

# Economic differences and coordinated development in Northwest China

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**Abstract:** Northwest China is one of the seven major geographical regions in China, including Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang. Since the implementation of a series of national policies such as the western development, the economy of the provinces and autonomous regions in Northwest China has been greatly developed. But the imbalance in the development process is also very prominent. Through the analysis of the factors that affect the transfer of the center of gravity and the impact of the shift on the region, we can explore a better path of regional coordinated development. This paper selects five northwest provinces, according to the center of gravity transfer model, studies the changes of the economic center of gravity from 2000 to 2018, and uses the Theil index method to calculate the difference degree of regional economy. The results show that: the development of Northwest China is not balanced, the economic gap between provinces is large. The economic center of gravity moves to the southeast and deviates from the geographical center of Northwest China. There is a positive relationship between the change of gravity center and the size of economic difference.

**Key words:** Northwest China; Center of gravity transfer; Coordinated development

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## 1 Introduction

With the rapid development and obvious enhancement of China's overall economic strength, the domestic economy has developed greatly in various regions. However, with the rapid development, the imbalance of regional economic development also follows. In view of this, one of the five overall plans proposed at the Third Plenary Session of the 16th Central Committee of the CPC is the regional coordinated development strategy, which is one of the major national strategies in the new era and an important part of the implementation of the new development concept and the construction of a modern economic system. The coordinated development of regional economy can not only promote the rapid improvement of the regional economy, but also coordinate and concentrate the Regional Advantageous forces, which can provide great impetus for the whole regional economic development. In 2000, the state began to implement the policy of developing the western region, aiming at improving the level of economic and social development in the western region. The coordinated development of Northwest China is related to the coordinated development of the whole country and the modernization process of the whole country. Subsequently, a series of national strategic measures to promote the development of Northwest China have provided a huge opportunity for the social and economic development of the five northwest provinces, and the economic level of each province has been significantly improved. How to seize the opportunity, narrow the economic gap between the five provinces in Northwest China and solve the problem of unbalanced regional development has become a crucial issue.

## 2 General Situation in Northwest China

Northwest China is one of the seven major geographical regions in China, including Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang, with a vast geographical area of about 3.0699 million square kilometers, accounting for about 1/3 of the national land area. Taking the provincial administrative regions as the division, this paper analyzes the impact of the shift of focus on the flow of resources and elements in Northwest China, and analyzes the population density, per capita GDP and the added value of three industries in each province. The

is: Shaanxi Province, Ningxia Hui Autonomous Region, Gansu Province, Xinjiang Uygur Autonomous Region and Qinghai Province. Human resources are not fully flowing among the northwest regions. Second, from the per capita GDP point of view, it can be clearly seen that there is a great gap between the five provinces in terms of total amount and development speed. Shaanxi Province ranked fourth in 2000 in terms of per capita GDP, but ranked first in 2018. The rapid economic development will certainly attract more resources and play a certain role in driving the surrounding areas. Third, from the perspective of the development of the three industries, the added value of the first, second and

**Table 1.** Population density, per capita GDP and added value of three industries in five provinces in Main Years

	2000	2006	2012	2018	
Population density(people per km <sup>2</sup> )	177.1	179.7	182.4	187.8	Shaanxi
	55.4	56.1	56.8	58.1	Gansu
	7.0	7.6	7.9	8.3	Qinghai
	83.4	91.0	97.4	103.6	Ningxia
	11.1	12.3	13.5	15.0	Xinjiang
Per capita GDP(yuan)	4968	11762	38564	63477	Shaanxi
	4129	8749	21978	31336	Gansu
	5138	11753	33181	47689	Qinghai
	5376	11784	36394	54094	Ningxia
	7372	14871	33796	49475	Xinjiang
Added value of primary industry(RMB100mn)	258	485	1370	1830	Shaanxi
	194	334	781	926	Gansu
	40	68	177	268	Qinghai
	46	80	199	279	Ningxia
	288	528	1321	1692	Xinjiang
Added value of secondary industry(RMB100mn)	783	2452	8074	11215	Shaanxi
	422	1043	2600	2762	Gansu
	109	332	1092	1094	Qinghai
	121	352	1159	1488	Ningxia
	538	1459	3482	4657	Xinjiang
Added value of tertiary industry(RMB100mn)	763	1806	5010	10896	Shaanxi
	437	900	2270	4416	Gansu
	115	249	624	1386	Qinghai
	128	295	983	1743	Ningxia
	538	1058	2703	6460	Xinjiang

data are shown below:

According to the data in the table: first, from the perspective of population density, there is a great gap among the five provinces in Northwest China. The difference between Shaanxi Province with the largest population density and Qinghai Province with the smallest population density is more than 20 times. The ranking of human resource advantages from high to low

third industries in each province is increasing year by year, but there are obvious differences in the growth rate and industrial structure among the provinces. From the perspective of industrial structure, in 2018, the proportion of three industries in Shaanxi Province was 1:6.1:6, Gansu Province was 1:3:4.8, Qinghai Province was 1:4:5.2, Ningxia Hui Autonomous Region was 1:5.3:6.2, Xinjiang Uygur Autonomous Region

was 1:2.8:3.8, Gansu Province and Xinjiang Uygur Autonomous Region had low proportion of secondary and tertiary industries. In terms of total amount, the added value of secondary and tertiary industries in Shaanxi Province is far ahead, while the industrial base of other provinces is relatively weak.

### 3 An empirical analysis of the change of the center of gravity

#### 3.1 Model introduction

If a large area consists of  $n$  small sub regions, the geographical center coordinates of a certain sub region  $i$  are  $(x_i, y_i)$ ,  $x$  and  $y$  are expressed by the longitude and latitude of the location respectively. The sum of a certain economic attribute of the sub region  $i$  in a certain period is represented by  $M_i$ , the calculation formula of the center of gravity of an economic attribute in the region is:

$$X = \frac{\sum_{i=1}^n M_i x_i}{\sum_{i=1}^n M_i}, \quad Y = \frac{\sum_{i=1}^n M_i y_i}{\sum_{i=1}^n M_i}$$

Let the moving distance of gravity center be  $D_{n-m}$  between  $m$  and  $n$ . The moving distance of the latitude coordinate of the center of gravity between  $m$  and  $n$  is

$y_n - y_m$ . The moving distance of longitude coordinate of gravity center between  $m$  and  $n$  is  $x_n - x_m$ .

$$D_{n-m} = 111.111 \times \sqrt{(x_n - x_m)^2 + (y_n - y_m)^2}$$

#### 3.2 Analysis on the shift of economic center of gravity

Using the economic aggregate data of Northwest China and other provinces from 2000 to 2018, the center of gravity coordinates of GDP in Northwest China and its annual moving distance in 18 years are calculated, which are shown in Table 2.

It can be seen from the table that the economic center of Northwest China has always been between  $37.14^\circ \text{N}$  and  $100.99^\circ \text{E}$  and  $102.39^\circ \text{E}$ . It is located near the junction of Wuwei City in Gansu Province and Haibei Tibetan Autonomous Prefecture of Qinghai Province. It is located in the south of the geographical center of gravity of Northwest China. It shows that the economic development is unbalanced among regions, and the economic density in the south is greater than that in the north. Taking 2009 as the dividing line, from 2000 to 2009, except for 2001 and 2003, the center of gravity of GDP in Northwest China has been moving to the southeast, and the moving distance has reached

Table 2. The shift of GDP gravity center

particular year	Center of gravity coordinate position		Moving distance	Moving direction
	longitude	latitude		
2000	100.99	37.66		
2001	101.06	37.65	7857	southwest
2002	101.19	37.59	15909	southeast
2003	101.12	37.63	8958	northwest
2004	101.28	37.56	19405	southeast
2005	101.41	37.50	15909	southeast
2006	101.51	37.46	11967	southeast
2007	101.70	37.39	22498	southeast
2008	101.93	37.31	4263	southeast
2009	102.23	37.19	35902	southeast
2010	102.14	37.23	10943	northwest
2011	102.20	37.21	7027	southeast
2012	102.24	37.19	4969	southeast
2013	102.23	37.20	1571	northwest
2014	102.20	37.20	3333	west
2015	102.25	37.19	5666	southeast
2016	102.39	37.14	16518	southeast
2017	102.37	37.15	2485	northwest
2018	102.34	37.16	3514	northwest

the maximum in 2009, which is about 35 km, and the trend of regional imbalance is increasing. After 2009, the movement range of the center of gravity of GDP in Northwest China has decreased. The distance between 2010 and 2018 is less than 10km per year. The center of gravity moves in the Northwest for four years, one year to the West and four years to the southeast, but the overall direction of the center of gravity is southeast. This shows that the number of times that GDP gravity center moves repeatedly increases, and the number of times of moving to the northwest shows that the GDP growth rate of northwest part has been significantly improved in these years, but the growth rate is not larger or continues to exceed that of the southeast part.

#### 4 The relationship between the change of economic center of gravity and regional differences

This paper chooses the Theil index method to measure the economic development differences in Northwest China. The calculation formula of Theil index  $T$  is as follows:

$$T = \sum_{i=1}^N \frac{Y}{Y_i} \log\left(\frac{Y}{Y_i} / \frac{P}{P_i}\right)$$

Among them,  $N$  is the number of sub regions, that

is, the five provinces included in the northwest region.  $\frac{Y}{Y_i}$  is the share of GDP of the  $i$  region in the total GDP

of the northwest region, and  $\frac{P}{P_i}$  is the share of the

population of the  $i$  region in the total population of the northwest region. The larger the Theil index is, the greater the economic differences among the northwest regions are, and the more uncoordinated the economic development is.

The Theil index from 2000 to 2008 is calculated and compared with the annual change of GDP gravity center in Northwest China, as shown in Table 3.

From the data in the table, it can be seen that the variation trend of regional economic differences is gradually decreasing from 2000 to 2007. This is because the reform and opening up has not been long, and it is in the early stage of the implementation of the western development strategy. The economic starting point of each province is relatively low, and the difference in development speed is also small. The economic level of the whole region is relatively low. Therefore, the regional economic disparity tends to shrink. In 2007, the difference degree of regional economy dropped to the lowest point of 0.00628. After that, it began

**Table 3.** The change of GDP center of gravity and the difference degree of regional economy

Particular year	Center of gravity coordinate position		Moving distance	Moving direction	Theil index T	Distance from geographical center of gravity
	longitude	latitude				
2000	100.99	37.66			0.00934	62.7399
2001	101.06	37.65	7857	southwest	0.00927	55.3575
2002	101.19	37.59	15909	southeast	0.00824	43.9276
2003	101.12	37.63	8958	northwest	0.00866	49.5138
2004	101.28	37.56	19405	southeast	0.00727	37.1584
2005	101.41	37.50	15909	southeast	0.00745	32.9461
2006	101.51	37.46	11967	southeast	0.00696	34.0009
2007	101.70	37.39	22498	southeast	0.00628	44.9829
2008	101.93	37.31	4263	southeast	0.00730	66.1405
2009	102.23	37.19	35902	southeast	0.00780	99.2999
2010	102.14	37.23	10943	northwest	0.00874	88.8319
2011	102.20	37.21	7027	southeast	0.00901	95.3188
2012	102.24	37.19	4969	southeast	0.00978	100.1542
2013	102.23	37.20	1571	northwest	0.00962	98.5900
2014	102.20	37.20	3333	west	0.00988	96.0401
2015	102.25	37.19	5666	southeast	0.01071	91.8333
2016	102.39	37.14	16518	southeast	0.01140	122.5999
2017	102.37	37.15	2485	northwest	0.01436	117.5133
2018	102.34	37.16	3514	northwest	0.01448	116.1599

to increase year by year, and the regional economic disparity continued to rise in 2018. This is because the foundation of regional economic development has been established, and the advantages of different regions and resources are gradually revealed. Some regions are developing rapidly, others are still developing slowly, and the gap of regional economic development is gradually widening.

According to the change trend of economic center of gravity, the distance of economic center of gravity from geographical center of gravity also decreased first and then increased, which was basically consistent with the change law of Theil index. It shows that the economic gap in Northwest China first decreases and then increases.

## 5 Suggestions on coordinated development of regional economy in Northwest China

The economic development of Northwest China is extremely unbalanced, and the regional economic differences are gradually expanding. The main reasons are as follows: first, the leading industries of different provinces are different, and the industrial structure of some provinces is unreasonable; second, there is less cooperation among provinces and the overall coordination degree is not enough; third, the development direction is not clear and the regional positioning is not clear.

In order to promote the coordinated economic development of the northwest region, strive to narrow the economic gap with the developed regions of China, and provide a solid foundation for the coordinated development of the national economy. The following suggestions are put forward:

Fully explore their own advantages in location and resources, and find industries with unique conditions for the development of this region. Relying on regional advantageous resources, we should develop industries and industries suitable for the local area. Strengthen infrastructure construction, strengthen vocational education, introduce and retain high-quality talents.

Promote industrial division and cooperation among provinces and optimize the industrial structure of each province. Reasonable industrial division and cooperation can promote inter provincial trade, thus driving the flow of human resources, capital and other elements among regions. Each province should combine its own characteristics, give full play to its comparative advantages, and strengthen economic

and cultural exchanges and cooperation with other provinces. Backward provinces can actively undertake the industrial transfer of better developed provinces, while better developed provinces can actively develop innovative industries to realize the upgrading and adjustment of industrial structure.

The government should introduce various policies and measures to accelerate the economic development of the region and strengthen the capital support in the backward and poor areas. Strengthen the implementation of the measures already introduced. For economically backward areas, funds should be concentrated for infrastructure construction such as roads, hydropower and communications, so as to achieve the basic level required by social and economic development. For better developed areas, funds should be used for scientific and technological innovation.

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