The Impact of Transportation on Common Prosperity

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Abstract. The experience of many countries shows that infrastructure construction can promote economic development, and transportation is a key part. However, there are few studies on the relationship and mechanism between transportation and common prosperity. Therefore, this paper uses the fixed effect model to study the three mechanisms of poverty alleviation, income adjustment and consumption structure based on the provincial data of China from 2000 to 2019. This study also uses the moderating effect model to explore the impact of Internet technology. The results show that transportation promotes common prosperity by reducing poverty, adjusting income and reshaping consumption structure, especially after 2012, but there is no good cooperation between Internet technology and transportation. Our finding highlights the practice that the Communist Party of China realizes common prosperity by developing transportation. Besides, the construction of intelligent transportation system and Internet of things should be strengthened to form a benign synergy between the Internet technology and transportation.

Keywords: transportation · common prosperity · inequality · Internet technology · mechanism

1 Introduction

Common prosperity is the essential requirement of socialism, and promoting equitable access to basic public services is an important performance of it [1]. Since the 21st century, especially after 2012, China's transportation development has been accelerating, which has caused great changes in the urban-rural structure. The government has adopted various intervention policies and invested a lot in transportation infrastructure, hoping to drive the development of local economy. However, will transportation exacerbate or reduce regional disparity? How can transportation promote common prosperity?

The previous literature mainly studies the effects of transportation on economic growth and income distribution, but less on the mechanism. One main view is that transportation increases accessibility, which decreases the trade cost between urban and rural areas, thus reducing the economic gap between regions [2]. Reference [3] analyzed the impact of transportation facilities on the economy in the context of India's PMGSY program, which points out that the labor force transfer between urban and rural areas. Reference [4] studied the causal mechanism of China's transportation infrastructure

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promoting economic growth from the perspective of market activity linkage, but found that the factor mobility is too low to increase the regional growth disparity. Reference [5] examined the relationship between transport infrastructure and urban-rural income disparities based on prefectural-level cities in China, and found that roads narrowed the urban-rural income gap by facilitating rural labour mobility. Obviously, the impact mechanism of transportation development on common prosperity still unclear, and few concentrates on this issue from the perspective of structural change.

With the rapid development of modern information technology and the rapid increase in Internet penetration, the Internet of Things (IoT) and Intelligent Transportation System (ITS) has become an important trend of transportation development [6]. After 2014, the government of China implemented the special plan of "Internet + Convenient Transportation" and "Internet + Efficient Logistics", hoping to make transportation and Internet technology jointly promote economic development. Then, what is the role of the Internet technology in the process of the impact of transportation on common prosperity? This is also a topic worth discussing.

The marginal contribution of this paper mainly has two aspects. First, this study attempts to explain the impact of transportation on common prosperity from the perspective of poverty alleviation, income adjustment and consumption structure. Second, we distinguished the two periods, with 2012 as the time node, which reflects the difference of transportation promotes common prosperity since the 18th CPC (Communist Party of China) National Congress. Third, we study the interaction between the Internet technology and transportation, which can guide the government to strengthen the synergy in the process of the equalization of infrastructure services.

In general, the more developed the transportation in a region, the more labor mobility can be promoted, the poverty will be gradually reduced, and the improvement of income and consumption structure will be brought at the same time, which will reduce regional inequality and achieve common prosperity. However, transportation and Internet technology are not well coordinated in this process. Therefore, our study has important practical significance for fiscal allocation. It can provide good policy guidance for the design and construction of transportation infrastructure and services, so as to help governments at all levels (central and local) carry out secondary distribution more wisely.

2 Theory and Methodology

2.1 Theoretical Links Between Transportation and Common Prosperity

Common prosperity refers to affluence shared by everyone. "Prosperity" reflects the society's possession of wealth and is the concentrated embodiment of the development level of social productive forces, and "common" reflects the way social members occupy wealth and is the concentrated embodiment of the nature of social production relations. Since the 18th CPC National Congress in 2012, the country has gradually put common prosperity in a more prominent position.

Meanwhile, as a basic, leading and strategic industry and an important service industry, transportation investment can redistribute social and economic resources by strengthening the equalization of transportation services. Ensuring basic, inclusive and comprehensive transportation services has become an important standard for common prosperity in China.

According to previous study, urbanization, income and the consumption structure are important factors affecting economic growth. However, these factors are not exogenous, which is affected by transportation development. Therefore, there are three possible mechanisms to the impact of transportation on common prosperity, including poverty alleviation effect, income adjustment effect and consumption structure effect.

Followed [7] and [8], We now construct an economic growth model by distinguishing between transport factors and non-transport factors in the traditional Cobb-Douglas production function. Group i is divided into urban and rural.

$$Y_{it} = A_t(aK)_{it}^{\alpha}(bL)_{it}^{\beta}((1-a)K)_{it}^{\gamma}((1-b)L)_{it}^{1-\alpha-\beta-\gamma}. \tag{1}$$

where Y_{it} is the output (or income) of group i at time t, A_t is the technological productivity, aK is total transportation capital as a is the proportion of transportation investment in total capital, bL is total transportation employment as b is the proportion of transportation employment in total population. $\alpha \in [0,1]$ is the elasticity of output with respect to the transport capital. Other parameters, such as $\beta \in [0,1]$, $\gamma \in [0,1]$, and $1\text{-}\alpha\text{-}\beta\text{-}\gamma \in [0,1]$, are defined in a likewise manner. Dividing (1) by L_{it}, we get the following per capita version:

$$\begin{aligned} Y_{it}/L_{it} &= A_t(aK)_{it}^{\alpha}(bL)_{it}^{\beta}((1-a)K)_{it}^{\gamma}((1-b)L)_{it}^{1-\alpha-\beta-\gamma}/L_{it} \\ y_{it} &= A_t e_t^{\delta T}((1-a)k)_{it}^{\gamma}((1-b)l)_{it}^{1-\alpha-\beta-\gamma}. \end{aligned} \tag{2}$$

where ${e_t}^{\delta T} = {(ak)_{it}}^{\alpha}{(bl)_{it}}^{\beta}$, T is the entropy form of transportation development and $\delta > 0$. Because the transportation capital and labor factors present a network in the region, it can be used by both urban and rural areas. Taking the natural logarithm of both sides of (2), then:

$$Lny_{it} = LnA_t + \delta T_t + \gamma k_{it} + \lambda l_{it} + c. \tag{3}$$

where $c = Ln(1\text{-}a)^{\alpha} + Ln(1\text{-}b)^{\lambda}$, and $\lambda = 1\text{-}\alpha\text{-}\beta\text{-}\gamma$. Based on (3), we can easily derive that:

$$\partial Lny_{it}/\partial T_t = \delta > 0 \tag{4}$$

Equation (4) shows that transportation development can promote economic growth, which is consistent with China's practice.

2.2 Statistical Methodology

Based (3), we can apply an OLS regression to explore the common prosperity. Besides transportation development, we controlled explanatory factors including demographic variables, economic indicators. The model is written:

$$CP_t = \delta T_t + \sum \varphi X_t \tag{5}$$

where CP is the indicators of common prosperity, including GDP per capita and the Theil index, which is a statistic primarily used to measure economic inequality [9]. The

greater the value, the greater the degree of difference. A simplified version of Theil index defined is as follows:

$$Theil = \sum_{n=1}^{N} y_i Ln \frac{y_i}{p_i} \tag{6}$$

where N is the number of regions, y_i is the proportion of the ith regional economic indicators in the whole, and p_i is the proportion of the ith regional population in the whole.

Transportation development (*Transport*) is a composite index using entropy method [10]. The weight is determined by the principle of information entropy, which can more objectively and accurately evaluate the development of transportation. We selected major indicators of highway and railway, including total passenger traffic, total freight traffic, line density, passenger turnover, freight turnover, employment in transportation industry.

Demographic variables including natural population growth (*Popg*) and Education (*Edu*). Education is measured by years of schooling of residents. Years of schooling is calculated as (the higher education student number*16 + high school student number*12 + secondary school student number*9 + primary school student number*6 + illiteracy number*1)/total population over 6 years old.

Economic variables including the consumer price index (*CPI*), total factor productivity (*TFP*) and other variables affecting GDP. TFP is calculated by SFA method [11]. The ratio of government expenditure to GDP (*Gov_g*) reflects the internal intervention of local government. The ratio of added value of the tertiary sector to GDP (*Third_g*) reflects the development of the tertiary sector, which affects the urban and rural employment situation. The ratio of real estate investment to GDP (*Re_g*) reflects changes in the real estate market. The ratio of total imports and outputs to GDP (*Trade_g*) reflects the development of trade.

We select the following variables for mechanism study:

Poverty Alleviation Effect. The ratio of urban population to total population (*Urban*) reflects the process of population urbanization, which shows the trend of labor force flowing from rural areas to cities. Poverty (*Poor*) is the number of rural poor from Poverty Monitoring Report of Rural China, and some years have missing values because of the lack of statistics.

Income Adjustment Effect. *Income_c* and *Income_r* reflect changes in the income of urban and rural people. We can easily see the actual impact of transportation development on the local area through these variables. *Income* is the difference between *Income_c* and *Income_r*, which can represent the absolute gap between urban and rural income, but it can not show the population flow. In order to reduce the influence of heteroscedasticity, we take logarithm for the above variables.

Consumption Structure Effect. Engel's coefficient is calculated as food, tobacco and alcohol expenditure/total expenditure. *Engel_c* and *Engel_r* reflect the change of consumption structure in urban and rural areas.

We apply the moderating effect model to study the moderation of the Internet [12]:

$$CP_t = \delta T_t + \zeta IT_t + \mu T_t \times IT_t + \sum \varphi X_t \tag{7}$$

Table 1. Descriptive statistics of the model variables.

Variable	Obs	Mean	Std. dev.	Min	Max
Theil	620	0.122	0.061	0.019	0.354
Transport	620	0.247	0.132	0.000	0.634
GDP	620	3.258	2.648	0.274	16.459
Income_c	620	1.977	1.225	0.472	7.385
Income_r	620	0.747	0.552	0.133	3.320
Engelc	620	0.350	0.055	0.193	0.512
Engelr	620	0.403	0.086	0.238	0.793
Urban	620	0.503	0.157	0.193	0.896
Poor	466	213.886	258.456	0	1521
IT	589	0.285	0.218	0.005	0.886
Edu	620	8.418	1.287	2.998	12.782
Gov_g	620	0.241	0.182	0.069	1.354
Third_g	620	0.454	0.089	0.296	0.837
Re_g	620	0.109	0.062	0.008	0.457
Trade_g	620	0.297	0.341	0.011	1.664
Popg	620	0.005	0.003	−0.002	0.013
CPI	620	1.023	0.019	0.967	1.101
TFP	620	1.525	0.743	0.051	2.980

where *IT* is Internet penetration, which reflects the application degree of local Internet technology. The coefficient μ reflects the moderation of the Internet technology in the process of transportation affecting common prosperity. For statistical reasons, there is no data on Internet penetration in 2019.

This paper examines transportation and common prosperity data for 31 provinces in China from 2000 to 2019. All data are from National Bureau of Statistics of China and relevant statistics. Table 1 shows the descriptive statistics of the model variables. In this period, the GDP of China has increased significantly, but the Theil index has no obvious trend. This may imply that the two dimensions of common prosperity in China are not unified. Therefore, this study needs to be combined with specific background of China.

3 Empirical Results

In this section, we apply the fixed effect model according to Hausman Test results. First, we make an overall estimation and analyze the impact of transportation development on common prosperity. Then we estimate the three possible mechanisms. Finally, we study the moderating effect of Internet technology. According to the specific situation in

China, we also divide the time period into two periods based on 2012, to analyze whether there are significant differences before and after the 18th CPC National Congress.

3.1 The Impact of Transportation on Common Prosperity

Table 2 presents the simple bivariate linear regressions to highlight the significant link between transportation and common prosperity. Column (1) and (4) apply the overall data, column (2) and (5) apply the data before 2012, column (3) and (6) apply the data after 2012. Table 3, Table 4, Table 5 and Table 6 use similar table structures.

Table 2. Estimated results of the impact of transportation on common prosperity.

	(1)	(2)	(3)	(4)	(5)	(6)
	Theil	Theil	Theil	LnGDP	LnGDP	LnGDP
Transport	−0.033	0.002	−0.274**	4.205***	4.600***	2.247**
	(0.044)	(0.042)	(0.077)	(0.712)	(0.546)	(0.833)
LnEdu	−0.078*	0.051	−0.087***	2.858***	1.692***	1.750***
	(0.042)	(0.043)	(0.017)	(0.563)	(0.356)	(0.196)
Popg	−1.046	−2.495	−0.890	−39.948**	−19.078	−11.068*
	(1.412)	(2.241)	(0.678)	(19.187)	(20.848)	(6.117)
Gov_g	−0.169**	−0.236***	0.171**	1.473***	1.588**	−2.181***
	(0.046)	(0.031)	(0.051)	(0.290)	(0.530)	(0.387)
Third_g	−0.110**	−0.060	−0.247***	0.960	−0.668	2.890***
	(0.048)	(0.091)	(0.033)	(0.585)	(0.939)	(0.422)
Re_g	−0.025	0.147**	−0.078*	1.885**	3.765***	0.120
	(0.053)	(0.047)	(0.046)	(0.603)	(1.001)	(0.487)
Trade_g	−0.017	0.033**	−0.064***	0.232	−0.092	−0.369
	(0.015)	(0.012)	(0.016)	(0.206)	(0.102)	(0.229)
TFP	−0.002**	−0.005**	0.004***	0.039***	0.016*	−0.000
	(0.001)	(0.001)	(0.001)	(0.009)	(0.009)	(0.008)
CPI	0.320***	−0.022	0.196	1.192**	2.314***	0.334
	(0.054)	(0.029)	(0.128)	(0.404)	(0.280)	(1.132)
Constant	0.076	0.126	0.267*	−8.356***	−6.663***	−3.954**
	(0.070)	(0.112)	(0.132)	(1.166)	(0.805)	(1.183)
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	620	372	248	620	372	248
adj. R2	0.536	0.292	0.469	0.924	0.904	0.805

Standard errors in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.001.

Results clearly show that better transportation lead to increased economic growth, but not the same with economic disparity. On average, a 1% increase in transportation development boosts GDP by 4.205%. This promotion was stronger (4.600%) before 2012 and weakened (2.247%) after 2012. In the same time, transportation development has no obvious effect on the Theil index before 2012, whereas after 2012, a 1% increase in transportation development decreases Theil index by 0.274%. This shows that after 2012, although the role of transportation development in promoting economic growth has weakened, it can reduce the gap between urban and rural areas.

3.2 Mechanism I: Poverty Alleviation Effect

Table 3 shows the first mechanism to explain the impact of transportation on common prosperity, the poverty alleviation effect has a significant effect, especially after 2012. In general, a 1% increase in transportation development boosts urbanization by 0.403%. There was no significant difference in this promotion before (0.376%) and after (0.384%) 2012. Meanwhile, transportation development has no obvious effect on the Theil index before 2012, whereas after 2012, a 1% increase in transportation development decreases the number of rural poor by 3.164%. After 2012, the government strengthened poverty alleviation and attached great importance to the role of transportation, which not only enhanced the mobility of population factors, but also reduced absolute poverty.

3.3 Mechanism II: Income Adjustment Effect

Table 4 presents the second mechanism to explain the impact of transportation on common prosperity, the income adjustment effect has an obvious effect. First, transportation development can increase the income of urban and rural residents. A 1% increase in transportation development boosts income of urban (rural) residents by 3.365% (3.388%). The signs indicate that better transportation has facilitated both urban and rural areas and increased people's income in general. Second, due to the difference in the income base between urban and rural residents, the income gap has become larger with the development of transportation as a whole. On average, a 1% increase in transportation development will increase the income gap by 3.345%, which is similar to that (3.478%) before 2012. However, after 2012, transportation development has no significant impact on the income gap. This means that although the development of transportation has brought about an increase in income, it has not widened the absolute income gap.

Since the 18th CPC National Congress, the government has fully coordinated the gap between urban and rural areas, so that transportation can not only accelerate the flow of factors, but also make rural factors more efficient through a series of farmers' income support plans. After the 19th CPC National Congress, the government paid more attention to the high-quality development of rural highway construction and served the common prosperity.

Table 3. Poverty alleviation effect of transportation on common prosperity.

	(7)	(8)	(9)	(10)	(11)	(12)
	urban	urban	urban	LnPoor	LnPoor	LnPoor
Transport	0.403***	0.376***	0.384**	4.759	5.960	−3.164**
	(0.098)	(0.066)	(0.122)	(3.741)	(5.371)	(1.385)
LnEdu	0.307***	0.161***	0.244***	−0.137	−0.252	−0.762*
	(0.073)	(0.040)	(0.042)	(1.381)	(1.512)	(0.414)
Popg	−4.785	−1.028	0.021	−98.181	−134.301	−1.796
	(3.329)	(2.395)	(1.736)	(70.674)	(96.962)	(17.898)
Gov_g	0.006	0.026	−0.162**	−1.045	−2.005	0.882
	(0.040)	(0.037)	(0.075)	(1.866)	(1.907)	(0.670)
Third_g	0.148*	−0.213**	0.518***	−2.750	−4.293	−1.094*
	(0.087)	(0.091)	(0.067)	(2.865)	(4.120)	(0.576)
Re_g	0.272**	0.443**	0.060	2.019	5.234	0.525
	(0.126)	(0.129)	(0.078)	(1.812)	(4.889)	(0.574)
Trade_g	0.062**	−0.019	0.093*	1.861**	1.699**	1.500**
	(0.030)	(0.018)	(0.046)	(0.603)	(0.728)	(0.496)
TFP	0.005***	0.002**	−0.000	0.100	0.177	−0.008
	(0.001)	(0.001)	(0.001)	(0.086)	(0.160)	(0.058)
CPI	−0.226**	0.100**	−0.123	−5.109	−0.400	−15.07***
	(0.072)	(0.032)	(0.191)	(4.491)	(5.576)	(3.780)
Constant	−0.114	0.004	−0.198	10.893	6.870	23.347***
	(0.175)	(0.113)	(0.203)	(7.176)	(7.188)	(4.011)
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	620	372	248	420	216	204
adj. R^2	0.844	0.828	0.761	0.739	0.397	0.971

Standard errors in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.001.

3.4 Mechanism III: Consumption Structure Effect

Table 5 presents the third mechanism to explain the impact of transportation on common prosperity, the consumption structure effect has an apparent effect. Transportation development has significantly reduced the Engel coefficient in urban and rural areas. On average, a 1% increase in transportation development decreases the Engel coefficient in urban (rural) areas by 0.125% (0.216%). It can be found that the impact of transportation on rural consumption structure is significantly higher than that in urban areas. Before

Table 4. Income adjustment effect of transportation on common prosperity.

	(13)	(14)	(15)	(16)	(17)
	LnIncome_c	LnIncome_r	LnIncome	LnIncome	LnIncome
Transport	3.365***	3.388***	3.345***	3.478***	0.585
	(0.616)	(0.605)	(0.621)	(0.461)	(0.536)
LnEdu	2.010***	2.073***	2.044***	1.517***	1.507***
	(0.459)	(0.436)	(0.486)	(0.376)	(0.181)
Popg	−33.924*	−29.746*	−35.645**	−6.491	−23.516**
	(16.790)	(16.673)	(16.860)	(16.418)	(6.529)
Gov_g	1.254**	1.855***	1.006**	0.567	−0.965**
	(0.380)	(0.307)	(0.399)	(0.343)	(0.396)
Third_g	2.211***	2.793***	1.813***	−0.162	2.890***
	(0.473)	(0.453)	(0.491)	(0.827)	(0.303)
Re_g	1.188**	1.276**	1.081**	3.721***	−0.336
	(0.507)	(0.541)	(0.501)	(0.620)	(0.294)
Trade_g	0.112	0.109	0.156	0.128	−0.385*
	(0.186)	(0.172)	(0.191)	(0.105)	(0.197)
TFP	0.031***	0.037***	0.027**	−0.002	0.010**
	(0.007)	(0.007)	(0.007)	(0.007)	(0.004)
CPI	0.981**	−0.112	1.464***	1.604***	−1.218
	(0.390)	(0.434)	(0.392)	(0.285)	(1.181)
Constant	−6.930***	−7.444***	−7.685***	−6.190***	−2.526**
	(1.098)	(0.977)	(1.156)	(0.959)	(1.193)
Fixed Effects	Yes	Yes	Yes	Yes	Yes
N	620	620	620	372	248
adj. R^2	0.929	0.931	0.917	0.895	0.829

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.001$.

2012, the marginal value of the consumption structure effect of transportation development was 0.079% (0.166%) in urban (rural) areas, which expanded to 0.325% (0.417%) after 2012.

After the 18th CPC National Congress, the government emphasized the supply-side structural reform. It aims to adjust the economic structure, realize the optimal allocation of factors, and improve the quality and quantity of economic growth. The development of transportation has increased accessibility, enabling urban and rural residents to obtain more diverse goods and services at a lower cost. Especially in rural areas, with the increase of Internet users and convenient transportation network, e-commerce shopping

Table 5. Consumption structure effect of transportation on common prosperity.

	(18)	(19)	(20)	(21)	(22)	(23)
	Engel_c	Engel_c	Engel_c	Engel_r	Engel_r	Engel_r
Transport	−0.125*	−0.079**	−0.325**	−0.216**	−0.166*	−0.417**
	(0.062)	(0.038)	(0.128)	(0.077)	(0.081)	(0.165)
LnEdu	−0.127**	−0.037	−0.204***	−0.332***	−0.162**	−0.378***
	(0.052)	(0.037)	(0.042)	(0.054)	(0.077)	(0.092)
Popg	1.739	−1.097	1.373	8.570**	7.997**	0.074
	(1.544)	(1.692)	(1.752)	(2.895)	(2.609)	(1.789)
Gov_g	0.013	0.060**	0.217**	−0.113	−0.207**	0.163
	(0.021)	(0.018)	(0.070)	(0.067)	(0.061)	(0.107)
Third_g	−0.399***	−0.078	−0.545***	−0.274***	0.038	−0.491***
	(0.053)	(0.069)	(0.054)	(0.075)	(0.109)	(0.089)
Re_g	−0.049	−0.175**	−0.012	−0.141*	−0.198**	0.049
	(0.052)	(0.051)	(0.064)	(0.074)	(0.078)	(0.090)
Trade_g	−0.010	−0.052***	0.049	−0.049**	−0.018	0.026
	(0.022)	(0.012)	(0.052)	(0.021)	(0.021)	(0.045)
TFP	−0.001	−0.001	0.010***	−0.002	−0.000	0.007**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
CPI	0.383***	0.219***	0.961***	0.519***	0.204***	0.899**
	(0.077)	(0.028)	(0.236)	(0.077)	(0.048)	(0.302)
Constant	0.434**	0.304**	0.049	0.766***	0.611***	0.547
	(0.135)	(0.087)	(0.256)	(0.111)	(0.156)	(0.351)
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	620	372	248	620	372	248
adj. R^2	0.680	0.283	0.730	0.799	0.675	0.652

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.001$.

has increased rapidly [13]. Therefore, the transportation development has brought great changes to the consumption structure, which has reduced the gap between urban and rural areas and promoted common prosperity.

3.5 Moderating Effect of Internet Technology

Table 6 presents the moderating effect of Internet technology to explain the impact of transportation on common prosperity. However, it is found that there is no good synergy between transportation and Internet technology. Compared with the results in Table 2. Internet technology can enhance economic growth and reduce economic disparity, but

Table 6. Estimated results of Moderating effect of Internet Technology

	(24)	(25)	(26)	(27)	(28)	(29)
	Theil	Theil	Theil	LnGDP	LnGDP	LnGDP
Transport	−0.081	0.001	−0.273**	4.934***	5.305***	1.187
	(0.062)	(0.053)	(0.090)	(0.829)	(0.792)	(0.846)
IT	−0.069*	−0.051	−0.033*	2.338***	2.982***	0.794***
	(0.034)	(0.038)	(0.019)	(0.433)	(0.461)	(0.192)
Transport × *IT*	0.155*	0.100	−0.016	−4.138**	−6.707***	1.264
	(0.088)	(0.138)	(0.087)	(1.416)	(1.569)	(0.967)
LnEdu	−0.032	0.059	−0.037	1.546***	1.290***	0.398
	(0.040)	(0.046)	(0.025)	(0.383)	(0.277)	(0.281)
Popg	−1.965	−2.309	−1.427*	−33.119	−25.888	−9.422
	(1.559)	(2.259)	(0.728)	(19.756)	(18.455)	(7.021)
Gov_g	−0.138**	−0.212***	0.156**	0.121	0.210	−1.572***
	(0.066)	(0.031)	(0.056)	(0.338)	(0.317)	(0.374)
Third_g	−0.098	−0.064	−0.200***	0.769	−0.234	1.400**
	(0.063)	(0.101)	(0.053)	(0.618)	(0.806)	(0.642)
Re_g	0.008	0.183**	−0.092*	0.894	1.686*	0.144
	(0.048)	(0.063)	(0.048)	(0.551)	(0.847)	(0.474)
Trade_g	−0.008	0.031**	−0.063***	0.147	−0.063	−0.344
	(0.015)	(0.012)	(0.015)	(0.136)	(0.097)	(0.203)
TFP	−0.002**	−0.005**	0.004***	0.029**	0.033**	0.016
	(0.001)	(0.002)	(0.001)	(0.008)	(0.009)	(0.010)
CPI	0.303***	−0.007	0.234	1.515***	1.573***	−1.299
	(0.056)	(0.030)	(0.144)	(0.406)	(0.204)	(1.101)
Constant	0.001	0.094	0.124	−5.897***	−5.146***	0.896
	(0.101)	(0.130)	(0.168)	(0.625)	(0.610)	(1.392)
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	589	372	217	589	372	217
adj. R^2	0.529	0.296	0.446	0.954	0.942	0.833

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.001$.

its effect is weaker than that of transportation. The regression results show that the interaction between transportation and Internet technology plays a reverse moderation. In general, Internet technology will reduce the positive effect of transportation to economic growth. Figure 1 shows the process. It can be clearly seen that for low-level Internet

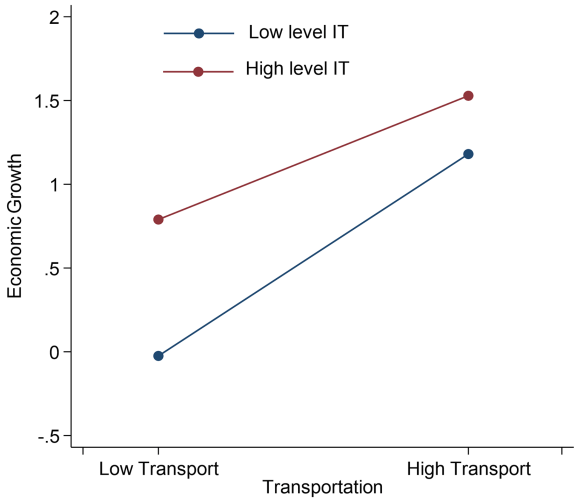

Fig. 1. Moderating Effect of Internet Technology

technology, transportation has a stronger impact on economic growth, while for high-level Internet technology, the impact is weaker.

After the 18th CPC National Congress, IoT and ITS promote the innovation of traffic management mode and business process reengineering with service as the core, but the integration of transportation and Internet technology is still at a low level. Mobility-as-a-Service (MaaS), with the core of big data, may be a direction for promoting the integration of transportation and internet technology [14].

4 Conclusion

This paper studies the impact of transportation on common prosperity in China using a comprehensive dataset at the provincial level. Regression results demonstrate a significant link between transportation and economic growth as well as economic disparity after the 18th CPC National Congress. We further analyze the mechanism of this link. The results show that transportation development will reduce poverty, increase urban and rural income and change the consumption structure, which will play a role in common prosperity. The disharmony between transportation and Internet technology may hinder the promotion effect.

The results of this study have important policy implications for decision makers. First of all, the government should pay attention to the role of transportation when promoting common prosperity. Transportation can not only increase GDP, but also narrow the gap between urban and rural areas to a certain extent. Secondly, the government can optimize the transportation infrastructure system and drive targeted poverty alleviation. The important reason for absolute poverty is the insufficient factor mobility, so how to optimize the existing transportation network is very important. Thirdly, it should be alert to the possible expansion of urban-rural income gap caused by transportation, and strengthen the inclusive and thorough nature of transportation services. Fourth, the

government should promote supply-side structural reform of transportation, to enrich the consumption choices of rural residents. Finally, the government should coordinate the relationship between Internet technology and transportation development, and develop the "Internet + Transportation" mode based on IoT and ITS.

Our study has several limitations. First, the connotation of common prosperity is very abundant, and this paper only focus on economic growth and disparity, thus we can study other social factors in the future. Second, the impact mechanism of transportation on common prosperity is very complex. Although we study urban and rural areas at the provincial level in China, the sample size and scope are still insufficient. In the future, we can study this issue from the urban level or expand other mechanisms.

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References

1. Xi JP (2021) Making solid progress toward common prosperity. Qiushi J 20:4–8
2. Donaldson D (2018) Railroads of the raj: estimating the impact of transportation infrastructure. Am Econ Rev 108(4–5):899–934
3. Asher S, Novosad P (2020) Rural roads and local economic development. Am Econ Rev 110(3):797–823
4. Banerjee A, Duflo E, Qian N (2020) On the road: Access to transportation infrastructure and economic growth in China. J Dev Econ 145:102442
5. Lu H, Zhao P, Hu H, Zeng L, Wu KS, Lv D (2022) Transport infrastructure and urban-rural income disparity: a municipal-level analysis in China. J Transp Geogr 99:103292
6. Speranza MG (2018) Trends in transportation and logistics. Eur J Oper Res 264(3):830–836
7. Li Y, DaCosta MN (2013) Transportation and income inequality in china: 1978–2007. Transp Res Part A 55:56–71
8. Liu H, He Q (2019) The effect of basic public service on urban-rural income inequality: a sys-GMM approach. Econ Res-Ekonomska Istraživanja 32(1):3211–3229
9. Theil H (1967) Economics and Information Theory. North Holland Publishing Company, Amsterdam
10. Zou ZH, Yi Y, Sun JN (2006) Entropy method for determination of weight of evaluating indicators in fuzzy synthetic evaluation for water quality assessment. J Environ Sci 18(5):1020–1023
11. Battese GE, Coelli TJ (1995) A model for technical inefficiency effects in a stochastic frontier production function for panel data. Empirical Economics 20(2):325–332
12. Dawson JF (2014) Moderation in management research: what, why, when, and how. J Bus Psychol 29(1):1–19
13. Hou J, Huo X, Yin R (2019) Does computer usage change farmers' production and consumption? Evidence from China. China Agric Econ Rev 11(2):387–410
14. Hensher DA (2018) Tackling road congestion – what might it look like in the future under a collaborative and connected mobility model? Transp Policy 66:A1–A8