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Research Article

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Multiple regression research on sports and economical structure relationship

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ABSTRACT

The paper makes research on sports industry development and economic indicators state relations, by reasonable defining sports and national economic indicators, adopts multiple regression mathematical method, researches overall sports industry and economic multiple relations, and researches on sports industry structure optimized development and economic ways. By establishing sports industry and economic multiple regression mathematical equation, it gets conclusion that increase per capita GDP and tertiary industry employees can impel sports industry development to the greatest extent.

Key words: sports industry, multiple regressions, SPSS, sports economy

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INTRODUCTION

Economy continuous development surely will drive sports industry forming and development. Similarly, sports development will also impel economic growth in turn, but which factors in economy can better impel sports industry development? The problem solution involves how to design scientific reasonable sports industrial policies, highlights key points' development and reduces blind investment, and rapidly impels sports industry development that has important practical significance.

By references, it applies multiple linear regression mathematical models to further research on sports industry and economic relation. Calculate multiple equation, as well as relational degree matrix analysis, sports industry important effects on economic development. By economic indicators coefficient sizes, it judges best economic factor that impels sports industry.

2 Economy to sports industry mathematical regression model

Sports industry development status indicators factors are quite a lot, the paper selects most typical three factors that are respectively sports industry product, sports consumption, sports industrial staff amount. These three factors basically can on behalf of Chinese sports industrial development form level that are defined as sports industry three sub factors, as Table 1.

Table 1: Economy, sports indicators

Indicator	Sub factor
Sports industry	Sports industry product
	Sports consumption
	Sports industrial staff amount
Economic development	Gross domestic product
	The tertiary industry product
	Per capita GDP
	Per capita consumption expenditures
	Per capita disposable income
	The tertiary industry staff amount

2.1 Indicator data collecting and processing

Sports industry and economic development factor data from year 1997 to 2007 is as following Table 2.

Table 2: Each factor previous data

	Year	1997	1998	1999	2000	2001	2002
Sports product	y_1	157.95	168.8	179.35	198.43	219.31	240.67
Sports consumption	y_2	2562.12	2687.96	2818.2	3014	3129.72	3250.28
Sports employees amount	y_3	471	478	482	488.09	493.04	193.25
GDP	x_1	78973.03	84402.28	89677.05	99214.55	109655.2	120332.7
The tertiary industry product	x_2	26988.15	30580.47	33873.44	38713.95	44361.61	49898.9
Per capita GDP	x_3	6420.18	6796.03	7158.5	7857.68	8621.71	9398.05
Per capita consumption	x_4	5832	6109	6405	6850	7113	7387
Per capita disposable income	x_5	5160.3	5425.1	5854.02	6280	6859.6	7702.8
The tertiary industry employees amount	x_6	18432	18860	19205	19823	20228	21090

	Year	2003	2004	2005	2006	2007
Sports product	y_1	271.65	319.76	366.43	423.847	199.06
Sports consumption	y_2	3476.44	3818.76	4140.4	4586.12	5216.2
Sports employees	y_3	493.15	493.2	493.17	493.18	493.18
GDP	x_1	135822.8	159878.3	183217.4	211923.5	249529.9
The tertiary industry	x_2	56004.73	64561.29	73432.87	84721.4	100053.5
Per capita GDP	x_3	10541.97	12335.58	14053	16165	18934
Per capita consumption	x_4	7901	8679	9410	10423	11855
Per capita income	x_5	8472.2	9421.6	10493	11759.5	13785.8
The tertiary industry employee	x_6	21809	23011	23771	24614	24917

During year 1997 to 2007, sports and economic correlation factors indicators original data has different dimensions, it needs to carry out dimensionless handling with data to eliminate different dimensions impacts, let model reliability to be higher, here adopts initial value transformation:

$$f(x(k)) = \frac{x(k)}{x(1)} = y(k), k = 1, 2, \cdots n \text{and} x(1) \neq 0$$

That is f initialized transformation. Take initialized transformation on matrix A , adopt matrix form transformation. In A, line respectively represents sports and economic relative indicators data. Define transformation matrix C :The matrix that lets original data matrix A to be transformed into initial value matrix D is called transformation matrix. Relationship is:

$$\mathrm{C} \bullet \mathrm{A} = \mathrm{D}$$

Matrix C general form is:

$$\mathrm{C} = \begin{pmatrix} 1/a_{11} & 0 & \cdots & 0 \\ 0 & 1/a_{21} & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & 1/a_{n1} \end{pmatrix}$$

Sports industry size is up to three indicators, to better regress economic factors, use weighted method to carry out dimensionless handling with sports industry factor indicators. Assume sports industry three indicators factors

weights are:

$$w = (w_1 \quad w_2 \quad w_3)$$
$$w_1 + w_2 + w_3 = 1$$

Take w

$$w = (0.4 \quad 0.3 \quad 0.3)$$

Among them， w represents each indicator weight in comprehensive evaluation sports industry, sports industry evaluation's sports product, sports consumption, sports employees data should be the data after initialized processing, otherwise it cannot calculate. Then sports industry comprehensive evaluation is:

$$Y = w_1 y_1 + w_2 y_2 + w_3 y_3$$

After handling with sports three indicators data, it gets dimensionless data, as following Table 3:

Table 3: Sports indicator data dimensionless processing

	Year1997	1998	1999	2000	2001	2002
Sports product	y_1 1.00	1.07	1.14	1.26	1.39	1.52
Sports consumption	y_2 1.00	1.05	1.10	1.18	1.22	1.27
Sports employees	y_3 1.00	1.01	1.02	1.04	1.05	0.41

	Year2003	2004	2005	2006	2007
Sports product	y_1 1.72	2.02	2.32	2.68	1.26
Sports consumption	y_2 1.36	1.49	1.62	1.79	2.04
Sports employees	y_3 1.05	1.05	1.05	1.05	1.05

After taking dimensionality reduction with sports indicators data as well as handling with economic indicators data, it gets data as following Table 4:

Table 4: Dimensionality reduction and initialize data

	Year	1997	1998	1999	2000	2001	2002
Sports product	Y	2.00	2.09	2.17	2.32	2.47	2.43
GDP	x_1	1.00	1.07	1.14	1.26	1.39	1.52
The tertiary industry product	x_2	1.00	1.13	1.26	1.43	1.64	1.85
Per capita GDP	x_3	1.00	1.06	1.11	1.22	1.34	1.46
Per consumption	x_4	1.00	1.05	1.10	1.17	1.22	1.27
Per capita disposable income	x_5	1.00	1.05	1.13	1.22	1.33	1.49
The tertiary industry employees amount	x_6	1.00	1.02	1.04	1.08	1.10	1.14

	Year	2003	2004	2005	2006	2007
Sports product	Y	2.84	3.19	3.52	3.93	2.59
GDP	x_1	1.72	2.02	2.32	2.68	3.16
The tertiary industry	x_2	2.08	2.39	2.72	3.14	3.71
Per capita GDP	x_3	1.64	1.92	2.19	2.52	2.95
Per capita consumption	x_4	1.35	1.49	1.61	1.79	2.03
Per capita income	x_5	1.64	1.83	2.03	2.28	2.67
The tertiary industry employees	x_6	1.18	1.25	1.29	1.34	1.35

2 .2 Multiple regression model establishment

Adopt SPSS to make multiple regressions modeling, multiple linear equation, two predicted equation forms are respectively as following:

$$Y = \sum_{i=1}^{6} a_i x_i + C$$

Among them，Y respectively represents sports industry comprehensive value that represented by economic indicators，X_i represents economic indicators data. C Represents constant.

Firstly introduce data into SPSS，make multiple regression, establish multiple linear regression equation, apply software SPSS, it can get as following Table 5:

Table 5: Model summary[b]

Model	R	R square	Adjust R square	Standard estimated error	Alter statistical quantity					Durbin-Watson
					R square alter	F Alter	df1	df2	Sig. F alter	
1	.980[a]	.960	.919	.17722	.960	23.699	5	5	.002	3.004
a. Predictive variable: (constant), x6, x4, x5, x3, x2 ◦										
b. Dependent variable: Y										

Regression equation significance test is as following Table 6.

Table 6: Test

Anova[b]						
Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	3.722	5	.744	23.699	.002[a]
	Residual	.157	5	.031		
	Total	3.879	10			
a. Predictive variable: (constant), x6, x4, x5, x3, x2 ◦						
b. Dependent variable: Y						

By above calculation, it can get multiple regression linear equations as:

$$Y = 2.195x_2 + 4.768x_3 - 4.453x_4 - 8.945x_5 + 14.238x_6 - 5.834 \qquad (3)$$

Regression value test, standardized residual conforms to following figure, it gets closer to normal distribution, which shows predicted value residual distribution is reasonable, model accuracy is good. Test histogram Figure 1:

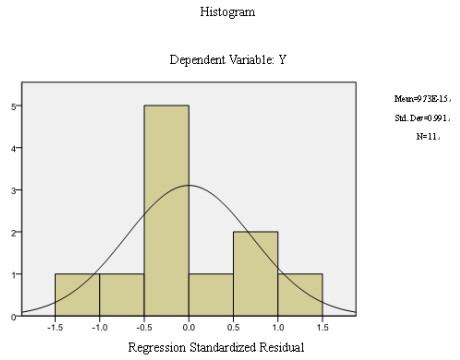

Figure 1: Standardized residual distribution

2.3 Error test

Make comparison between actual sports comprehensive level value and regression equation calculation value as well as its error value as following Table 7.

Table 7: Actual value and predicted value comparison

Actual value	Regression value	Error
2.00	1.96925	0.015
2.09	2.20450	0.055
2.17	2.04031	0.060
2.32	2.33749	0.008
2.47	2.47690	0.003
2.43	2.49677	0.027
2.84	2.67222	0.059
3.19	3.38573	0.061
3.52	3.57111	0.015
3.94	3.72728	0.054
2.59	2.66045	0.027
Error average value		0.035

CONCLUSION

The paper takes sports industry comprehensive level as dependent variable to establish economic relative indicators that is variable multiple regression models. Model calculation result well conforms to error test. And from regression equation variable coefficients, it gets that increase the tertiary industry employees can better impel sports industrial development. It needs each department to increase investment on the tertiary industry, add construction of the tertiary industry economic chain, let more people participate so that better impel sports industry overall rapidly development.

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