

The Impact of High-speed Railway Opening on Economic Growth in Heilongjiang Province

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Abstract

With the arrival of China's high-speed rail era, it greatly shortens the distance of time and space, and speeds up the flow of economic factors. This paper selects the panel data of 11 prefecture-level cities in Heilongjiang Province except the provincial capital from 2014 to 2021, and uses the multi-period difference-difference method to analyze the impact of high-speed railway construction on the urban economic development of Heilongjiang Province. The results show that in the short term, high-speed railway construction can promote the economic development of Heilongjiang Province.

Keywords

High-speed Rail; Economic Development; Double Difference; Heilongjiang Province.

1. Introduction

China's high-speed railway construction started late, but the construction development speed is fast. In 2025, China's high-speed railway mileage is expected to increase to 50,000 km, marking that China is about to enter the era of high-speed rail. As a prerequisite for social development, transportation infrastructure has a close relationship with economic development. The opening of high-speed rail can promote the flow of factors between regions, increase the links between regions, change the regional spatial economic development pattern, and inject new momentum into economic growth.

This paper takes Heilongjiang Province as an example to explore the impact of high-speed rail on economic development. In the construction of public infrastructure, the construction and improvement of transportation infrastructure has a particularly critical and far-reaching impact on economic growth. The improvement of transportation infrastructure in a region can reduce the cost of population flow and shorten the time of population flow to the region, which will have a long-term and profound impact on the economic development of a region. In recent years, the economic development of Heilongjiang Province is sluggish and the population aging is intensified. The opening of high-speed rail has two effects on the agglomeration and diffusion of the permanent urban population in Heilongjiang Province.

First, with the opening of high-speed rail, transportation becomes more convenient, reducing the cost of population migration, which may accelerate the transfer of urban population in Northeast China to more economically developed cities and provinces;

Secondly, the opening of high-speed rail shortens the migration time between regions, accelerates the flow of human capital and other factors to the cities opened by high-speed rail, and promotes the spatial agglomeration of economic factors.

In order to explore the impact of the opening of high-speed railway on the urban economy of Heilongjiang Province, this paper studies the impact of high-speed construction on the urban economic development of Heilongjiang Province by using multi-period differential.

2. Literature Review

From the impact of high-speed rail on regional spatial pattern. Some scholars have pointed out that high-speed rail can not only affect the spatial pattern of big cities, but also improve the economic structure of small cities and cities with relatively slow economic development level, and promote economic growth from the micro level.

By analyzing the data of 261 prefectural-level cities, Wen and Han concluded that the opening of high-speed railways has a significant impact on the pattern of regional economic development in China, with the spatial distance between cities shrinking and the accessibility between cities increasing. The diffusion effect of high-speed railways is constantly improving the imbalance of regional economic development in China.

Jia and Qin point out that although high-speed rail improves the accessibility between cities, the balanced economic pattern between regions may be broken due to the different impact of traffic lines on economic growth in different regions. Taking 2010 as the policy node, Li, Huang and Zhang used the traditional differential method to study the panel data of 58 prefecture-level cities in Fujian Province from three aspects: economic growth, industrial structure upgrading and urbanization, and then concluded that the opening of high-speed rail had a promoting effect on regional GDP in the short term, but it was related to the level of local economic development, and there were significant differences. China's research on the relationship between high-speed rail and economic growth started late, and mainly focused on prefecture-level cities or areas with high economic development level such as the Yangtze River Delta, and relatively few research on high-speed rail in Northeast China.

In view of this, this paper selects 11 prefecture-level cities in Heilongjiang Province as research objects, and uses the difference-difference method to analyze the economic effects brought by the opening of high-speed rail into Heilongjiang Province.

3. Research Method

3.1. Model Design

The method of difference-in-differences (DID) is very effective in analyzing and evaluating whether the policy effect is significant. In studying the impact of high-speed rail on economic effects, some scholars choose to adopt the traditional DID method. Under this model, the nodes at which individuals are subject to the policy time are the same. The experimental group and the control group are divided according to whether they are subject to the policy impact before and after the node.

If the control group opens high-speed rail after the node, these cities need to be deleted, and a large number of samples will be lost, which will have a certain impact on the empirical results. Since the opening time of high-speed rail in different prefecture-level cities in Heilongjiang Province is different, in order to make the empirical results more accurate, this paper adopts the multi-phase DID method. The multi-phase DID effectively solved the problem of opening high-speed rail in different regions at different times. The model configuration is as follows:

$$Y_{it} = \beta_0 + \beta D_{it} + \gamma X_{it} + \mu_i + \theta_t + \varepsilon_{it} \quad (1)$$

Where: i represents different cities, t represents time, and the explained variable Y represents the impact of the opening of high-speed rail on the economy of Heilongjiang Province. In this paper, the logarithm of regional actual GDP is used to represent; D_{it} is the main explanatory variable. If the city is opened to high-speed rail in year t , it will enter the experimental group, as $D_{it}=1$, whereas the control group means $D_{it}=0$, that is, the city has not opened high-speed

rail in the sample period. X_{it} is the control variable selected in this paper. There are three covariables selected in this paper, including the development level of the tertiary industry, the degree of financial development, and the government financial expenditure. μ_i represents the individual dummy variable of different city differences. θ_t represents the time dummy variable; ε is the random disturbance term. The main parameter concerned in this paper is β . If $\beta > 0$, it indicates that the opening of high-speed rail has a positive effect on the economic growth of Heilongjiang Province; If $\beta < 0$, it means that the opening of high-speed rail has a negative effect on the economic growth of Heilongjiang Province.

3.2. Data Specification

The data sample in this paper is the panel data of 11 prefecture-level cities in Heilongjiang Province from 2014 to 2021 to study the impact of high-speed rail opening on the economic development of Heilongjiang Province.

Data sources include: China Urban Statistical Yearbook and Heilongjiang Provincial Statistical Yearbook for 2014-2021. STATA software was used for statistical analysis.

3.3. Variable Selection

Dependent variable: regional real GDP. This paper uses regional real GDP as the dependent variable, which can reflect the economic scale of a region and directly reflect the economic development level of Heilongjiang Province.

Core variable: The opening of high-speed rail (D_{it}). Since the opening time of high-speed rail in different regions is not consistent, this paper takes the completion and opening time as the basis. If it is completed and opened to traffic in that year, it is recorded as that year; If it is completed in the current year and opened to traffic in the following year, it is recorded as the following year.

Control variables: Referring to previous studies of scholars, the control variables selected in this paper include: the development level of the tertiary industry, the degree of financial development and government financial expenditure.

The description of variable indicators is shown in Table 1.

Table 1. Descriptive statistics

	(1)	(2)	(3)	(4)	(5)
Variables	N	mean	sd	min	max
id	88	6	3.180	1	11
year	88	2,018	2.304	2,014	2,021
treated	88	0.364	0.484	0	1
time	88	0.250	0.435	0	1
y	88	9.186e+06	7.403e+06	2.060e+06	3.120e+07
cost	88	2.285e+06	1.220e+06	620,773	5.289e+06
finance	88	7.977e+06	4.698e+06	1.405e+06	1.961e+07
structure	88	41.50	5.801	19.76	56.90
did	88	0.250	0.435	0	1
lny	88	6.834	0.338	6.314	7.494
lncost	88	6.295	0.242	5.793	6.723
lnfinance	88	6.814	0.298	6.148	7.292
Number of id	11	11	11	11	11

Tertiary industry development level (structure): Tertiary industry development level is an important indicator of regional economic development. The higher the development level of the tertiary industry, the more developed the regional economy.

The development level of the tertiary industry is expressed by the proportion of the added value of the tertiary industry in the GDP of each prefecture-level city.

Financial development degree: financial development degree (finance). In areas with a higher level of financial development, financing costs are relatively low, further reducing the investment costs of enterprises. Local governments can further enhance the flow of talents by easing financial credit constraints and promoting corporate investment. In this paper, the proportion of the loan amount of financial institutions to the GDP at the end of the year is expressed.

Government financial expenditure (cost): Government expenditure is generally related to local economic development, and this paper is expressed by the actual government expenditure of each prefecture-level city.

4. Empirical Analysis

4.1. Baseline Regression Analysis

According to the establishment of the above econometric model, the panel data of Heilongjiang Province from 2014 to 2021 are used for full-sample regression econometric analysis, and the empirical results are shown in Table 2. The DID regression coefficient after the opening of high-speed railway is 0.5576, and it is significant at 1% level, indicating that the opening of high-speed railway has promoted the economic growth of Heilongjiang Province. It can be seen from the regression results that the opening of high-speed rail has a positive impact on the economic development of Heilongjiang Province.

Table 2. The empirical results

Variables	lny		
		2017 year	0.0141**
did	0.5576***		(0.0245)
	(0.0155)	2018 year	0.0220**
lncost	0.127***		(0.0258)
	(0.0891)	2019 year	0.0401**
lnfinance	0.0142***		(0.0283)
	(0.0874)	2020 year	0.0479**
bili	0.0111***		(0.0300)
	(0.00125)	2021 year	0.0752**
2015 year	0.00682**		(0.0296)
	(0.0165)	Constant	6.136***
2016 year	0.0110**		(0.705)
	(0.0195)	Observations	88
		Number of id	11
		R-squared	0.679

Note: Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.2. Parallel Trend Test

Parallel trend test is a hypothesis that must be met for multi-phase DID, that is, the experimental group and the control group should have similar development trends and similar

characteristics before the policy implementation. Only when the parallel trend test is met can the multi-phase DID model be used.

The parallel trend test method of the multi-period DID model is also carried out using the event study method, and the policy occurrence point in each region is inconsistent. Therefore, the test of multi-period DID is related to the opening time of high-speed rail in the region, and the sample time should be subtracted from the time of respective policy implementation.

In order to avoid collinearity of regression results, the data of the first and second phases before the implementation of the policy were excluded.

If the effect of the policy before implementation is not significant, but the effect of the policy after implementation is significant, then the parallel trend test is valid.

It can be intuitively seen from the parallel trend test chart in Figure 3 that the estimated coefficient fluctuates around 0 in the first 5 periods of policy implementation (95% confidence interval includes 0 value), indicating that the opening of high-speed rail has no significant effect on regional economic development.

After the opening of the high-speed railway, it is significantly different from the zero axis and positive, indicating that the high-speed railway has played a positive role in promoting the economic development of Heilongjiang Province within 6 years after the opening of the high-speed railway, satisfying the parallel trend test hypothesis.

However, due to the impact of the COVID-19 pandemic, the opening of high-speed rail in some of these cities has not had a particularly significant economic boost.

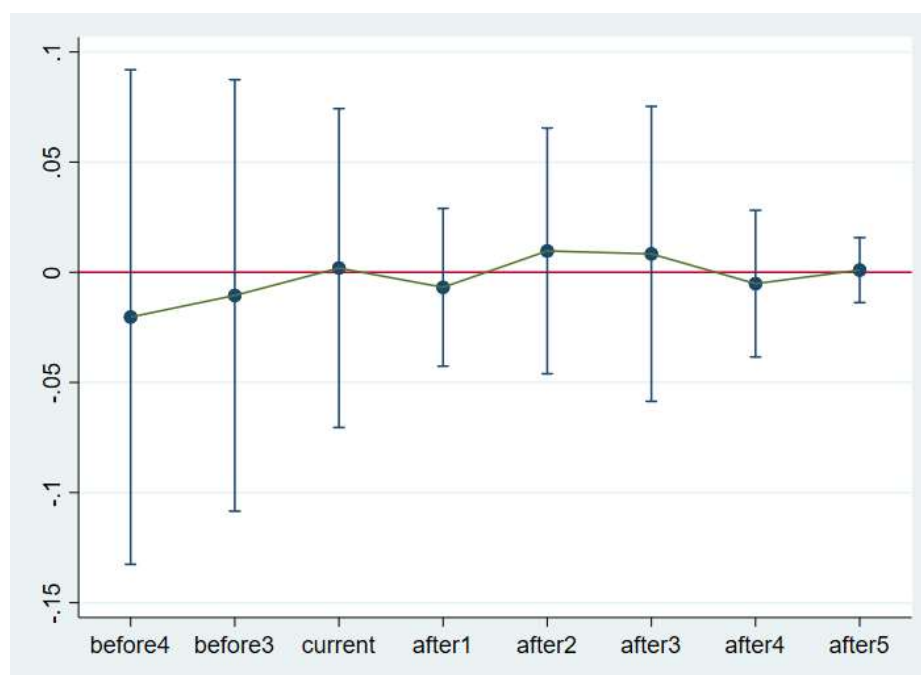


Figure 1. The parallel trend test chart

5. Conclusion and Suggestions

This paper uses the data of 11 prefecture-level cities in Heilongjiang Province from 2014 to 2021, adopts the multi-period DID method, and takes the actual opening time of high-speed rail as the policy point to study the impact of high-speed rail opening on local regional economic development. This paper selects the development level of the tertiary industry, the degree of financial development and government financial expenditure as the control variables, and draws the following conclusions:

In the context of building a new development pattern, China's economy has shifted from high-speed development to high-quality development, and transportation infrastructure, as a prerequisite for social development, plays a vital role in economic development. With the advent of China's high-speed railway era, high-speed railway has a positive promoting effect on the economic development of Heilongjiang Province. The time and space distance between cities has been significantly reduced due to the completion and opening to traffic of high-speed railway, and the flow barriers between factors have been gradually broken, attracting the inflow of high-quality talents, reducing the cost of information collection among enterprises, and more conducive to the formation of industrial agglomeration, thus attracting capital inflow. Different regions have different levels of economic development, and the impact of high-speed rail on economic growth will be different. On the whole, the opening of high-speed rail will promote regional economic development, but due to the "siphon effect", it will expand the development imbalance between cities to a greater extent, and then lead to the uncoordinated economic development between regions.

The sample period studied in this paper is 2014-2021. Due to the relatively short sample period, high-speed rail has a long-term effect on regional economic development, and the short-term impact may not represent the long-term effect.

Based on the above conclusions, the following policy recommendations are put forward: All regions should seize the development opportunities in the era of high-speed rail, take high-speed rail as the support point of economic development, increase the construction of supporting facilities for the opening of high-speed rail, increase the improvement of basic public transport facilities, shorten the time for citizens to travel to high-speed rail stations, and improve the convenience of citizens to take high-speed rail.

Each region should develop distinctive projects to build local city brands and increase their attractiveness.

In addition, the characteristic prefecture-level city can be taken as the starting place to promote its entry into the market to a greater extent, expand its economic effect, attract more investment, and further promote economic development.

Heilongjiang Province is located in the northeast of China, so it should strengthen the cooperation with neighboring Jilin and Liaoning regions, strengthen the industrial correlation between the regions, realize the synergy and complementarity of cities in the region, and overcome the "siphon effect" caused by the construction of high-speed rail.

References

- [1] Da G, Yanjun C, Chang L. The Low-Carbon Policy and Urban Green Total Factor Energy Efficiency: Evidence from a Spatial Difference-in-Difference Method [J]. *International Journal of Environmental Research and Public Health*, 2023, 20(4).
- [2] Eryu Z, Xiaoyu H, Peng X. Does Smart City Construction Decrease Urban Carbon Emission Intensity? Evidence from a Difference-in-Difference Estimation in China [J]. *Sustainability*, 2022, 14(23).
- [3] Hongge Z, Zhenhuan C, Shaopeng Z, et al. The Role of Government Innovation Support in the Process of Urban Green Sustainable Development: A Spatial Difference-in-Difference Analysis Based on China's Innovative City Pilot Policy [J]. *International Journal of Environmental Research and Public Health*, 2022, 19(13).
- [4] Shuping C, Jinli L, Jingxue X, et al. High-Speed Railway Opening and Urban Innovation Dividend -- A Case Study of Guangzhou Zhuhai Intercity High-Speed Railway [J]. *Land*, 2022, 12(1).
- [5] Qifei C, Meng W. Opening of high-speed rail and the consumer service industry: Evidence from China [J]. *Economic Analysis and Policy*, 2022, 76.
- [6] Lexuan S, Wei L. Has the opening of high-speed rail reduced urban carbon emissions? Empirical analysis based on panel data of cities in China [J]. *Journal of Cleaner Production*, 2021, 321.

- [7] Dandan W, Dennis Y W, Taotao D. Transportation Development, Spatiotemporal Convergence, and Urban Land Use: Study of the Opening of High-Speed Rails in the Yangtze River Delta, China[J]. Journal of Urban Planning and Development,2021,147(3).
- [8] Lei Z, Xuemeng G, Libin Z. How Does Transportation Infrastructure Improve Corporate Social Responsibility? Evidence from High-Speed Railway Openings in China[J]. Sustainability,2021, 13 (11).
- [9] Sungjo H, Yonggun K. Predicting Regional Economic Change in Gangwon Province due to the Opening of High-Speed Railway[J]. Journal of the Korean Urban Management Association,2017,30 (3).
- [10]Jingson X. Analysis of the Impact of the Opening of Wuhan-Guangzhou High-speed Rail on the Innovation Ability of Cities Along the Line based on Empirical Test[P]. 2022 International Conference on mathematical statistics and economic analysis (MSEA 2022),2022.
- [11]Xiujuan L, Zheneng H, Chuanhao W. Does the opening of high-speed rail enhance urban entrepreneurial activity? Evidence from China [J]. Socio-Economic Planning Sciences, 2023,88.
- [12]Xia W, Li B, Yin S. Identification of Influencing Factors for Sustainable Development: Evaluation and Management of Regional Innovation Performance in Heilongjiang, China[J]. Sustainability,2020,12 (7).
- [13]Chen W, Lei Y, Wu S, et al. Opportunities for low-carbon socioeconomic transition during the revitalization of Northeast China: Insights from Heilongjiang province[J]. Science of the Total Environment,2019,683.