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Research Article

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Grey model weighting method-based large-scale sports competitions to urban tourism impacts evaluation research

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ABSTRACT

Large-scale sports events will drive urban or even national economy rapidly development, which is a general agreement. The paper takes Beijing Olympic Games as an example; it studies on large-scale sports events to urban impacts and makes evaluation. In grey GM(1.1)model, according to passenger volume reception per month during 2003 to 2007, it predicts passenger volume reception in every month of 2008, according to measurement and actual value comparison, it gets changing impact values. It has maximum proportion in Tertiary industry, secondly is Beijing per capita GDP, the lightest proportion is number of passengers reception, make normalization processing with three weights, and makes comparative analysis.

Key words: Grey model, weighting methods, Beijing Olympic Games, Urban impact

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INTRODUCTION

In 2008 Beijing Olympic Games, nation set up national fitness activities, the event not only affected national large and medium type cities, but also had certain impacts on economic relative backward cities' survival. It not only propelled to international sports advancement, but also speeded up our country sports power construction paces from economy, education and culture multiple aspects [1-5].

World economy globalization, internationally numerous sports events development has become more normalized, hosting world top level's Olympic Games is an acceptance of a country international position [6-9]; hosted Beijing Olympic Games per one time could improve international positions, improve international publicity, started from culture perspective, Olympic Games could promote national cohesive force, upgrade citizen cultural quality and other cultural soft powers [10-14]. The paper mainly researches on huge changes that Beijing Olympic Games brings to tourism.

APPLY GREY GM(1.1) TO EVALUATE SPORTS TOURISM IMPACTS

Collect Beijing passengers reception (person) every month from 2003 to 2009, establish following Table 1.

Table 1: Passengers' reception per month from 2003 to 2009

Month	2009	2008	2007	2006	2005	2004	2003
1	541600	541019		517640	487520	386765	330009
2	572686	479208	468685	528780	477634	475290	282496
3	683404	694372	510617	576064	600920	509220	505049
4	706295	677586	549291	575336	567510	526534	491714
5	706567	713699	490005	556293	577550	515650	468926
6	692410	756600	469343	503906	535574	482802	499989
7	694108	749327	542341	510391	540696	499302	455720
8	697451	848495	558876	483831	551259	519794	483624
9	743911	988568	527940	504473	546671	518316	473648
10	777398	921091	617274	627675	651110	609984	566510
11	749450	738462	641675	599271	602067	560064	510400
12	610476	602737	498374	419753	517414	453043	444375

Grey prediction

In grey GM(1.1)model, according to above Table every month passengers reception from 2003 to 2007, it predicts every month passengers reception in 2008, compares with actual value, it gets changing impact values .

Grey GM(1.1) model is established, given original time 2005-2009 information column:

$x^{(0)} = (x^{(0)}(1),\ x^{(0)}(2),\ x^{(0)}(3),\ x^{(0)}(4),\ x^{(0)}(5))$

To $x^{(0)}$ coordinate AGOgeneration, it has $x^{(1)} = AGOx^{(0)},\ x^{(1)}(k) =$ *then*

$x^{(1)} = (x^{(1)}(1),\ x^{(1)}(2),\ x^{(1)}(3),\ x^{(1)}(4),\ x^{(1)}(5))$

By $x^{(0)}$ generated GM（1,1） parameter corresponding a, b, and according to following formula to identify: $(B^T B)^{-1} B^T y_N$

Based on $X^{(0)}$ and $X^{(1)}$, it gets: $B = \begin{bmatrix} -z^{(1)}(2) & 1 \\ -z^{(1)}(3) & 1 \\ -z^{(1)}(4) & 1 \\ -z^{(1)}(5) & 1 \end{bmatrix} = \begin{bmatrix} -0.5(x^{(1)}(1)+x^{(1)}(2)) & 1 \\ -0.5(x^{(1)}(2)+x^{(1)}(3)) & 1 \\ -0.5(x^{(1)}(3)+x^{(1)}(4)) & 1 \\ -0.5(x^{(1)}(4)+x^{(1)}(5)) & 1 \end{bmatrix}$

$y_N = (x^{(0)}(2),\ x^{(0)}(3),\ x^{(0)}(4),\ x^{(0)}(5))^T$

Input B, y_n into established equation: $\hat{a} = \begin{bmatrix} a \\ b \end{bmatrix} = (B^T B)^{-1} B^T y_N$

It gets GM(1, 1)model, $x^{(0)}(k)$ GM(1.1) whiten formdifferential equation is : $\frac{dx^{(1)}}{dt} + ax^{(1)} = b$

Thereupon it gets time reduced equation, as following show:

$$\hat{x}^{(0)}(t+1) = \hat{x}^{(1)}(t+1) - \hat{x}^{(1)}(t) = (1-e^{\hat{a}})[x^{(1)}(1) - \frac{\hat{b}}{\hat{a}}]e^{-\hat{a}t}$$

Utilize Matlab to solve time sequence. It gets following Table 2.

Table 2: Year 2008 predicted value and actual value (person)

Month	Predicted value	Actual value	Difference absolute value	Impact ratio
1	585960	541019	44941	8.3067323%
2	495280	479208	16072	3.3538672%
3	544340	694372	150032	21.606862%
4	573480	677586	104106	15.364249%
5	511870	713699	201829	28.2792886%
6	480750	756600	275850	36.4591594%
7	548250	749327	201077	26.834346%
8	541220	748495	207275	27.6922358%
9	521030	888568	367538	41.362957%
10	626130	921091	294961	32.0230032%
11	663660	738462	74802	10.1294312%
12	481860	602737	120877	0.200546839%

Draw month and impact ratio broken line Figure 1.

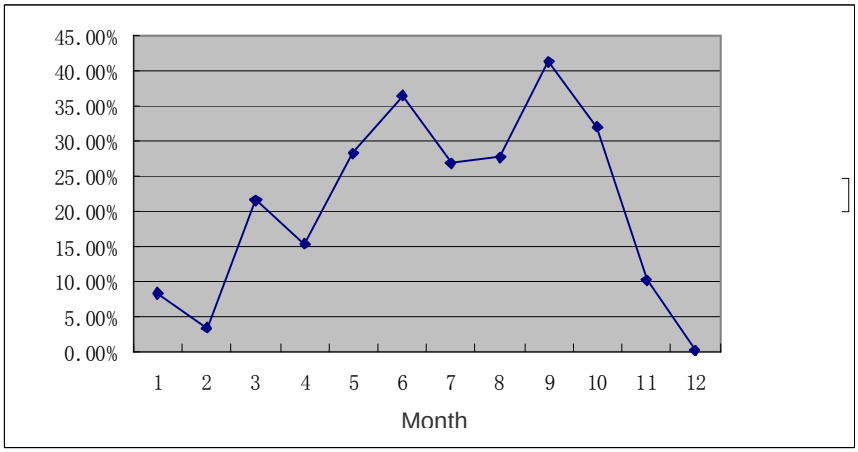

Figure 1: Month and impact ratio broken line

By Figure 1, it can present changing trend that year 2008 Beijing Olympic Games brought to Beijing passengers, on a whole, it is in the rising trend, which roughly explains Beijing passengers impacts become bigger and bigger with Beijing Olympic Games hosted. Targeted image change form and Olympic Games hosting, we make detailed analysis: Beijing Olympic Games in 2008 hosted in August, it indicated by figures that impact ratio diminishing trend in April could still turn around, the trend was in greatly rising in passengers, it arrived at peak value in June that showed Olympic Games organization attracted a great deal of passengers to visit it, impact value slightly diminished with time increased, until September to October, considered October 1st long holiday impacts, Olympic Games passengers increased to maximum value in a year again, Beijing passengers impact ratio got closer to zero that arrived at previous normal level with Olympic Games ending.

Utilize weighting method to solve Olympic Games long-term impact

Beijing Olympic Games in 2008 has already passed nearly five years, for long-term impacts that Beijing Olympic Games brought into China and world, the paper on the basis of searching each kind of data, it finds out three main factors to define whether Beijing Olympic Games can long-term affect China and world, whether it could attract domestic and international attentions, it gets relation Figure 2 and Figure 3 as well as Figure 3 and Figure 4.

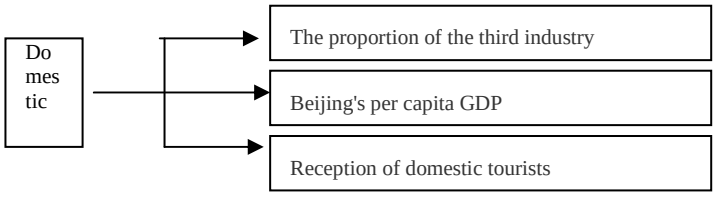

Figure 2: Domestic

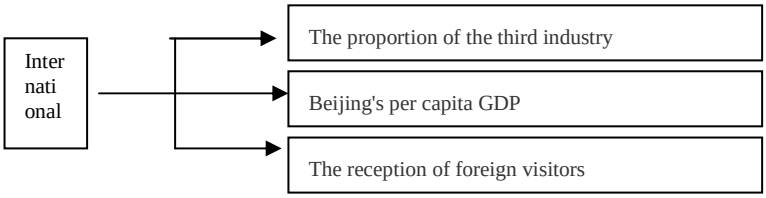

Figure 3: International

According to Figure 3 showed three factors, it establishes function relationship: $y = ax_1 + bx_2 + cx_3$

Among them, a, b, c is each factor weight, targeted three factors' importance grade, endow different factors with 1, 2, 3 three weights. It has maximum proportion in Tertiary industry, secondly is Beijing per capita GDP, the lightest proportion is number of passengers reception. Make normalization processing with three weights, it gets:

$$a = \frac{3}{1+2+3} = 0.5 \ , \ b = \frac{2}{1+2+3} = 0.33 \ , \ c = \frac{1}{1+2+3} = 0.167$$

Table 3: International impact degree value

Year		Proportion of the tertiary industry	Beijing GDP	International tourists number
1990	0.400354	31.88%	756.45	893
1991	0.467871	34.58%	893.77	1025.14
1992	0.555222	36.14%	1, 114.32	1111.91
1993	0.689762	37.91%	1, 511.61	1131.95
1994	0.859628	39.56%	1, 971.92	1239.02
1995	1.043099	40.24%	2, 462.57	1367.9
1996	1.19285	43.01%	2, 902.20	1395.05
1997	1.356489	45.53%	3, 360.21	1469.12
1998	1.474571	48.81%	3, 688.20	1527.09
1999	1.610766	50.84%	4, 034.96	1656.81
2000	1.807422	52.12%	4, 551.15	1813.99
2001	1.977512	52.38%	4, 950.84	2042.61
2002	2.242666	52.93%	5, 408.76	2725.32
2003	2.599592	52.93%	6250.81	3198.67
2004	3.488868	50.75%	8072.83	4923.93
2005	3.98085	50.42%	9164.1	5713.63
2006	4.434879	50.59%	10366.37	6056.57
2007	5.136505	52.58%	12188.85	6656.02
2008	5.592489	53.66%	13698.15	6403.69
2009	6.018595	59.40%	15046.45	6289.2
2010	7.089164	60.40%	17165.98	8511.2

Table 4: Domestic impact degree value

Year		The proportion of the tertiary industry	Beijing GDP	Domestic tourists number that visits Beijing
1990	0.61712	31.88%	756.45	2191
1991	0.75442	34.58%	893.77	2741
1992	0.939337	36.14%	1, 114.32	3412
1993	1.384491	37.91%	1, 511.61	5292
1994	1.581399	39.56%	1, 971.92	5561
1995	1.791276	40.24%	2, 462.57	5848
1996	1.996947	43.01%	2, 902.20	6210
1997	2.207668	45.53%	3, 360.21	6566
1998	2.388547	48.81%	3, 688.20	7000
1999	2.586245	50.84%	4, 034.96	7498
2000	2.815102	52.12%	4, 551.15	7848
2001	3.014981	52.38%	4, 950.84	8255
2002	3.250624	52.93%	5, 408.76	8761
2003	3.335115	52.93%	6250.81	7603
2004	4.086906	50.75%	8072.83	8505
2005	4.531678	50.42%	9164.1	9012
2006	5.04066	50.59%	10366.37	9684
2007	5.73002	52.58%	12188.85	10210
2008	6.361075	53.66%	13698.15	11006
2009		59.40%	15046.45	12361
2010		60.40%	17165.98	21463

Therefore, it gets actual trend chart and fitting curve have many difference, with Olympic Games hosting, domestic impact values trend and international impact values are greatly increased, starts from year 2008 hosting former period till afterwards of year 2008, Beijing Olympic Games impacts brought to Beijing not only restricts hosting periods, its impacts is long-term, big scale.

CONCLUSION

Apply grey GM(1.1)model to predict passengers reception per monthof2008, it gets changing impact values, the paper finds out three main factors to define Beijing Olympic Games whether can long-term affect China and world, whether can attract domestic and international attentions. Beijing Olympic Games impacts brought to Beijing not only restricts hosting periods in 2008, its impacts is long-term, big scale.

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