

Study on the Influence of High-speed Railway Opening on China's Urban and Rural Economic Development

Zijian Wang

High School Attached to Shandong Normal University, Shandong, China

wang24854863@gmail.com

Abstract. High-speed rail system in China is advancing at an impressive pace which has yet to reach a consensus among scholars regarding its effect on urban and rural economic development. This paper employs literature review and theoretical analysis to dissect the intrinsic mechanisms through which the launch of high-speed rail system lines affects urban and rural economic development, using personal observations to explore the complex relationship between the launch of high-speed rail system lines and urban-rural economic development. The study finds that the launch of high-speed rail system lines can accelerate the common development of urban and rural economies. The Siphon effect of high-speed rail system can exacerbate the imbalance in urban-rural economic development, while the diffusion effect can propel rural economic development into a fast lane. High-speed rail systems are "instrumental variables, with their effectiveness depending on the existing economic foundation, policy design, and regional development stage of both urbanized zones and rural regions. The effect of high-speed rail system on urban and rural economies hinges on supporting policies and development stages.

Keywords: High-speed rail system, urban and rural economic, Siphon effect, diffusion effect.

1. Introduction

1.1. Research Background

The 20th National Congress of the Communist Party of China in 2022 proposed to prioritize the development of agriculture and rural areas, promote integrated urban-rural development, and facilitate the flow of elements between urbanized zones and rural regions. It emphasized fully leveraging the important role of rural areas as consumer markets and factor markets, comprehensively advancing rural revitalization, promoting urbanization with counties as key carriers, driving integrated urban-rural development, enhancing economic ties between urbanized zones and rural regions, and smoothing out the economic cycle between them. Based on information from the National Bureau of Statistics website, the ratio of per capita disposable income of urban residents to that of rural residents in China was 2.34:1 in 2024. It is expected that for a considerable period, the dual structure of urban and rural economies will remain a significant factor in the imbalance of economic development between urbanized zones and rural regions, constraining China's progress toward 'innovation, coordination, green development, openness, and sharing'.

China's high-speed rail system is steadily advancing towards the construction of a "Eight Vertical and Eight Horizontal" high-speed rail system network, with plans to reach a total operating mileage of about 50,000 kilometers by 2025. The coverage of the high-speed rail system network will further expand. High-speed rail system offers advantages such as fast speeds, safety, punctuality, and low pollution, providing convenient transportation for people and increasingly becoming an important mode of travel. Therefore, the launch of high-speed rail system, to some extent, shortened the distance between urbanized zones and rural regions, altered the spatial and temporal patterns of urbanized zones and rural regions, promoted economic exchanges and connections between urbanized zones and rural regions, and has had a profound effect on the gap in urban and rural economic development in China.

1.2. Literature Review

The effect of high-speed rail system on the economic development gap in China has been extensively studied by the academic community, scholars have not yet reached a consensus on what effects the launch of high-speed rail system lines will have on the economic development of China's rural and urban regions. Of the effect effects of the launch of high-speed rail system lines, which one is more prominent, the siphoned effect or the diffusion effect? First, Kato and so on took the Japanese high-speed rail system as their research subject and found that the construction and opening of high-speed rail system increased the degree of agglomeration, thereby enhancing the economic productivity of the region [1]. Key components of manufacturing, including capital, labor, and technology have the characteristic of transferring to developed areas. The launch of high-speed rail system lines has made the traffic conditions of the affiliated areas better and increased the attractiveness of cities. Cities, leveraging their advantages in industrial foundation, public services, and innovation resources, attract more production factors to agglomerate. Second, the launch of high-speed rail system lines has a radiation effect, narrowing the gap in regional economic development. Lin Shi and so on found that the launch of high-speed rail system lines has significantly promoted regional economic integration, which is conducive to the realization of the economic development gradient effect and promotes the coordinated development of the regional economy [2]. Urban areas tend to focus on developing industries that have a high value-added component, such as high-end manufacturing and modern service industries, while rural areas can rely on characteristic agriculture, eco-tourism, and other industries to form industrial complementarity with cities. For example, some rural areas close to cities use the advantage of passenger traffic brought by high-speed rail system to develop rural tourism, which develops in coordination with the urban tourism service industry, achieving a collaborative upgrade of industries and a linked growth of urban and rural economies. Through discussions on these issues, the effect effects of high-speed rail system can be clearly recognized, it is possible to approach the development and launch of high-speed rail system rationally. Therefore, it is of significant importance to deeply explore How high-speed rail system will affect the economic development gap between urbanized zones and rural regions in China. This article collects, organizes, analyzes, and refines the literature the effect of the advancement of China's high-speed rail system on the urban and rural economies. Sorts out and conclude the views of scholars at home and abroad, grasps the latest development trends of high-speed rail system construction and urban and rural economy, and uses important perspectives of theories such as the growth pole theory, income gap theory, and dual economic structure to analyze the internal mechanisms of the effect of the launch of high-speed rail system lines on the development of urban and rural economies.

1.3. Research Significance

As a significant innovation in the field of modern transportation, high-speed rail system has profoundly changed the inter-regional spatial and temporal relationships with its advantages of high speed, efficiency, and large capacity. Since Japan opened the world's first high-speed rail system in the 1960s, high-speed rail system construction has flourished globally. By the end of 2024, China's high-speed rail system network rapidly expanded to 48,000 kilometers, setting a new historical record. Not only did high-speed rail system improve the transportation network, but it also had a significant effect on urban and rural economies landscape. The flow and reallocation of production factors between urbanized zones and rural regions was promoted by breaking traditional geographical spatial constraints, and brought new opportunities and challenges to the economic development of urbanized zones and rural regions. A thorough study of the effect of high-speed rail system on the urban and rural economy is of significant practical importance for rationally planning regional development strategies and promoting the process of urban-rural integration.

2. Definition and Theoretical Basis of Related Concepts

2.1. Development of High-speed Rail

High-speed rail system refers to a railway transportation system designed for speeds of 250 kilometers per hour or above, characterized by its fast speed, high safety, and good comfort. Since the functioning of high-speed rail system, many countries and regions have vigorously developed this mode of transportation for the new era. The Chinese high-speed rail system network has developed rapidly, with many indicators ranking first in the world. This has significantly improved China's level of transportation.

2.2. Theoretical Basis

2.2.1 Growth pole theory

In 1950, the growth pole theory was proposed firstly by French economist François Perroux and western regional economics considers it a cornerstone of the concept of economic regions, providing a foundation for the theory of unbalanced development. Due to the growth pole theory, economic growth generally starts from one or several "growth centers" and then spreads to other sectors or regions gradually. Economic development can be driven by choosing a specific geographical area as a growth point. A growth pole can be a city or a region, which, through its progressive leading industrial sectors and expanding industrial complex, exerts a dominant effect and an innovative role on surrounding areas.

2.2.2 The theory of income gap

The income gap theory was first theoretically analyzed by Nobel laureate Kuznets, who initially proposed the inverted "U" shape of income distribution gap in his 1995 publication "Economic Development and Income Inequality". Yanyan Zhang and so on estimated the effect of transportation infrastructure construction on economic growth using railway data and also found that the relationship between the two exhibits a clear "inverted U shape" [3].

2.2.3 Theory of dual economy

The dual economy theory was first proposed by Buerck in 1933, where he divided the Indonesian socio-economic structure into traditional and modern sectors. In 1954, a famous paper "Economic Development with Unlimited Supplies of Labor" was published by Lewis, which further described the dual economic characteristics of developing countries. Lewis's model posits that the marginal productivity of the traditional agricultural sector is zero or negative, with workers providing labor at the minimum wage level, resulting in an unlimited supply of labor. The wages in the urban industrial sector are slightly higher than in the agricultural sector, attracting surplus agricultural population to migrate to urban industrial sectors [4].

3. The Effect of High-speed Rail System Opening on Urban and Rural Economy

3.1. High-speed Rail System can Accelerate the Common Development of Urban and Rural Economies

The two-way flow of resources is promoted by high-speed rail system, which breaks down the geographical barriers between urbanized zones and rural regions. Agricultural specialties from rural areas are transported nationwide, driving the rural economy; intangible cultural heritage is spread through the commercial districts of high-speed rail system stations, promoting the integration of urban and rural cultures. The tourism resources of rural areas surrounding high-speed rail system (such as aviation towns, gliding bases) are connected with urban tourists, driving the upgrading of the cultural and tourism industry.

3.1.1 The improvement of high-speed rail network can improve the accessibility between urban and rural areas

High-speed rail system significantly enhances the accessibility of urban and rural economies within and outside regions by shortening the spatial and temporal distances. For example, the Weiyang. The high-speed rail system in Shandong forms a high-speed rail system loop. in the Jiaodong Peninsula, incorporating multiple cities into a "1-hour economic circle," which promotes the internal flow of resources and functional complementarity among urban agglomerations. The Super high-speed rail loop in the Yangtze River Delta connects the provinces of Shanghai, Jiangsu, Zhejiang, and the municipality of Anhui, forming a networked layout that greatly compresses the spatial and temporal distances linking primary urban centers with adjacent non-metropolitan zones (such as Southern Anhui), driving resource sharing and factor mobility. The improvement in accessibility can also optimize the regional urban-rural economic layout, reduce transaction costs, and expand market reach [5].

3.1.2 The opening of high-speed railway can promote the industrial coordination and cluster development between urban and rural areas

High-speed rail system has shortened commuting times between regions, promoting cross-regional employment and technological exchange. Research by Huihui Deng and so on. found that high-speed rail system significantly enhances regional economic development levels [6]. The Zhangjiang Hi-Tech Park in Shanghai and the Suzhou Industrial Park are connected by high-speed rail system, forming a collaborative model of "R&D in Shanghai, production in Suzhou." High-speed rail system freight trains (such as for fresh produce and electronics) reduce transportation losses, driving upstream and downstream companies in the supply chain to cluster around high-speed rail system hubs.

High-speed rail system promotes cross-regional integration of industrial chains and the formation of industrial clusters. The high-speed rail system equipment parks in Weifang and Liaocheng, Shandong, have formed industrial clusters through technological innovation, with the leading industry's output value growing by 20.75% in 2024. High-speed rail system indirectly drives manufacturing upgrades by promoting the agglomeration of production services (such as R&D and logistics), creating an "effort integration effect".

The effect of high-speed rail system on the integration of urban and rural economies is systemic. It promotes the flow of factors and industrial synergy through physical connections, and drives deeper regional cooperation through economic and cultural integration. High-speed rail system construction and operation not only aids in the upgrading and optimization of industrial structures in both urbanized zones and rural regions, enhancing their competitiveness and innovation capabilities, but also advance the integration and unification of industries between urban and rural regions.

3.2. The Suction Effect of High-speed Rail Opening can Aggravate the Imbalance of Urban and Rural Economic Development

Siphon effect refers to the gradual transfer of production factors from the marginal region to the central region, which weakens the economic development foundation of the marginal region and is not conducive to the economic development of the marginal region.

The central areas of high-speed rail system cities have a solid foundation for economic growth, complete infrastructure conditions, and government policy support, which can bring superior conditions for corporate growth and personal development [7]. After the introduction of high-speed rail system, rural areas have lost their competitive edge compared to central regions. Various production factors such as human resources, capital, and technology are increasingly attracted to the central regions, gradually shifting from rural areas with weak economic development, inadequate infrastructure, and poor living standards. This is specifically manifested in:

Firstly, the transfer of industrial resources from rural areas to high-speed rail system cities has intensified. According to research by Shanming Jia and Chenglin Qin, the regional economic pattern

in China has gradually become unbalanced due to the completion of the high-speed rail system network in 2020 [8]. Before the high-speed rail system was operational, rural industries, under the condition of aggregating various local resources and elements, would find advantageous industries suitable for local development, but their main markets were limited to surrounding areas. After the high-speed rail system opened, transportation between different regions became more convenient, improving regional accessibility. As a result, to seek broader consumer markets, the main industries in rural areas have shifted their business locations to urban areas, thus significantly lagging behind in economic development.

Secondly, it exacerbates the outflow of professional talent from rural areas to high-speed rail system cities. The introduction of high-speed rail system has improved accessibility between regions, leading people to choose employment in areas with good economic prospects and convenient transportation when making job choices. Employment locations are mainly concentrated in first-tier and second-tier cities across provinces. As a result, there is a significant loss of talent from rural areas, which is even more detrimental to their economic development.

Thirdly, exacerbate the tilt of rural market consumption towards high-speed rail system cities. Yi Liu and so on. found that the launch of high-speed rail system lines significantly promotes labor mobility and concentration in cities along the line, bringing abundant labor resources to major central stations, thereby boosting local economic development [8]. After the introduction of high-speed rail system, residents from towns may choose to travel by high-speed rail system to cities for education, healthcare, entertainment, and other consumption, leading to a decline in local service industries. For example, after the opening of Zhengzhou's high-speed rail system, the foot traffic at large malls in surrounding prefecture-level cities decreased by about 15%. In Jingzhou, Hubei, after the launch of high-speed rail system lines, a large number of people flowed to Wuhan, causing a contraction in the local consumer market and resulting in a "corridor effect."

3.3. The Diffusion Effect of High-speed Rail Opening Can Promote the Rural Economic Development into the Fast Lane

The diffusion effect refers to the gradual transfer of production factors from central regions to peripheral areas, thereby driving economic development in these peripheral regions. The diffusion effect is related to the level of development of high-speed rail system networks; the more developed the high-speed rail system network, the more pronounced the diffusion effect will be. This effect facilitates the spread of quality resources and elements from central to peripheral regions, gradually narrowing the economic development gap between regions [9].

Against the backdrop of the rural revitalization strategy, the efforts to strengthen agriculture, benefit farmers, and enrich rural areas have been continuously increasing, significantly enhancing the attractiveness of vast rural areas. The launch of high-speed rail system lines has enabled the accommodation of urban resource spillover of urban resources in the late industrialization phase. Using spatial econometric methods, Cong Cen and Wei Jiang have concluded that the economic development of various prefecture-level cities is positively affected by high-speed rail system in Guangdong, significantly promoting economic growth in the region [10].

Firstly, the launch of high-speed rail system lines provides the possibility for rural areas to receive urban spillover population and educational resources. Rural economic development hinges on human resources. The productivity renaissance in peripheral rural economies and the agricultural sector begins with the rejuvenation of the local population and talent in agriculture. As the wage gap between industrial and agricultural sectors narrows, some migrant workers have reversed their intentions to move to cities, gradually shifting towards returning home for entrepreneurship and property investment, local rural relocation, or part-time work. The return of urban laborers and economic talents to the countryside is becoming a trend in the technological and institutional modernization of Chinese agriculture and rural society. The return of population leaves some agricultural transfer populations in rural areas, which can help mitigate risks associated with rapid urbanization to some extent, effectively address the "bottom collapse" of rural social structures, solve labor issues for rural

economic development, and also effectively tackle social problems such as left-behind children and empty-nest elders, contributing to the stability and development of rural society.

Secondly, the launch of high-speed rail system lines has facilitated the rural areas in absorbing capital and technological resources that overflow from cities. The progress of the rural economy is based on financial security. The return of population not only solves the human resource issue for rural economic development but also brings back substantial funds. They invest in various industries according to local conditions, individual capabilities, and technological needs. The massive influx of returnees and newcomers also constitutes a significant consumer market, playing an irreplaceable role in invigorating the rural market. The surplus funds accumulated from urbanization serve as a "reservoir" for the capital shortage in rural economic development, especially with the policy support of the rural revitalization strategy, providing a clear direction for the spatial expansion of urban capital. The large-scale operation of agriculture and the deep adjustment of the rural economic structure have made agriculture and rural areas a new opportunity for urban capital seeking development. Investment in rural areas, as an important part of urban-rural integration, effectively connects with the returning workforce, becoming a significant support for promoting the supply-side structural reform of agriculture and rural areas, and driving the modernization in China's agricultural sector and countryside development.

Thirdly, the introduction of high-speed rail system provides a guarantee for rural areas to undertake industries and services that spill over from cities. The development of rural economy, with thriving industries as the focus, is the engine of rural economic growth. Without industrial support, it is impossible to retain the population. With the support of technology and capital from urban-rural integration, the reform of agricultural land system continues to deepen, and the trend towards moderate-scale agricultural operations is evident, with the steady advancement of agricultural industrialization and modernization. The advanced concepts, high-end technologies, and substantial funds brought by urban-rural integration guide small-scale farming into the track of modern agricultural development. With the development of rural infrastructure and informatization, agricultural enterprises often prefer to combine with raw material production areas, source materials locally, reduce costs, and achieve value-added processing and transformation of agricultural products on the spot. When urbanization reaches a certain stage, influenced by factors such as cost and environment, the layout of industrial enterprises increasingly tends to move to the suburbs. From central cities to surrounding small and medium-sized towns and rural areas, they migrate, leveraging the vast rural hinterland and cheap land costs to expand the production chain and upgrade the supply chain. The centralized development model of industrial parks is gradually being replaced by a relatively decentralized industrial layout, fostering a group of agriculture-related processing, trade and logistics, and entrepreneurial e-commerce enterprises with local characteristics. Undertaking industries that spill over from urban centers have emerged as crucial catalysts for rural industrial development. Rural economic development can be accelerated through methods such as high-speed rail system + agriculture, high-tech + finance, and high-speed rail system + tourism, which facilitate the spillover of various elements such as urban manpower, capital, and technology to rural areas. This has caused changes in accessibility, which in turn alters the regional spatial structure and ultimately affects the temporal and spatial layout of the transportation network.

In summary, the launch of high-speed rail system lines primarily brings a significant locational advantage to central urban areas, leading to the continuous agglomeration of various factors of production in these urban areas, which is conducive to further stimulating technological innovation capabilities. However, with the agglomeration of various factors of production in urban areas, the "siphon effect" generated by the introduction of high-speed rail system is detrimental to the economic development of peripheral regions, thereby widening the disparity in economic development between urbanized zones and rural regions. Once the factors of production have agglomerated to a certain extent in urban areas, due to congestion effects and resource integration, they will actively diffuse to the peripheral regions, which is the "diffusion effect" generated by the launch of high-speed rail system lines, promoting the economic development of these peripheral regions. This, to some extent,

is beneficial for narrowing the economic development disparity between urbanized zones and rural regions.

4. Conclusion

The effect of high-speed rail system on urban and rural economies depends on the supporting policies and the stage of development. High-speed rail system itself is a "instrumental variable", and its effects depend on the original economic foundation of urbanized zones and rural regions, policy design, and the stage of regional development. How to seize the opportunities presented due to the rapid growth of high-speed rail system to promote balanced economic development between urbanized zones and rural regions in China, this article proposes several suggestions:

First, improve the layout of the transportation network between urbanized zones and rural regions, and enhance the convenience of transportation between urbanized zones and rural regions. Develop a transportation network that is both convenient and accessible between urbanized zones and rural regions, strengthen economic exchanges between urbanized zones and rural regions, drive rural development with cities, and promote the construction of integrated urban-rural development.

Second, improve the market mechanism for factors between urbanized zones and rural regions, and promote the rational flow of factors between urbanized zones and rural regions, as well as between regions. Pay more attention to policies and financial support that spill over from cities to rural areas, and introduce more proactive and reasonable policies to serve economic development.

The introduction of high-speed rail system has a "double-edged sword" effect on the rural economy, and its ultimate effect depends on policy guidance, regional resource integration, and the degree of farmer participation. If the opportunities brought by high-speed rail system can be utilized reasonably, the rural economy is expected to achieve a transformation from "transfusion" to "hematopoiesis", promoting rural revitalization and sustainable development.

This article primarily discusses the effect of the launch of high-speed rail system lines on the economic development gap between urbanized zones and rural regions in China. Although some new research ideas are proposed based on the studies of other scholars, there are still shortcomings in this article's research that need further improvement in the following aspects: First, when exploring the effect of China's high-speed rail system on the urban-rural economy, due to the significant regional development gap in China, a quantitative analysis of the effect of high-speed rail system on the urban-rural economy could not be conducted, and thus further improvement is needed. Second, this article elaborates on the effect mechanism of high-speed rail system on the urban-rural economy, observing only the short-term effect of high-speed rail system on the urban-rural economy, while the long-term effect of high-speed rail system on the urban-rural economy requires further long-term tracking research and in-depth discussion in the future.

References

- [1] Wetwitoo J., Kato H. High-speed rail system and regional economic productivity through agglomeration and network externality: A case study of inter-regional transportation in Japan. *Case Studies on Transport Policy*, 2017, 5 (4): 549-559.
- [2] Shi Lin, Fu Peng, Li Liuyong. Study on the effect of high-speed rail on regional economic integration. *Shanghai Economic Research*, 2018 (1): 53-62,83.
- [3] Zhang Yanyan, Yu Jinping, Li Dexing, *Transportation Infrastructure and Economic Growth: A Study on Railway Transportation Infrastructure in Countries along the "Belt and Road"*. *World Economic Research*, 2018 (03): 56-68+135.
- [4] Lewis. *The Theory of Dual Economy*. Beijing Institute of Economics Press, 1989.
- [5] Wen Yan, Han Xu. The Influence of High-speed Rail on Urban Accessibility and Regional Economic Spatial Pattern in China. *Human Geography*, 2017. 32 (1): 99-108.

- [6] Deng Huihui, Yang Luxin, Pan Xueting. Whether the opening of high-speed railway can help the upgrading of industrial structure: facts and mechanisms. *Financial research*, 2020 (06): 34-48.
- [7] Zhang Kezhong, Tao Dongjie. Economic Distribution Effects of Transportation Infrastructure--Evidence from the Opening of High-speed Rail. *Economic Dynamics*, 2016 (06): 62-73.
- [8] Jia Shanming, Qin Chenglin. The influence of high-speed railway on the balance of China's regional economic pattern. *Regional research and development*, 2015, 34 (2): 13-20.
- [9] Liu Yi, Zhang Ningchuan, Zhou Lingyun, High-speed railway construction and regional balanced development--Evidence from the opening of Beijing-Tianjin-Hebei high-speed Railway. *Journal of Peking University (Philosophy and Social Sciences)*, 2018 (03): 60-71.
- [10] Cen Cong, Jiang Wei. High-speed Rail Opening, Spatial Spillover and Regional Economic Growth--Evidence from 21 Prefecture-level Cities in Guangdong Province. *Regional Research and Development*, 2020, 39 (1): 24-27.