Residents' Income Distribution and Living Conditions Survey Questionnaire from China Economic Climate Monitoring Center of National Bureau of Statistics and uses OLS regression to empirically analyze the impact of various factors of urban and rural women's human capital on their income levels. The results show that the increase in investment in all aspects of women's human capital (education, health and work experience) has significantly increased women's income, men's return on investment of health is generally greater than that of women whereas women's work experience has a greater impact on their income levels than men.

**Index Terms**—Income, human capital, gender, OLS.

## I. INTRODUCTION

With the rapid development of economic, people's income and living standards have continued to improve. The absolute household income per capita of Chinese urban and rural residents increased from 343.4 yuan in 1978 to 2,6955.1 yuan in 2013, which shows that the people's income level has achieved tremendous growth. But at the same time, the distribution of social income is not balanced. Obviously, there are many factors that cause changes in residents' income. This article will analyze the impact of female human capital on their income and the difference in the return on human capital investment between gender.

## II. LITERATURE REVIEW

The return on investment of human capital to personal income is very obvious and many studies in this field have been carried out in the existing literature. Wei Zhong believes that investment in human capital can improve people's profitability from both production capacity and allocation capacity, thereby increasing people's income. [1] Li Shi believes that the rate of return of the labor market to human capital is gradually increasing, which is mainly reflected in the ever-expanding population of different education levels and the income gap between technical and non-technical personnel. [2] Martins found that according to the human capital theory, high-income industries often have employees with high levels of human capital [3], [4].

Investment in human capital can be divided into many aspects, among which investment in education has a

significant impact on personal income. Long Cuihong pointed out that the income distribution gap caused educational inequality but with the improvement of educational equity, the income inequality did not be improved. [5] Zhang Dongping and Bai Juhong found that there are significant differences in the rates of illiteracy and semi-illiteracy in areas with different income levels and the proportion of people with a high school degree or above. [6] Wu Xiangpeng believes that investment in education plays an important role in the income distribution of developing countries. [7] The rate of return on investment is different at different stages of education, and the difference in family income further leads to different levels of education. Chen Zongsheng *et al.* [8] found that the correlation between different education stages and income levels is different. The low-income group has a relatively large population with a low-level (below junior high school) diploma, and a relatively small population with a high-level (college-level or above) diploma; while the high-income group has a relatively large population with a high-level (college-level and above) diploma and the population with a low-level (below junior high school) diploma is relatively small. Zhang Junsen found that the rate of return on human capital in education has continued to increase and the importance of investment in education in the various influencing factors of income disparity has gradually increased. [9] Glomn and Ravikumar believe that for developing countries with more low- and middle-income people, the average public education system can reduce the difference in education level, thereby reducing the gap in personal income; while in the social human capital stock is higher Private education in developed countries that can promote social development in developing countries requires a higher level of investment, which can easily lead to further deterioration of social income inequality [10], [11].

Investing in healthy capital in human capital can also increase personal income. Wei Zhong believes that the increase of people's investment in health capital in rural areas gives farmers more non-agricultural employment opportunities and increased income [1]. Du Xiuzong believes that the increase in human capital investment quantified by per capita food expenditure, per capita health care expenditure and per capita education expenditure has significantly increased the income of urban residents [13].

This paper divides human capital into three aspects: education level, health status, and work experience, and uses OLS regression to analyze the impact of different female

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human capital investments on their income.

### III. MODEL CONSTRUCTION

The basic form of the OLS regression equation used in this article is as follows:

$$\ln inc = \beta_0 + \beta_1 hea + \sum_{f=1}^9 \alpha_f edu_f + \beta_2 exp + \varepsilon \quad (1)$$

where  $\ln inc$  is the logarithm of the residents' income,  $hea$  is the health status,  $edu$  is the number of years of education,  $exp$  is the work experience, and  $\varepsilon$  is the random error term.  $edu_1$ ,  $edu_2$ ,  $edu_3$ ,  $edu_4$ ,  $edu_5$ ,  $edu_6$ ,  $edu_7$ ,  $edu_8$ ,  $edu_9$  respectively

$$\ln inc = \beta_0 + \beta_1 hea + \beta_2 edu + \beta_3 exp + \beta_4 gen + \beta_5 gen * hea + \beta_6 gen * exp + \varepsilon \quad (2)$$

### IV. STATISTICAL ANALYSIS

#### A. Variable Definitions

- Annual income of residents,  $inc$ . The total work income of each resident in 2013 (wage or net operating income, etc.).
- Health status,  $hea$ . This article divides the health status into five types: very good, good, fair, bad, and very bad. Taking "very good" as the reference group, set "good", "fair", "bad", and "very bad" "Four dummy variables.
- Years of education,  $edu$ . Measured by the number of years that the labor force has received standardized

represent the dummy variables of have not attended school (including non-formal education such as literacy classes), elementary school, junior high school, high school, vocational high school/technical school, technical secondary school, junior college, undergraduate and postgraduate degree.  $\alpha_f$  is the rate of return on education at each corresponding education level.  $\beta_0$  is a constant term,  $\beta_1$  represents the rate of return on healthy human capital,  $\beta_2$  represents the rate of return on education and  $\beta_3$  represents the rate of return on work experience.

On the basis of Model 1, the gender dummy variable and its interaction terms with other human capital elements except education level are included in Model (2) which is as follows:

school education and divided into nine stages of education including non-school (including non-formal education such as literacy classes), elementary school, junior high school, high school, vocational/technical school, technical secondary school, junior college, college, undergraduate and postgraduate. Using students who have not attended school (including non-formal education such as literacy classes) as the reference group, eight dummy variables have been set up which respectively represent the other eight education stages.

- Work experience,  $exp$ . The year in which the worker has engaged in the job as of 2013.

TABLE I. DESCRIPTIVE STATISTICS OF MAIN VARIABLES

Variable	Number of samples			Mean			Standard deviation
	All	Women	Man	All	Women	Men	
Logarithm of residents' income ( $\ln inc$ )	5530	2424	3106	10.28	-	-	0.82
State of health ( $hea$ )							
Good	2695	1184	1511	0.49	0.49	0.48	0.50
Fair	1028	453	575	0.19	0.19	0.18	0.39
Bad	107	40	67	0.02	0.02	0.02	0.14
Very bad	10	4	6	0.00	0.00	0.00	0.04
Education level ( $edu$ )							
Elementary school	265	128	137	0.05	12.21	12.26	0.21
Junior high school	1435	601	834	0.26			0.44
High school	1036	446	590	0.19			0.39
Vocational/Technical School	247	88	159	0.04			0.21
Technical secondary school	401	195	206	0.07			0.26
Junior college	1045	462	583	0.19			0.39
Undergraduate	967	440	527	0.18			0.38
Postgraduate	96	37	59	0.02			0.14
Work experience ( $exp$ )	5530	2424	3160	11.55			11.47
gender ( $gen$ )	5530	2424	3106	0.44	-	-	0.50

#### B. Sample Description

##### 1) Data sources

The data used in this article is the data obtained from the 2013 survey questionnaire on income distribution and living conditions of urban and rural residents of the China Economic Climate Monitoring Center of the National Bureau of Statistics. This survey mainly includes the total personal income, gender, education level, health status, working experience, etc. in 2013. A total of 5,530 people is used for

analysis, of which 3,106 were male samples and are 2424 female samples, accounting for 56.17% and 43.83% of the overall sample respectively.

##### 2) Health state

As it is shown in Table I, the average resident income is 38318.61 yuan and the number of laborers whose health status is respectively very good, good, average, bad, and very bad account for 30.56%, 48.73%, 18.59%, 1.93%, and 0.18% of the total, indicating that urban and rural residents are

generally healthy. The percentages of women’s health status are 30.65%, 48.84%, 18.69%, 1.65%, and 0.17% while males are 29.84%, 47.82%, 18.20%, 2.12%, and 0.19%. It can be seen that the ratio of very good, good and average of women is higher than that of men while the ratio of poor and very bad health of women is lower than that of men. That is, women’s overall health is slightly better than men.

3) *Education level*

At all levels of education, the education level of urban and rural residents is in the majority of junior high schools, high schools, junior colleges and undergraduate, and their proportions are 25.95%, 18.73%, 18.90%, and 17.49% respectively, of which the number of people at junior high school education level is the largest. There are only a few people who have never attended school, or at the level of elementary school, vocational /technical school, technical secondary school and postgraduate. Their proportions are 0.69%, 4.63%, 4.47%, 7.25%, and 1.47% respectively. There is no significant difference between the average number of years men and women receive education. That is to say, the education level of men and women among urban and rural residents is generally not significantly different. The number of females who have not attended school or have elementary

school, junior high school, high school, vocational/technical school, technical secondary school, junior college, undergraduate, postgraduate education respectively accounted for 1.11%, 5.28%, 24.79%, 18.40%, 3.63%, 8.04%, 19.06%, 18.15%, 1.53% while the number of males who have not attended school or have primary school, junior high school, high school, vocational/technical school, technical secondary school, junior college, undergraduate, postgraduate education respectively accounted for 0.35%, 4.34%, 26.39%, 18.67%, 5.03%, 6.52%, 18.45%, 16.68%, 1.87%. It can be seen that the number of urban and rural women receiving lower education is generally lower than that of men, and the proportion of uneducated women is higher than the proportion of uneducated men. But the proportion of people receiving higher education shows no significant difference between gender.

4) *Work experience*

In terms of work experience, the average working years of the overall labor force is 11.47 years, the average working experience of men is 12.65 years and the average working experience of women is 9.96, indicating that women's work experience is generally not as rich as that of men.

TABLE II. ESTIMATED RATE OF RETURN ON HUMAN CAPITAL: OLS

Variable	Model 1	Model 2	Variable	Model 1	Model 2
State of health			State of health		
Good	-0.109*** (0.033)	-0.060** (0.029)	Postgraduate	1.361*** (0.184)	
Fair	-0.123*** (0.043)	-0.133*** (0.037)	Work experience	0.018*** (0.002)	0.013*** (0.001)
Bad	-0.451*** (0.115)	-0.222*** (0.089)	Gender (woman=1)		-0.260*** (0.040)
Very bad	-0.306* (0.353)	-0.127* (0.286)	Gender*Good		-0.042* (0.044)
Years of education		-0.068*** (0.004)	Gender*Fair		0.007* (0.056)
Elementary school	0.273* (0.150)		Gender*Bad		-0.242* (0.144)
Junior high school	0.390*** (0.141)		Gender*Very bad		-0.182* (0.452)
High school	0.575*** (0.143)		Gender*Work experience		0.004** (0.002)
Vocational/Technical School	0.643*** (0.159)		Constant term	8.787*** (0.872)	9.394*** (0.588)
Technical secondary school	0.669*** (0.148)		Number of samples	2424	5530
Junior college	0.818*** (0.143)		Prob > F	0.000	0.000
Undergraduate	1.042*** (0.145)		R-squared	0.296	0.280

Note: The robust standard errors are in parentheses. \*\*\*, \*\*, \* indicate that the results are significant at the levels of 1%, 5%, and 10%, respectively.

C. *Analysis of Regression Results*

This paper uses Stata 13.0 to perform ordinary least squares regression on models (1) (2). In Table II, model (1) uses female samples to estimate the impact of female human capital elements on their income. Model (2) uses all samples, add gender dummy variables and interaction terms between gender and various human capital elements in the model to explore the different effects of female and male human capital on their income. Since the maximum variance inflation factor exceeds 10 when the interaction item of gender and education level is added, this interaction item is removed and the interaction item of gender and other human capital elements is retained.

First, it can be seen that in Model 1, the regression coefficients for good, fair, bad and very bad health conditions are significantly negative and generally show a decreasing trend, that is, compared with women with very good health conditions, the annual income of women with good health decreased by 10.9%, that of women with fair health decreased by 12.3%, that of women with poor health decreased by 45.1% and that of women with very poor health decreased by 30.6%. Therefore, women's health status is positively related to their income.

Second, there is a positive impact of female educational human capital on their income. It can be seen from Model 1 that compared with women who have never attended school,

the income of women who graduated from elementary school increased by 27.3%, that of women who graduated from junior high school increased by 39.0%, that of women who graduated from high school increased by 57.5% and that of women who graduated from vocational/technical school increased by 57.5%. The income of women who graduated from technical secondary school increased by 66.9%, that of women who graduated from junior college increased by 81.8%, that of women who graduated from university increased by 104.2% and that of women who are postgraduate increased by 136.1%. The return on an additional year of each education stage is 4.6% for elementary school, 3.9% for junior high school, 5.5% for high school, 8.4% for vocational/technical school, 9.3% for technical secondary school, 8.1% for junior college, 11.7% for undergraduate and 10.6% for postgraduate. It can be seen that the rate of return on undergraduate and postgraduate education is the highest and the impact of primary school and junior high school education on income is not much different. This is because the popularization of compulsory education has enabled many women to reach the level of junior high school education. But the return on education of high school is lower than that of vocational/technical schools and technical secondary schools. This also shows that direct work after high school is generally not as good as direct work after graduation from vocational/technical schools and technical secondary schools, which means after graduating from high school, continue to accept college or university can effectively increase income levels.

Third, in Model 1, the economic income can increase by 1.8% for every additional year of work experience that women accumulate. So, the accumulation of women's work experience can significantly increase their income.

Fourth, it can be seen from Model 2 that the regression coefficients of the interaction terms between the gender dummy variable and the four dummy variables of health status are statistically significant. Men with very good physical health have 26% higher annual income than women and men with good health have 4.2% higher annual income than that of women. Men with average health have an annual income of 0.7% lower than women. Men with poor health have an annual income of 24.2% higher than women. Men with very poor health have an annual income 18.2% higher than women. Therefore, there is a significant difference in the return on health between men and women. The cross term of gender and work experience in Model 2 is significant at the level of 5%, and the return on each additional year of work experience of women is 0.4% higher than that of men. So, there is a significant difference between the return on the work experience of men and women.

## V. ENDOGENOUS PROBLEMS

The estimation bias that may be caused by endogeneity in this article is mainly reflected in two aspects. One is that human capital factors affect income while income also affects human capital factors. High-income earners are able to have better medical and educational conditions and high income may also be the reason for poor health. This is the endogeneity caused by the mutual causation and mutual influence between the explanatory variables and the

explained variable. The second is that factors such as personal ability and family background may affect income, education level and health status. But it is difficult to observe or obtain those statistic data, thus they are not included in this model.

## VI. CONCLUSION

This paper uses the expanded Mincer's income equation to do OLS regression and analyzes the relationship between health, education, work experience and economic income. The results show:

The improvement of health status can significantly promote income growth. Compared with women with very good health conditions, good, fair, bad and very bad health conditions will reduce women's wages by 10.9%, 12.3%, 45.1% and 30.6%, respectively.

The improvement of education level can significantly promote income growth. The average return on education is 7.9%. With the popularization of compulsory education, people's education level has generally risen. The rate of return on income at all stages of education has generally increased, among which the rate of return on undergraduate education is the highest.

Accumulation of work experience can significantly promote income growth. The average return on work experience is 1.8%. There is a significant difference in the rate of return of health status and work experience to income. Men with very good, good, bad and very bad health have higher incomes than women, and women with fair health have higher incomes than men. The return on the work experience of women is 0.4% higher than that of men.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

## AUTHOR CONTRIBUTIONS

In the whole process, the author herself collects, organizes, thinks, revises and finally completes this article.

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