Industrial Structure Evolution and Economic Growth in Dingxi City Based on Shift-Share Method and Location Quotient Analysis

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Abstract According to the statistical data in the years 2004 − 2008, both Shift − Share Analysis and Location Quotient Analysis are used to compare the economic development status of counties (districts) in Dingxi City in the years 2004 and 2008. Advantages and disadvantages of industrial structure and competitiveness are analyzed, as well as the impacts of existing industrial structure on economic growth. Development direction and development focus of primary, secondary and tertiary industries are found out. Countermeasures for accelerating the economic development of counties (districts) in Dingxi City are put forward, such as increasing the inputs in characteristic agriculture, promoting the development of primary industry, speeding up the construction of large and medium industrial enterprises, enhancing the development of secondary industry, strengthening comprehensive environmental improvement in tourist area, and actively developing tertiary industry.

Key words Shift-Share Analysis, Location quotient, Industrial structure, Dingxi City, China

Dingxi City is located in the center of Gansu Province, north-west China, belonging to the less developed area. Dingxi City has jurisdiction over Anding District, Lintao, Weiyuan, Longxi, Tongwei, Zhang County, and Min County, a total land area of 19 642. 49 square kilometers and a total population of 2 935. 1 thousand at the end of the year 2008. Its total output value reaches 10 564 million yuan in the year 2008; and proportion of primary, secondary and tertiary industries has adjusted from 41:27:32 in the year 2004 to 36:23:41 in 2008. It is of positive significance for the economic development and poverty alleviation in counties (districts) of Dingxi City to find out the development status, industrial structure, the advantages and disadvantages of industrial development, and their impacts on economic growth. Structural changes of the three industries in counties (districts) of Dingxi City are analyzed by using on Shift-share Method and Location Quotient Analysis, aiming to offer references for the future development of counties (districts) in Dingxi City, China.

1 Research method and data source

1.1 Research method

1.1.1 Shift-share Method (SSM). Shift-share Method is put forward by an American scholar Dunn in the 1960s, mainly used to analyze the impacts of industrial structure change on regional economic growth. It is widely applied in the analysis on regional economic structure in foreign countries[1]. The funda-

mental principle of Shift-share Method is to regard regional economy as a dynamic process, taking the economic development of a given region as reference system and carrying out comparison between the economic growth in research region and the economic growth in reference system. Variation of economic aggregate G in research region in a certain period of time is broken up into share component N and shift component S. And then, S is divided into structural shift component P and competitiveness shift component D. Thus, reasons for regional economic development or recession are analyzed, in order to find out the industrial sectors with comparative advantage, as well as the rational principles for future adjustment of regional industrial structure[2]. Equation for the variation of economic aggregate is

$$G = N + S = N + P + D \qquad (1)$$

1.1.2 Shift-share Model[3−5]. Assuming that economic aggregate and structure of region i have changed in the time period of $[0, t]$, economic aggregates of region i in annual base period and annual final period become $b_{i,0}$ and $b_{i,t}$, respectively. Regional economy is divided into n industrial sectors. $b_{ij,0}$ and $b_{ij,t}(j = 1, 2, \cdots, n)$ are the economic aggregates of industry j in region i at annual base period and annual final period. P_0 and B_t are the economic scales of the upper-grade region of region i at annual base period and annual final period. B_{j0} and B_{jt} are the economic scales of industry j in upper grade region at annual base period and annual final period, resectively. Hence, we have:

Change rate of industrial sector j in region i at the time period of $[0, t]$ is:

$$r_{ij} = \frac{b_{ij,t} - b_{ij,0}}{b_{ij,0}} \quad (j = 1, 2, \cdots, n) \qquad (2)$$

Change rate of industrial sector j in the upper-grade region

at the time period of $[0,t]$ is：

$$R_j = \frac{B_{j,t} - B_{j,0}}{B_{j,0}} \quad (j=1,2,\cdots,n) \qquad (3)$$

Taking the share of each industrial sector as the standard, standardized treatment is carried out according to the following equation. And the standardized scale of each industrial sector in region i is

$$b'_{ij} = \frac{b_{i,0} \times B_{j,0}}{B_0} \quad (j=1,2,\cdots,n) \qquad (4)$$

Hence, the increment G_{ij}, share component N_{ij}, shift component S_{ij}, structural shift component P_{ij}, and competitiveness shift component D_{ij} in industrial sector j in region i at the time period of $[0,t]$ are：

$$G_{ij} = b_{ij,t} - b_{ij,0} = N_{ij} + P_{ij} + D_{ij} \qquad (5)$$
$$N_{ij} = b'_{ij} \times R_j \qquad (6)$$

$$P_{ij} = (b_{ij,0} - b'_{ij}) \times R_j \qquad (7)$$
$$D_{ij} = b_{ij,0} \times (r_{ij} - R_j) \qquad (8)$$
$$S_{ij} = P_{ij} + D_{ij} \qquad (9)$$

1.2 Data source and treatment According to the classification standard, the industry of Dingxi City is divided into primary, secondary and tertiary industries. The years of 2004 and 2008 are taken as the annual base period and annual final period of the research, respectively. Data are from the 2005 and 2009 *Dingxi Statistical Yearbook*. GDP of the counties（districts）in Dingxi City in the years 2004 and 2008 is selected, as well as the output values of primary, secondary and tertiary industries. Taking the price in the year 2004 as a constant price, price in 2008 are converted. Table 1 reports the GDP and its composition of the counties（districts）in Dingxi City in the years 2004 and 2008[6].

Table 1 GDP and its composition of the counties（districts）in Dingxi City in the years 2004 and 2008 ×10^8 yuan

Counties（Districts）	GDP		Primary industry		Secondary industry		Tertiary industry	
	2004	2008	2004	2008	2004	2008	2004	2008
Anding District	12.491 1	16.086 8	4.315 4	4.301 2	3.427 8	4.017 7	4.747 9	7.767 8
Lintao County	12.239 4	15.329 0	4.252 0	5.357 5	4.220 3	4.917 7	3.767 1	5.053 8
Weiyuan County	5.828 6	7.424 1	2.944 5	3.760 8	0.794 6	0.610 1	2.089 5	3.053 2
Longxi County	11.319 1	17.490 2	3.499 7	4.742 5	3.493 4	6.141 8	4.326 0	6.605 9
Tongwei County	8.105 2	8.323 3	3.751 6	3.598 4	1.162 0	0.843 7	3.191 5	3.881 1
Zhang County	3.901 3	4.095 8	2.234 4	1.992 8	0.600 9	0.240 1	1.066 0	1.859 7
Min County	7.153 7	8.433 2	3.576 8	3.615 1	1.849 8	1.857 0	1.727 1	2.961 1
Dingxi City	59.513 3	75.741 5	24.641 5	27.367 0	15.949 5	17.343 7	18.922 3	31.030 8

2 Result and analysis

2.1 Economic structure analysis of counties（districts）in Dingxi City According to the section data, time-series data of the GDP and the output values of the three industries in counties（districts）in Dingxi City in the yeas 2004 and 2008, shift-share analysis result of three industries in counties（districts）in Dingxi City are calculated by using equations 2–9（Table 2）.

Table 2 Shift-share analysis result of three industries in counties（districts）in Dingxi City

County（District）	Industry	Code	b'_{ij}	$b_{ij,0}-b'_{ij}$	r_{ij}	$r_{ij}-R_j$	G_{ij}	N_{ij}	P_{ij}	D_{ij}	S_{ij}
Anding District	Primary industry	1	5.171 9	−0.856 5	−0.003 3	−0.113 9	−1.442 8	−0.856 5	−0.094 7	−0.491 5	−0.586 3
	Secondary industry	2	3.347 6	0.080 2	0.172 1	0.084 7	0.377 5	0.080 2	0.007 0	0.290 3	0.297 3
	Tertiary industry	3	3.971 6	0.776 3	0.636 1	−0.003 8	1.254 8	0.776 3	0.496 8	−0.018 2	0.478 5
Lintao County	Primary industry	4	5.067 7	−0.815 7	0.260 0	0.149 4	1.105 5	0.560 5	−0.090 2	0.635 2	0.545 0
	Secondary industry	5	3.280 1	0.940 1	0.165 2	0.077 8	0.697 4	0.286 7	0.082 2	0.328 5	0.410 7
	Tertiary industry	6	3.891 5	−0.124 4	0.341 6	−0.298 4	1.286 7	2.490 2	−0.079 6	−1.123 9	−1.203 5
Weiyuan County	Primary industry	7	2.413 3	0.531 2	0.277 2	0.166 6	0.816 3	0.266 9	0.058 8	0.490 6	0.549 4
	Secondary industry	8	1.562 1	−0.767 4	−0.232 3	−0.319 7	−0.184 6	0.136 5	−0.067 1	−0.254 0	−0.321 1
	Tertiary industry	9	1.853 2	0.236 3	0.461 2	−0.178 7	0.963 7	1.185 9	0.151 2	−0.373 4	−0.222 2
Longxi County	Primary industry	10	4.686 7	−1.187 0	0.355 1	0.244 5	1.242 8	0.518 4	−0.131 3	0.855 7	0.724 4
	Secondary industry	11	3.033 5	0.459 9	0.758 1	0.670 7	2.648 4	0.265 2	0.040 2	2.343 0	2.383 2
	Tertiary industry	12	3.598 9	0.727 1	0.527 0	−0.112 9	2.280 0	2.303 0	0.465 2	−0.488 3	−0.023 0
Tongwei County	Primary industry	13	3.355 9	0.395 7	−0.040 8	−0.151 4	−0.153 2	0.371 2	0.043 8	−0.568 1	−0.524 4
	Secondary industry	14	2.172 2	−1.010 1	−0.274 0	−0.361 4	−0.318 4	0.189 9	−0.088 3	−0.420 0	−0.508 3
	Tertiary industry	15	2.577 0	0.614 5	0.216 1	−0.423 8	0.689 6	1.649 1	0.393 2	−1.352 6	−0.959 4
Zhang County	Primary industry	16	1.615 3	0.619 1	−0.108 2	−0.218 8	−0.241 7	0.178 7	0.068 5	−0.488 8	−0.420 3
	Secondary industry	17	1.045 5	−0.444 7	−0.600 4	−0.687 8	−0.360 8	0.091 4	−0.038 9	−0.413 3	−0.452 2
	Tertiary industry	18	1.240 4	−0.174 5	0.744 6	0.104 7	0.793 7	0.793 8	−0.111 6	0.111 6	0.010 9
Min County	Primary industry	19	2.962 0	0.614 9	0.010 7	−0.099 9	0.038 2	0.327 6	0.068 0	−0.357 4	−0.289 4
	Secondary industry	20	1.917 2	−0.067 4	0.003 9	−0.083 5	0.007 2	0.167 6	−0.005 9	−0.154 5	−0.160 4
	Tertiary industry	21	2.274 5	−0.547 4	0.714 5	0.074 6	1.234 0	1.455 5	−0.350 3	0.128 9	−0.221 4

If $b_{ij,0} - b'_{ij} > 0$, corresponding location quotient is greater than 1, belonging to the sunrise industry sector with abundant earnings. If $b_{ij,0} - b'_{ij} < 0$, proportion of industrial sector is lower than the average level of Dingxi City, belonging to the deficit industry sector. According to Table 2, we have：

（1）Both secondary and tertiary industries in Anding be-

long to the sunrise industry sector with abundant earnings; while the primary industry belongs to deficit industry sector. According to the increment G_{ij} and shift component S_{ij}, tertiary industry takes the top place. According to the competitiveness shift component D_{ij}, both secondary and tertiary industries are at the forefront. Therefore, tertiary industry is the leading industry in Anding and secondary industry is the key industry.

(2) Secondary industry in Linyao County is the sunrise industry sector with abundant earnings. Both primary and tertiary industries belong to deficit industry sector. According to the increment G_{ij}, both primary and tertiary industries are at the forefront. According to the shift component S_{ij}, tertiary industry takes the first place. According to the competitiveness shift component D_{ij}, secondary industry takes the first place. Therefore, secondary industry is the leading industry in Linyao County and primary industry is the key industry.

(3) Primary industry in Weiyuan County is the sunrise industry sector with abundant earnings; while secondary industry belongs to deficit industry sector. According to the increment G_{ij}, both primary and tertiary industries are at the forefront. According to the shift component S_{ij}, both secondary and tertiary industries lag behind. According to the competitiveness shift component D_{ij}, primary industry takes the top place. Therefore, primary industry is the leading industry in We iyuan County, but it lacks the growth potential. Tertiary industry is the key industry.

(4) The three industries in Longxi County belong to the sunrise industry sector with abundant earnings. According to the increment G_{ij}, all the primary, secondary and tertiary industries are at the forefront. According to the shift component S_{ij}, secondary industry takes the top place. According the competitiveness shift component D_{ij}, both primary and secondary industries are at the forefront. Therefore, secondary industry is the leading industry in Longxi County; and primary industry is the key industry.

(5) Both primary and tertiary industries in Tongwei County are the sunrise industry sector with abundant earnings; while secondary industry belongs to deficit industry sector. According to the G_{ij}, S_{ij} and D_{ij}, all the three industries lag behind. Therefore, primary industry is the leading industry in Tongwei County; and secondary industry is the key industry, which both lack the competitive advantage.

(6) Primary industry in Zhang County belongs to the sunrise industry sector with abundant earnings; while both secondary and tertiary industries are deficit industry sector. According to the G_{ij}, S_{ij} and D_{ij}, all the three industries lag behind. Therefore, primary industry is the leading industry in Zhang County; and secondary industry is the key industry, which both lack the competitive advantage.

(7) Primary industry in Min County belongs to the sunrise industry sector with abundant earnings; and both secondary and tertiary industries are deficit industry sector. According to the increment G_{ij}, all the three industries lag behind. According to the shift component S_{ij}, all the three industries are in the middle. According the competitiveness shift component D_{ij}, pri-

mary and tertiary industries are at the forefront. Therefore, primary industry is the leading industry in Min County; and secondary industry is the key industry.

2.2 Location Quotient Analysis   Growth advantage of each industry S_{ij} is taken as the horizontal axis; and share component N_{ij} is taken as the longitudinal axis, so as to establish a diagram of sector advantage analysis. Fig.1 shows that sector 1 includes the secondary and tertiary industries in Anding, the primary and secondary industries in Linyao, the primary industry in Weiyuan, the primary and secondary industries in Longxi. Sector 1 is a growth advantage sector. And sector growth advantage has greater contribution to sector total increment than the share component. Tertiary industry in Zhang County belongs to sector 2, which is a growth advantage sector, but has smaller contribution to total increment than the share component. Sector 4 includes the secondary industry in Weiyuan, the primary, secondary and tertiary industries in Tongwei, the primary and secondary industries in Zhang County, and the primary and secondary industries in Min County, which is a growth sector having no advantages. And its position is on the decline.

A diagram of sector shift component is established (Fig. 2) by taking the competitiveness shift component D_{ij} as the horizontal axis and the structural shift component P_{ij} as the longitudinal axis. Fig. 2 illustrates that the sector 1 includes the secondary industry in Anding District, the secondary industry in Lintao, the primary industry in Weiyuan, and the secondary industry in Longxi, which have relatively good industrial base and strong competitive strength. Tertiary industry in Anding is located at the sector 3, which has poor industrial base but fast development speed. Sector 4 includes the tertiary industry in Weiyuan, the tertiary industry in Longxi, the primary and tertiary industries in Tongwei, the primary industry in Zhang County, and the primary industry in Min County, which have relatively good industrial base, but its influence on economic structure is in a downward trend. Sector 5 includes the primary industry in Anding, the tertiary industry in Lintao, the secondary industry in Weiyuan, the secondary industry in Tongwei, and the primary industry in Zhang County, which have relatively good industrial base but poor competitive strength. The primary industry in Lintao, the primary industry in Longxi, the tertiary industry in Zhang County, and the tertiary industry in Min County are located at the sectors 7 and 8, which have poor structure and lack the competitive strength.

3   Countermeasures and suggestions

3.1   Increasing input in characteristic agriculture; promoting the development of primary industry   Developing characteristic agriculture has greatly promoted the economic development in Dingxi City. The key is to develop planting industry, mainly the potato, traditional Chinese medicinal materials, forage livestock, and plateau summer vegetable. Taking Anding, Weiyuan, Lintao, Min County as the key regions, planting industry of potato is developed. Taking Min County as the center, planting industry of traditional Chinese medicinal materials
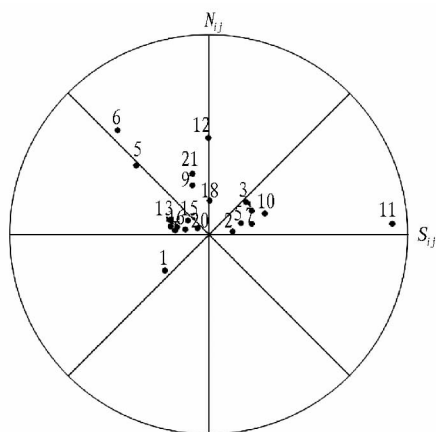
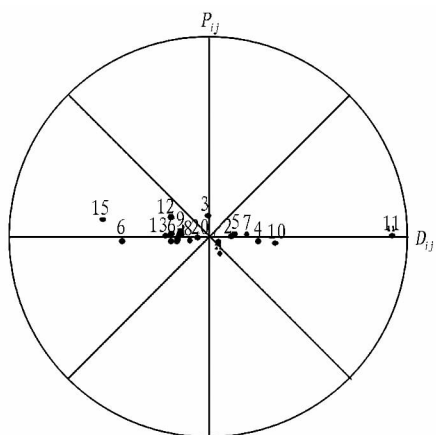**Fig. 1   Advantage analysis of the sectors in counties（districts）in Dingxi City**

Fig. 2   Shift component of the sectors in counties（districts）in Dingxi City

is promoted in Anding, Longxi, Weiyuan and other counties and districts. Development of forage livestock is paid special attention in the counties and districts, such as Anding, Tongwei, Weiyuan and Zhang County. Development of the characteristic agriculture mentioned above should be based on the provincial market and the markets outside the province, improve the product competitiveness, and promote the agricultural efficiency and the rural economic development.

3.2   Speeding up the construction of large and medium-sized industrial enterprises; promoting the development of secondary industry   Government should break through green barriers, carry out green upgrading of products, take the adjustment of industrial structure and the optimization of industrial allocation as the core, support the four industries of agriculture byproducts processing, biological medicine, mineral exploitation and processing, and machinery manufacturing, and adopt the clean production technology, recycling technology, clean energy and renewable energy technology, energy and water saving technology, and no waste or less waste technology to establish the industrial recycling economy system, and to promote the development of secondary industry.

     Relying on the leading enterprises of Dingxi Shufeng Company, Longxi Qingji Company, Lintao Tengsheng Company,

the three counties of Anding, Longxi and Lintao should vigorously develop the deep processing of potato. By the support of Gansu Fuzheng Pharmaceutical Sci & Tech Co., Ltd., the Longyuan Zhongtian Pharmaceutical Co., Ltd., the Gansu Jinling Pharmaceutical Co., Ltd, the Gansu Zhongyou Pharmaceutical Co., Ltd., and the Minhai Pharmaceutical Co., Ltd., Longxi and Min County should develop biomedical industry. Taking fine chemical products as the final goods, Zhang County should develop large-scale exploitation and processing of chloralkali, sodium carbonate, sodium chlorate and other minerals based on the abundant bitterns resources. Anding, Longxi and Lintao should develop machinery manufacturing by relying on the Gansu Huateng Oil Machinery Manufacturing Co., Ltd., Gansu Taohe Tractor Manufacturing Co., Ltd., Dingxi Gaoqiang Bolt Co., Ltd., Gansu Dingxi Crane Factory, and Weihe Fuli Manufacturing & Repairing Co., Ltd..

3.3   Strengthening the comprehensive environmental rehabilitation; actively developing the tertiary industry   Government should actively develop the rich natural and cultural tourism resources, establish the industrial pattern of ecotourism, red tourism and cultural tourism, strengthen comprehensive environmental control in tourism sites, and realize the sustainable development of tourism. At the same time, government should also develop green logistics and specialized market, decrease the transportation costs of products and raw materials, reduce the repeated construction, realize the zero inventory of enterprises, design and construct the circulation channel of e-commerce, optimize the distribution center, and form a logistics center with rational asset structure, technological structure and labor structure, which has the characteristics of regional industry.

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