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SPSS relative factor analysis-based Chinese sports industrial structure optimization research

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ABSTRACT

The paper takes general administration of sport of China statistical data as evidences, carries out analysis according to statistics of sports and relative industrial data during 2006-2008. Firstly make briefly illustration on sports and relative industrial status, secondly use SPSS relative statistical indicators data to make analysis and define sports and correlation industries correlation effects, finally applies factor method to further define indicators and sports output value relations, and gets sports output value regression equation. It provides references for sports and relative industrial development and structure adjustment.

KEYWORDS

Factor analysis; Correlation analysis; Sports industry; Structure optimization; Mathematical model.

INTRODUCTION

In order to grasp Chinese sports and relative industrial information, general administration of sport of China makes statistics of sports and relative industries in 2006-2008, and publishes statistical data. Sports industrial development is crucial to economic development, understand sports and relative industrial information has important significances in speeding up and optimizing industrial structure. Since statistical data is published, scholars' studies on sports and relative industrials have made rapidly progress. Among them, Liu Han-Sheng(2011)by analyzing national sports and relative industrial data, applied grey mathematical theory to study on relative industrial internal connections, which provided references for sports industry sustainable development. Yang Qian (2011) researched sports industry and economic relations by grey relative analysis method, she pointed out that sports industry sub-factor fitness entertainment had highest correlation degree with economy, and national economy played strong leading role in sports industry development, in 2012, Yang Qian made analytic comparison of cohabitation data, made quantitative analysis of sports and relative industrial efficiency, which provided quantization evidence for structure optimization. Liu Han-Sheng(2011)researched correlation industries internal connections by grey mathematical theory. The paper based on fully referencing previous research results, adopts statistics to analyze relative industrial correlations and utilizes multiple linear methods to research on sports and relative industries.

SPORTS AND RELATIVE INDUSTRIES STATISTICAL DATA

According to general administration of sport of China investigation, sports and relative industrial investigation have data (extract from general administration of sport of China website) as following TABLE 1:

TABLE 1 : Statistical data overview

Type	Year 2006		Year 2007		Year 2008	
	Value added (one hundred million Yuan)	Employee (ten thousand people)	Value added (one hundred million Yuan)	Employee (ten thousand people)	Value added (one hundred million Yuan)	Employee (ten thousand people)
Sports organizational management activity	74.80	18.71	89.36	18.98	117.56	20.87
Stadiums management activity	18.24	2.58	23.04	2.41	30	2.62
Sports fitness leisure activity	46.98	11.78	58.79	13.32	74.49	15.03
Sports intermediary activity	2.02	0.87	3.00	0.96	4.46	1.35
Sports training activity	4.46	1.91	7.91	2.21	13.48	3.56
Sports lottery	21.47	11.11	29.63	13.37	35.27	17.64
Sports products, clothes, shoes and caps manufacturing	705.12	195.44	898.10	214.00	1088.31	234.13
Sports products, clothes, shoes and caps selling	76.45	11.13	110.77	15.20	141.79	18.54
Stadiums building	33.17	2.77	44.63	3.29	49.61	3.35
Total	982.89	256.30	1265.23	283.74	1554.97	317.09

During 2006 to 2008, sports and relative industrial total output value's value added has been increasing in successive years, number of employees are also continuously increasing in three years. Sports industrial rapidly development promotes civil employment, sports and relative industrial structure scale are rapidly growing. Relative industrial development is wholly I the rising trend. But relative industrial rising amplitude is not the same, by Figure 1; it is clear about sports relative industries output value contribution rate in sports. By TABLE 2, it is clear about changing rate of relative industry output value, employee contribution rates in total output value and total employees during 2006 to 2008.

In Figure 1, TYZZ, TYCG, TYJS, TYZJ, TYPX, TYCP, TYYPZZ, TYXS, TYJZ respectively represents sports organizational management activity, stadiums management activity, sports fitness leisure activity, sports intermediary activity, sports training activity, sports lottery, sports products, clothes, shoes and caps manufacturing, sports products, clothes, shoes and caps selling, and stadiums building. It is clear that sports lottery, sports products, clothes, shoes and caps manufacturing occupies maximum contribution rate in sports output value that occupies 70%. Other industries contribution rates are less than 1%. It shows sports industry structure is not reasonable.

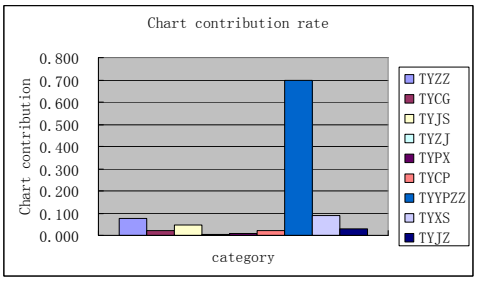

Figure 1 : 2008 relative industries contribution rate

TABLE 2 data shows if contribution rate is in the steady state, then the industry development level synchronizes with sports industrial development overall level, if contribution rate is in the rising states, then the industrial development level is ahead of sports industry development overall level, if contribution rate is in the diminishing state, then the industry development level falls behind sports industry development overall level. From table, it is clear that correlation industries advance developed ones that are also rapidly developing industries, there are sports products, clothes, shoes and caps selling and sports training activity. Industries that development is relative backward are sports products, clothes, shoes and caps manufacturing and stadiums building. Other sports industries developments nearly synchronize with overall development level. Industrial structure is adjusting proportions in sports total output value, manufacturing industries and building industry cools down, and other industries appear rising trend, it is clear that sports correlation industrial structure is adjusting.

TABLE 2 : Relative industries output values, employees contribution rates

Type	Contribution rate					
	Year 2006		Year 2007		Year 2008	
	Value added (one hundred million Yuan)	Employee (ten Thousand people)	Value added (one hundred million Yuan)	Employee (ten thousand people)	Value added (one hundred million Yuan)	Employee (ten thousand people)
Sports organizational management activity	0.076	0.073	0.071	0.067	0.076	0.066
Stadiums management activity	0.019	0.010	0.018	0.008	0.019	0.008
Sports fitness leisure activity	0.048	0.046	0.046	0.047	0.048	0.047
Sports intermediary activity	0.002	0.003	0.002	0.003	0.003	0.004
Sports training activity	0.005	0.007	0.006	0.008	0.009	0.011
Sports lottery	0.022	0.043	0.023	0.047	0.023	0.056
Sports products, clothes, shoes and caps manufacturing	0.717	0.763	0.710	0.754	0.700	0.738
Sports products, clothes, shoes and caps selling	0.078	0.043	0.088	0.054	0.091	0.058
Stadiums building	0.034	0.011	0.035	0.012	0.032	0.011

SPORTS RELATIVE INDUSTRIES MULTIPLE LINEAR ANALYSIS

Relative industries correlation analysis

Judge each variable correlation indicator, use correlation coefficient to express, assume there are two variables that are respectively x_1, x_2, according to variables data, calculate two variables correlation coefficient r.

$$r = \frac{\frac{1}{n}\sum(x_1 - \bar{x}_1)(x_2 - \bar{x}_2)}{\sqrt{\frac{\sum(x_1 - \bar{x}_1)}{n}}\sqrt{\frac{\sum(x_2 - \bar{x}_2)}{n}}}$$

Correlation coefficient absolute value is less than or equal to 1, correlation coefficient has positive value and negative value that respectively corresponds to positive correlation and negative correlation. Operate sports relative industries statistical data in SPSS, and get correlation coefficient matrix TABLE 3.

TABLE 3 : Correlation coefficient

Correlation										
		TYZZ	**TYCG**	**TYJS**	**TYZJ**	**TYPX**	**TYCP**	**TYYPZZ**	**TYXS**	**TYJZ**
TYZZ	Pearson correlation	1	.997*	.995	.998*	.999*	.959	.983	.978	.919
	Significance (bilateral)		.049	.064	.044	.030	.183	.119	.135	.258
	N	3	3	3	3	3	3	3	3	3
TYCG	Pearson correlation	.997*	1	1.000*	1.000**	1.000*	.978	.994	.991	.946
	Significance (bilateral)	.049		.015	.005	.019	.134	.070	.086	.210
	N	3	3	3	3	3	3	3	3	3
TYJS	Pearson correlation	.995	1.000*	1	.999*	.999*	.983	.996	.994	.954
	Significance (bilateral)	.064	.015		.020	.034	.119	.055	.070	.194
	N	3	3	3	3	3	3	3	3	3
TYZJ	Pearson correlation	.998*	1.000**	.999*	1	1.000*	.976	.993	.990	.944
	Significance (bilateral)	.044	.005	.020		.014	.139	.075	.091	.214
	N	3	3	3	3	3	3	3	3	3
TYPX	Pearson correlation	.999*	1.000*	.999*	1.000*	1	.971	.990	.987	.936
	Significance (bilateral)	.030	.019	.034	.014		.153	.089	.104	.228
	N	3	3	3	3	3	3	3	3	3
TYCP	Pearson correlation	.959	.978	.983	.976	.971	1	.995	.997*	.993
	Significance (bilateral)	.183	.134	.119	.139	.153		.064	.048	.076
	N	3	3	3	3	3	3	3	3	3
TYYPZZ	Pearson correlation	.983	.994	.996	.993	.990	.995	1	1.000*	.976
	Significance (bilateral)	.119	.070	.055	.075	.089	.064		.016	.140
	N	3	3	3	3	3	3	3	3	3
TYXS	Pearson correlation	.978	.991	.994	.990	.987	.997*	1.000*	1	.981
	Significance (bilateral)	.135	.086	.070	.091	.104	.048	.016		.124
	N	3	3	3	3	3	3	3	3	3
TYJZ	Pearson correlation	.919	.946	.954	.944	.936	.993	.976	.981	1
	Significance (bilateral)	.258	.210	.194	.214	.228	.076	.140	.124	
	N	3	3	3	3	3	3	3	3	3

***. It is significant correlated in 0.05 horizontal(bilateral); **. It is significant correlated in .01 horizontal(bilateral).**

In sports relative industries, correlated three other industries are sports intermediary activity, stadiums management activity and sports training activity, which shows these sports industries are closely related to sports industries totality, give priority to develop the three sports industries can promote and drive other sports industrial development.

Factor analysis

Factor analysis model expresses all variables and variable statistical data in the form of matrix: $X = \begin{bmatrix} x_{11} & x_{12} \cdots x_{1p} \\ x_{21} & x_{22} \cdots x_{2p} \\ \vdots & \vdots \ddots \vdots \\ x_{n1} & x_{n2} \cdots x_{np} \end{bmatrix}$

N shows samples observation times, p is number of variables, $X_i = (x_{1i}, x_{2i}, x_{3i} \cdots x_{ni})', i = 1,2 \cdots, p$ carries out standardization processing with data, eliminates dimensions. Calculate correlation coefficient, coefficient matrix $R = X'X$

Matrix R feature value corresponding orthogonal feature vector matrix: $U = \begin{bmatrix} u_{11} & u_{12} \cdots u_{1p} \\ u_{21} & u_{22} \cdots u_{2p} \\ \vdots & \vdots \ddots \vdots \\ u_{p1} & u_{p2} \cdots u_{pp} \end{bmatrix}$

Let $F = UX'$, then it has: $FF' = \begin{bmatrix} \lambda_1 & 0 \cdots 0 \\ 0 & \lambda_2 \cdots 0 \\ \vdots & \vdots \ddots \vdots \\ 0 & 0 \cdots \lambda_p \end{bmatrix}$

In above formula F is main factor matrix, and $F_i = U_i X', i = 1,2 \cdots, p$, ◦

In case no special factors, factor model: $\begin{cases} X_1 = u_{11}F_1 + u_{12}F_2 + \cdots + u_{1m}F_{m1} \\ X_2 = u_{21}F_1 + u_{22}F_2 + \cdots + u_{2m}F_{m1} \\ \cdots\cdots \\ X_p = u_{p1}F_1 + u_{p2}F_2 + \cdots + u_{pm}F_{m1} \end{cases}$,

Let $a_{ij} = u_{ij}\lambda_j^{1/2}$, factor loading matrix $A = (a_{ij})_{p \times m}$, therefore, factor analysis mathematical model:

$$\begin{cases} X_1 = a_{11}F_1 + a_{12}F_2 + \cdots + a_{1m}F_{m1} + \varepsilon_1 \\ X_2 = a_{21}F_1 + a_{22}F_2 + \cdots + a_{2m}F_{m1} + \varepsilon_2 \\ \cdots\cdots \\ X_p = a_{p1}F_1 + a_{p2}F_2 + \cdots + a_{pm}F_{m1} + \varepsilon_p \end{cases}$$

Among them, $F = (X_1, X_2, X_3 \cdots X_p)'$, is called common factor, $A = (a_{ij})_{p \times m}$ is factor loading matrix, a_{ij} is factor loading. Residual ε is special factor, is mutual independent and conforms to normal distribution $N(0, \sigma_i^2)$.

SPSS correlation calculation

In complex problems, variables numbers are quite a lot, it brings inconvenience to problem solution. Factor analysis is a method that defines fewer variables through analyzing each variable correlation. By defining common factors from variables, refine some principal components, reduce variables dimensions, and then can use fewer variable to replace all variables. Running results in SPSS is as following TABLE 4.

In TABLE 4, result shows that first principal component feature root is 8.865, variance contribution rate is 98.5%. According to factor extracting conditions, in the analysis, principal component is one piece. Select the first factor.

Following Figure 2 is factor analysis calculation result obtained scree plot, Figure 2 is ranking is according to components feature values sizes, from Figure 2, it is clear that only the first feature value is very big, and others feature values are small, so principal component extracts one.

TABLE 4 : Principal component table

Component	Initial feature value			Extract square sum and input		
	Total	Variance %	Accumulation %	Total	Variance %	Accumulation %
1	8.865	98.500	98.500	8.865	98.500	98.500
2	.135	1.500	100.000			
3	2.919E-16	3.243E-15	100.000			
4	2.207E-16	2.452E-15	100.000			
5	1.355E-16	1.506E-15	100.000			
6	3.674E-17	4.082E-16	100.000			
7	-1.170E-16	-1.301E-15	100.000			
8	-2.275E-16	-2.528E-15	100.000			
9	-3.918E-16	-4.353E-15	100.000			

Extract method: Principal component analysis.

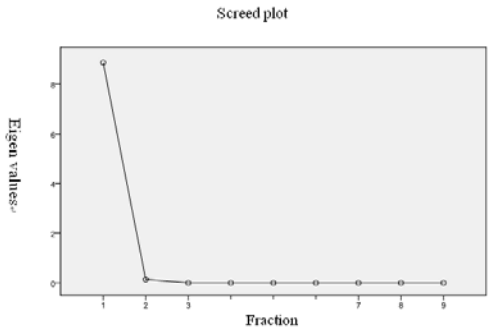

Figure 2 : Scree plot

TABLE 5 : Factor loading

Component matrix[a]	
	Component
	1
TYZZ	.988
TYCG	.997
TYJS	.999
TYZJ	.996
TYPX	.994
TYCP	.991
TYYPZZ	.999
TYXS	.998

TYJZ	.968

Extract method: Principal component analysis P; a. Already extract one component.

By TABLE 5, it can use extracted indicator to show principal component expression:

$$F_1 = 0.988x_1 + 0.997x_2 + 0.999x_3 + 0.996x_4 + 0.994x_5 + 0.991x_6 + 0.999x_7 + 0.998x_8 + 0.968x_9$$

CONCLUSION

According to sports relative industries correlation analysis, it gets in sports industries; it should take sports intermediary activity, stadiums management activity and sports training activity as leading to promote sports industries development, by correlation analysis, it is known that some industries have no correlations, which don't conform to practice, it proves sports industrial structure irrationality, industries haven't shaped network, it has industries disjoints. Factor analysis method shows sports relative industries can be summarized as one principal component; it proves sports industries should have stronger correlations. So, sports industrial structure optimization development should take sports intermediary activity, stadiums management activity and sports training activity as leading, and meanwhile strengthen each industry associated relationships.

REFERENCES

[1] Liu Bao, Hu Shan-lian, Xu Hai-xia, Gao Jian-hui; Indices of the equality of essential public health services in China[J]. Chinese Journal of Health Policy, **2(6)**, 13-17 **(2009)**.

[2] Zhang Da-chao, Li Min; Studies on Evaluation Index System of Public Sports Facilities Development Level in China[J]. China Sport Science, **33(4)**, 3-23 **(2013)**.

[3] Cai Jing-tai, Fan Bing-you, Wang Ji-shuai; A Survey of Residents' Satisfaction Degree for Urban Public Sport Services[J]. Journal of Beijing Sport University, **6**, **(2009)**.

[4] Wang Guo-hong, Zhang Wen-hui; Construction of the Evaluation Index System of City Community Sports——Taking Shanghai as an Example[J]. Journal of Chengdu Physical Education Institute, **36(2)**, **(2010)**.

[5] Zhang Jie, Wu Ying; The Evaluation Index System of Extracurricular Sports Activities in Secondary Schools in Shanghai under the Background of Sunshine Sports[J]. Journal of Shanghai Physical Education Institute, **6**, 80-82 **(2012)**.

[6] He Ying, Xu Ming; Study on Evaluating System of Sports Consciousness of Community Residents in Southwest Cities[J]. Journal of Chengdu Physical Education Institute, **33(2)**, 43-45 **(2007)**.

[7] He Ying, Xu Ming; Theoretical and empirical study on evaluation mode of sports service satisfaction degree in city community[J]. Journal of Wuhan Institute of Physical Education, **41(11)**, 40-42 **(2007)**.

[8] Chen Yang, Ma Ge-sheng; An Empirical Study on Community Sports Service Residents' Satisfaction Index Model[J]. China Sport Science and Technology, **45(4)**, **(2009)**.

[9] He Ying, Xu Ming; Theoretical and empirical study on evaluation mode of sports service satisfaction degree in city community[J]. Journal of Wuhan Institute of Physical Education, **41(11)**, 40-42 **(2007)**.