Empirical analysis on the relationship between IDI and economic growth

-----Based on 2000-2010 provincial panel data of china

Lu Chen
Department of Public Economics
Xiamen University
Xiamen, China
e-mail: lulu19881104@126.com

Abstract—with the popularization of Internet and the advent of information economy, information development level is becoming one of the main factors to influence the regional economic growth. This paper, by using modified Cobb - Douglas production function, based on the estimation results of 2000-2010 provincial panel data shows that the more developed area, the higher the level of information development, and the more notable promoting effect the level of information development on the regional economic growth.

Keywords- IDI; Economic growth;Panel data

I. INTRODUCTION

With the advent of 21st century, the world has been speed up entering the information society. The level of information development has become an important flag to symbolize the developing level of the productivity, the national comprehensive strength and international competitiveness. Since 2003, international organizations such as ITU, UNCTAD, UNESCO, WB, WEF and so on, have carried out a series of theoretical study, calculation and comparison on the comprehensive evaluation index of information. Chinese government pays high attention to the information work, and uses Information Development Index (IDI) which is work out by the national bureau of statistics to evaluate, monitor the national information development process, and the realization of the overall goal. The index included infrastructure, use, knowledge, environment and effect, consumption of information, explains the overall level of national information development. According to CNNIC estimation, China is staying in the medium level of the world information development. Beijing, Shanghai occupies the top two among 31 provinces (autonomous region, municipality city). It is the low overall level, the unbalanced district development and the existence of the digital gap-regional that leads the gap between rich and poor becoming larger and larger. So, it is very important to further study the present situation and trend of our information development level, and analysis the relationship between information development level and economic growth. Though the current domestic scholars have many theoretical researches and empirical researches, however, they mainly focused on evaluation of economic information level, and which is based on quantitative economic model is very few. Therefore, this paper based on 2000-2010 provincial panel data, analyzed the relationship between IDI and the regional economic growth.

II. THEORETICAL ANALYSIS ON THE ECONOMIC GROWTH EFFECT OF INFORMATION DEVELOPMENT LEVEL

The United States economists Romer and Lucas who are the representative of The New Growth Theory hold that knowledge is an endogenous variable of economic growth. The development of information technology must encourage the knowledge innovation and technology innovation. At the same time, it can accelerate the speed of information transmission and lead to the sustained growth of the economy. So, information development level becomes the power and source to promote economic growth. First of all, the information development can improve labor productivity, enhance international competitiveness. Investment in information technology has high benefit. By using high-tech achievements, it can implement the technical transformation of various industries, promote the automation of its production, improve product quality and labor productivity, reduce product cost, and then improve the competitiveness of our products. Along with the rapid increase of labor productivity and sustained economic growth, the country's international competitiveness has been improved rapidly. Secondly, the development of information can promote industrial structure supererogation. The information industry has been the top focus of industrial development, not only in itself increasing value created year by year, but also leading to the development of other industries and the whole structural upgrades. Finally, with development of the information, the information technology can be widely applied to the field of socio-economic and social production, and drive the upgrading of traditional industries. Meanwhile, the development of information technology has brought to revolutionize management mode (online shopping), and gave birth to a number of new industries. In a word, the information industry has play an important role in national economy, also confirmed a huge position on economic growth. Therefore, the information development has become an important symbol to show comprehensive national strength of the various countries and regions.

Published by Atlantis Press, Paris, France.

III. EMPIRICAL ANALYSIS ON THE RELATIONSHIP BETWEEN IDI AND ECONOMIC GROWTH IN CHINA

A. Model Selection

Cobb-Douglas production function was put forward by mathematician Cobb and economist Douglas in the 1930s, which is used to predict the production of national, regional industrial system or large enterprises, or analysis the way to develop production. It breaks through the assumption that capital output ratio and savings rate are unchanged in Harrod-Domar model. And its simple form makes it meaningful in the theoretical analysis and application of economic. General form of the Cobb-Douglas production function is:

$$Y=AL^{\alpha}K^{\beta}. \quad (1)$$

Here Y represents gross industrial output value, L is the number of labor input, K is the capital invested, which generally refers to the net value of fixed assets. A, α, β are three parameters, and $0 <\alpha <1$, $0 <\beta <1$. A is a constant, which is usually interpreted as the technical level parameter, α is the elastic coefficient of labor output, β is the elastic coefficient of capital output. This paper selected a modified Cobb-Douglas production function as the economic growth model, in the form of:

$$Y=CL^{\alpha}K^{\beta}A^{\theta}. \quad (2)$$

Among them, Y represents GDP, L is the labor factor, using the current number of employees instead. K is the capital factor, represented by the fixed assets invested in current period. C is a constant. A is technology development factor, using IDI instead of it. Take logarithm on both sides of the production function to get the new form of model:

$$\ln Y=\ln C+\alpha \ln L+\beta \ln K+\theta \ln A+\mu. \quad (3)$$

This article uses the panel data to estimate the regression model. Panel data also known as Longitudinal Data, refers to observation collection of both different cross-section individuals and different times. From the horizontal point of view, it is data of different cross-sectional individual at certain time; from the longitudinal point of view, it includes time-series data for each cross section. Therefore, the panel data model can increase the degree of freedom of the model and reduce the extent of multicollinearity, which could obtain more accurate parameters evaluation. Due to restrictions of statistical data, this paper selected the panel data of only 31 provinces, cities and autonomous regions in China from 2000 to 2010 for analysis.

B. Model setting

1) The fixed effect model on relationship between IDI and economic growth

According to the characteristics of the panel data, we can set up a simple pooled model, cross-section fixed effects model, time fixed effects model, and the time and cross-section fixed effects model. This paper used OLS method and the estimation method of fixed effects model in Eviews to get the results in the list below.

TABLE I. THE ESTIMATION RESULTS IN EVIEWS

	pooled model	**cross-section fixed effects model**	**time fixed effects model**	**the time and cross-section fixed effects model**
α	0.499558 (0.0000)	0.787274 (0.0000)	0.334390 (0.0000)	0.343332 (0.0002)
β	0.492678 (0.0000)	0.449302 (0.0000)	0.707013 (0.0000)	0.249771 (0.0000)
θ	2.907158 (0.0000)	1.916396 (0.0000)	2.617524 (0.0000)	0.970723 (0.0056)
Adjusted R-squared	0.969594	0.995494	0.980079	0.996975
Sum squared residual	12.99496	1.754192	8.261085	1.139198
freedom	337	307	327	296

The table shows that all kinds of models have high goodness of fit. The time and cross-section fixed effects model is highest, and cross-section fixed effects model takes second place. But, from the estimation results, we can see that θ is not significant in the time and cross-section fixed effects model. In addition, we can carry out the fixed effects test.

In fact, to test whether the cross-section fixed effects model exists or not, we take the cross-section fixed effects model as unrestricted model, and the pooled one as restricted one. Then construct F statistics as follow:

(4)

SSEγ is the sum squared residual of restricted model, and SSEμ is the sum squared residual of unrestricted one. m is said the number of restricted conditions. T represents sample size, and k is the number of parameters to be estimated in unrestricted model. Under the condition of null hypothesis that the constraint is true, F statistics asymptotic obey F distribution whose degrees of freedom is (m, T - k). That is F ~ F (m, T - k). Take the data in table I into the formula to calculate:

$$F = \frac{\frac{12.99496 - 1.754192}{30}}{\frac{1.754192}{307}} \quad (5)$$

With a significance level of 0.05, the critical value of F (30,307) is less than 2. Therefore, we can initially determine the existence of the cross-section fixed effects.

In the same way, calculate the F statistics of time fixed effects model and the two-way fixed effects model. Simultaneously, cross-section fixed effects model has high goodness of fit, not only the whole model but also the each estimation of regression coefficient are significant, and the symbols are consistent with expectations. So, we set cross-section fixed effects model.

2) The random effect model on relationship between IDI and economic growth

We still use the annual economic data (2000-2010) of 31 provinces and autonomous regions in China to estimate the cross-section random effects model, its estimation results by using Eviews are as follows:

TABLE II. THE ESTIMATION RESULTS OF RANDOM EFFECTS MODEL

	α	β	θ
cross-section random effects model	0.561474 (0.0000)	0.427290 (0.00000	2.479121 (0.0000)
	Adjusted R-squared		
	0.986381		
	Sum squared residual		
	2.281772		

The regression results in the table above, we can see that the cross-section random effects model also has goodness of fit. The whole model and the each estimation of regression coefficient are significant. Here, should we choose the fixed effects model or random effects model in the end? Therefore, we further conduct the Hausman test. The Hausman test result by using Eviews is in following table:

TABLE III. THE RESULTS OF HAUSMAN TEST

Test summary	Chi-Sq.Statistic	Chi-Sq.d.f	Prob.
Cross-section random	65.331473	3	0.0000

According to the test results, we reject the null hypothesis, that is, it should be set cross-section fixed effects model, namely

$$\ln Y = -1.956032 + 0.787274 \ln L + 0.449302 \ln K + 1.916396 \ln A \quad (6)$$

IV. CONCLUSIONS AND POLICY SUGGESTIONS

It can be seen from the results of empirical analysis that the level of information development, in the long run, is one of the reasons to promote economic growth. The regression results show that from 2000 to 2010, elastic coefficients of the capital, labor and information development level are 0.449302, 0.787274 and 1.916396. Clearly, the information development level has become another important factor affecting the economic growth after the capital and labor. IDI every 1% increases, the economy will grow by 1.916396% with no variation of other factors. At the same time, the regression results of cross-section fixed effects model show that information development level of different regions has significant different impact on their economic growth. The information development level of the eastern part, which is represented by Beijing, Shanghai, Tianjin, has higher impact on the economy growth than the western one which takes Sichuan, Guizhou as representative. In view of this, we put forward the following policy suggestions.

A. Narrow area information gap, and bridge the digital divide

The study above shows that information development level will be a growth pole to promote sustained, rapid and healthy economic development in the future. The information gap is not only a major performance of regional economic disparities, but also an important reason. Narrow area information gap, as well as overall coordination on the eastern and western will be a reciprocal measure to reduce regional economic disparities.

B. Use information technology, and promote industrial upgrading

In a new round of industrial structure adjustment, by increasing science and technology investment, improving information level, the information industry has become the pillar industry for economic development. Because of the high correlation degree between information industry and other industries, as well as the strong permeability, broaden the field of information industry will increase the export and create new jobs, and upgrade industrial structure at every step.

C. Increase the education investment, reserve technical personnel

Technological innovation cannot be separated from the reserve of talent. Shortage of IT personnel is very detrimental to economic development. It will not only affect the stamina of IT development, but also affect the development of the whole economy. Therefore, the Government is ready to increase investment in human resources

REFERENCES

[1] Tao Jiang, Rongming Ren, YUAN Xiang, "Empirical Research on the Relation between the Informatization and Economic Growth of China——Based on Panel Data Analysis of Regional Differences",

Science of Science and Management of S.& T., vol.6, pp. 120-125, 2010.

[2] Yu-kai Shao, Huan - chen Wang, Sai - xing Zeng, "The Relative Analyse between the Informatization Index and the Economy Growth in China", Information Science, vol.24, pp. 172-174, 2006.

[3] Shuying Wang and Yunze Ma, "The Level of Information in America and Its Influence on the American Economy", World Economics and Politics, vol.8, pp. 75-79, 2003.

Published by Atlantis Press, Paris, France.