# Analysis of the Impact of New Fixed Asset Investment on Total Factor Productivity in Information Industry of China

## Zhao Degen

Beijing Jiaotong University, School of Economics and Management,

Haidian, Beijing, China

zhaodegen12345@163.com

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**Abstract.** This paper selects the provincial panel data from 2006 to 2015, uses DEA-Malmquist method to measure China's total factor productivity, and then makes an empirical analysis with investment of the whole society in new fixed assets in information transmission, computer services and software industry. This paper finds that new fixed assets in information transmission, computer services and software industry have a significant role in promoting China's total factor productivity, which belongs to the technology progress-driven type and has a "time-lag" effect.

## 1. Introduction

ICT industry is the basic element of promoting informatization. Generally speaking, there are three ways that has been verified for informatization to promote economic growth. However, whether investment in ICT industry can improve China's TFP(Total Factor Productivity), and how investment in ICT(Information and Communication Technology) industry affects China's TFP, have not been studied in the existing literature.

Therefore, this paper first sorts out the relevant literature of information industry on economic growth, puts forward the corresponding theoretical hypotheses, and then selects the provincial panel data of China from 2006 to 2015 to analyze the impact of information industry's new investment of information transmission, computer services and software industry on China's total factor productivity.

## 2. Analytical framework and research assumptions

### 2.1 Role of new fixed assets in information transmission, computer services and software industry in Technological Progress.

The endogenous growth theory attributes the important impetus of economic growth to the innovation activities in various fields supported by the accumulation of knowledge in the whole society , which has been analyzed by Romer [1], Barro and Lee [2]and Benhabib and Spiegel [3], and the efficiency of information production and dissemination is crucial to the accumulation of knowledge in the whole society. Information transmission, compute services and software industry are important link in that development of China 's informatization, which have strengthened the information sharing and processing capability of the whole society, and play a significant role in promoting China' s technological progress.

Hypothesis 1: Investment in new fixed assets in information transmission, computer services and software industry have a significant role in promoting China's technological progress.

### 2.2 Role of investment in new fixed assets in information transmission, computer services and software industry on total factor productivity.

Jeanneney and Hua[4]analyze China's total factor productivity, and draws the unanimous conclusion that China's total factor productivity growth is mainly driven by technological progress.

Hypothesis 2: China's total factor productivity growth is driven by technological progress.

Hypothesis 3: Investment in new fixed assets in information transmission, computer services and software industry enhances China's total factor productivity through technological progress.

Brynjolfsson and Hitt found that ICT capital investment has a lagging effect on productivity and economic growth through empirical research, sometimes even up to seven years. [5]

Hypothesis 4: Investment in new fixed assets in information transmission, computer services and software industry has a "time lag" effect on China's total factor productivity.

## 3. Model construction

Referring to the existing literature, this paper uses panel data, considering the explained variables, interpreted variables and control variables to set up the following model:

$$TFPCH_{it} = \beta_0 + \beta_1 II_{it} + \beta_2 IE_{it} + \beta_3 INT_{it} + \beta_4 R\&D_{it} + \beta_5 Gov_{it} + \beta_6 Urban_{it} + \beta_7 Lnst_{it} + \beta_8 HR_{it} + \beta_9 FDR_{it} + \alpha_{1,i} + \varepsilon_{1,it}$$

Considering network externalities through the Internet, total factor productivity has a non-linear impact, the following model is set up.

$$TFPCH_{it} = \beta_0 + \beta_1 II_{it} + \beta_2 IE_{it} + \beta_3 INT_{it} + \beta_4 R\&D_{it} + \beta_5 Gov_{it} + \beta_6 Urban_{it} + \beta_7 Lnst_{it} + \beta_8 HR_{it} + \beta_9 FDR_{it} + \alpha_{1,i} + \varepsilon_{1,it}$$

TECHCH and EFFCH set the same model for reference. Where i denotes a province, t denotes a time (year) and α denotes a fixed component of individual differences among provinces. TFPCH, TECHCH and EFFCH are calculated by DEA 2.1. Explanatory variable is II(Investment in new fixed assets in information transmission, computer services and software industry). The control variables are R&D, Gov(The Level of Government Financial Expenditure), Urban(Urbanization rate), Lnst(Market structure), Edu(Human capital level) and FDI.

## 4. Regression analysis

Time series often have unit root, which will lead to pseudo-regression. So we first test the stationarity of the variables, and find that R&D, Gov, Urban, Lnst and FDR have unit root. We obtain stationary sequences for R&D, Gov, Urban, Lnst and FDR by logarithm. The models pass the Hausmann test, and there are no enough reason to refuse to use the random effect model, so the random effect model is chosen.

Table 1. Estimation results of stochastic effects of new fixed investment in information transmission, computer services and software industry on total factor productivity and its decomposition indicators.

| Variables | TFPCH (1) | TFPCH (2) | TECHCH (3) | TECHCH (4) | EFFCH (5) | EFFCH (6) |
|---|---|---|---|---|---|---|
| II | 0.003574** (2.1200) | -0.002477 (-0.5292) | 0.007153*** (3.9796) | 0.004310 (0.9861) | -0.003502** (-2.2028) | -0.006820*** (-3.4707) |
| II (-1) | —— | -0.000188 (-0.0277) | —— | -0.001454 (-0.2161) | —— | 0.001230 (0.2222) |
| II (-2) | —— | 0.007565* (1.6979) | —— | 0.002776 (0.9178) | —— | 0.004904* (1.5990) |
| IE | 0.005403 (0.8370) | -0.003381 (-0.4038) | 0.001154 (0.2677) | -0.005699* (-1.6263) | 0.003717 (0.6777) | 0.001893 (0.2443) |
| INT | -0.000221 (-0.8695) | 0.001178*** (3.0241) | -9.05E-05 (-0.3650) | -0.000611 (-0.9487) | -0.000110 (-0.8734) | 0.001779*** (3.7039) |
| INT^2 | —— | -0.000123** (-2.3584) | —— | 0.000429 (0.7381) | —— | -1.65E-05*** (-3.8949) |
| LnR&D | -0.001990 (-0.5719) | 0.004040 (0.5510) | -0.015444*** (-2.7538) | -0.013826*** (-2.8910) | 0.012644* (1.7868) | 0.018050** (1.9673) |
| LnGov | -0.013505 (-1.1378) | -0.003655 (-0.3148) | -0.019176** (-2.2194) | 0.000209 (0.0234) | 0.003899 (0.3596) | -0.003739 (-0.3196) |
| LnUrban | 0.054716 (1.4021) | 0.054170** (2.1456) | 0.060170** (2.0725) | 0.091849*** (3.6168) | -0.007478 (-0.2720) | -0.036612 (-0.9753) |
| LnLnst | -0.020721** (-2.5525) | -0.016924 (-0.9784) | -0.016310*** (-3.9960) | -0.008273 (-1.2542) | -0.004860 (-0.6341) | -0.008924 (-0.6028) |
| HR | -0.005043 (-1.2208) | -0.004797 (-0.8195) | -0.004607 (-1.1925) | 0.02157*** (-6.6723) | -0.000121 (-0.03030) | -0.002580 (-0.5339) |
| LnFDR | 0.008778*** (2.6984) | 0.007941** (3.0470) | 0.001922 (1.2305) | 0.000737 (0.7647) | 0.006880** (2.40310) | 0.007277*** (2.8448) |
| C | 0.929172*** (5.6844) | 0.846252*** (6.3362) | 0.910843*** (7.1319) | 0.684348*** (5.7427) | 1.029824*** (10.2417) | 1.158031*** (7.6925) |
| N | 308 | 247 | 308 | 247 | 308 | 247 |
| R^2 | 0.236659*** | 0.178686*** | 0.300098*** | 0.194765*** | 0.150340*** | 0.121109*** |

Note. Significance level * p<0.1; ** p<0.5; *** p<0.01.

From the analysis results, it can be concluded that new fixed assets in information transmission, computer services and software industry have a positive effect on technological progress and a negative effect on technical efficiency, which is similar to the results of most existing studies. New fixed assets in information transmission, computer services and software industry improve total factor productivity by improving the rate of technological progress. Through models (2) and (6), it can be seen that new fixed assets in information transmission, computer services and software industry have a "time lag" effect on total factor productivity and technical efficiency.

## 5. Conclusions and recommendations

Based on the provincial panel data from 2006 to 2015, It is found that new fixed assets in information transmission, computer services and software industry can significantly promote China's technological progress, inhibit China's technological efficiency, and promote China's total factor productivity that is driven by technological progress with a "time lag" effect. According to the characteristics of information transmission, computer service and software industry, we should increase investment in information transmission, computer service and software industry, and promote the long-term growth of China's economy according to the characteristics of China's own national conditions.

## References

[1] Romer P M. Endogenous Technological Change[J]. Nber Working Papers, 1999, 98(98):71-102.

[2] Barro R J, Lee J W. Sources of economic growth[J]. 1994, 40(1):1-46.

[3] Benhabib J,Spiegel MM. The role of human-capital in economic-development evidence from aggregat cross-country data. [J]. Journal of Monetary Economics, 1994, 34(2):143-173.

[4] Jeanneney S G, Hua P, Liang Z. Financial development, economic efficiency, and productivity growth: evidence from china. [J]. Developing Economies, 2010, 44(1):27-52.

[5] Brynjolfsson E, Hitt L M. Computing Productivity: Firm-Level Evidence[J]. Social Science Electronic Publishing, 2003, 85(4):793-808.