Research Paper

Analysis on Integration Path of Urban and Rural Industries Based on Economic Data Model

A Case Study of Strategy Planning of Taiyuan Rural Revitalization

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Abstract

In the background of ongoing urbanization in China and prominent "dualistic" contradiction between urban and rural areas, rural revitalization is extremely urgent. Currently, common problems concerning industry, ecology and humanities exist in rural areas. This paper attempts to figure out the causes for differences in industrial development in rural areas on the basis of macro data analysis and industrial spatial distribution.

Given the lack of quantitative analysis of the relationship between urban and rural development and industrial structure, this paper adopts SPSS statistical software to conduct regression analysis on the statistical data of Taiyuan City in the past ten years. Based on the relationship between industrial proportion and urban-rural income ratio, this paper proposes how the adjustment of urban industrial structure promotes the industrial development in surrounding rural areas and the narrowing of urban-rural income gap.

From the perspective of rural industry undertaking or complementation with urban industry, this paper then puts forward the idea of undertaking the transfer industry within the scope of ensuring the aggregation effect of the city center and the carrying capacity of the ecological environment, proposing an industrial development path from agriculture to processing industry and then to culture, tourism and recreation industry for the villages in Taiyuan.

Keywords

Regression analysis, Industrial structure, Urban-rural integration, Taiyuan path

1. Introduction

1.1. Urban-rural dual system

Under the past 40 years of reform and opening up policy, China's industry has developed rapidly. The population gathering brought about by the spatial clustering of the industry has caused the rapid expansion of the city. Rapid urbanization has led to a prominent problem of urban-rural dual structure. Since ancient times, urban and rural areas have been born out of a relationship of natural conditions and economic structure. A series of urban-rural dual policies, such as industrial priority development in the planned economy of New China, have

led to a strict separation of urban and rural social and economic structures (Yifu Lin, 2002), resulting in severe restrictions on the flow of production factors between urban and rural areas. It was not until the implementation of the reform and opening up policy that the urban-rural dual structure was loosened. Engels said: "All urban problems are caused by poverty in the countryside." Therefore, the common development of urban and rural areas is the mission of an era. The development of urban and rural integration is inseparable from the economic development driven by industry. The development of industry cannot be separated from the support of construction space.

1.2. Urbanization

Since World War II, Western scholars have begun a lot of research on urbanization, and international scholars have never stopped discussing urban-rural relations. Since the 1980s, with the acceleration of the globalization process, the theory of coordinated urban and rural development has become the main direction of discussion. The proliferation of large cities from the top down, the rural industrialization from the bottom up and foreign direct investment drive the development of rural to semi-urban. There is a lack of management in the semi-urbanized areas in rural areas (Ruoxiang Jia et al., 2002; Shenghe Liu et al., 2004). The global capital allocation, market, talents, technology recombination and allocation caused by economic globalization have brought in a large influx of foreign capital. With the rapid development of processing and manufacturing, a large number of rural semi-urban areas have been created. With the acceleration of China's urbanization process, China's urbanization rate has reached 60% by 2017. Industrialization since the 1980s has accelerated the disappearance of rural areas, and a large number of small and medium-sized cities and small towns have developed. The growth of GDP has a significant correlation with urbanization, and the development of the economy has driven the development of urbanization. In the early days of reform and opening up, the development of industrialization accelerated urbanization and brought about a significant improvement in the national economy. In the 20th century, China's economic development entered a period of transition. The agglomeration of industry led to the difference of space economy, accompanied by a large number of labor pools, which led to the typical urban dual structure problem. What followed was the central government's proposal to build a series of financial support policies, such as characteristic small towns, urban-rural integration, and beautiful villages, in an attempt to narrow the gap between urban and rural areas through urban reincarnation. In 2003, Professor Xie elaborated on a series of urban problems brought about by the development of urbanization, and proposed the road of new urbanization 4 (Zhiqiang Xie, 2003), which triggered the thinking of urban scholars, sociologists and politicians. . Scholars in economics believe that cities should be aggregated and cannot reverse the laws of industrial, labor, capital and other factors. With the development of industrialization, China began a large-scale land development process. Since the 1990s, large-scale development zones, industrial parks, and high-tech parks have been built. The following picture shows the urban and rural development trends of Chinese cities from 2004 to 2017. The data of Figure 1 as bellow was missing urban area data in 2004-2007, and noted that the urban area is the area of the city proper before 2006

(Source from National Bureau of Statistic of China).

Figure 1 China's urban expansion trend chart

It can be seen from the table that the speed of urban construction area expansion in China has been positively correlated with the rate of population agglomeration, and there is no significant increase in urban population density. A series of urban and rural development issues that followed have entered the vision of the planning industry, academic circles and political circles. The expansion of industrial land has led to the spread of construction land, and the economic development and urbanization brought about by industrialization have allowed China to develop rapidly. Under the background of the gradual disappearance of the demographic dividend, Zhao Min and other scholars proposed that the development of rural space should adhere to the "smart contraction" view. 5 Zhang Li discussed the deterioration of the demographic dividend and the qualitative transformation of urbanization. The land expansion brought about by rapid urbanization has led to the local government's high dependence on land finance. How should China's urbanization and construction land development develop in the context of the current transformation of development mode? Does industrial development, which is a pillar of the national economy, play a major role in promoting urbanization? What is the strategic guiding significance of the relationship between urbanization and industrial development and the development of land use for its rural development? How to develop the industrial economy of Taiyuan's countryside in the context of industrial transformation and development?

2. Methodology

2.1. Objective

This paper attempts to use the econometric method to conduct regression analysis on historical statistical data. The research goal is to use quantitative methods to find out the relevant factors affecting urban agglomeration in urban and rural development, and to use satellite remote sensing images of land construction and expansion to Taiyuan. An objective analysis of land use in the past 15 years. In the 40 years of reform and opening up, China's urbanization rate has doubled (Figure 2), which is nearly double the time of the UK's urbanization rate (Figure 3).
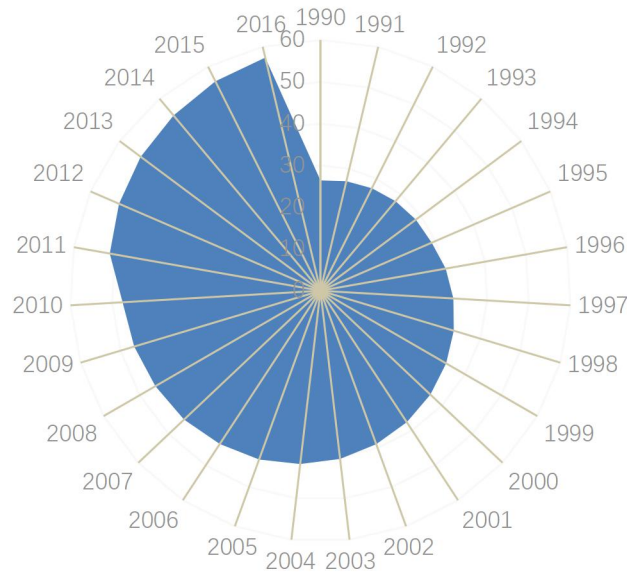
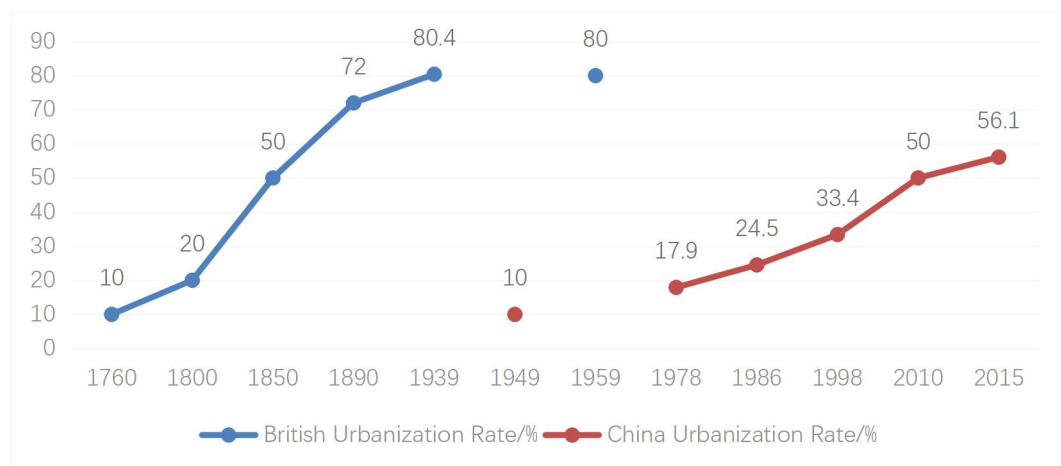**Figure 2 Mainland-China's average urbanization rate**

Figure 3 Time-varying chart of urbanization rate between British and China

In economic geography, the spatial aggregation index system was extensively studied by Western scholars in the 1970s. So far, no ideal spatial aggregation index system has been established (Masahisa Fujit et al., 2005; Pierre-Pilippe Combes et al.,2008). According to years of data collection and observational research, the factors that cause population aggregation to form spatial imbalance development are labor productivity, transportation costs, and trade costs. Based on the degree of data acquisition, this paper establishes an incomplete model of urbanization rate research model, showing in Figure 4 as bellow.
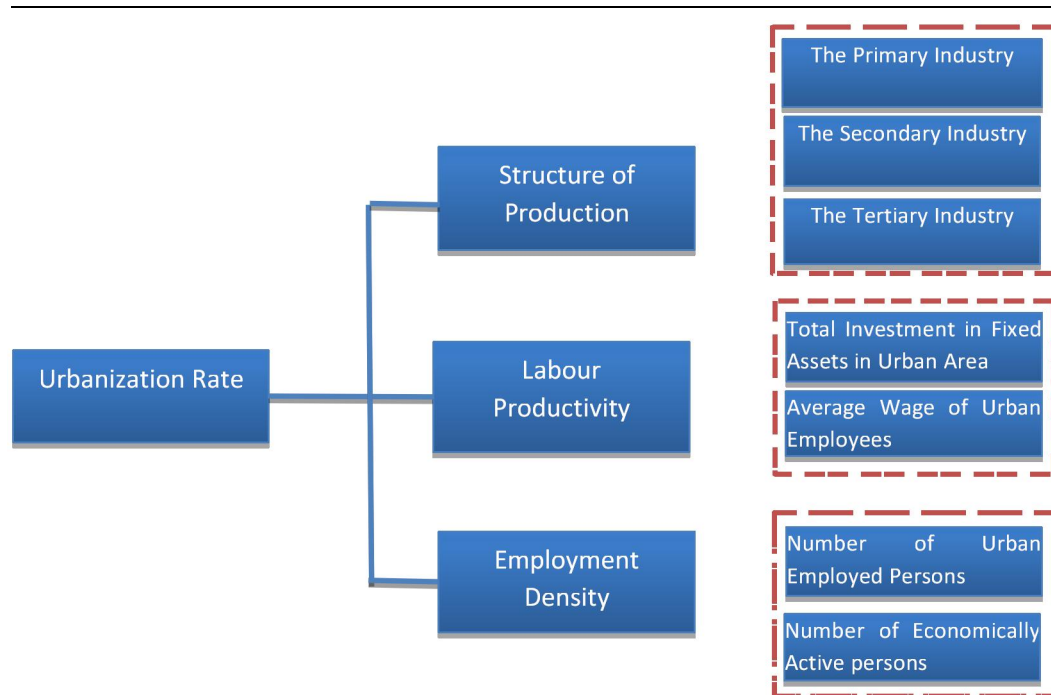
Figure 4 Research framework model (the author self-painting)

2.2.   Model hypothesis

The SPSS software was used to analyze the urbanization rate and independent variables of the dependent variables. Before doing the regression analysis, the relationship between the independent variable and the dependent variable is depicted in a scatter plot (Fig 5) to find the relationship between each dependents. According to the observation analysis, the general linear regression model is established as follows:

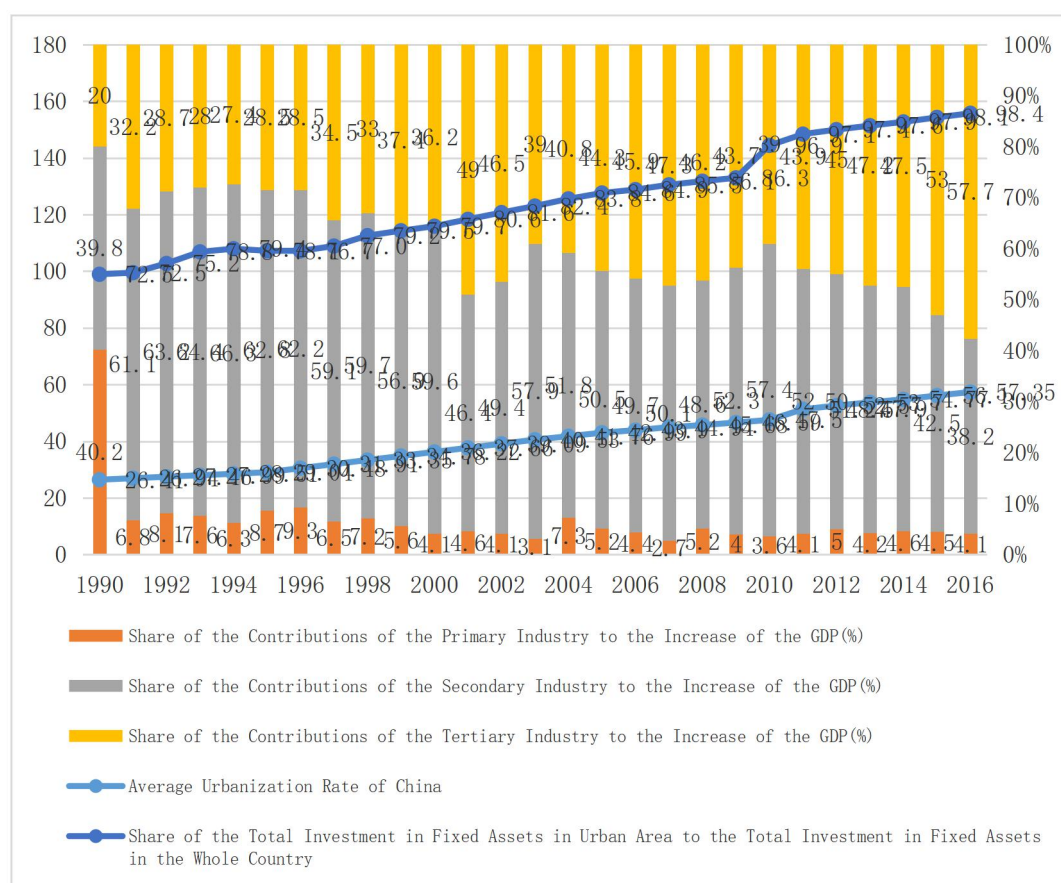$y = \alpha_i + \Sigma\beta_i x_i + \varepsilon$ (Equation 1)

Figure 5 Urbanization rate related variable icon

2.3. Data selection and processing

According to the research framework established in the research method, the whole country is studied as the whole geospatial target, and each city is where the space gathers. Therefore, the data indicators corresponding to the elements in the corresponding research framework are searched, and the data model is established by SPSS software for regression analysis (Xiaojun Huang et al., 2008; Chenggu Li et al., 2004). Looking for statistics from 1990 to 2016 from the China City Statistical Yearbook, the year was chosen in 1990 because the implementation of the 1989 reform and opening up policy promoted the development of the market economy. By the year 2016, it was considered the international trade elements in the latest year data available, and also 2016 is the year in which US sanctions against China's international trade began. The data indicators were selected: the national average urbanization rate, the contribution of the primary industry to GDP, the contribution of the secondary industry to GDP, the contribution of the tertiary industry to GDP, the gross domestic product (nominal GDP), and the investment in fixed assets of the whole society (100 million yuan), urban fixed assets investment (100 million yuan), employed persons (10,000 people), primary industry employed persons (10,000 people), secondary industry employed persons (10,000 people), tertiary industry employed persons (10,000 people), Fourteen data indicators for urban employed persons (10,000 people), rural employed persons (10,000 people), and economically active population (10,000 people).

Considering the magnitude of the data and the homogeneity of the samples, I processed some of the data. The specific treatment method is: calculating the ratio of the contribution of the primary industry to GDP, the contribution ratio of the secondary industry to GDP, the contribution ratio of the tertiary industry to GDP, the ratio of urban fixed assets investment to the fixed investment of the whole society, and the first production. The ratio of employed persons, the ratio of employed persons in the secondary industry, the ratio of employed persons in the tertiary industry, the ratio of employed persons in urban areas, the ratio of employed persons in rural areas, and the proportion of employed persons in economically active population. There are 10 independent variables entering the regression equation in the model.

3. Model analysis

3.1. Data out-put

General linear regression was performed using SPSS, and a stepwise regression method was used to establish the model. The modeling path given by the stepwise regression modeling method is shown in Figure 6. The coefficient is as shown in the table column "B": the proportion of urban employment is a variable that significantly affects the urbanization rate, followed by the tertiary industry to urbanization. The rate plays a small positive effect. In the second model, the independent variable of the tertiary industry's GDP is tested by the reliability coefficient of 0.01, and the three coefficients of the model are all tested by the reliability coefficient of 0.05. However, in Model 3, which is the most stable one, the proportion of second-employed workers is obviously a negative correlation to the urbanization rate. Bring the regression coefficient into Equation 1, and get the general linear regression equation: $Y=3.045+113.305X_1+0.12X_2-39.071X_3+\varepsilon$ (Equation 2), where X_1 is the independent variable urban employment ratio, X_2 is the independent variable third. The contribution rate of industry to GDP, X_3 is the proportion of employed persons in the secondary industry of independent variables, ε is the error term, and Y is the urbanization rate of the dependent variable.

系数ᵃ

模型		非标准化系数		标准系数	t	Sig.
		B	标准 误差	试用版		
1	(常量)	-.962	1.120		-.859	.398
	城镇就业人员(万人)占比	110.700	2.921	.991	37.902	.000
2	(常量)	-2.332	.882		-2.644	.014
	城镇就业人员(万人)占比	95.038	4.019	.851	23.650	.000
	第三产业对GDP的贡献率(%)	.182	.039	.167	4.628	.000
3	(常量)	3.045	2.650		1.149	.262
	城镇就业人员(万人)占比	113.305	9.342	1.015	12.128	.000
	第三产业对GDP的贡献率(%)	.120	.047	.110	2.580	.017
	第二产业就业人员(万人)占比	-39.071	18.302	-.126	-2.135	.044

a. 因变量: 全国平均城镇化率

Figure 6 SPSS model coefficient table

Anova^d

模型		平方和	df	均方	F	Sig.
1	回归	2544.378	1	2544.378	1436.553	.000^a
	残差	44.279	25	1.771		
	总计	2588.657	26			
2	回归	2565.258	2	1282.629	1315.559	.000^b
	残差	23.399	24	.975		
	总计	2588.657	26			
3	回归	2569.127	3	856.376	1008.560	.000^c
	残差	19.529	23	.849		
	总计	2588.657	26			

a. 预测变量: (常量), 城镇就业人员(万人)占比。

b. 预测变量: (常量), 城镇就业人员(万人)占比, 第三产业对GDP的贡献率(%)。

c. 预测变量: (常量), 城镇就业人员(万人)占比, 第三产业对GDP的贡献率(%), 第二产业就业人员(万人)占比。

d. 因变量: 全国平均城镇化率

Figure 7 Model stability coefficient table

模型汇总

模型	R	R方	调整 R方	标准 估计的误差
1	.991^a	.983	.982	1.33085
2	.995^b	.991	.990	.98741
3	.996^c	.992	.991	.92147

a. 预测变量: (常量), 城镇就业人员(万人)占比。

b. 预测变量: (常量), 城镇就业人员(万人)占比, 第三产业对GDP的贡献率(%)。

c. 预测变量: (常量), 城镇就业人员(万人)占比, 第三产业对GDP的贡献率(%), 第二产业就业人员(万人)占比。

Figure 8 Model summary table

From the bellowing figure 7, the stability of the model is shown. The residual coefficient of Model 3 is the smallest, the stability is gradually increased, and the P values are all less than 0.01, so the model is statistically significant.

The autocorrelation analysis of the model is carried out, and the residual histogram and scatter plot are drawn. The distribution of residuals does not show obvious regularity, indicating that there is no autocorrelation in the data of this problem.

3.2. Model analysis

From the regression analysis of statistical data from the year 1990 to 2016, it is concluded that increasing the proportion of urban employed population is a positive factor in the process of urbanization. The proportion of employed persons in the secondary industry is negatively related to urbanization. The industry has moved beyond urban areas to non-urban areas. Therefore, in today's urban-rural integration development, how to promote the development of rural areas is not to increase the number of jobs in the countryside, but to take advantage of the advantages of the countryside to promote the development of rural characteristics. There should be a concentrated central city and regional economy to promote the common development of surrounding towns and villages, stop the rough development of the construction of land for large-scale demolition and construction, and

turn to intensive and efficient development. The accumulation of urban population and industry is an inevitable trend of economic development.

4. Case study of Taiyuan

4.1. Analysis of industry and urbanization

Taiyuan belongs to the capital city of central China. In recent years, the economic aggregate has increased steadily. In 2017, the city's GDP reached 338.218 billion yuan, accounting for 22.6% of the province's GDP, a year-on-year increase of 14.43%, and a three-product structure ratio of 1.2:37.6:61.8 (Source from the city Statistical bulletin). However, due to the geographical location and development conditions, the development of districts and counties is uneven. Compared with the six districts of Taiyuan City, Gujiao, Loufan, Qingxu and Yangqu are the suburbs of Taiyuan City. The rural characteristics are obvious. In 2017, the total GDP of the three counties and one city was only 23.553 billion yuan, accounting for only Taiyuan City. The total economic output is 7%, of which Loufan County has a minimum of 2.11 billion yuan.

As of 2017, the city's permanent population in the city of Taiyuan reached 4.38 million, of which the rural population was 670,000, the overall urbanization rate has reached 84.7%, ranking third in the provincial capital cities (data from local cities' statistics bulletin). However, the level of urbanization development in districts and counties is obviously different. The average level of urbanization in Liucheng District is above 90%, and the highest is 97.57% in Wanbai District. The average level of urbanization in the three counties and one city is only 45%. The lowest is Qing. Xu County 33.55%.

According to the China Urbanization Quality Report (2013) jointly issued by the Chinese Academy of Social Sciences and the China Economic Weekly, the total urbanization quality of Taiyuan City is 0.52, ranking 80th in the country and 4th in the six central provinces. The disposable income of GDP and urban residents is second to last and the first in the six provincial capitals of the central region. As a heavy industrial city, Taiyuan has long been a high-energy, high-pollution extensive industry as its economic development path, and its resource environment has been severely challenged (Yongzhen Duan, 2017). The master plan of the city of the year 2004, showing that Taiyuan's is going to transform into a high-tech and technology-intensive industrial city.

4.2. Analysis of land use

According to recent pictures of Taiyuan city remote sensing satellites, land use data is extracted. The land use in 1999, 2004 and 2011 was classified and the land use type was analyzed by satellite remote sensing images as the year of 1999, 2004 and 2011.

By collecting and sorting the land area of different land types according to the year, the table 1: statistical classification table of land use is obtained. The data from 1999 and 2004 were from the land use analysis and identification of satellite remote sensing images. It can be seen from the analysis that after years of land use control and industrial structure adjustment, the area of industrial land and the land area of the mining industry have been effectively controlled, and the scope of living and residential land is constantly expanding.
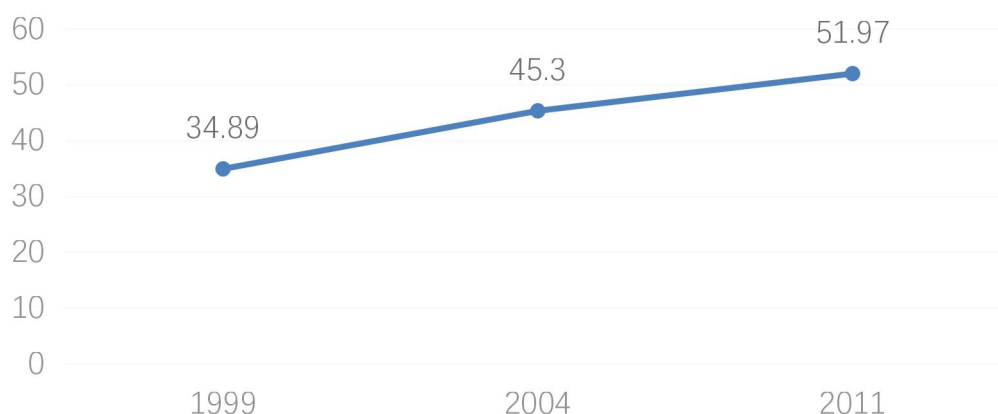
Figure 9 Industrial land share as the year 1999, 2004, 2011

Indicators	Year of 1999 （Remote sensing images）KM²	Year of 2004 （Remote sensing images）KM²	Year of 2011 （Remote sensing images）KM²
Industrial Area	34.87	45.3	51.97
Living Area	634.38	783.85	838.85
Mining sites	38.07	33.14	33.34
Total area(industrial land, residential land, etc..)	1428.09	1928.40	3527.66

Table 1 Statistics of land use table

After the remote sensing image is processed by the GIS software, the data and visualization of the classified land are analyzed. In this article, I use yellow plots as living and habitat area, brown for industrial use, and blue for mining. From this point of view of time evolution, mining land is gradually decreasing, and distributed in the periphery of the mining area, and after the adjustment of industrial structure, part of the mining land has been converted into industrial land. Through the ecological restoration work in mining subsidence areas in recent decades, the ecology of the mining area has been greatly restored.

From the perspective of the layout of urban industrial land, it is mainly distributed along the Weihe River and the main traffic trunks. The distribution of living and residential land is relatively scattered. The urban area is mainly concentrated in the plain area of the central part of the Weihe River, and the land is continuously spreading to the surrounding areas, and the rural residential areas are scattered. Among them, the land surrounding the mining area has been converted from mining land to industrial land, and a large amount of residential land is distributed around the industrial land. With the transformation of heavy industry and the adjustment of industrial structure, combined with the increase in the area of urban land development and construction, the economic benefits of urban land are at the

bottom. At present, the per capita land area of Taiyuan City is higher than that of other big cities in China. The main reason is that the skeleton is large, the layout is scattered, and the national defense industry is more. The industrial, warehouse and protective land accounts for 50% of the total land area, while the main land in urban land. Part of the living and residential land is only 30%.
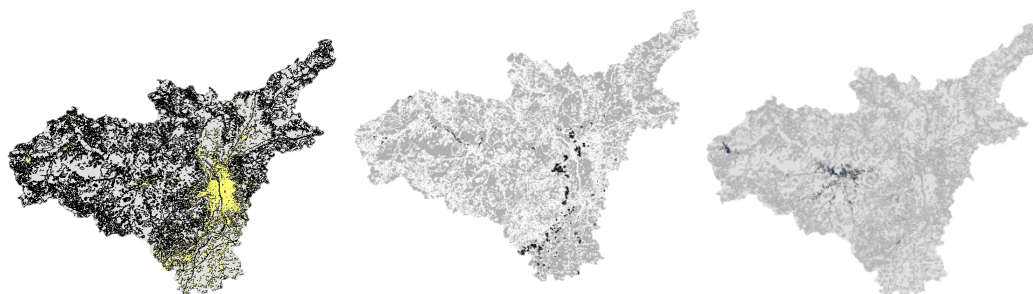

Figure 10 Distribution map of residential land, industrial land and mining land in Taiyuan City in 1999
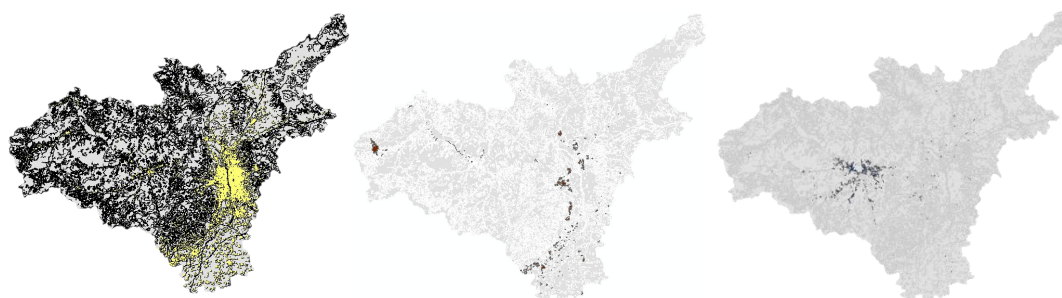

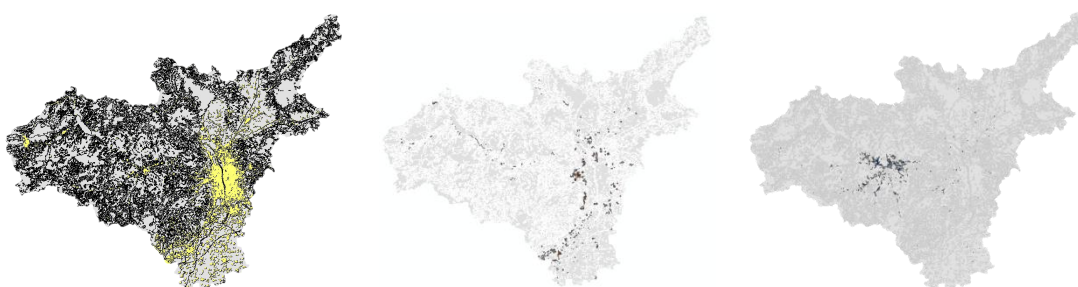**Figure 11 Distribution map of residential land, industrial land and mining land in Taiyuan City in 2004**

Figure 12 Distribution map of residential land, industrial land and mining land in Taiyuan City in 2011

4.3.   Summary

The total construction land of Taiyuan City has an average annual growth rate of 587.6 hectares, with a small average annual growth rate, which is equivalent to that of Shijiazhuang, far smaller than cities such as Hohhot, Zhengzhou, Xi'an and Hangzhou.

The demand for construction land in Taiyuan City is spatially different, among which Xiaodian District and Qingxu County are growing rapidly. Among all types of construction land, the growth of independent industrial and mining land is the fastest, the growth of urban construction land is slow, and the land for rural settlements is not decreasing.

From 1998 to 2006, the total construction land in Taiyuan's central urban area showed a growing trend, with an average annual growth rate of 11 square kilometers, and the growth rate increased year by year. From 2001 to 2006, the annual construction land in Taiyuan City increased by 3.92 square kilometers, far less than the annual growth of construction land in the central city. It shows that the future growth of urban construction land in Taiyuan City is mainly due to the construction land demand in the central city.

Taiyuan is the city that in the stage of centralized urbanization now. And the central city tends to be excessively intensive. The marginal area is extensively used. The urban expands strictly big with low efficient land use. In the future, through the transformation of the old city and the increase of investment in the new district, the main urban area will be promoted from excessive intensive to rational and intensive development, while promoting the peripheral area from extensive to intensive use.

Based on the land price perspective, the evaluation of the current residential, industrial and commercial land will promote the central position of the urban area. As the same time, it should demonstrate the land rent benefit of the urban land to fully exploit and realize the economic value of the land, in order to optimize the spatial structure of the city, and revitalize the old city. About 321 hectares of residential land and 267 hectares of industrial land do not meet the location and land rent conditions, and propose adjustments.

5. Research enlightenment

5.1. Economy of Industrial

Development ideas and objectives adhere to the general principle of "taking the town with the township", guide the development of the "small town group", and build a "central city-small town group-township-village" linkage development situation to realize the "City Belt Township and Township Belt". The organic linkage development system of villages and villages (Big villages) with villages (Small villages) will complement the short-term economic development of districts and counties, guide the development direction of towns and villages. Sorting out and improving the urban and rural spatial development strategy, and strengthen the equalization of urban and rural service facilities. Promote rural revitalization and development by region, sub-type and echelon. The village should retain its own characteristics, such as the distinctive culture, the social structure of "acquaintances", the unique way of life, and the characteristic buildings and production tools left over from history, to develop the rural cultural tourism industry. Protect the ecology, support the scale of agriculture and industrial cluster development.

5.2. Land use efficiency

The urban growth boundary should be strictly controlled to improve the economic benefits of urban production space and ensure the aggregation effect of large and medium-sized cities. Let the tertiary industry with high efficiency in land production such as innovation and technology and productive services return to the city center to lead the city's new round of economic development. Through rural revitalization, we will promote a more rational distribution of production factors in urban and rural areas and large areas, and improve the efficiency of the use of economic resources. The government-led land development path should be transformed to allow more market economies to participate in rural revitalization. Considering that not all rural areas can participate in the division of labor in the market

economy, rural revitalization should have a focus. In China, where resources are scarce, what is more needed is to adopt a smart growth strategy in areas with outstanding development advantages.

Taiyuan City has entered the mature period stage of urbanization. Now the land use of the central urban area tends to be excessively intensive, the marginal area uses extensive land, and the city expands rapidly. In the future, through the transformation of the old city and the increase of investment in the new district, the main urban area will be promoted from excessive intensive to rational and intensive development, while promoting the peripheral area from extensive to intensive use.

5.3. Labor

From the perspective of urbanization rate, the urbanization rate under the resident population statistics is much higher than the urbanization rate under the household registration population. To a certain extent, the household registration system has hindered the free flow of labor across regions. Due to the regional differences in rents and the continuous migration of industries to the periphery of the city, the labor force from rural to urban areas mainly gathers outside the city center to make a living. With the continuous development and changes of the market and technology, the existing labor force needs to constantly update the knowledge structure to adapt to changes in market demand and to have a place to live in the city. Therefore, the development of science, technology, transportation and the rising cost of urban living are also factors that limit the increase in urbanization rate.

5.4. Future research

In the middle of this paper, the study of urbanization rate is analyzed from the perspective of national urban data. While the provincial-level super-large city as the growth pole of regional development, Gucheng Li and etc. have carried out the economic support model for the regional economy of China's urbanization. The analysis made a qualitative analysis from the aspects of urbanization rate, built-up area, urban economic density and regional economy, and found out the data represented by each development factor. In the follow-up study, the provincial cities will be separated from the megacities such as Beijing, Shanghai, Shenzhen and Guangzhou according to the type of international cities, and they will be studied as independent urbanization processes in large and medium-sized inland cities. The agglomeration of industry leads to the difference of space economy, accompanied by a large number of labor gathering, which leads to the typical urban dual structure problem.

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