

## **Regional Differences Between Transportation Infrastructure Constraints and Real Estate Development Investment—Panel Data Analysis at the China and Regional Levels**

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**Abstract.** This paper takes the provincial panel data of 2002-2016 as a sample, and uses panel regression to analyze the constraint effect of transportation infrastructure on the regional allocation of real estate development investment in China. The estimation results show that the traffic infrastructure has significant effect on China's real estate development investment; The construction conditions of transportation infrastructure in different regions play an important role in China's real estate development investment. In view of this, the government should formulate a differentiated policy based on the difference in endowment of transportation infrastructure development and pay attention to the binding effect of transportation infrastructure investment on real estate development resource allocation.

### **1. Introduction**

Transportation infrastructure is inextricably linked to real estate development investment. Transportation infrastructure has a decisive influence on the spatial pattern of the city, which plays a key role in the spatial allocation of real estate development investment. In recent years, China's transportation infrastructure has developed rapidly. The investment in transportation infrastructure construction increased from 466.15 billion yuan in 1998 to 473.376 billion yuan in 2016. The highway mileage in 1998-2016 increased from 1,278,500 kilometers to 4,696,300 kilometers. The growth of transportation infrastructure investment and the extension of the transportation network have undoubtedly played an important role in supporting the development of China's economy. However, there is an imbalance in the regional allocation of China's transportation infrastructure investment. In 2016, the mileage of highways in the central and eastern regions accounted for 59.43% of the national total, and the proportion of railway operating mileage accounted for 59.49% of the country. The spatial layout of the transportation infrastructure is the same as the spatial distribution of real estate development investment, showing a high degree of spatial agglomeration.

Throughout the literature at home and abroad, scholars mainly carry out two aspects: First, to examine the relationship between urban infrastructure and real estate development investment from a macro perspective. Saugata et al. (2010) pointed out that the existing infrastructure configuration will have a great impact on the real estate value of the surrounding area. Stadelmann et al. (2011) pointed out that infrastructure has driven the price of surrounding housing, and the housing capitalization effect is obvious. Zhang Dong (2014) used the provincial panel data from 1998 to 2010 to show that this constraint effect was achieved through the “location reengineering” process, and this location selection is not highly dependent on the current urban infrastructure construction in the short term. Li Jing (2018) used the 1997-2015 provincial panel data to construct a dynamic panel model to study the impact of transportation infrastructure on the spatial distribution of real estate development investment.

Generally speaking, there are few studies on the impact of China's transportation infrastructure construction on real estate development investment changes in the existing literature. The literature has paid little attention to the problem of regional allocation of real estate development investment, and more is only to study the impact of total investment on the economy and urbanization. Therefore, this paper uses the 30 provincial-level data from 2002-2016 (the missing data in Tibet), and empirically analyzes the following questions through the panel model: What is the inherent relationship between transportation infrastructure and real estate development investment; whether the transportation infrastructure has a relationship with the regional allocation of real estate development investment in China.

## **2. Variables, Data, and Model Settings**

### **2.1 Variable selection and data description**

The research data in this paper is the panel data of 30 provincial administrative regions in China from 2002 to 2016 (the missing data in Tibet). The variables selection and processing methods are as follows:

Real estate development investment (rei): expressed in terms of actual real estate development investment in each province.

Transportation infrastructure (transport): expressed in terms of traffic density, that is, the sum of road and rail mileage divided by the corresponding province's land area.

This paper intends to select the control variables that may affect the regional distribution of real estate development investment differences as follows:

Economic level (gprgdp): expressed as the average annual growth rate of real GDP per capita.

Industrial structure (structure): measured by the ratio of the added value of the tertiary industry to the total GDP of the corresponding province.

City size (area): expressed in the area of built-up area in each provincial and urban area.

Urban population density (popdensity): measured by the proportion of the total urban population in each province to the corresponding province area.

In order to better analyze the changes of real estate development investment in different regions, this section divides China's provincial administrative regions into six regions of North China, Northeast China, East China, Central South, Southwest China and Northwest China according to the principle of official division, excluding Hong Kong, Macao and Taiwan. The research data in this paper are all from the EPS global database and the Wind database (National Bureau of Statistics of Data Sources). In order to eliminate the impact of inflation, the nominal investment amount and the nominal per capita GDP are converted into actual values. The treatment method adopts the 2002 fixed-asset investment index and the consumer price index to be flattened, and all variables are processed in logarithm. The statistics of all variables are shown in Table 1.

Table 1 Description of variables

Area	Variable	Observation Value	Mean	Standard Deviation	Minimum	Maximum
National	rei	450.00	1204.62	1261.03	4.68	7628.38
	transport	450.00	75.70	48.12	3.48	218.37
	gprgdp	450.00	10.72	6.03	-23.51	41.02
	structure	450.00	41.00	8.36	28.60	80.23
	area	447.00	1327.75	998.82	98.94	5808.12
	popdensity	450.00	2409.28	1365.36	186.00	6307.38
East China	rei	105.00	1896.34	1513.14	103.64	6380.98
	transport	105.00	110.54	47.77	37.78	218.37
	gprgdp	105.00	10.30	5.09	-7.81	23.43
	structure	105.00	41.39	8.00	30.90	69.78
	area	103.00	1848.02	1109.00	501.33	4795.47
	popdensity	105.00	2289.33	1066.05	555.00	4822.00
Central South	rei	90.00	1372.59	1441.24	20.10	7628.38
	transport	90.00	85.80	38.50	25.00	163.48
	gprgdp	90.00	10.89	4.63	3.56	22.36
	structure	90.00	39.99	5.60	28.60	54.25
	area	90.00	1725.48	1375.27	146.67	5808.12
	popdensity	90.00	2586.76	1378.84	453.00	5967.00
North China	rei	75.00	1077.01	938.32	4.68	3526.47
	transport	75.00	82.56	45.86	6.67	157.74
	gprgdp	75.00	10.62	7.92	-1.43	41.02
	structure	75.00	45.96	14.66	31.51	80.23
	area	74.00	1065.96	372.10	453.99	2056.45
	popdensity	75.00	1967.08	961.85	508.00	3974.00
Southwest China	rei	60.00	1090.54	915.41	83.01	3641.38
	transport	60.00	73.20	41.45	23.85	176.21
	gprgdp	60.00	12.42	4.90	3.18	29.27
	structure	60.00	40.67	4.28	33.40	48.80
	area	60.00	941.15	543.43	320.45	2615.59
	popdensity	60.00	2163.46	1074.15	237.00	4029.00
Northeast China	rei	45.00	1053.29	1094.76	116.77	4662.22
	transport	45.00	46.95	20.16	15.07	86.48
	gprgdp	45.00	8.94	7.42	-23.51	20.29
	structure	45.00	38.55	4.98	29.42	54.04
	area	45.00	1612.73	463.26	810.10	2798.20
	popdensity	45.00	2343.18	1568.10	340.00	5504.00
Northwest China	rei	75.00	344.34	408.87	16.92	1867.19
	transport	75.00	27.17	23.56	3.48	86.14
	gprgdp	75.00	10.92	6.26	-2.53	26.14
	structure	75.00	38.41	3.91	32.30	51.41
	area	75.00	532.54	306.60	98.94	1199.37
	popdensity	75.00	3042.74	1845.29	186.00	6307.38

Note: Data Source EPS Global Database and Wind Database (Data Source National Bureau of Statistics).

## 2.2. Model setting

Due to regional differences in panel data, this paper will establish a fixed-effect model for empirical analysis, and all empirical operations are done on State13.0. This paper establishes the following measurement model:

$$\ln rei_{it} = \beta_0 + \beta_1 \ln transport_{it} + \theta X_{it} + \eta_{it} + \varepsilon_{it} \quad (1)$$

$i$  and  $t$  represent regions and time, respectively,  $\eta_i$  represents regional effects, and  $\varepsilon_{it}$  is a random disturbance term.  $X$  is a set of control variables that may affect real estate development investment behavior, including the average annual growth rate of GDP per capita ( $gprgdp$ ), industrial structure (area), urban population (popularity).

### 3. Estimation Results and Analysis

The estimated results in table 2 show that at the national level, the transportation infrastructure significantly affects real estate development investment at the level of 1%, with a constraint coefficient of 0.752, which indicates that for every 1% increase in transportation infrastructure, real estate development investment will increase by 0.752%. The regional estimation results show that the development level of transportation infrastructure construction in different regions has a great impact on the regional allocation of real estate development investment in China. In general, the impact of transportation infrastructure on the current location change of real estate development investment is very obvious in different regions, both are significant at the 5% level, but the degree of performance is very different. From the estimation coefficient, the most important influence of the transportation infrastructure on the location structure of real estate development investment is the northeast region, and the constraint coefficient is 1.297, which indicates that In the region, every 1 unit of transportation infrastructure changes, real estate development investment will increase by 1.297 units. The least impact of the transportation infrastructure on the real estate development investment location structure is the North China region, with a constraint coefficient of 0.460, which indicates that in this region, real estate development investment will increase by 0.460 units for every unit of transportation infrastructure change. It can be seen from table 2 that the degree of influence of transportation infrastructure on the location structure of real estate development investment is: Northeast, Central South, Northwest, Southwest, East China and North China. This may be because the economy of East China and North China is relatively more developed, the urban transportation infrastructure is more complete than the other four regions, the stock is relatively larger, the initial allocation of real estate development investment in the region is more balanced, and the investment in transportation infrastructure is more in the later stage. It is the improvement and repair of the existing urban transportation infrastructure, which cannot cause a substantial increase in the overall level of transportation infrastructure construction. Therefore, it will not lead to a large amount of real estate development investment entering the region, so the constraint coefficient is obviously smaller than that in the northeast and northwest regions.

This indicates that the constraints on real estate development investment are different according to the degree of development of transportation infrastructure in different regions. Areas with good transportation infrastructure construction are less constrained, but areas with relatively poor development of transportation infrastructure have a greater constraint on real estate development investment, which once again proves that differences in the development of transportation infrastructure will significantly affect the spatial allocation of real estate development investment. In general, the formation of real estate development investment location structure will depend to a large extent on the overall improvement of the level of transportation infrastructure construction. If the overall level of transportation infrastructure in a region is greatly improved, its impact on the location structure of real estate development investment is more obvious, and the binding effect of transportation infrastructure on real estate development investment is more obvious, such as the northeast and northwest regions. In this way, the level of urban transportation infrastructure construction is not perfect, but through continuous improvement, the overall level of transportation infrastructure has been greatly improved, which can attract large-scale entry of real estate development investment, and the performance is relatively larger. On the contrary, the East China and North China regions are relatively more developed due to their own economy, and the urban transportation infrastructure is well-developed, the stock is relatively larger, the initial allocation of real estate development investment in the region is more balanced, and the real estate exhibition is

also faster. The investment in the transportation infrastructure in the later period is more to improve and repair the existing urban transportation infrastructure, and it will not cause a substantial increase in the overall level of transportation infrastructure construction. Therefore, it will not lead to a large amount of real estate development investment entering the region, thus failing to make large-scale changes in real estate development investment ,and its constraint coefficient will be smaller.

From the estimation results in Table 2, it can be seen that for the control variables, the impact of city size on real estate development investment is significant in all six regions. The impact of real GDP per capita on real estate development investment is only significant in the northwest region. The impact of structure on real estate development investment is significant in the East China region, the Central South region, the North China region and the Southwest region. The impact of urban population density on real estate development investment is only significant in the Central South, Southwest and Northwest regions.

Table 2 Empirical results

Variables	National	East China	Central South	North China	Southwest China	Northeast China	Northwest China
Intransport	0.752*** (0.090)	0.505** (0.206)	0.613*** (0.184)	0.460** (0.183)	0.548*** (0.061)	1.297*** (0.099)	0.619*** (0.059)
lnpgdp	-0.115** (0.048)	-0.136 (0.128)	-0.304 (0.207)	-0.126 (0.144)	-0.048 (0.097)	-0.027 (0.047)	-0.412*** (0.120)
lnstructure	0.844* (0.441)	1.348*** (0.463)	2.152*** (0.371)	1.017*** (0.313)	1.433*** (0.413)	-0.424 (0.482)	-0.868 (0.881)
lnarea	1.254*** (0.175)	0.950*** (0.099)	0.850*** (0.087)	1.878*** (0.209)	1.424*** (0.078)	1.713*** (0.145)	0.639*** (0.054)
lnpopdensity	0.206*** (0.071)	0.171 (0.121)	0.326*** (0.120)	0.066 (0.188)	0.235*** (0.049)	-0.001 (0.072)	0.234*** (0.063)
constant C	-9.664*** (2.022)	-8.097*** (2.324)	-11.804*** (2.495)	-12.492*** (2.385)	-12.190*** (1.880)	-9.290*** (1.737)	1.824 (3.391)
R <sup>2</sup>	0.780	0.768	0.782	0.711	0.940	0.922	0.818

Note: The table brackets indicate the robust standard error. \*\*\*, \*\*, and \* indicate significant at 1%, 5%, and 10%.

#### 4. Summary

According to the official division method, this paper divides 30 province-level regions into six regions, and uses China's 2002-2016 provincial panel data to construct a panel model to empirically analyze the impact of transportation infrastructure on the regional allocation of real estate development investment. The empirical results show that the difference in the development level of inter-regional transportation infrastructure has a significant impact on the location structure of China's real estate development investment. According to the estimation coefficient, the regions with relatively developed economy and relatively complete transportation infrastructure construction, such as East China and North China, have less influence on the location structure of real estate development investment, and their constraint coefficients are 0.505 and 0.46. Respectively, areas with relatively backward economy and imperfect transportation infrastructure construction, such as the northeast and northwest regions, have a greater impact on the location structure of real estate development investment, and their constraint coefficients are 1.297 and 0.619. This shows that the development of transportation infrastructure plays an important role in the regional differences in real estate investment in China.

In view of this, the government should pay attention to the differences in the constraints of transportation infrastructure on real estate development investment when formulating real estate-related policies. China's provincial capitals and municipalities can be roughly divided into three categories. The first category is first-line and hot second-tier cities, which the economic base is good, the market is relatively perfect, the transportation infrastructure is developing well, and the market mechanism can play a better role. Therefore, the real estate regulation and control policies for

such cities should be stable, achieve the improvement of urban quality, and promote the construction of transportation integration. The second category is some medium-developed second-tier cities. Their economic base is relatively good, economic growth is relatively fast, and real estate prices are mostly overvalued. For example, Shijiazhuang, Zhengzhou, etc., the bubble is more serious, and the stock inventory pressure is relatively high. Therefore, the real estate regulation and control policies for such cities should be tight, focusing on structural adjustment. The third category is other cities, whose economic base is weak, the scale of transportation infrastructure and public facilities is still insufficient, and the real estate prices in most cities are underestimated, but this does not mean that real estate prices have a large space, but it means that they lack the basis of support, therefore, for such cities should seize the opportunity of economic transformation under the new normal, increase the construction of transportation and supporting facilities in these areas, and provide more employment opportunities, enhance the competitive advantage of the region, improve the market environment, and establish a long-term mechanism for the healthy development of the real estate market.

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