Econometric Analysis of Factors Affecting Social Labor Productivity in China

LI Qingshan[a],*

[a]Business School, China University of Political Science and Law, Beijing, China.
* Corresponding author

Abstract

Factors that affecting the social labor productivity are numerous, but in our paper, four variables which we interest in are selected for analysis, they are per capita income, urban green area, public transportation investment, and technical contract number. By the use of econometric analysis, we may find which factor is significant and which is not, and then, make some suggestions for the government.

Key words: Social labor productivity; Affect factors; Econometric analysis; Policy suggestions

INTRODUCTION

Chinese Academy of Sciences has repeatedly released a report that: China's labor productivity compared to developed countries severely lagging behind the developed countries to decades, only equivalent to the United States of 1/12, and to Japan of 1/11, the low productivity is not an individual phenomenon, but the country with a universal problem. Therefore, improving the labor productivity is not only related to the development of the national economy, but also directly affects the sustainable and stable development of the enterprise. The increase of labor productivity is the basis of the accumulation of wealth, the increase of real wages and the improvement of living standards, while the increase of labor productivity is helpful to restrain the inflation caused by the rise in nominal wages, at least wage cost driven inflation will be effectively alleviated. Therefore, it is urgent to study the problem of labor productivity. The issue of labor productivity is meaningful in each country around the word, but it is hard for each country to really make clear of what are important factors to promote it and what are not. There are so many factors are affecting the social labor productivity, and income is being seen as the main factor which affects labor productivity most in traditional theory, what's more, some other factors are also being seen as important as income which can as well as influence the labor productivity directly, for example, labor's welfare, company system, staff quality, office facilities, and so on. These factors may have been paid a lot of attention by countries for their direct influence, and nearly all countries are working hard to do it, even some countries have got a big good mark on it.

However, we care most are some indirect influence factors. Because the literature about the analysis of direct factors is too much, and one unbelievable thing is that some governments have done its endeavor to rise the productivity but the result out of its expectation, harvest little. Some companies with high salaries, big welfare, humanized rules, and convenient facilities, but it is hard for him to arise the labor productivity more. So, in order to find other reasons, we have to cast our eyes on some other factors which may influence the labor productivity in the indirect ways, that is also the important meaning of this paper. Although the analysis method is kind of simple, the starting point and the original intention are worthy of approval.

1. LITERATURE REVIEW

1.1 Domestic Research Status

For a long time, the viewpoint which the labor productivity has been seen as a comprehensive index to measure the

efficiency of labor use has aroused wide attention of scholars, a large number of papers about labor productivity are discussed and explored the academic article. The research on the labor productivity of the scholars is not only about the basic theory, but also about the practical application, mainly involved in the following aspects: the conception of labor productivity, calculation method and evaluation index of labor productivity, the relationship between labor productivity and commodity value, research on the development law and characteristics of the overall labor productivity in the country or region, factors affecting the labor productivity in the macro level and enterprise level, decomposition of labor productivity growth rate, and so on. The main research contents of domestic are mainly in the following aspects:

Ye Yuan (2004) believes that the factors affecting the efficiency of labor production in the construction industry, including macroeconomic, technological progress and capital equipment, the quality of employees and workers wages, etc., and she made the quantitative analysis of the three aspects of technological progress, capital equipment rate, and employee's wages by using the Douglas function and linear function, point out that technological progress plays an important role in the growth of labor productivity, from 1991 to 2000, the growth of labor productivity increased by more than the wage growth, and the growth of wages also increased the productivity of labor; Liu (2011) in the "the analysis of the effect of technological progress on the construction industry labor productivity", according to the Cobb - Douglas production function and Solow growth model established the labor productivity growth function model, and analysis the impact of technological progress and capital deepening on labor productivity growth, and made one conclusion that the positive influence of technological progress on labor productivity is greater than capital investment; Liu Kuaijun and Qin Dawei (2010) used linear regression model to analyze the effect of wages on labor productivity of construction industry, and pointed out that wages is very important in promoting the labor productivity, 1 yuan wages increased can drive labor productivity increased by 1.45 yuan; Zhou Jun (2009), analyzed the contribution of labor productivity growth to he real wages, found that the driving forces from the salary of the construction industry which are the representative of the labor intensive industry is higher than the high-tech industry as a representative of the knowledge intensive industry in promoting the labor productivity.

1.2 Foreign Research Status

Abdul Kadir M. R. (2005) lists 50 factors that affect labor productivity in the construction industry from the micro level, by visiting the main roles of construction, the contractors, developers and consultants, and inform them score the importance of factors, and then sort the importance of the factors, the study draws the 5 most important factors affecting the construction of labor productivity, material shortage, the supply interruption of the material due to delay paying the supplier's purchase price, the changes of consultant, the delay of the construction drawing, and contractor manager is not effective for field management; G. Allen Steven (1985) believes that the main reason for the decline in labor productivity in the construction industry is the reduction of labor intensity, it is due to the change in the demand of the construction industry, other important reasons causing the decrease of labor productivity include the average number of employees, capital labor ratio, trade unions and workers' average age of the workers.

2. DEFINITION OF LABOR PRODUCTIVITY

Labor productivity indicates the labor efficiency of the workers, it can be expressed as the number of products produced within the unit time, also can be expressed as the amount of the consumption of labor time when produce products. Labor productivity is the most important and in a central position form of productivity, in early western economics, productivity is labor productivity, until after the two World War, the two concepts of productivity and labor productivity were distinguished and standardized. Labor productivity is not only reflected in the efficiency of the production factors, it should be a comprehensive reflection of the production efficiency of the whole production factors.

Because of the differences in the calculation of labor productivity, labor productivity can be divided into social labor productivity and individual labor productivity, Individual labor productivity can be divided into individual labor productivity which counted in every producers' productivity and the efficiency of the enterprise, which counted in average efficiency of all people. Usually, the individual labor productivity refers to the enterprise labor productivity. The calculation of social labor productivity includes all employees in the department or industry. The productivity of social labor is obviously depending on the labor productivity of the enterprises, and the relationship between them is basically consistent. However, with social labor productivity growth and change, the change of social labor productivity may exceed the range of the change of individual labor productivity.

But, what should be emphasized is, the definition of labor productivity in this paper refers to the social labor productivity.

3. VARIABLES SELECTION AND MODEL CONSTRUCTION

The same as others analyses before, we also take the variable " income " into consideration for its occupying the most important position in various influencing factors. If we do this work without this variable, we will face

failing in the regression model. Other specific will be introduced as follows.

a) *laboref* : represents the labor productivity, the dependent variable in this paper;

b) *income*: means per capita income, the most important factors;

c) greenco*ver*: the urban green area, workers care more and more about the outside environment, so, if there is serious air pollution around his life, the low working efficiency may happen;

d) *pubinvest*: represents the public transportation invest, owing to traffic jam problem is more and more popular in big city, if there is a big traffic jam when you on the road of working, you will be feel anxious and bored, and then start your work without good mood;

e) *tecsales*: represents the technological progress, the more advanced facilities invented, the more convenient

when you work.

The refore, under the function of variables below, a regression model can be constructed:

$$laboref = \beta_0 + \beta_1 income + \beta_2 greencover + \beta_3 pubinvest + \beta_4 tecsales + \mu \qquad (1)$$

In the model, β_0 is a constant, β_i (i=1, 2, 3, 4) is the coefficient of each variable, which means that under the condition of other variables are fixed, when this variable changes by 1 unit, the amount that the dependent variable changes, μ is the residuals.

With the twenty years' (1993-2014) time series data which originate from China Statistical Yearbook, the first regression result is as follows.

From Table 1 we can find that, the effect of model fitting is good with R^2=0.9952, but what disappointment us is that there only two variables are significant,

Table 1
The First Regression Result

laboref		Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
income		3.404263	.3926088	8.67	0.000	2.575931	4.232596
greencover		1500.797	486.5505	3.08	0.007	474.2646	2527.328
pubinvest		−10.11773	19.49329	−0.52	0.610	−51.24498	31.00952
tecsales		.1707605	.1549195	1.10	0.286	−.1560912	.4976121
_cons		−50001.18	13902.21	−3.60	0.002	−79332.28	−20670.08

Note. R-squared = 0.9952.

especially the "income", consistent with other scholars' conclusion, is very significant; the two coefficients value means that keep other variables unchanged, when the per capita income rise 1 yuan, the labor productivity may increase 3.4yuan per person, and when the green area coverage rate rise 1%, the labor productivity may increase 1500.8 yuan per person. The other two variables are insignificant, the coefficient of public transportation investment is negative, means that expand the amount of investment is not benefit for the increase of productivity, and that is impossible.

Based on deeper analysis, we may see that all variables value are in a common tendency of rising, which

will lead to a wrong regression. So, in order to eliminate the common tendency, we should add another variable "years", and make the second regression.

4. ELIMINATING TIME TREND

After adding the new variable "years", we then form a new model to conduct the second regression.

$$laboref = \beta_0 + \beta_1 income + \beta_2 greencover + \beta_3 pubinvest + \beta_4 tecsales + \beta_5 years + \mu \qquad (2)$$

The second regression results are as follow:

Table 2
The First Regression Result

laboref		Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
income		3.880616	.6420991	6.04	0.000	2.519426	5.241805
greencover		3160.234	1832.54	1.72	0.104	−724.5779	7045.045
pubinvest		−12.18969	19.68485	−0.62	0.544	−53.91971	29.54032
tecsales		.1631481	.155668	1.05	0.310	−.1668533	.4931495
years		−2156.114	2294.966	−0.94	0.361	−7021.224	2708.996
_cons		4194246	4517594	0.93	0.367	−5382625	1.38×10^7

Note. R-squared = 0.9954, Adj R-squared = 0.9940.

Table 3
The Third Regression Results

llaboref |	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
lincome |	.5403271	.1023394	5.28	0.000	.3208309	.7598232
lgreencover |	3.062735	.4789209	6.40	0.000	2.035551	4.089918
lpubinvest |	−.0535605	.0479318	−1.12	0.283	−.1563639	.0492429
lpubinvestt1 |	.097019	.0459407	2.11	0.053	−.0015141	.1955521
ltecsales |	.032941	.1111077	0.30	0.771	−.2053614	.2712434
ltecsalest1 |	.2376518	.0870387	2.73	0.016	−.4243312	−.0509724
_cons |	−3.467547	1.861188	−1.86	0.084	−7.459398	.5243047

Note. *R*-squared = 0.9974, Adj *R*-squared = 0.9964.

After the regression with variable "years" can we find that the results are even worse than before, although we still get a good R^2=0.995, the most variables are insignificant except "income". What's worse, the coefficient of "pubinvest" is negative.

5. OTHER PROBLEMS ANALYSIS

One problem in our model worth paying attention to is, the coefficients of each variable are a valid value which means with other conditions unchangeable, how many the dependent variable will change if one variable changes by 1 unit. However, it is unscientific in our reality, take income for example, if the labors' salaries increased 1 yuan, the productivity will increase 3.88 yuan; and if the labors' salary increased another 1yuan, the amount of productivity will increase is also 3.88, as we all know, labor productivity is at diminishing marginal in economic theory, and with the continue increasing of salary, the increasing amount of productivity will be continuously decreasing, therefore, it is necessary for us to change the variables into logarithm . After we take logarithm, the coefficient means that when 1unit changes happened in a variable, the percentage of the dependent variable will change, if 1 unit increased in salary, the productivity may increase 3.88%.

In the process of the investment of public transportation, the use of funds will not immediately improve the effectiveness of labor productivity, for example, in the early repair of the road, the original road will be removed and blocked, then it will influence the workers who go for work in car or by bus, they will spend a lot of time to find another road and bear the pains of longer distance, and they will bear traffic jam in other road, spend more money on oil, all of these factors will affect their passion of work. Therefore, to make public transportation investment real impact on social labor productivity should be after a certain period of time, in other words, we should consider the problem of time

delay. Similarly, one new facility brought in will not affect productivity immediately, because the company must have its workers trained, the problem of time delay also exists. So, for better dealing with this problem, we take one phase lag to "pubinvest" and "tecsales", and construct model 3.

$$\begin{aligned} \text{llaboref} = \beta_0 &+ \beta_1 \text{lincome} + \beta_2 \text{lgreencover} \\ &+ \beta_3 \text{llpubinvest} + \beta_4 \text{lpubinvestt1} \\ &+ \beta_5 \text{ltecsales} + \beta_6 \text{ltecsalest1} + \mu \end{aligned} \quad (3)$$

In model 3, each variable has been taken into log, and variables "pubinvest" and "tecsales" have been taken into one phase lag. With model 3, we conduct another regression.

In table 3 we can find that, the significant of variables has gotten an obvious improve, with R^2=0.9974, and adjust R^2=0.9964, the model fits better than before. Variables "income" ,"greencover", "pubinvestt1", and "tecsalest1" are all significant at different level with the coefficients value are 0.54, 3.06, 0.09, and 0.24. It is correct to take one phase lag to "pubinvest" and "tecsales", their coefficients means that if the amount of public invest increases 1%, the productivity will increase 0.097% in the nest year, and if the rate of using new facilities increases 1%, the productivity will increase 0.24% in the next year.

6. THE FINAL MODEL

Under the analysis of below, we can construct our final model by eliminating the variables of "lpubinvest" and "ltecsales".

$$\begin{aligned} \text{llaboref} = \beta_0 &+ \beta_1 \text{lincome} + \beta_2 \text{lgreencover} \\ &+ \beta_3 \text{lpubinvestt1} + \beta_4 \text{ltecsalest1} + \mu \end{aligned} \quad (4)$$

Then the results of this regression model are as follows:

Table 4
The Regression Results of Final Model

llaboref	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
lincome	.5003832	.0798849	6.26	0.000	.3310348	.6697316
lgreencover	2.89767	.4152246	6.98	0.000	2.017434	3.777907
lpubinvestt1	.0876135	.0439496	1.99	0.064	−.0055555	.1807825
ltecsalest1	.2493079	.068977	3.61	0.002	−.3955326	−.1030832
_cons	−2.195525	1.468783	−1.49	0.154	−5.309206	.9181552

Note. R-squared = 0.9972, Adj *R*-squared = 0.9965.

In the final model, all the variables are significant, with their coefficients are 0.5, 2.9, 0.09, and 0.24. 1% increase in per capita income, green coverage rate, public transportation investment, and technical contract, the labor productivity will increase 0.5%, 2.9%, 0.9%, and 0.24%. So, the final model can be written as:

$$llaboref = -2.2 + 0.5lincome + 2.9lgreencover + 0.09lpubinvestt1 + 0.24ltecsalest1$$

CONCLUSION

By using the time series data and regression model, this paper analysis the impacts of income, urban green coverage, public investment, and technical sales of the labor productivity. During the process of analysis, we continued to find the problem and corrected, and determined the final model. According to the results, the highest coefficient value of variables is urban green coverage with the value is 2.9, the second is income with a coefficient value 0.5, other variables make a small influence on productivity, with their coefficients are 0.24 and 0.09. In other words, urban green coverage has the biggest impact on labor productivity, reflects that at a certain wage level, people is more and more care about the outside environment but not only money, and it is necessary for the government to expand the area of green coverage.

Of course, there are some limitations in this study, for example, in the study of factors, the research sample is the industry practitioners, and industry practitioners tend to focus on the perspective of their own position, may lack the objective and comprehensive judgment, which will lead to the existence of bias. Therefore, in the future research can increase the proportion of experts and scholars, to further optimize the investigation method, get more accurate results.

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