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High-Speed Rail Development and Common Prosperity: From the Perspective of Farmers' Income Growth

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Abstract: Chinese-style modernization is a modernization where all people achieve common prosperity, and common prosperity is the essential requirement of socialism with Chinese characteristics. Increasing the income of low-income groups, especially rural residents, is a crucial foundation for achieving common prosperity. This paper uses data from Chinese prefecture-level cities from 2008 to 2020 to explore the enabling effect of high-speed rail on common prosperity from the perspective of increasing farmers' income. The study finds that the opening of high-speed rail can significantly promote farmers' income growth and has a positive incremental effect on the strategic goal of common prosperity. This paper provides experiential references for addressing the issue of common prosperity from the perspective of accessibility in transportation infrastructure construction.

1. Introduction

Common prosperity is the essential requirement of socialism with Chinese characteristics. The report of the 20th National Congress of the Communist Party of China emphasized the need to "increase the income of low-income groups, improve the distribution system, and steadily advance common prosperity; meanwhile, accelerate the construction of a strong transportation network." Given the current stage of unbalanced urban and rural development in our country, the low-income population, particularly in rural areas, is vast, accounting for nearly 60% of the total population. Therefore, promoting income growth for farmers is conducive to effectively raising the income levels of low-income groups and contributes to achieving the strategic goal of common prosperity (Li and Zhu, 2022; Linet al., 2023). Based on economic growth theory, transportation infrastructure can promote sustained and stable economic growth by enhancing the spatial mobility of economic factors. It is an important channel for driving economic development in lagging regions and accelerating regional economic integration (Luo and Peng, 2016). However, can high-speed rail, as

a crucial hub of our transportation infrastructure, assist in achieving common prosperity? Existing literature has seldom explored this question.

This article will explore the impact of high-speed rail on common prosperity from the perspective of the income leap of rural residents. On one hand, promoting farmers' income growth is not only a requirement for advancing urban-rural integrated development but also an important foundation for achieving common prosperity for all people. However, under the long-term influence of the urban-rural dual economic structure, it has led to prominent contradictions such as unbalanced urban and rural development and insufficient rural development, which are detrimental to urban-rural integration and China's socio-economic transformation (Guo and Liu, 2021). Scarcity of resource allocation, limited employment opportunities, and low skill levels are all significant reasons for the lag in rural development. The economic lag in rural areas and the relatively low income of farmers have become one of the bottlenecks restricting rural revitalization and high-quality economic development. The No. 1 central document in February 2023 emphasized in its opinions on comprehensively promoting rural revitalization that for the "three rural" issues, it is necessary to "broaden the channels for farmers to increase their income and become prosperous, promote farmers' employment and income growth, and improve the efficiency of agricultural operations." Against this backdrop, establishing a long-term mechanism for increasing farmers' income is of great significance for solidly advancing balanced socio-economic development and common prosperity.

On the other hand, high-speed rail (HSR), as the main artery of the national economy and a major livelihood project, has become a crucial force in enhancing regional economic development. Since the opening of the Beijing-Tianjin Intercity Railway in 2008, the HSR construction industry has developed rapidly, and the main framework of China's HSR network, the "Four Vertical and Four Horizontal" lines, has been fully completed. HSR can improve the efficiency of the flow of production factors such as labor and technological capital. The migration of farmers to cities for work and the relocation of capital to rural areas with lower costs are conducive to increasing non-agricultural employment, thereby exerting an employment effect (Chen et al., 2018). At the same time, HSR can compress time and space, connect regions, and promote the exchange and dissemination of knowledge through enhanced human capital mobility, thus fostering agricultural technology exchange and innovation, improving the knowledge environment of rural residents, and thereby exerting a technological effect (Zhang and Feng, 2019). Therefore, under the scenario of HSR empowerment, can it play a role in increasing farmers' income to promote common prosperity? This is of great significance for the coordinated achievement of the dual strategic goals of a strong transportation nation and common prosperity.

The potential research contributions of this paper are as follows: First, by integrating the new context of China's modernization development, it extends the economic benefits of high-speed rail to the realm of common prosperity. Specifically, this paper incorporates the benefits of high-speed rail into scenarios that reflect common prosperity, such as poverty alleviation and income increase for farmers. This has significant value for accelerating the construction of a strong transportation nation to effectively achieve common prosperity and for advancing the strategic goal of common prosperity in the process of China's modernization. Second, from the perspective of common prosperity, it enriches the research on the economic consequences of high-speed rail construction. This paper explores the effect of high-speed rail on increasing farmers' incomes from the perspective of income leaps for low-income groups, providing important insights into enhancing common prosperity and promoting coordinated urban-rural development through the accessibility of transportation infrastructure. Third, by integrating the employment and technological effects of high-speed rail construction, it provides new evidence from the perspective of high-speed rail opening for the goal of common prosperity in China's vast rural areas. This has important

significance for promoting the construction of high-speed rail infrastructure and establishing long-term mechanisms for farmers' wealth.

2. Theoretical deduction and research hypothesis

Building a long-term mechanism for increasing farmers' income is a key task in achieving common prosperity for all people. As an important carrier for the flow of production factors, high-speed rail can exert the effects of "time-space compression" and "boundary breakthrough." By shortening travel time and spatial distance between two places, it can accelerate labor mobility, promote capital deepening, and facilitate technological exchange. Consequently, the introduction of high-speed rail may empower farmers to increase their income, thereby contributing to the realization of common prosperity (Shi et al., 2018). The theoretical analysis of this paper is as follows:

First, the opening of high-speed rail can enhance the level of regional economic development and promote farmers' income through agglomeration and diffusion effects. Based on the theory of the transportation economic belt, the construction and introduction of transportation infrastructure make it easier for elements such as labor, industry, and information to gather on a large scale in central areas with favorable geographical conditions along transportation lines. Under the interaction of the transportation system and economic activities, a transportation economic belt is formed (Yang and Han, 1999). As a crucial transportation infrastructure, high-speed rail can exert economic agglomeration effects. By increasing factor inputs and promoting technological progress, it effectively reduces production costs and improves labor productivity, thereby achieving sustained economic growth in central areas (Wu et al., 2017). Once the agglomeration reaches a certain scale, the economic center will transmit production factors such as industries and technologies to neighboring areas, exerting diffusion effects. This promotes balanced development in the economic belt region, thereby enhancing rural economic benefits and facilitating the increase of farmers' income and the realization of common prosperity.

Second, the opening of high-speed rail can have a positive employment effect by promoting an increase in farmers' income through higher levels of non-agricultural employment. The income of rural residents mainly consists of agricultural income, business income, wage income, property income, transfer income, and other income. Among these, property income and transfer income are closely related to local policies and constitute a small proportion of farmers' income. Due to the influence of the urbanization process, agricultural income and business income face growth challenges due to frequent land transactions. Therefore, non-agricultural employment becomes the key to addressing the pressure to increase farmers' income. As a crucial transportation facility for enhancing regional connectivity, high-speed rail can overcome the spatial mobility barriers of production factors caused by low regional connectivity, optimize the allocation of labor resources, and promote rural residents' access to non-agricultural employment opportunities in cities by enhancing urban-rural accessibility. This facilitates the transfer of agricultural labor to non-agricultural industries, effectively increasing the scale of non-agricultural employment among rural residents, thereby positively impacting farmers' income. Additionally, the construction of high-speed rail stimulates capital flow. Influenced by cheap labor and raw materials, labor-intensive industries and enterprises with high production costs are more inclined to relocate to small and medium-sized cities closer to rural areas. The shortening of the urban-rural distance also makes rural areas more accessible to external capital investment, optimizing the rural industrial structure and creating more non-agricultural employment opportunities for rural residents to increase farmers' income.

Thirdly, the introduction of high-speed rail can leverage technological effects to enhance the mobility of human capital, thereby driving agricultural technological innovation. This can jointly promote farmers' income growth and prosperity through direct channels of improving agricultural production efficiency and indirect channels of strengthening the ability to reallocate time. On one hand, high-speed rail can compress time and space, connect regions, and increase the mobility of human capital as carriers of knowledge. This breaks the spatial limitations of knowledge spillover, accelerates the dissemination of information, and reduces distortion and unnecessary losses during the transmission process. Consequently, it strengthens the exchange and interaction of knowledge between agricultural technicians and rural residents, guides high-quality labor towards rural areas, and promotes the level of agricultural technological innovation and rural mechanization (Lu et al., 2022). Agricultural technological breakthroughs can effectively improve labor productivity, enhance the quality of agricultural products, lower agricultural production costs, and strengthen the market comparative advantage of agricultural products. This deepens the structural reform of the agricultural supply side, thereby directly contributing to agricultural efficiency and farmers' income growth (Barrett et al., 2010). On the other hand, agricultural technological innovation can enhance the time reallocation effect by improving agricultural production efficiency. By reducing the time spent on agricultural labor, it increases the time available for non-agricultural employment, thus promoting farmers' income growth and prosperity (Yang and Mu, 2020).

In summary of the theoretical analysis, the introduction of high-speed rail can effectively enhance the spatial flow of factors, accelerate the movement speed of production factors such as labor, capital, and technology, and exert positive employment and technological effects. It can expand non-agricultural employment to broaden farmers' income sources and improve agricultural technology innovation through enhanced human capital flow. Consequently, high-speed rail construction becomes a long-term mechanism to increase farmers' income and helps achieve the strategic goal of common prosperity. Therefore, the following core hypothesis is proposed:

Hypothesis: Under the condition that other *factors remain unchanged, the opening of high-speed rail can promote farmers' income and empower common prosperity.*

3. Research design

3.1. Sample Selection and Data Sources

Since the opening of the first high-speed rail line, the Beijing-Tianjin Intercity Railway, in 2008, China's high-speed rail has experienced rapid development. Therefore, this paper uses data from 282 prefecture-level cities in China from 2008 to 2020 as the initial research sample. The data mainly comes from the EPS Data Platform Database and the China Research Data Service Platform (CNRDS), with missing data supplemented by various statistical yearbooks of China. The initial research sample was processed as follows: (1) Cities with severe data deficiencies were excluded. (2) For cities with minor data deficiencies, this paper used interpolation methods to fill in the gaps. (3) All continuous variables were winsorized at the top and bottom 1%. Ultimately, 3,666 valid observations were obtained.

3.2. Main variable definition

Measurement of farmers' income increase. This paper uses the per capita disposable income of rural residents (in ten thousand yuan) to measure the income level of farmers (*RuralD*).

Measurement of High-Speed Rail Opening. This paper uses the interaction term between the city dummy variable (*Treat*) and the time dummy variable (*Time*) to measure the opening of high-speed rail (*HSR*). Specifically, if a prefecture-level city has opened a high-speed rail, *Treat* is assigned a

value of 1; otherwise, it is 0. For the time dummy variable *Time*, if the high-speed rail is opened in the first half of the year (before June 30), it is assigned a value of 1 for that year and subsequent years; if the high-speed rail is opened in the second half of the year, it is assigned a value of 1 for the following year and subsequent years; otherwise, it is 0.

3.3. Model Specification

Since high-speed railways in various prefecture-level cities were constructed at different times, this paper employs a multi-period difference-in-differences model to examine the income-increasing effect of high-speed rail openings on farmers. The specific model is set as follows:

$$RuralDI_{i,t}=\alpha_0+\alpha_1 HSR_{i,t}+\alpha_2 Controls_{i,t}+\mu_i+\delta_t+\varepsilon_{i,t} \quad (1)$$

In model (1), $RuralDI_{i,t}$ represents the per capita disposable income of rural residents in city i in year t, and $HSR_{i,t}$ represents the binary variable for the opening of high-speed rail in city i. $Controls_{i,t}$ denotes a set of control variables for city i in year t, including: regional economic development level ($GDP_{i,t}$), regional financial development level ($Finance_{i,t}$), size of the prefecture-level city ($Size_{i,t}$), urbanization level ($Urban_{i,t}$), and consumption level ($Consume_{i,t}$). Additionally, the model controls for city-specific and year-specific effects.

4. Empirical analysis

4.1. Benchmark regression results

Table 1 reports the regression results of the impact of high-speed rail (HSR) on farmers' income at the prefecture-level city. In column (1), the regression coefficient of HSR_t is significantly positive at the 1% statistical level in a regression controlling for individual and year effects. In column (2), the regression coefficient of HSR_t remains significantly positive at the 1% statistical level after adding control variables. These results indicate that the introduction of high-speed rail can promote farmers' income growth and contribute to achieving common prosperity. The hypothesis of this paper is effectively validated.

Table 1. Benchmark regression results

Variable	(1)	(2)
	$RuralDI_t$	$RuralDI_t$
HSR_t	**0.047*****	**0.048*****
	(5.49)	**(6.07)**
GDP_t		0.062***
		(2.60)
$Finance_t$		-0.058***
		(-4.01)
$Size_t$		0.125***
		(9.92)
$Urban_t$		-0.322***
		(-2.88)
$Consume_t$		-0.197***
		(-2.63)
City/Year	Yes	Yes
Cons	1.354***	-1.814***
	(22.60)	(-3.48)
Obs	3666	3666
R^2	0.9449	0.9515

4.2. Robustness test

4.2.1. Parallel Trend Test

An important assumption of the Difference-in-Differences method is that cities with high-speed rail and cities without high-speed rail have similar trends in changes in farmers' income levels before the introduction of high-speed rail, meaning there are no significant differences. If the trend in changes between cities with high-speed rail and those without is not significantly different before the introduction of high-speed rail, but shows significant differences after its introduction, this indicates that the increase in farmers' income levels is indeed brought about by the high-speed rail. To verify this logic, this paper sets up dummy variables for the four years before and after the introduction of high-speed rail to conduct a parallel trend test.

Fig 1 shows the results of the parallel trend test. The results indicate that before the introduction of high-speed rail in prefecture-level cities, the coefficients hovered around zero, suggesting no significant difference in the trend of farmers' income levels between cities with and without high-speed rail. However, after the introduction of high-speed rail, the coefficients gradually diverged from zero, indicating a significant difference in farmers' income levels between cities with high-speed rail and those without. Therefore, the parallel trend test confirms that the introduction of high-speed rail in prefecture-level cities can indeed increase farmers' income levels.

4.2.2. Placebo Test

To examine the extent to which the aforementioned results are influenced by omitted variables, random factors, and other aspects, this paper constructs a random experiment by randomly selecting cities with high-speed rail openings and randomly generating opening times. The distribution of estimated coefficients reported in Fig 2 shows that most of the false estimated coefficients are insignificant, indicating that there are no serious omitted variables in the model specification and that the conclusions remain robust.

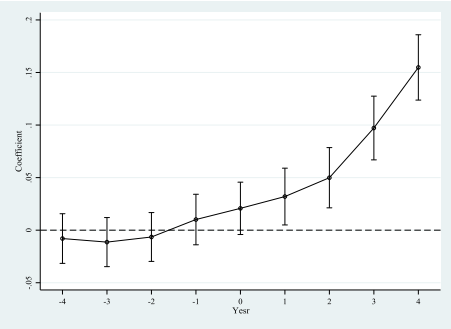

Fig 1. Parallel trend test

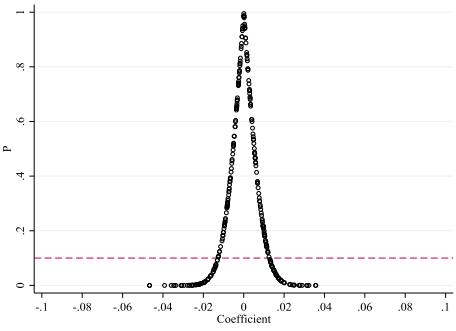

Fig 2. Placebo test

5. Conclusion

This article proposes the following important policy implications:

First, building a strong transportation network empowers the strategy of common prosperity. The introduction of high-speed rail facilitates the spatial flow of resources, accelerating the movement of labor, capital, technology, and other production factors, thereby effectively increasing farmers' income levels. Efforts should continue to promote the construction of high-speed rail, strategically plan its spatial distribution, enhance the accessibility of urban high-speed rail, fully unleash its economic spillover effects, reduce regional income disparities, and advance the process of common prosperity.

Second, leveraging technology to increase farmers' income and create a favorable environment for wealth generation. The mechanisms discussed in this article indicate that the opening of high-speed rail primarily promotes farmers' income through employment and technological effects. Therefore, the government should actively introduce employment policies that benefit the public, establish platforms for technological knowledge, guide farmers in participating in wealth creation, and accelerate the achievement of the strategic goal of common prosperity for the entire nation.

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