Technology Evolution of Transportation Infrastructure and Upgrading of Industrial Structure

Zhong Li[1,*], Fengxia Wang[1]

[1]Jiangsu Maritime Institute, Nanjing, China

*Corresponding author

Keywords: Transportation infrastructure, Technology evolution, Industrial structure upgrading

Abstract: Studying the impact of technology evolution of transportation infrastructure on industrial structure, which is triggering by high-speed train is the focus of this paper. Introducing technology evolution of transportation infrastructure into factor endowment model, we can find technology evolution of transportation infrastructure promote industrial structure upgrading. Basing on this, using Yangtze River Delta region 8 large and medium cities data in 2002-2011,the paper estimates dynamic panel data model.The result shows technology evolution of transportation infrastructure can promote local industrial structure upgrading and city's industry upgrading from low-end value chain to high-end value chain.

1. Introduction

From 1997 to 2007, China gradually implemented 6 nationwide railway speed increases. In 1993, the national average train travel speed was only 48.1 km/h. After six speed increases, the national average train travel speed was increased to 70.18 km/h in 2007. In particular, on April 18, 2007, the sixth speed increase marked the coming of China's high-speed railway era, with the maximum railway operation reaching 250 km, which was significantly improved compared with the previous five speed increases. The Yangtze River Delta region is considered to be China's "region with the strongest comprehensive strength".In 2008, the GDP of the Yangtze River Delta accounted for 21.69 percent of the national total, an increase of 3.25 percentage points compared with 1995. The total volume of imports and exports accounted for 36.13 percent of the country, an increase of 1.09 times over 1995. Moreover, since the reform and opening up, the Yangtze River Delta has become a region attracting more foreign investment in China, with the accelerating speed of population flow, the rapid growth of export trade and the gradual improvement of scientific and technological level. The industrial structure of the Yangtze River Delta has shown an obvious trend of upgrading, especially the rapid development of the service industry, which has become a new engine of regional economic growth. Therefore, the study on the evolution of transportation infrastructure technology for the upgrading of industrial structure in the Yangtze River Delta region is not only of great case significance for the adjustment of industrial structure and the promotion of industrial layout, but also of great reference significance for policy adjustment and government decision-making.

2. Model, Variables, and Data

The main purpose of this paper is to examine the impact of the technological evolution of transportation infrastructure on the upgrading of industrial structure. A common approach is to use the multiple difference method as a research method (Zhou Hao and Zheng Xiaoting, 2011). The advantage of this approach is that it not only considers the growth differences of cities with and without speed increase, but also makes a horizontal comparison between the growth differences of cities with and without speed increase. Through Equation (1), we have established the form of the empirical equation in this paper, and the regression equation can be written as:

$$\ln uis_{it} = \alpha + \beta \ln acc_{it} + \gamma d_i + \varphi \ln X_{it} + f_i + \varepsilon_{it}$$

  DOI: 10.25236/ieesasm.2021.037

In the formula, the explained variable is the logarithm of the upgrading of industrial structure. The explained variable includes accessibility acc, transportation technology change factors d and some other control variable vectors that affect the upgrading of industrial structure, which is controlled by the city fixed effect f.

2.1 Explanation of Core Variables

Changing factors of Transportation Technology (D). D represents the impact of transportation technology changes on industrial structure upgrading. When there is no change in transportation technology, the change of industrial structure is only determined by accessibility (other control variables are certain). However, when transportation technology changes, the change of industrial structure is not only affected by accessibility but also related to the evolution of transportation technology. Therefore, we can consider the traffic technology change factor as a dummy variable. D assigns 0, 1.1 means that the change of transportation technology has a significant impact on the upgrading of urban industrial structure, while 0 means that the change of transportation technology has no significant impact on the upgrading of urban industrial structure.

2.2 Control Variables

Human capital. A large number of literatures have verified the effect of human capital on economic growth. Generally speaking, human capital has a positive promoting effect on the upgrading of industrial structure.

FDI and Trade. In the open economic environment, with the introduction of foreign capital, there will be technology spillover effect to a certain extent, which has a positive effect on industrial upgrading. The upgrading of factor endowment structure can be realized through the acceleration of capital accumulation, and then the optimization of foreign trade structure can be realized. The optimization of trade structure in turn drives the acceleration of capital accumulation, thus improving the domestic industrial structure of developing countries.

The government factors. On the one hand, when government spending goes into public services such as education and health and public infrastructure, it helps improve economic efficiency. On the other hand, when government expenditure mainly occurs in administrative costs, it will not have a positive effect on the efficiency of economic development, and sometimes even damage the economic efficiency due to the ineffective allocation of resources.

Demand factors. The change of demand structure will directly promote the change of production structure and supply structure, thus leading to the change of the proportion of related industries in the whole national economy.

Investment factors. The change of the flow direction of social investment also reflects the different structure. The different flow direction of investment will directly affect production and supply, and be used in different industries. Therefore, the influence on the upgrading of industrial structure is also different.

2.3 Source and Description of Data

The paper Converts the actual utilized foreign capital and total import and export trade into RMB respectively by using the current USD to RMB exchange rate. In order to accurately analyze the influence of the factors affecting the industrial structure upgrading, the influence of the price change factor is removed. The data selected in this paper are from China Statistical Yearbook (2002-2011), Statistical Yearbook of various cities and Autonomous regions, and Statistical Bulletin of National Economic and Social Development of various cities and Autonomous regions.

Table1 Statistical description of variables

Variable	Obs	Mean	Std.Dev.	Min	Max
lnuis emp	50	-1.161	0.137	-1.496	-0.901
lncon	50	9.306	0.252	8.749	9.791
lnfdi	50	-2.699	0.360	-3.414	-1.604
lngov	50	-2.587	0.158	-2.908	-2.292

lnhc	50	3.637	0.204	3.354	4.203
lninex	50	-0.351	0.661	-1.400	1.058
lnfai	50	-0.696	0.201	-1.113	-0.370
lnuiss gdp	50	-0.989	0.0852	-1.165	-0.821
acc	50	-2.597	1.245	-4.876	-0.758

3. Results and Analysis

Taking 2008 as a discontinuity point, this paper investigates two periods, namely 2002~2007 before railway speed increase and 2008~2011 after railway speed increase. The overall effect of railway speed increase is analyzed by comparing the years from 2002 to 2007 and 2008 to 2011.

According to the general procedure of panel estimation, we first do Hausman test, and the results show that the fixed effect model should be adopted. The estimation results are shown in Table 2. In order to ensure the accuracy of empirical model prediction, sequence correlation must also be tested. We conducted intra-group autocorrelation test (Wald test) and inter-group contemporaneous correlation test (Breusch-Pagan LM).The results showed that there were both intra-group autocorrelation and inter-group contemporaneous correlation. Therefore, after the simultaneous correlation between groups is overcome, we use the generalized least square method (FGLS) to estimate the model. The estimated results are shown in Table 3:

After fully considering the control variable, with the GDP of the third industry to GDP ratio as the explained variable regression results are very significant, depicting railway speed impact of industrial structure upgrade estimated coefficient d significantly positive, agree with mentioned above expectations, which accelerated the railway transportation infrastructure technology evolution of increased along the city's industrial structure. For the period from 2008 to 2011 after the acceleration, D is 0.0261 and passes the test of significance level of 5%, which indicates that compared with the period without the acceleration, the upgrading speed of industrial structure during the acceleration period has significantly increased by 2.61 percentage points. The change of transportation technology can promote the upgrading of industrial structure, which is consistent with economic intuition. The empirical results of this paper also verify the conclusion of Chen and Hall (2012), indicating that the sixth acceleration in 2007 is one of the important sources for these five cities to achieve industrial upgrading. At the same time, we find that the regression result with the number of employment as the explained variable is significant without the addition of control variables, but it is not significant after the introduction of control variables, and the estimated coefficient is negative, indicating that the change of transportation technology has little impact on the upgrading of industrial structure. The author thinks that this is mainly because the opening of high-speed railway affects people's commuting mode. Before the operation of high-speed railway, people's commuting mode was relatively simple, so the activity radius was small. However, after the opening of high-speed railway, the activity radius increased significantly, so more cities chose to live in.

As for other factors, consumption level and human capital level have a significant positive impact on industrial structure upgrading, which is in line with the expectation of industrial structure upgrading theory. As for foreign direct investment, import, export and fixed asset investment have a negative impact on industrial structure upgrading, which is consistent with the conclusion of Yan Haizhou (2010).

Table2 regression results of the influence of transportation foundation evolution

	lnuis_gdp		lnuis_emp		lnuis_gdp
lnacc	0.0150*	0.0397***	0.0277***	0.0287*	
	(1.75)	(4.20)	(5.55)	(2.04)	
d	0.0542**	0.0261**	0.0801***	-0.0204	

	(2.62)	(2.92)	(6.22)	(-1.50)
lncon		-0.180**		-0.0160
		(-3.27)		(-0.17)
lnfdi		0.0405**		-0.0838***
		(2.98)		(-4.14)
lngov		-0.00517		0.00889
		(-0.19)		(0.21)
lnhc		0.301***		0.221***
		(7.50)		(5.67)
lninex		-0.132***		-0.128***
		(-8.42)		(-8.22)
lnfai		-0.0642**		0.0242
		(-2.80)		(0.54)
_cons		-0.254		-1.890*
		(-0.50)		(-2.12)
Wald test		3.691		2.175
Breusch-Pagan LM test		16.725		15.524
N	50	50	50	50
P(hausman)	0.00	0.00	0.00	0.00
	FE	FE	FE	FE
*, ** and *** represent significant in the degree of 10%, 5% and 1% respectively				

4. Conclusion

Based on the panel data and generalized least square estimation method of five accelerated cities in the Yangtze River Delta region from 2002 to 2011, this paper analyzes the impact mechanism of transportation infrastructure technology evolution on industrial structure. By controlling per capita consumption expenditure, human capital, total amount of import and export, foreign direct investment, technological innovation and other variables, the essential impact of technological evolution of transportation infrastructure on industrial structure upgrading is revealed. The main conclusions are as follows: Sped up the knowledge spillover to the speed increase, promote knowledge cities full flow in the urban agglomeration, every city in accordance with their own intellectual endowments to maximize production, product, and then implements the site along the upgrading of industrial structure, speed up throughout the 2008-2011 period, shanghai-nanjing line and shanghai-hangzhou line stops its industrial structure by about 4.27%.

5. Acknowledgement

The paper is the achievement of the research fund project of philosophy and social science of universities in jiangsu province , research on the “mechanism and countermeasures of comprehensive transportation hub to promote the development of modernserviceindustry” . (Item number : 2018SJA0698)The paper is the achievement of the administration of research projects of modern educational technology , research on the “Influencing Factors and Mechanism of Information Literacy of Higher Vocational College Students” .(Item number : 2019-R-77418) The paper is the achievement of the research fund project of Jiangsu Maritime Institute of universities Thousand sails plan in jiangsu province , research on the “Transportation Economics Team” .

References

[1] Pred A. The Spatial Dynamics of U.S. Urban-Industrial Growth, 1800-1914[M].Interpretative and Theoretical Essays, 1966,The MIT Press, Cambridge, MA.

[2] Feldman, M. The Geography of Innovation, Kluwer Academic Publishers[M], Boston,1994

[3] Gråsjö, U. Knowledge Production and Spatial Spillovers. An Accessibility Approach[J]. JIBS Dissertation Series No. 34,2006, Jönköping.

[4] Johansson, S. and Karlsson, C. R&D Accessibility and Regional Export Diversity[J]. Annals of Regional Science,2007,41(3).

[5] Andersson, Å.E. Increasing Networking Possibilities and Global Structural Transformation[J].Journal of Applied Regional Science,1998, 3.

[6] Shao Hui.Agglomeration of Producer Services in Beijing[J].Acta Geographica Sinica,2008,63(12):1289-1298

[7] FANG Yuan-ping , BI Dou-dou , XIE Man. Spatial Correlation Characteristics and Dynamic Mechanism of Knowledge Intensive Business Service: A Spatial Econometric Analysis of Guangdong Province[J].Scientia Geograohica Sinica,2014,34(10):1193-1201

[8] SHEN Yuming, QIU Ling, WANG Maojun, REN Wangbing, SHANG Yuli.Industry Relevancy Analysis of Producer Services in China [J].Acta Geographica Sinica,2007,62(8):821-830