How to use big data and spatial econometric model to explain the high-quality development of western China?

Feiliang Niu[1], Haifeng Yu[2, *], Gulisun Aisa[3, a]

[1,2,3]Kashi University, Xinjiang, 844066, China

*Corresponding author: Email: 394948435@qq.com
[a]Email: 15801399893@163.com

Abstract. based on the western region from 2013 to 2020 in 11 provinces (except in Tibet) panel data, build high quality development index evaluation system, information entropy to explore the western region development, by calculation and using spatial econometric model analyzes the upgrading of human capital, industrial structure optimization, they are between the coupling effect on the quality and economic development. The results showed that :(1) the high quality development index showed that the development of Chongqing, Sichuan and Shaanxi in the western region was better, followed by Guangxi, Yunnan and Guizhou, while the development of the remaining provinces and cities was lagging behind, showing a gradual decline from the east to the west. (2) The spatial correlation analysis of the spatial Moran index shows that there is a stable spatial dependence, mainly with "high-high" type and "low-low" type, and there is a spatial polarization trend. (3) The spatial econometric model reveals that without considering the cross-term, human capital upgrading has no significant effect on high-quality economic development, while industrial structure optimization has a significant effect on high-quality economic development. PVAR model is used to find that human capital and industrial structure have a joint effect on economic development. The SPDM model including cross term is established and it is found that the cross effect of the two has a very significant promoting effect on the high-quality economic development.

Keywords: high quality development, PVAR, spatial metering

1 Introduction

The high quality development of China western region is an important part of the high quality economic development in China. Since the implementation of the western development strategy in 2000, the development of western region has made remarkable achievements. However, a series of problems such as the slow pace of industrial upgrading and the serious brain drain in the western region have not been fundamentally solved, which leads to the slow development of parts of the western region. Technology progress and capital accumulation is central to the economic development, the devel-

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opment of high quality is an urgent need to enhance human capital and industrial structure according to the optimization of resources endowment, and the two important pillar for the high quality economic development in western China unanswered whether there is a significant role in promoting, there will be series of related issues that need to be discussed.

2 Why do you think that the western region of China needs to achieve high-quality development?

With the national emphasis on high-quality economic development, there have been more and more articles on the study of high-quality economic development and its influencing factors, and the research on human capital and high-quality economic development is the key direction, which must have a clear understanding of human capital. So far some scholars have have clearly defined the connotation of the human capital of interpretation can be traced back to the earliest William Petty (1755) "the land is the mother of wealth, labor is the father of wealth", by subsequent scholars constantly improve the human capital theory, we find that the theory of the core is through education, Training and other ways to improve production capacity and thus income level [1]. That is, the transformation from human resources to human capital, especially the upgrading of human capital structure, is the key to economic promotion, and also the solid foundation and long-term power to promote economic development.[2-6] This paper uses PVAR and SPDM model to explore the impact of human capital upgrading, industrial structure optimization and other related factors on high-quality economic development by constructing a high-quality development index system, which has certain practical value for high-quality economic development in western China.

3 What factors should be considered in the construction of high-quality economic development indicators?

High quality development needs to explore the principle and system of index system construction. The establishment of the index system is based on the national concept of five-in-one development., as shown in Table 1.

Table 1. Evaluation system of high quality development index of western economy

Objective evaluation system	level 1 indicator	level 2 indicator	level 3 indicator	attribute	unit	weight
High quality and quantity development	supply-side reform	industrial structure change	tertiary industry proportion (%)	positive	%	0.0165
			inancial industry added value (yuan)	positive	yuan	0.2694
			the scale of social financing	positive	100 million yuan	0.0396
	Innovation-driven	talent development	The average number of college students per 100,000 population	positive	population	0.0238

			R&D, staff full-time equivalent	positive	Population/year	0.0029
			The number of higher education teachers	positive	population	0.0030
		Research and Experimental development (R&D)	(R&D, The internal expenditure of innovation	positive	10000yuan	0.0011
			The number of new product development projects in high-tech industry	positive	number	0.0241
			The number of patent applications authorized	positive	item	0.0303
	Opening to the outside world	developing international trade	Opening to the outside world	positive	%	0.0610
			International tourism revenue	positive	USD	0.0619
			Imports	positive	USD	0.1708
	Coordinated development of ecological	coordinated	green coverage area (ha)	positive	ha	0.0532
		The urban-rural coordinated	The urban-rural coordinated gap	negative	population	0.0350
			The urban-rural income gap	negative	yuan	0.0038
	In terms of improving people's livelihood	economic development	Real GDP	positive	Yuan	0.1355
		In terms of medical security	the number of employees participating in basic medical insurance	positive	population	0.0072
			Number of beds in medical institutions	positive	number	0.0333
			The number of health technicians	positive	population	0.0061
		In terms of public welfare	the length of urban bus routes	positive	KM	0.0050
			Number of terminals in electronic Reading Room of public library	positive	number	0.0165

4 How to measure the spatial correlation of economic indicators?

Based on the complexity of spatial autocorrelation, a series of methods to measure spatial autocorrelation have been proposed in relevant literature, among which Moran 's I index is the most widely used, whose value range of θ is $[0,1]$. Previous analysis shows that economy and geography are equally important, so $\theta = 0.5$. Then the global Moran′s Ⅰ index map of high-quality economic development can be drawn.

The spatial distribution of high quality economic development in western China is not a random state. The specific distribution needs further analysis. Therefore, it is necessary to introduce spatial correlation analysis into the analysis of the high quality development level of the western region economy, otherwise the analysis results are likely to have regression bias.

5 Spatial econometric model analysis of human capital, industrial upgrading and high-quality development in western China

5.1 Selection of model indicators

Variable selection. Explained variable: High Quality Development Level Index of Western China (HQD). The core explanatory variable of the model: human capital upgrading (HC). This paper measures the status of human capital upgrading by the advanced level of human capital. Through the analysis of others' research on economic development, it is found that high-quality economic development is closely related to the development of advanced human capital. Control variables: there are many other factors affecting the high-quality economic development of each region. In order to avoid regression bias caused by omitted variables, this paper successively included control variables into the model for testing:

Table 2. Descriptive statistics of variables

variable	Variable interpretation	mean	SD	minimum value	maximum value
hqd	high quality development level index	0.274	0.161	0.0127	0.722
tsa	industrial structure optimization effect	0.952	0.137	0.4615	1.224
hc	human capital advanced	20.876	.0142	20.587	21.115
rz	Social financing scale	3552.324	2383.008	117	14334
rd	research funding	1110006	987125.6	65029	4276383
lh	Environmental factors	0.00252	0.002	0.000	0.0097
jk	import level	0.387	0.154	0.104	0.7762

5.2 Panel econometric model selection and result analysis

General spatial panel model:

$$\begin{cases} y_{it} = \tau y_{i,t-1} + \rho w_i^{'} y_t + x_{it}^{'}\beta + d_i^{'} X_t \delta + u_i + \gamma_t + \varepsilon_{it} \\ \varepsilon_{it} = \lambda m_i^{'} \varepsilon_t + v_{it} \end{cases} \tag{1}$$

Where, $y_{i,t-1}$ is the first-order lag of the explained variable y_{it}; $d_i^{'} X_t \delta$ represents the spatial lag of explanatory variables, and $d_i^{'}$ is the ith row of the corresponding spatial weight matrix D; γ_t is time effect; And $m_i^{'}$ is the ith row of the weight matrix M of the disturbance term space. Due to the generality of the above formulas, the following special cases are usually considered.

If $\lambda = 0$, it is "spatial Dubin model".

If $\lambda = 0$ and $\delta = 0$, it is "spatial autoregressive model".

If $\tau = 0$ and $\delta = 0$, it is "spatial autocorrelation model".

If $\tau = \rho = 0$ and $\delta = 0$, it is "spatial error model".

In the analysis above space correlation, we find in the western region's economic development there has a significant high quality since the space correlation, which fully shows the explore the influence factors of high quality in the western region economy development influence is especially important when considering the space factors. In order to accurately select appropriate models and ensure the robustness of empirical results, LM, Wald and LR tests are used to successively test and screen three spatial econometric models: SPLM, SPEM and SPDM.

Table 3. Granger causality test of PVAR model

The null hypothesis	chi-square	Degrees of freedom	Pvalue	conclusion
Human capital upgrade is not the Granger cause of economic development	7.269	1	0.007	reject
Industrial structure optimization is not the Granger cause of economic development	0.008	1	0.927	accept
Economic development is not the Granger cause of industrial structure optimization	3.028	1	0.082	reject
Human capital upgrading and industrial structure optimization are not Granger causes of economic development	7.280	2	0.026	reject

By establishing the model PVAR ,which found that human capital is the granger cause of economic development, industrial structure optimization is not the granger cause of economic development, and economic development is the granger cause of industrial structure optimization, but at the same time test variable coefficient of human capital and industrial structure joint significantly, the chi-square statistic is 7.280, The P value is 0.026, which rejects the null hypothesis that "industrial structure optimization and human capital upgrading are not Granger causes of economic development". The optimization of human capital affects economic development, and economic development forces the upgrading of industrial structure. The influence of human capital on industrial structure has a mediating effect, indicating that the upgrading of human capital has a multifaceted effect on economic development, both direct and indirect. Combined with SPDM model, it is found that the two have joint effects on economic development.

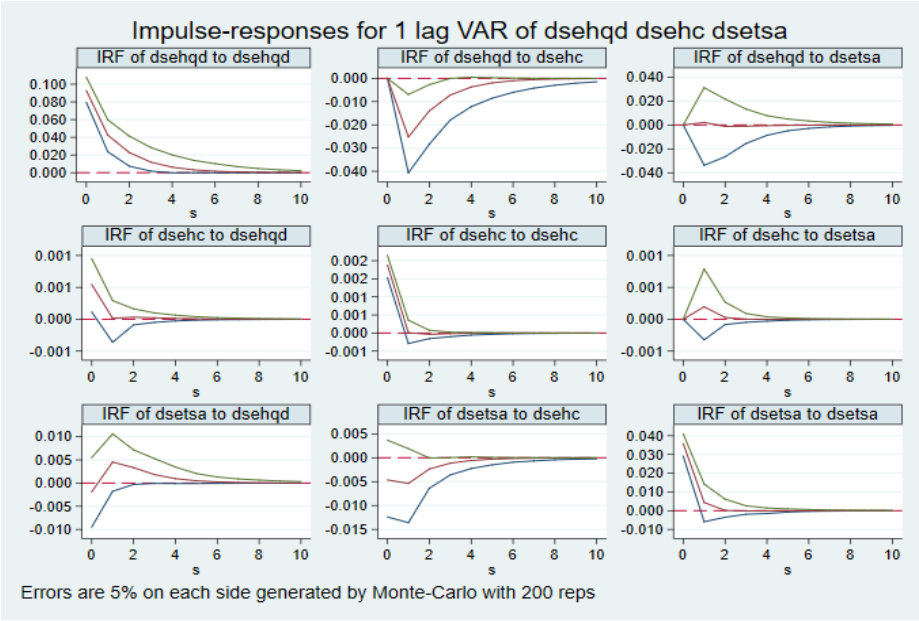

Fig. 1. Impulse response shock relation diagram of human capital, industrial structure and economic development

Table 4. Adding control variables to test the stability of cross-variable SPDM model

model	(1)	(2)	(3)	(4)	(5)	（6）
sehctsa	0.441***	0.333***	0.241***	0.130	0.433***	0.197***
	(0.088）	(0.0807)	(0.0624)	(0.0792)	(0.0835)	(0.0567)
serz		0.305***				0.0939**
		(0.0613)				(0.0456)
serd			0.412***			0.375***
			(0.0745)			(0.0648)
selh				0.708***		0.267*
				(0.145)		(0.153)
sejk					-0.223***	-0.162***
					(0.0604)	(0.0363)
Wx sehctsa	0.360*	0.289	0.193	-0.0921	0.186	-0.0220
	(0.193）	(0.177)	(0.135)	(0.165)	(0.191)	(0.138)
Wx serz		0.129				-0.176
		(0.145)				(0.116)
Wx serd			1.175***			0.520
			(0.255)			(0.358)
Wx selh				2.235***		0.956**
				(0.336)		(0.432)
Wx sejk					0.0710	0.163*
					(0.133)	(0.0928)

Spatial rho	0.470***	0.223	-0.507***	-0.334*	0.482***	-0.407**
	（0.128）	(0.164)	(0.186)	(0.190)	(0.133)	(0.190)
R^2	0.239	0.550	0.725	0.674	0.188	0.719

It shows that the advancement of human capital has a negative impact on economic development, which starts to decline after the first period and tends to zero in the seventh period. Economic development has a positive impact on the optimization of industrial structure, which starts to decline after the first period and tends to zero in the sixth period. Economic development forces the upgrading of industrial structure, and only the transformation of industrial structure can maintain steady economic growth.

6 Conclusions and Implications

6.1 Research Conclusions

Based on the panel data of 11 provinces and cities in western China from 2013 to 2020, this paper established an index system composed of 21 groups of data by combining the five aspects of high-quality development concept with their development characteristics. Through high quality development index, the development of the western region has made remarkable achievement. The spatial correlation shows that the well-developed provinces and cities are surrounded by the well-developed provinces and cities (high-high), the well-developed provinces and cities are surrounded by the poorly developed provinces and cities (high-low), and the poorly developed provinces and cities are surrounded by the poorly developed provinces and cities (low-low). In general, the development of all provinces and cities is in a steady upward trend.

6.2 Countermeasures and suggestions

The development of the western region got into a new stage of development, from the development of high quality index, the part of the western region development has entered a rapid development stage. The effective policy to remain the steady implementation of cases, the provinces and cities to provide for the development of comparative lag adjust measures to local conditions of the policy measures. This paper puts forward the following suggestions: First, talent is the blood of development, industry is the body of development, the two are inseparable, while increasing the introduction of talents, attention should also be paid to the loss of talents and the optimization of industrial structure. We should promote industrial upgrading through talent development, and promote talent development through industrial upgrading. Second, paying attention to the coordinated development within the region, control the impact of trade imports.

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