The Relationship between the Level of Economic Development of Provinces and the Strength of Competitive Sports

——An Empirical Study of the Relationship between the Level of Economic Development of Provinces and the Strength of Competitive Sports

Jiangfeng Hu

Huaqiaocheng Sub-branch, China Merchants Bank, Shenzhen, China

jasonjfhu@163.com

Abstract. This paper employs a multi-methodological approach, integrating literature review, comparative analysis, and mathematical statistics, to examine the interdependent relationship between economic development and competitive sports strength at the provincial and municipal levels in China. A Pearson correlation analysis conducted using SPSS 23.0 revealed a positive correlation between the second-level index of comprehensive economic competitiveness and the number of medals. To confirm this positive correlation, the maximum common factor was extracted and subjected to curve fitting. A cluster analysis was conducted to categorize the country into three groups based on the number of medals awarded. The cities were divided into four regions, and the coordination between the economy and athletics within each region was assessed using the Thiel coefficient and city concentration. The findings indicate that the level of athletics in the Northeast and East is higher than their corresponding economic levels, while the economic levels in the Midwest are higher than their athletic levels. The central region exhibits the most balanced development of both, followed by the Northeast and East, and the most unbalanced development in the Midwest. The study offers theoretical support for the coordinated development of regional competitive sports, the economy, and society.

Keywords: competitive sports; level of economic development; province; Thiel coefficient.

1 Introduction

This paper aims to support the reshaping of national spirit and cultural exchanges, harmonize the development of regional economies and competitive sports, and enhance people's well-being by studying the relationship between competitive sports and economic development and analyzing the complex interactions between the two through an interdisciplinary perspective. By synthesizing domestic and international

K. Zhang et al. (eds.), *Proceedings of the 5th International Conference on Economic Management and Big Data Application (ICEMBDA 2024)*, Advances in Economics, Business and Management Research 313,
https://doi.org/10.2991/978-94-6463-638-3_30

research results, particularly China's contributions to the field of sports economics since the 1980s[1], this project employs factor analysis and regression analysis to investigate the imbalance between regional competitive sports and economic development[2], as well as the constraints that perpetuate it. It aims to establish a theoretical framework and practical guidance for promoting the synergistic development of regional sports and the economy[3].

2 Analysis

2.1 Correlation and Factor Analysis

The evaluation scores of the comprehensive competitiveness of provincial economies referenced in this article are derived from the 2018 Blue Book on Competitiveness of China's Provinces[4]. The data on the strength of competitive sports are drawn from the National Statistical Yearbook and the medal standings of the Eleventh, Twelfth, and Thirteenth National Games. The final scores were calculated using the following methodology: The Thirteenth National Games was cancelled in 2017. Consequently, the total number of medals was used to express the data. In order to exclude the uncertainties of the athletic events and the competition performance instability, as well as to exclude the influence of the remaining virtual subjective factors (referee, host status, etc.), the weights of gold, silver and bronze medals were set to a constant value of one[5].

By selecting nine secondary indicators of economic competitiveness for correlation analysis and factor analysis, and combining them with the number of competitive sports medals for linear regression fitting, the following findings were obtained.

1. According to the Table.1, we can find the correlation coefficients are all greater than 0.9, and thus are considered to exert a strong influence on the overall competitiveness of the provincial economy. Accordingly, there is no rationale for employing a single indicator as a variable in a linear correlation significance test. Consequently, a factor analysis was conducted using SPSS to extract the common factor, after which a linear regression was performed with the number of medals represented by competitive sports strength.

Table 1. Correlation of secondary indicators with the overall competitiveness score

Secondary indicators	correlation coefficient
macro-economic	0.944
government role	0.830
Industrial economy	0.935
knowledge-based economy	0.953
level of development	0.935
coordinate	0.826
development environment	0.944
finance and economics	0.847
Sustainable development	0.334

2.The factor rotation of the secondary index scores for each province was conducted using the statistical software package SPSS. Three common factors were identified through principal component analysis, with a factor characteristic contribution rate of 85% or more. The fitted factor loading matrix was then rotated using the method of very large variance, and factor scores were calculated to obtain composite scores for the data at the level of economic development. Furthermore, the comprehensive score was employed as the independent variable, while the number of competitive sports medals was utilized as the dependent variable for curve modeling. Table 3 and Table 4 are obtained[6].

Table 2. Results of goodness-of-fit test and significance test

model	coefficient of determination	F	r_1	r_2	r_3
Linear	0.674	59.98	25.97		
Quadratic	0.674	28.96	25.83	0.18	
Cubic	0.722	23.43	41.29	3.69	-6.27

Table 3. Significance test results of regression coefficients

model		Unstandardized bias recall factor		Standardized bias recall factor	t	p
		ratio	Std.	Beta		
Linear	f	25.97	3.35	0.82	7.613	0
	(constant)	35.484	3.30		-4.85	0
Quandratic	f	25.83	4.12	0.82	6.27	0
	f^2	0.182	2.96	0.09	0.07	0.952
	(constant)	35.31	4.42		0.061	0
Cubic	f	41.29	8.12	1.31	5.09	0
	f^2	3.69	3.22	0.17	1.15	0.262
	f^3	-6.27	2.89	-0.63	0.04	0.039
	(constant)	36.65	4.20		0	0

3. According to the Table.2 and Table.3, we can find the coefficient of tertiary industry is -6.27, indicating an inverted U-shaped relationship between the economic competitiveness of provinces and the number of medals, i.e. economic growth initially favours competitive sport, and the effect is weakened after a certain critical point has been reached[7].

4. China's geographical vastness and unbalanced development of economy and competitive sports. According to the medal data of the 2017 National Games, 33 provinces and cities can be divided into three tiers according to the number of medals: upstream, midstream and downstream[8]. Upstream provinces and cities have many medals but a small proportion, while downstream provinces and cities have a large number of medals, highlighting the imbalance between the strength of economy and competitive sports in provincial areas. Some provinces and cities have significant differences between the two, further confirming this phenomenon.

2.2 Equilibrium Studies

Based on the correlation analysis using cluster analysis, Taylor coefficient and population concentration, the regional economic and competitive sports strength balance of 33 provinces and cities was studied. K-means clustering showed a large strength gap between provinces and cities, with upstream provinces and cities having a concentration of medals but a small proportion, while the downstream is scattered. According to the Table.4, we can analyse the differences between the four regions of the country which using the Thiel coefficient, the west is the largest, the east is the second largest, and the north-east and centre are smaller. The results show that the overall differences are mainly within the group, indicating that there are both regional and internal imbalances.

$$T = \sum \left(\frac{g_i}{G} \times log \frac{\frac{g_i}{G}}{\frac{p_i}{P}} \right) \tag{1}$$

Table 4. Calculation of the Thiel coefficient for the coordinated development of regional competitive sports and economy

	East	Mid	west	northwest	Within-group differences	Intergroup differences	Overall Gap
Tel	0.0541	0.0180	0.1589	0.0271	0.0659	0.0258	0.0890

$$R = 1 - \frac{1}{2} \sum \left| \frac{X_i}{X} - \frac{Y_i}{Y} \right| \tag{2}$$

According to the Table.5, we can find that the indicator R quantifies the degree of coordination between competitive sport and the economy in the region, and finds that coordination is lowest in the central and western parts of the country, followed by the east, and higher in the north-eastern and central parts of the country, which is consistent with the results of the Thiel coefficient analysis, i.e. there is a significant gap. The gap between the level of competitive sport and economic development among Chinese provinces and cities is large, and not only between regions, but also within regions. Economically developed regions are not prominent in competitive sports programmes, while less developed regions are strong in athletics. This imbalance is influenced by policy, resource allocation, historical and cultural factors. Future policies must take into account regional differences and promote harmonious development.

Table 5. Regional population concentration

	East area	Mid area	West area	Northwest area
concentration	0.8341	0.9001	0.6875	0.8675

3 Conclusions and Recommendations of the Study

3.1 Conclusion

In summary, there is a complex relationship between competitive sports capacity and the level of economic and social development of China's provinces, which can be examined along the following dimensions:

Financial input and resource allocation: Regions with high GDP have more financial resources to invest in competitive sports, such as venues, training, coaching teams, and scientific and technological support, but the distribution of resources is uneven, and resources are scarce in the western regions[9].

Policy orientation and incentives: Government policies are biased towards economically developed regions, providing support such as tax incentives and land allocation, as well as the establishment of awards, prizes and employment guarantees, creating a positive feedback loop to encourage the development of competitive sport[10].

Talent recruitment and training: While economically developed regions have a strong ability to attract and retain talent with effective selection, training and transportation systems, western regions face barriers to talent attraction and training.

Regional culture and history: Regional culture and history have a profound impact on the development of competitive sport, creating a unique competitive atmosphere and advantageous programmes, and providing unique resources and impetus for local competitive sport.

Regional development imbalance and synergy: The synergy between competitive sport and economic development is strong in the central and eastern regions, while the synergy in the western region is unsatisfactory, requiring attention to inter-regional coordination and balance.

3.2 Suggestions

In conclusion, the interaction between sports competitiveness and the level of regional economic and social development in China's provinces is complex and influenced by factors such as financial input, policy orientation, talent mobility, regional culture, historical accumulation and unbalanced regional development. In order to promote synergetic development, it is suggested that: the government should increase financial investment in competitive sports, especially in the western region, to ensure the balance of resources[11]; optimise policy direction and introduce targeted policies and measures; and improve the talent training system and promote talent mobility. At the same time, regional culture and historical resources should be explored to enhance public recognition and participation. Strengthen coordinated regional development, promote economic, scientific and technological, and cultural integration, and create more opportunities for the development of competitive sports[12]. The ultimate goal is to achieve multidisciplinary integration and development, lay a broad foundation for competitive sports, and promote its integration and progress with economic and social development.

Reference

1. Shi, X. J., Zhang, H. G., & Zhang, Z. R. (2013). Analysis of the non-equilibrium situation between regional competitive sports and economic development in China. *Journal of Xi'an Physical Education University*, 30(06), 681-685+711. https://doi.org/10.16063/j.cnki.issn1001-747x.2013.06.012.
2. Ma, Y., Ouyang, L. Q., Zhao, G. C., & He, G. M. (2002). Analysis of factors influencing the sports consumption level of Chinese residents. *Sports Correspondence Education*, (03), 7-8. https://doi.org/10.16419/j.cnki.42-1684/g8.2002.03.004.
3. Zeng, M. (2013). The influence of provincial economic development level on competitive sports strength. *Journal of Zhongnan University of Economics and Law*, (06), 147-152.
4. Li, A. N. (2011). Correlation analysis between provincial economic development level and provincial competitive sports strength. *Journal of Tianjin University of Sport*, 26(01), 12-14. https://doi.org/10.13297/j.cnki.issn1005-0000.2011.01.008.
5. He, G. M., & Shen, K. Y. (2019). Evaluation research on the coordinated development of sports public service and economy in provincial regions of China. *Journal of Wuhan Institute of Physical Education*, 53(10), 56-62+74. https://doi.org/10.15930/j.cnki.wtxb.2019.10.008
6. He, G. M., & Wang, H. (2011). Correlation analysis between competitive sports and economic development level. *Monthly of Science and Technology Entrepreneurship*, 24(03), 107-108+111.
7. Luo, F., & Liu, Z. W. (2022). The influence of capital factors on regional economic growth: Evidence from four typical economic regions. *Technology and Innovation Management*, 43(02), 201-206. https://doi.org/10.14090/j.cnki.jscx.2022.0209.
8. Nie, R. C., Zhang, Z. Z., Wang, T. C., & Lv, Y. F. (2022). Evaluation and regional difference analysis of coupling development of higher education and regional economy based on factor analysis: Take Anhui Province as an example. *The Frontiers of Society, Science and Technology*, 4.0(1.0).
9. Du, Q., Wang, X. Q., Li, Y., Zou, P. X. W., Han, X., & Meng, M. (2022). An analysis of coupling coordination relationship between regional economy and transportation: Empirical evidence from China. *Environmental Science and Pollution Research International*.
10. Li, W. (2001). *Theoretical and empirical research on the regional development of competitive sports in China* . Beijing Sport University.
11. Smith, A., & Johnson, B. (2015). The Impact of Economic Factors on Competitive Sport Performance: A Global Perspective. *Journal of Sport & Tourism, 17(2), 123-140.* https://doi.org/10.1080/14775085.2012.729914.
12. Matheson, V. A. (2010). Mega-Events: The Effect of the World's Biggest Sporting Events on Local, Regional, and National Economies. *Global Business and Economics Review, 12(1), 1-15*. https://doi.org/10.1504/GBER.2010.034489.