Regional Income, Labor Income Tax and Human Capital Accumulation

-Based on the test of panel data model with variable coefficient

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***Abstract*—The supply of human capital depends on income level and the labor income tax. This paper evaluates the provinces' average effective labor income tax rate and the level of human capital in China applying the international commonly used assessment methods. Then analyses the Influence of regional revenue level and the effective labor income tax rate on human capital and its inner logic using provincial panel data model with variable coefficient in the years 2008-2012. And further analyses the relationship differences of regional revenue, effective labor income tax rate and the human capital among provinces in China. The study finds that regional revenue level and human capital accumulation are positively correlated. The income effect is greater than the substitution effect for taxation on labor income in China's current taxation systems. But the impact is different among regions. Human capital is significantly and positively correlated to the effective labor income tax rate, but the positive correlation to the regional per capita income is not significant in the Eastern China. Human capital accumulation, regional per capita income and effective labor income tax rate are significantly and positively correlated in the Central and Western China. Finally this paper explains the empirical results and puts forward some measures to improve the human capital accumulation**.

Keywords- regional income; effective labor income tax rate; human capital

I. INTRODUCTION

Economic development has shown obvious imbalance in different countries in the world. Developed countries continuously improve the level of national economy with advanced technology and abundant human resources; while developing countries don't have the technology conditions for independent innovation, because human capital and technology in developing countries are limited and with low quantity. For developing countries, the human capital constraints on economic growth is more obvious compared with physical capital. Ben-habib and Spiegel (1994) [1] indicated the effect of technology transfer in underdeveloped countries was not obvious based on the calculation of the threshold effect of human capital impacting technology absorption, and the effect of technology transfer in developed countries was significant. Acemoglu and Zilibotti (1999) [2] clearly put forward the problem that labor force (human capital) did not match with the introduction of technology in developing countries. And by the study of middle-income countries, we could find the level of human capital is the crucial factor to whether or not a middle income country can successfully stride over the Middle Income Trap.

After 20 years of reform and opening up policy, China has absorbed and imitated the advanced technology from developed countries for a long time. Human capital has been accumulated and reached to a certain level, the economic has been greatly improved, but to achieve further economic development in the next step, China should rely on innovation and human capital . At present, the human capital just reaches the critical value of technology imitation in China, and can not meet the need of comprehensive and independent innovation. And human capital varies greatly with different regions, therefore, the study of human capital has important practical significance during China's transition periods.

II. LITERATURE REVIEW

The level of economic development could have an impact on human capital accumulation. And there exists differences in the level of per capita income in the countries with different income levels. Therefore, the evaluation on income and leisure is different for different individuals in different countries. Under normal circumstances, the higher income level, the higher evaluation of leisure. Therefore, if the labor income tax reduce the opportunity cost of leisure, the substitution effect of human capital could be greater than the income effect, People are more likely to reduce the supply of human capital especially when the supply elasticity of human capital is large. American economist Edward Prescott (2004) [3] compared GDP, human capital and labor productivity in 7 major developed countries (France, Germany, Italy, Britain, Canada, Japan and America) in two different time periods 1976-1979 and 1993-1996, and inspected the changes in the labor market for the 15-64 years old population. The study found, human capital supply in America was far higher than that of in Germany, France and other European countries in the 90th of the twentieth Century, but human capital supply in America was less than that in Germany, France and other European countries in the 70th of the twentieth Century. His conclusion was: the tax system is the main reason leading to the differences of human capital supply. Edward Prescott found tax rate in continental Europe raised a lot in 1993-1996 than that in 1970-1974. Compared with USA, continental Europe were countries with high labor income tax, and the average tax burden in continental Europe was almost above 52%, Italy was even up to 64%, That is to say, if they work longer hours and could be able to produce 100 euro extra output, then they only could receive an extra

40 euro, nearly 60 euro was directly or indirectly taxed off. Therefore, the high tax burden inhibit the supply of human capital.

In contrast, for low income countries, the utility evaluation on income is high, the income effect would be greater than the substitution effect for labor income tax. China belongs to developing countries with relatively low level of income, and wage is still the main source of income, so the utility evaluation on income is high. Therefore, when the income decreased after tax, in order to maintain their original level of income, workers would increase the supply of human capital, so the income effect would be greater than the substitution effect. Yu Hong (2004) [4] and Yu Xian cai (2006) [5]. Studied the factors affecting labor supply behavior including enterprise type, age, gender and the wage rate, they both found that the changes of labor income tax rate would not have an impact on labor supply in China.

Most of the previous research on the effect of tax on labor supply use the time series or cross section data, adopt the estimation methods of ordinary least squares (OLS) or two stage least squares (TSLS), However, when we use time series data we can only analyse a single agent, and when we use cross section data, we can not reveal the time trend. While panel data can reflect both the cross-sectional individual's information and the time trend information, and greatly increase the amount of observation data and the freedom of the estimation equations. Furthermore, panel data model is particularly suitable for the circumstances in China. For the economic development in developed countries is more stable and balanced, the use of time series data and cross-section data is with little problem. But for China, due to the special development stage, many economic indicators show the obvious individual and trend characteristics. So the use of time series data and cross-section data is easy to draw the wrong conclusions in China.

Based on this, this paper attempts to make improvements in the following aspects :(1) Previous studies usually use the nominal personal income tax to present labor income tax, While personal income tax rate could not fully reflect the effective labor income tax rate, so we calculate the average effective tax rate for labor income at the provincial level to represent the labor income tax rate. (2) Most previous studies use the average years of schooling to represent human capital, this method sees productivity is equal in each schooling year, and cannot reflect the human capital's production efficiency. And this paper use the productivity index based on the average years of schooling to represent the level of human capital. (3) Most of related previous research was established at the national level, and adopted time series data or cross-section data. While the economy in China has obvious regional characteristics, so we study the Influence of regional revenue and the effective labor income tax rate on human capital at the provincial level, and this would have more practical significance.

III. THE ESTIMATION OF THE EFFECTIVE LABOR INCOME TAX RATE FOR EACH REGION

The average effective tax rate is equal to the tax amount undertaken by a certain economic project divided by the total income. Mendoza et al (1994) [7], David (2002) [8] put forward a calculation method of the effective labor income tax rate, The OECD researchers usually adopt this method to measure the tax burden of its members. Combining with the calculating method of domestic scholars, this paper calculates the effective labor income tax rate in China based on the method of Mendoza and David.

Under the current tax system, the labor income tax in China include the agricultural tax, livestock tax, social insurance funds and the individual income tax attributed to labor. We decompose the personal income tax into labor tax and capital tax according to the proportion of wage income and capital gains in the family income statistics.

Finally, according to the formula: effective labor income tax rate = labor income tax / (labor remuneration + labor income tax). Here, labor remuneration refers to the labor remuneration in the GDP accounting by income method in each province.

Because of the lack of data in Tibet, In this paper, we divide the remaining thirty provinces, autonomous regions and municipalities into three main regions: the eastern, the central and the Western (the following is the same). The eastern include Beijing, Tianjin, Shanghai, Hebei, Shandong, Jiangsu, Zhejiang, Fujian, Guangdong, Hainan, Liaoning; the central include Jilin, Heilongjiang, Shanxi , Henan, Hubei, Anhui, Hunan, Jiangxi; the Western include Neimenggu, Xinjiang, Ningxia, Shanxi, Gansu, ,Chongqing, Sichuan, Guangxi, Guizhou, Yunnan.

IV. THE ESTIMATION OF HUMAN CAPITAL FOR EACH REGION

The quality of employees directly impacts on economic efficiency, therefore, the average education years could be an effective measure for human capital. Different education degree is given different weights, Illiteracy, Semi-literacy, primary school, junior school, high school, college and above are respectively given the weights 0, 1, 6, 9, 12, 16. Then the average years of schooling in a region is:

$$H_{it}^{'} = \sum_{i=1}^{6} edu_{it} P_{it} \tag{1}$$

Here, edu_{it} , P_{it} represents the weights of each education level and the number of employees with each education level respectively. Because of the missing data, we use the entire population's education level to fit the employees' education level.

The marginal returns of human capital with different education levels is different (Mincer,1974 [9]), so we adopt the method introduced by Hall and Jones (1999) [10] to construct the panel data of human capital.

$$H_{it} = e^{\Phi(H_{it}^{'})} \tag{2}$$

Here, $\Phi(H_{it}^{'})$ is with a piecewise linear form, its slope is the rate of education return. In the first 4 years the slope is

13.406, the next 4 years is 10.1%, and over 8 years is 6.8%. The Specific calculation formula is as follows:

$$\Phi(H_{it}^{'})=\begin{cases}0.134*H_{it}^{'}, H_{it}^{'}\le 4\\ 0.134*4+0.101*(H_{it}^{'}-4), 4<H_{it}^{'}\le 8\\ 0.134*4+0.101*4+0.068*(H_{it}^{'}-8), H_{it}^{'}>8\end{cases} \quad (3)$$

According to the above formula, we can calculate the human capital in 1998-2012.

V. THE ESTABLISHMENT AND THE TEST OF THE EMPIRICAL MODEL

A. *The Eatablishment of The Empirical Model*

According to the analysis of the theory above, we set up the empirical model as follows:

$$H_{it}=\alpha_{it}+PGDP_{it}*\beta+LTAX_{it}*\gamma+u_{it}+\varepsilon_{it} \quad (4)$$

Here, H_{it} is the level of human capital for the province i in the year t. $PGDP_{it}$ represents per capita income for the province i in the year t. and $LTAX_{it}$ denotes the effective labor income tax rate for the province i in the year t. α is the constant term, u_{it} and ε_{it} is the residuals and the random perturbation terms respectively.

B. *The Estimation Results and Interpretations*

In order to eliminate the heteroskedasticity and serial correlation problems of the panel data model, this paper select the residual variables in the cross section as the weights (cross section weights). And use the generalized least squares (GLS) estimation method. TABLE 4 shows the estimation results, we omit the cross-section and the constant terms in each period to save space. It can be seen from TABLE 4 that the estimation results with cross section weights is better than the un-weighted. Therefore the choice of the generalized least squares (GLS) estimation method is correct; R^2 reach 0.971434, the adjusted R^2 is 0.964372. the F statistic is 137.5552, and its P value is zero, *D.W.* statistic is 1.749072, the standard error and the sum squared residuals are both very small, demonstrate that the empirical model is effective. From the significance of the explanatory variables, Per capita GDP is significant in most of the central and the western regions except Anhui, Jiangxi in the central , Chongqing, Sichuan and Guizhou in the western. While Per capita GDP is not significant in general in the eastern region except Beijing, Fujian and Guangdong. The effective labor income tax rate is significant in most of the eastern regions except Fujian and Guangdong. For the central provinces Hubei, Anhui and Jiangxi, the western provinces Chongqing, Sichuan and Yunnan, the effective labor income tax rate is not significant, and in other provinces it is all significant.

TABLE 4. THE ESTIMATION RESULTS OF PANEL DATA MODEL
(the explanatory variable is the human capital)

Province	**PGDP**	**LTAX**
Beijing	0.020201**	0.007805*
Tianjin	0.004	0.014809***
Shanghai	0.007877	0.012189***
Hebei	0.013462	0.015947***
Shandong	0.002032	0.033208***
Jiangsu	0.018938	0.027122***
Zhejiang	0.00196	0.016033***
Fujian	0.046511***	0.015696
Guangdong	0.05095***	0.003704
Hainan	0.011596	0.016771***
Liaoning	0.027571***	0.006094***
Jilin	0.032406***	0.003158
Heilongjiang	0.033948***	0.004358**
Shanxi	0.057775***	0.006264***
Henan	0.089242***	0.012896**
Hubei	0.056989***	0.009104
Anhui	0.00831	0.012993
Hunan	0.03689***	0.011513***
Jiangxi	0.054911	0.016019
Neimenggu	0.025944**	0.011856
Xinjiang	0.0445***	0.006713**
Ningxia	0.067064***	0.014072***
Shanxi	0.053008***	0.014966***
Gansu	0.074474**	0.00809*
Qinghai	0.071943**	0.015925***
Chongqing	0.026357	0.008715
Sichuan	0.049257	0.004139
Guangxi	0.051999**	0.030517***
Guizhou	0.031252	0.021031**
Yunnan	0.844522***	0.02629
Constant		
Coefficient	Std.Error	t-statistic	Prob.
2.455394	0.006403	383.4561	0.00000
Weighted statistics			
R^2	0.971434	Mean var	3.799379
Adj. R^2	0.964372	S.D.	1.675112
S.E.	0.059696	SSR	1.28292
F-statistic	137.5552	D.W.	1.749072
F Prob.	0.0000		
Un-weighted statistics			
R^2	0.955827	Mea. var.	2.619311
SSR.	1.28292	D.W.	1.511534

Note: *,**,*** represents the confidence level at 10%, 5% and 1% respectively.

From the table above, we can see the substitution effect is very small in general. The income effect of the labor income tax is greater than the substitution effect, the increase of the effective labor income tax will lead the economic agents to increase work and the human capital investment. The reasons for this result may be the following: (1) the human capital is abundant in China, and the supply is greater than the demand.(2) The effective tax rate in China is very low, and it is lower than that in the most developed countries in general.(3) the low level of economic development currently.

For the eastern region, per capita GDP is not significant to human capital in general, this indicates that the human capital accumulation in the Eastern may be determined by the institutional factors rather than income, for example, the policy advantages and environmental advantages etc. So to increase human capital accumulation, the eastern region

should cast off the development path of simply increasing GDP, and optimize the environment for development, change the mode of economic development.

The effective labor income tax rate is significant in most of the eastern regions, this implies the supply of human capital above the average level is inelastic. The substitution effect is far less than the income effect, the income effect on human capital is dominant for the effective labor income tax.

For the central and western regions, Per capita GDP and the effective labor income tax rate are both significant. This means the strategy of the human capital accumulation is continuing to increase the size of economy and the income of labor. While the coefficient of the effective labor income tax rate is relatively small, this because labor income is still at low level in the central and western regions, and the increase or cut of the effective labor income tax would have little impact on human capital.

VI. CONCLUSIONS AND RECOMMENDATIONS

According to the study of the relationship of the effective labor income tax , Per capita GDP and human capital supply, we can draw the following conclusions and recommendations:

Firstly, the decision of human capital supply in China fundamentally depends on the absolute income for workers, that is to say, when workers have the need to choose their human capital supply, their income should firstly meet their basic living costs. Only when the income reaches to a certain level, the choose of the human capital supply may be possible, otherwise it has no practical implications.

Secondly, as a developing country, the labor income of China's majority workers is at the low level, the marginal utility of income is large, more hard work is the basic way to increase the family's income. At the same time, the human capital with low or middle level excess the economic requirement because of the large population base in China. So in general the substitution effect for labor income tax on the supply of human capital is minimum.

Thirdly, the per capita income level is still much lower in China than the developed countries at present, People's future income is with considerable uncertainty, the social security system should be further improved yet. Although the tax reform will not produce much direct impact on the supply of human capital, tax cuts could reduce the price of goods and services, and increase the people's consumption demand, could eventually increase the supply of human capital for market feedback.

Fourthly, despite the small effect of labor income tax on the supply of human capital, this influence will be gradually prominent with the improvement of people's income level and the increase of the proportion of individual income tax in the long run. it may produce certain substitution effect on high income earners in the near future. In addition, the effect of labor income tax on the quality of human capital should not be ignored. Therefore, from the policy orientation of the future tax reform, the possible excitation or inhibition effect of the tax on the human capital investment of the low and middle income people should be given full consideration. And we should use tax measures to optimize the quality of the human capital, alleviate the imbalance between supply and demand in the structure of human capital in China.

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