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Industrial Agglomeration, Spatial Spillover Effects and Regional Economic Growth: An Empirical Study based on 10 Prefecture-Level Cities in Shaanxi Province

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Abstract

Based on the panel data of 10 prefecture-level cities in Shaanxi Province from 2000 to 2019, this paper uses the spatial Dubin model to study the spatial spillover effect of industrial agglomeration on regional economic growth. Through the empirical analysis, the following conclusions are drawn: (1) Industrial agglomeration will promote the economic growth of the region, but inhibit the economic growth of the adjacent areas; (2) at this stage, it is difficult for government expenditure and fixed asset investment to play a good economic effect on regional economic growth, and financial loans can continue to give full play to their advantages; (3) through the evolution map of temporal and spatial trends, it can be observed that the level of economic development in northern Shaanxi is the highest, that in Guanzhong area is the second, and that in southern Shaanxi is relatively low, and the distribution characteristics are relatively stable, but with the passage of time, the center of gravity shifts from north to south.

Keywords

Industrial Agglomeration; Regional Economic Growth; Spatial Spillover Effect; Location Entropy.

1. Introduction

In the new period, China's economy has changed from the original stage of rapid growth to the stage of high quality development. As the country with the most complete industrial sector, industrial agglomeration, like other industrial agglomeration, has a profound impact on the level of economic growth in the new period. The impact of industrial agglomeration on regional economic growth has always been the focus of domestic and foreign scholars, and industrial agglomeration, as an important part of industrial agglomeration, has attracted the attention of domestic scholars in recent years. Gang et al. used the cross-section data of 2000, it is found that social capital will accelerate the process of industrial agglomeration, and then promote regional economic growth [1]. Zhao considered that globalization, marketization and urbanization will lead to regional industrial agglomeration, and industrial agglomeration is an important reason for the imbalance of regional economic development [2]. Deng et al. analyzed the spillover effect of industrial agglomeration on regional economic growth from a spatial perspective and found that industrial agglomeration has a significant role in promoting regional economic growth [3]. Ma et al. deeply discussed the impact of industrial agglomeration on the efficiency of green economy, and empirical tests showed that industrial agglomeration not only directly promoted the efficiency of green economy, but also indirectly improved the efficiency of green economy through government intervention [4]. Lian mainly explored the relationship between industrial agglomeration and labor productivity [5].

To sum up, few studies have studied the impact of industrial agglomeration on regional economic growth from a spatial perspective, and most of them use national provincial panel

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data to carry out research. However, there are obvious differences in industrial agglomeration and regional economic development level among different regions, and it is difficult for provincial panel data to reflect the real situation of a certain region. Based on this, the paper makes the following attempts: (1) using the prefecture-level city panel data of Shaanxi Province to analyze the impact of industrial agglomeration on regional economic growth with the help of spatial econometric model, so as to enrich the regional research content. (2) by means of partial differential method, the spatial total effect of industrial agglomeration on regional economic growth is decomposed into direct effect and indirect effect, and the influence of industrial agglomeration on the economic growth of this region and its adjacent areas is measured more accurately, and then some targeted policy suggestions are put forward;(3)combined with the evolution trend diagram of time and space, the temporal and spatial evolution process of industrial agglomeration and regional economic growth is analyzed. With a view to putting forward constructive suggestions on the long term.

2. Model Selection and Variable Description

2.1. Model Selection

This paper focuses on the spatial impact of industrial agglomeration on regional economic growth, so the spatial measurement model is selected to verify the relationship between the two, and the model is constructed as shown in (1):

$$lnpgdp_{it} = \rho W_n lnpgdp_{it} + \delta_1 LQ_{it} + \delta_2 X_{it} + \theta_1 W_n LQ_{it} + \theta_2 W_n X_{it} + u_i + y_t + \varepsilon_{it}$$
$$\varepsilon_{it} = \lambda W_n \varepsilon_{it} + u_{it} \quad (1)$$

Among them, lnpgdp represents the logarithmic form of per capita GDP; LQ represents the level of industrial agglomeration; X represents the combination of control variables; W_n represents the type of spatial weight matrix; u_i represents the fixed effect; y_t represents the time effect; ε_{it} is a random disturbance term; λ represents the spatial error coefficient and reflects the spatial effect of the random disturbance term ε_{it}; ρand θrepresents the spatial lag coefficient, which reflects the spatial dependence among the variables.

According to the change of ρ, θ and λ, the model can be evolved into spatial lag model, spatial error model and spatial Dubin model. If both ρ and θ in the model are 0, it will evolve into a spatial error model; If both λ and θ are 0 in the model, it will evolve into a spatial lag model; if λ is 0 in the model, it will evolve into a spatial Dubin model. As for the spatial impact of industrial agglomeration on regional economic growth, which spatial measurement model is applicable, it still needs to be verified by the relevant tests.

This paper adopts Lesage and Pace [6]. The total effect is decomposed into direct effect and indirect effect by partial differential method, so as to verify the spatial spillover effect between variables. Its formula (2) is:

$$Y = (1 - \rho W)^{-1}(X\beta + WX\theta) + R \quad (2)$$

Where R includes the intercept term and the error term, The expected value partial differential matrix of Y (regional economic growth) corresponding to the core explanatory variable X (industrial agglomeration) can be can be expressed as formula (3):

$$\left[\frac{\partial E(Y)}{\partial x_{1k}} \cdots \frac{\partial E(Y)}{\partial x_{Nk}}\right] = \begin{pmatrix} \frac{\partial E(y_1)}{\partial x_{1k}} & \cdots & \frac{\partial E(y_1)}{\partial x_{Nk}} \\ \vdots & \ddots & \vdots \\ \frac{\partial E(y_N)}{\partial x_{1k}} & \cdots & \frac{\partial E(y_N)}{\partial x_{Nk}} \end{pmatrix} = (1 - \rho W)^{-1} \begin{pmatrix} \beta_k & \cdots & w_{1N}\theta_k \\ \vdots & \ddots & \vdots \\ w_{N1}\theta_k & \cdots & \beta_k \end{pmatrix} \quad (3)$$

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In formula (3), diagonal elements are direct effects, non-diagonal elements are indirect effects, and the total effects are the sum of direct effects and indirect effects.

2.2. Setting of Spatial Weight Matrix

In order to reflect the adjacent relationship between cities and cities in Shaanxi Province, this paper chooses to set the adjacent matrix as spatial weight matrix to study the spatial influence of industrial agglomeration on regional economic growth. The formula (4) is as follows:

$$W = \begin{cases} 0, \text{i is not adjacent to j} \\ 1, \text{i is adjacent to j} \end{cases} \tag{4}$$

When the region i is adjacent to the region j, the value of W is 1, and when the region i is not adjacent to the region j, the value of W is 0.

2.3. Description of Variables

In this paper, 10 prefecture-level cities in Shaanxi Province from 2000 to 2019 are selected as research samples to analyze the spatial impact of industrial agglomeration on regional economic growth. The data involved come from Shaanxi Statistical Yearbook, China Statistical Yearbook and Shaanxi Provincial Government work report.

2.3.1. Explained Variables: Regional Economic Growth

At this stage, the academic circles have not formed a unified opinion on the measurement index of regional economic growth. Scholars hold their own views and make use of the per capita gross domestic product (GDP) respectively [7,8], actual regional gross domestic product [9], average annual growth rate of GDP per capita [10], growth rate of gross industrial output [11], regional industrial value added [12] , regional gross domestic product [13], and other indicators to measure the level of regional economic growth. This paper selects the method approved by most scholars and selects the logarithmic form of per capita regional gross domestic product to measure the regional economic growth.

2.3.2. Core Explanatory Variables: Industrial Agglomeration

At present, the methods of measuring industrial agglomeration mainly include location entropy, industry concentration, spatial Gini coefficient, Huffindal-Hershman index (abbreviated as HHI index) and E-G index. Considering the availability of data, this paper adopts location entropy to measure the level of industrial agglomeration by referring to the practices of Zhang [14] and Chen et al. [15], and formula (5) is:

$$LQ_{ij} = \frac{q_{ij}/q_j}{q_i/q} \tag{5}$$

LQ_{ij} is used to represent the level of regional j industrial agglomeration, q_{ij} represent the total industrial output value of the region j, q_j represent the gross domestic product of the region j, q_i represent the industrial gross domestic product of Shaanxi Province, and q represent the gross domestic product of Shaanxi Province. When LQ_{ij}> 1, it shows that the region j has the advantage of industrial specialization, and the level of industrial agglomeration is higher than the average level of Shaanxi Province; when LQ_{ij}= 1, it shows that the level of regional j industrial agglomeration is consistent with the average level of Shaanxi Province; when LQ_{ij} < 1, it indicates that the region j is at a disadvantage in terms of industrial production, and the level of industrial agglomeration is lower than the average level of Shaanxi Province.

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2.3.3. Control Variable

Government expenditure scale (fis): according to the national economic accounting formula, we can understand that government expenditure is an important factor of GDP, which will have a direct impact on the development of the national economy, labor employment and so on. However, there is an optimal range of government expenditure, when it is in the optimal range, government expenditure will stimulate rapid economic growth; on the contrary, after exceeding the maximum range, government expenditure may have a restrictive effect on the economy [16]. This paper selects the ratio of local government expenditure to the gross domestic product of the region (local government expenditure / GDP) to measure the scale of government expenditure.

Infrastructure level (inv): investment, as one of the "troika" to stimulate economic growth, is an important part of realizing high quality of economy in the new period, and has a profound effect on regional economic development. However, this does not mean that excessive reliance on investment to achieve economic growth is a desirable economic development model, because investment also has an optimal range for economic growth, moderate investment can activate the market atmosphere, improve market vitality, and lay a good market environment foundation for economic growth; on the contrary, excessive investment may inhibit economic growth. This paper selects the ratio of the total investment in fixed assets of the whole society to the gross domestic product of the region (the total investment in fixed assets of the whole society / GDP) to measure the level of infrastructure.

The degree of financial development (fin): the prosperity of the financial industry can provide a strong financial guarantee for the regional economic development. The supply side of funds and the demand side of funds can quickly obtain funds with lower transaction costs and information costs, so as to meet the consumption or investment expenses needed by individuals or enterprises in the long-term development process. The high-frequency trading process will also accelerate the financing of funds, create a good market atmosphere, and contribute to the sustained and high-quality development of the economy. This paper selects the ratio of the total amount of regional financial loans to the gross domestic product (GDP) of the region (the total amount of regional financial loans / GDP) to measure the degree of financial development.

3. The Temporal and Spatial Evolution Trend of Industrial Agglomeration and Regional Economic Growth

In this paper, the industrial agglomeration level and regional economic growth level of Shaanxi prefectural cities in 2004, 2009, 2014 and 2019 are presented in the form of visual image by using Arcgis10.2 software, and then the dynamic evolution trend is observed in order to put forward more targeted policy suggestions.

3.1. Analysis of the Temporal and Spatial Evolution Trend of Regional Economic Growth

It can be observed from figure 1 that the regional economic growth level of Shaanxi Province is the highest in northern Shaanxi (Yan'an and Yulin), followed by Guanzhong region (Xi'an, Xianyang, Baoji, Weinan and Tongchuan), and relatively low in southern Shaanxi (Ankang, Shangluo and Hanzhong). Because energy resources are relatively scarce, Yan'an and Yulin are in the forefront of economic development by virtue of inherent advantages such as oil and mineral resources. Xi'an, as the central city of the country and the provincial capital of Shaanxi Province, has received the policy support of the central and local governments, and has remarkable advantages in education, science and technology, transportation facilities and so on, which lays a good resource and environment foundation for the rapid growth of the regional economy. Under the radiation action of Xi'an, the economic development level of other cities in

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Guanzhong area is also relatively high. Ankang, Shangluo and Hanzhong are in the south of Qinling Mountains, which are difficult to be irradiated by Xi'an, and lack of dominant industries as support, resulting in a relatively backward level of economic development. Shaanxi Province takes Qinling as the boundary, and there is a significant gap in economic development between the south of Qinling and the north of Qinling. Therefore, we should focus on excavating the advantages of natural resources in southern Shaanxi, such as cultivating ecotourism by virtue of climate and environmental advantages, so as to strengthen the close relationship between the north and the south and alleviate the problem of obvious economic differences between the north and the south.

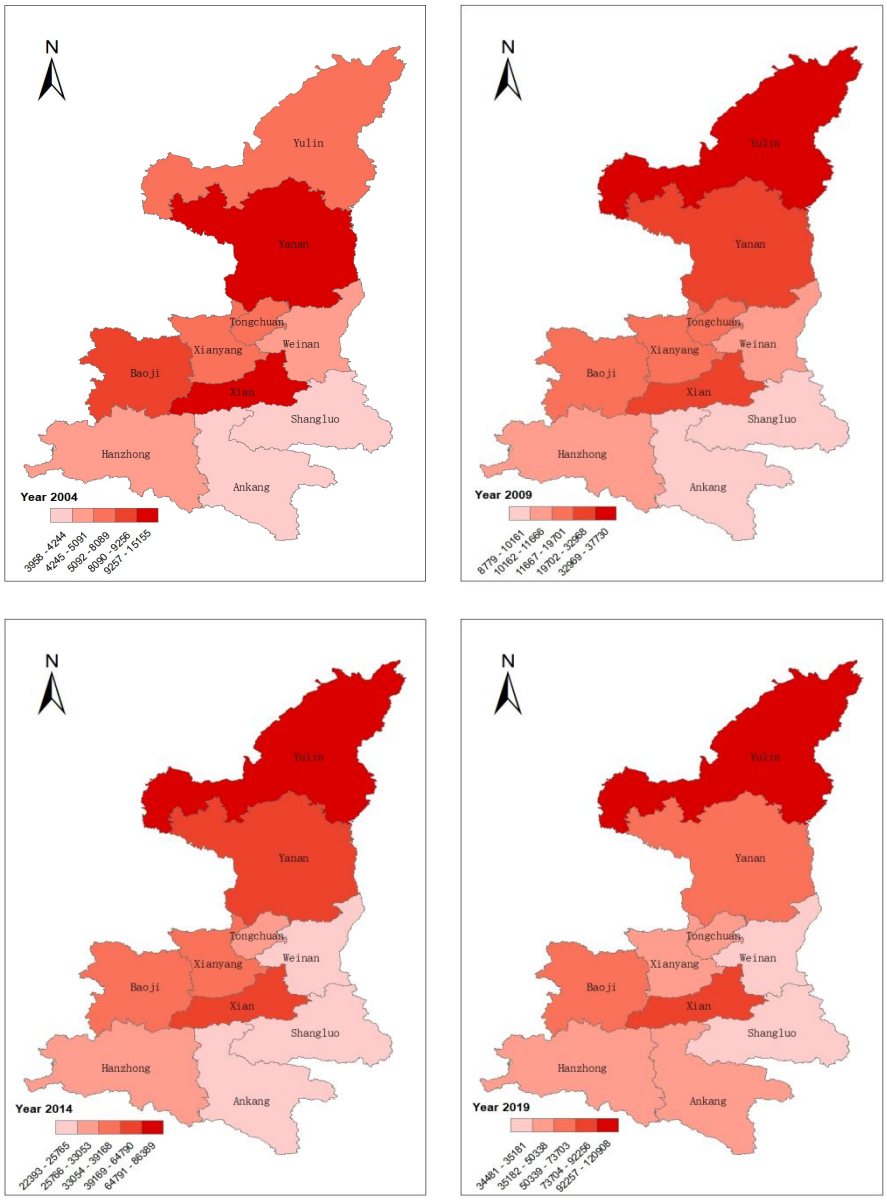

Fig 1. Spatial and temporal evolution trend of regional economic growth level in Shaanxi Province

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3.2. Analysis of the Temporal and Spatial Evolution Trend of Industrial Agglomeration

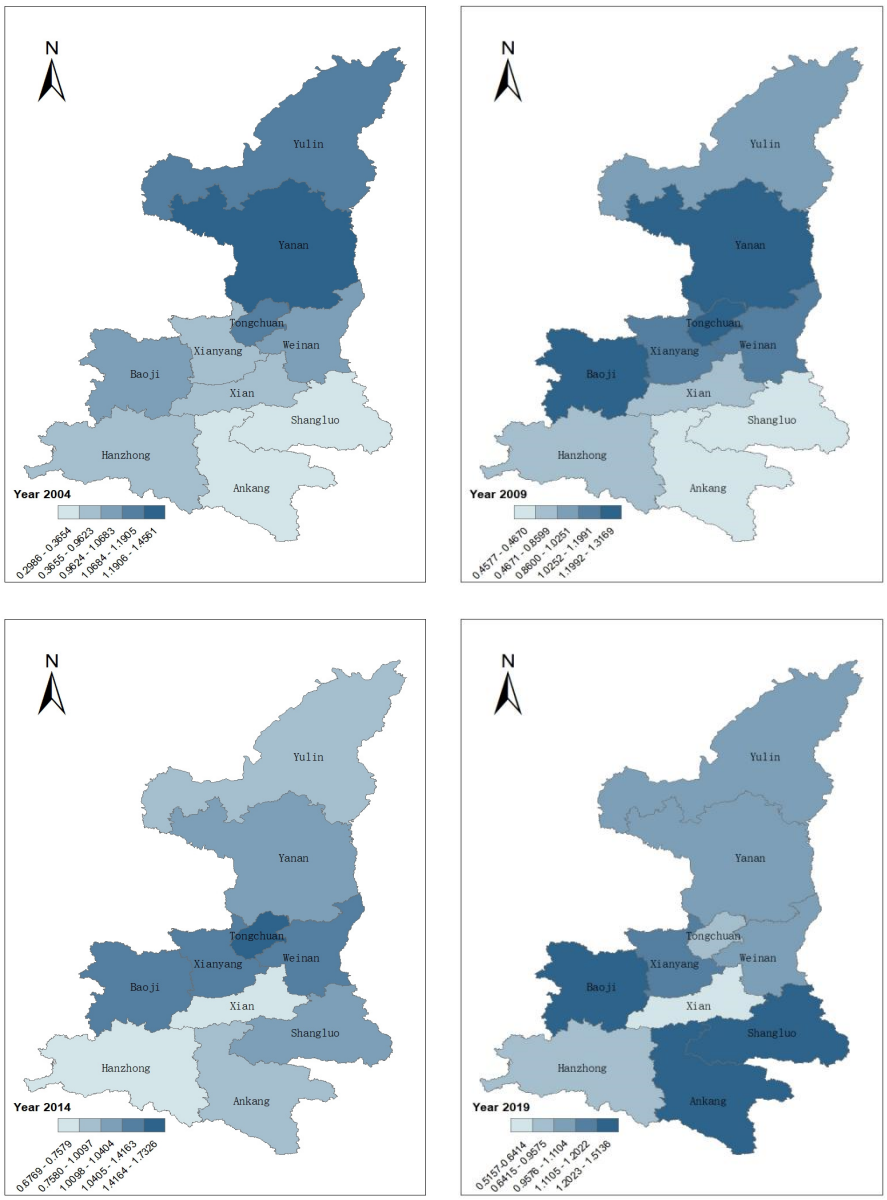

Fig 2. Spatio-temporal evolution trend of industrial agglomeration level in Shaanxi Province

Through figure 2, it can be observed that with the passage of time, the center of gravity of industrial agglomeration has gradually shifted from northern Shaanxi to Guanzhong and southern Shaanxi. Northern Shaanxi is dominated by coal, oil and other energy industries, so it is in the forefront of industrial development, with the advantage of specialized production, the degree of industrial agglomeration is relatively high; with the promotion of clean energy and the policy impact of environmental regulation, the traditional energy industry is affected, the later development is relatively weak, and the level of industrial agglomeration is declining. The industrial structure of Guanzhong area is relatively balanced, so it has been in the middle reaches. Because of the relative backwardness of economy and the lag of service industry development, the industrial development in southern Shaanxi still takes the traditional industry as the main income, so the industrial development presents the agglomeration trend in the later stage. By virtue of inherent resource advantages, northern Shaanxi can realize service transformation on the basis of the original industry, focus on technological innovation,

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cultivate high-tech industries and strategic emerging industries, improve energy production and utilization efficiency, and realize high-quality economic development based on technology. Guanzhong area should give full play to Xi'an 's first advantages and rely on the spillover effect of education and science and technology to improve industrial technology. With the help of transportation advantages, we should build industrial industrial chains and provide advanced industrial products for inland provinces and provinces and countries along Belt and Road Initiative. Southern Shaanxi should pay attention to the diversified development of industries, should not rely too much on industrial industries to achieve economic growth, avoid the risks brought about by the market environment and policy environment, and achieve sustained and healthy economic growth.

4. Econometric Test and Empirical Results

4.1. Spatial Correlation Test

Before the empirical analysis of spatial econometric, this paper should verify the spatial correlation of regional economic growth, otherwise it is difficult to use spatial econometric model. In previous studies, we will choose Moran's I and Geary to test the spatial correlation. This paper selects the most common test to judge the spatial correlation of regional economic growth. The formula is as follows:

$$\text{Moran's I} = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}(Y_i - \bar{Y})(Y_j - \bar{Y})}{S^2 \sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}}$$

Among them, $S^2 = \frac{1}{n}\sum_{i-1}^{n}(Y_i - \bar{Y})^2$; $\bar{Y} = \frac{1}{n}\sum_{i=1}^{n} Y_i$, The range of Moran's I is [- 1, 1]. When Moran's I is positive, it shows that the regional economic growth among prefectural cities shows positive correlation; when Moran's I is negative, it shows that the regional economic growth among prefectural cities shows negative correlation; when Moran's I is 0, it indicates that there is no spatial correlation effect on regional economic growth among prefectural cities. The closer the absolute Moran's I is to 1, the stronger the spatial correlation is. The global Moran's I's result is shown in Table 1:

Table 1. Global Moran's I result

year	Moran's I	expectations.	Standard Deviation	Z statistical value	P value
2004	0.078	-0.111	0.203	0.162	0.036
2009	0.169	-0.111	0.208	1.349	0.089
2014	0.175	-0.111	0.203	1.410	0.079
2019	0.090	-0.111	0.197	1.022	0.053

Through the results of Table 1, it can be observed that Moran's I is significantly positive, indicating that the degree of economic development of prefecture-level cities in Shaanxi Province has a positive spatial correlation and mutual promotion with each other. Therefore, the impact of industrial agglomeration on regional economic growth can be further analyzed with the help of spatial econometric model.

4.2. Spatial Econometric Analysis of Industrial Agglomeration on Regional Economic Growth

First of all, this paper uses the test to determine whether the impact of industrial agglomeration on regional economic growth is applicable to the spatial measurement model, and the empirical results are shown in Table 2. According to Table 2, LM-err test, R-LM-err test, LM-lag test and R-LM-lag test all reject the null hypothesis at the significance level of 5%, that is, prove the

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existence of spatial lag effect and spatial error effect. In this case, the spatial Durbin model should be selected initially. According to Hausman test, the p value is 0.000, rejecting the null hypothesis H0: the coefficient is generated under random effect, indicating that the fixed effect should be selected to verify the relationship between industrial agglomeration and regional economic growth. In order to further explore the stability of the spatial Durbin model, the Wald test and LR test were carried out to determine whether the spatial Durbin model could be simplified into a spatial lag model or a spatial error model. The Wald test results were Prob > chi2 =0.0033 and Prob > chi2 =0.0121, respectively. LR test results were Prob > chi2 = 0.0000 and Prob > chi2 = 0.0000, respectively, which proved that spatial Durbin model could not be simplified into spatial lag model or spatial error model. Finally, LR test was used to determine the time effect, individual effect or double fixed effect. P values were 0.000, indicating that the double fixed effect could not be simplified into time effect or individual effect.

Table 2. LM Test result

	LM test	Statistics	P value
Spatial error	Moran's I	14.509	0.000
	Lagrange multiplier	189.435	0.000
	Robust Lagrange multiplier	15.905	0.000
Spatial lag	Lagrange multiplier	178.377	0.000
	Robust Lagrange multiplier	4.847	0.028

To sum up, the spatial impact of industrial agglomeration on regional economic growth should be analyzed by the spatial Dubin model under the double fixed effect, and the spatial measurement results are shown in Table 3.

Table 3. Spatial measurement result

Explanatory variable	SDM	Direct effect	Indirect effect	Total effect
LQ	0.245*** (0.00)	0.223*** (0.00)	-0.200*** (0.02)	0.033 (0.74)
Fis	-0.540** (0.03)	-0.858*** (0.00)	-5.208*** (0.00)	-6.066*** (0.00)
Inv	-0.199*** (0.00)	-0.215*** (0.00)	-0.333*** (0.01)	-0.549*** (0.00)
Fin	0.101** (0.03)	0.160*** (0.00)	0.982*** (0.00)	1.142*** (0.00)
W*LQ	-0.216*** (0.00)			
W*fis	-4.059*** (0.00)			
W*inv	-0.216** (0.02)			
W*fin	0.757*** (0.00)			
Rho	0.236*** (0.01)			
Sigma2_e	0.007*** (0.00)			
Observations	200			
R-squared	0.682			

Note: p statistics are in parentheses; *** represents P < 0.01, ** represents P < 0.05, * represents P < 0.1

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This paper focuses on the spatial impact of industrial agglomeration on regional economic growth, so we should focus on the analysis of the results of core explanatory variables. Through the observation table 3, it can be seen that the coefficient of industrial agglomeration is significantly positive, indicating that industrial agglomeration is generally beneficial to improve the economic level of cities at various prefectural levels in Shaanxi Province. Through effect decomposition, it is not difficult to find that the direct effect of industrial agglomeration is significantly positive, indicating that industrial agglomeration will promote the economic growth of the region, because specialized production can improve production efficiency, promote the development of advanced technology, and lay a good material and technical foundation for economic growth. The indirect effect of industrial agglomeration is significantly negative, indicating that industrial agglomeration will inhibit the economic growth of neighboring areas, because industrial agglomeration will accelerate the accumulation of labor, capital, technology and other factors of production, while areas lacking factor resources lack the material basis of economic growth.

This paper selects the scale of government expenditure, the level of infrastructure and the degree of financial development as the control variables, so as to explain the results in this part in order to provide constructive policy recommendations. Through the observation table 3, it can be seen that the direct and indirect effects of the scale of government expenditure and the level of infrastructure are significantly negative, indicating that both government expenditure and fixed asset investment can not play an important role in the economic growth of the region and adjacent areas, because the government expenditure and fixed asset investment exceed the optimal range, and excessive government intervention and investment expenditure may have a negative effect on regional economic growth. The direct and indirect effects of the degree of financial development are significantly positive, indicating that increasing financial loans can still contribute to regional economic growth at this stage, because strong financial security can provide enterprises and individuals with sources of funds, maintain normal business operations and personal life, create a good market atmosphere for the region, and have a profound impact on consumption, investment and so on. And then it has a positive effect on regional economic growth.

5. Conclusions and Policy Recommendations of the Study

Based on the panel data of prefectural cities in Shaanxi Province from 2000 to 2019, this paper studies the spatial impact of industrial agglomeration on regional economic growth by using spatial econometric model. The results show that industrial agglomeration will promote the economic growth of the region, but inhibit the economic growth of adjacent areas. It is difficult for government expenditure and fixed asset investment to continue to give full play to their economic advantages, while financial loans can continue to stimulate the economy, which has obvious economic impact on regional economic growth. Through the temporal and spatial trend evolution map, it can be observed that the economic development level of Shaanxi prefectural cities is relatively stable, showing the spatial distribution characteristics of decreasing from north to south in turn, while industrial agglomeration with the passage of time, the center of gravity shifts from north to south. Based on this, the article puts forward the following constructive suggestions:

First, Shaanxi Province should still take industry as the industrial foundation, give full play to the advantages of industrial agglomeration, promote the coordinated development of other industries, and make contributions to economic growth. However, the industrial development in different regions should avoid the problem of homogenization, and put forward differentiated development schemes according to their respective actual conditions. For example, northern Shaanxi can focus on technological innovation and cultivate high-tech

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industries and strategic emerging industries by virtue of industrial foundation. Guanzhong area can improve industrial processing technology with the help of Xi'an 's first advantages and the spillover effect of education and science and technology. While developing industry in southern Shaanxi, we should pay attention to the diversified development of industry and reasonably avoid the risks arising from the market environment and policy environment.

Second, the government should reasonably control the scale of government expenditure and the level of infrastructure, reduce government expenditure and fixed asset investment to the optimal range, so as to give full play to the role of government expenditure and fixed asset investment in promoting economic growth. The prosperity of the financial industry can provide a strong financial guarantee for economic growth, realize the rapid financing of funds, bridge the supply and demanders of funds, activate the atmosphere of the economic market, and then promote the high-quality development of the regional economy. Therefore, we should moderately expand the scale of financial loans and continue to give full play to the positive impact of the development of the financial industry on regional economic growth.

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References

[1] Chen Gang, Yin Xiguo, Pan Yang. Social capital, industrial agglomeration and economic growth: an empirical study based on China [J]. Journal of Guangdong Business School, 2006(05): 9-14.

[2] Chen Zhao. Government behavior, market integration, industrial agglomeration and regional gap the economic logic of regional economic development in China [J]. Learning and Exploration, 2007(02): 124-129.

[3] Deng Ruobing, Liu Yan. Industrial agglomeration, Spatial spillover and Regional Economc growth: a study based on Spatial Panel Dubin Model [J]. Exploration of Economic problems, 2016(01): 66-76.

[4] Ma Yanrui, Liu Qiang. Study on the mechanism and effect of industrial agglomeration on green economy efficiency [J]. Exploration of Economic problems, 2021(07): 101-111.

[5] Lian Fei. Spatial econometric Analysis of Industrial agglomeration and Labor Productivity: empirical evidence from 34 cities in Northeast China [J]. Journal of Central South University of Finance, Economics and Law, 2011(01): 108-114.

[6] LESAGEJ, PACERK. Introduction tospatial econometrics [M]. New York:Chapman and Hall/ CRC, 2009: 340.

[7] Zhang Cheng, Cai Wanhuan, in Tongshen. Regional economic growth and carbon productivity: an analysis based on convergence and decoupling index [J]. China's Industrial economy, 2013(05): 18-30.

[8] Xu Bin, Chen Yufang, Shen Xiaobo. Clean energy development, carbon dioxide emission reduction and regional economic growth [J]. Economic Research, 2019, 54(07): 188-202.

[9] Yuan Liansheng, Fu Peng. The dual effect of cultural industry development on regional economic growth is based on the empirical data of China's inter-provincial panel [J]. Economic Review, 2018, 9(01): 75-87.

[10] Sun Bindong, Wang Ying. Institutional change and Regional Economic growth: an empirical Analysis of China [J]. Shanghai Economic Research, 2007(12): 3-11.

[11] Zhao Qiwei, Zhang Cheng. Financial deepening, FDI spillover effects and regional economic growth: based on the analysis of provincial panel data from 1997 to 2004 [J]. Quantitative Economic, Technical and Economic Research, 2007(06): 74-82.

ISSN: 2688-9323

[12] Tu Zhengge. The motive force of total factor productivity and regional economic growth is based on the analysis of the non-parametric production frontier of large and medium-sized industries in 28 provinces and cities from 1995 to 2004 [J]. Nankai Economic Research, 2007(04): 14-36.

[13] Lu Zhongwei, Li Junhao. Study on the role of R & D Spatial spillover on Regional Economic growth [J]. Statistical study, 2008(03): 27-34.

[14] Zhang Yue, Li Tingting. Spatial effect and influencing factors of industrial agglomeration in China [J]. Economic latitude and longitude, 2021, 38(05): 3-11.

[15] Chen Yufeng, Cheng Siyuan, Zhu Zitao. Can industrial agglomeration improve the energy efficiency of the Yangtze River economic belt? [J]. Zhejiang Journal of Studies, 2021(01): 106-115.

[16] Dai Jinping, Liu Jincai. A study on the nonlinear relationship between government fiscal expenditure and regional economic growth-based on the threshold test of China's inter-provincial panel [J]. Journal of Social Sciences, 2017(04): 57-64.