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Time series-based Chinese basketball reserve talents cultivation research

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ABSTRACT

Though Chinese basketball event has achieved highly effective advancement in recent years, it still keeps big paces with developed countries; obtained results in some international main competitions are not going well. Importance causes for the phenomenon is shortage of Chinese basketball reserve talents resources. How to better cultivate Chinese basketball reserve talents becomes a crucial problem in Chinese sports. According to Chinese basketball development and basketball reserve talents cultivation status, the paper applies time series to make analysis and research on each sports school (take Hebei as an example) every year basketball aspect enrollment status, it gets enrollment is constantly decreasing, we should pay attention to the phenomenon. Make comparative analysis of Chinese basketball coaches' job titles, ages and education background levels as well as youth cultivation funds, it gets that Chinese basketball coaches status and national emphasis are urgently to be further strengthened.

KEYWORDS

Time series; Comparative analysis; Reserve talents; Basketball games.

INTRODUCTION

Presently, Chinese basketball sports level is at a disadvantage stage in international, basketball reserve talents cultivation status compares to some basketball event developed Europe and America, it still has a long way to go, in high level basketball league matches, and it is difficult to spring up excellent new staff. One of main causes for Chinese basketball sports levels show declination is deficiency of high level reserve talents resources, if it want to improve Chinese domestic basketball league matches' levels and basketball event position in international, and let basketball to sound develop, we should focus on basketball reserve talents cultivation.

Bai Xi-Lin in the article "Think about Chinese basketball reserve talents cultivation system, he put forward that Chinese basketball reserve talents cultivation system started forming since 50s, and called it "the national sports system". It also was centered on each level each kind of sports school to cultivate basketball reserve persons in different extents, and also included each province and army sports team self cultivated basketball reserve persons. It was a method that nation used little investment to cultivate relative high level basketball athletes. With the support of "the national sports system", Chinese basketball event gradually started developing, levels were also constantly promoting, cultivated great deals of excellent basketball athletes, let Chinese basketball to go outside of Asia and take part in international games. However, with formation of market economy system, and its subsequent series of social reformation, it caused great impacts on current basketball reserve talents cultivation system, existing drawbacks of basketball reserve talents cultivation system accordingly exposed.

Liu Yun-Lin in the article "World basketball development trend and Chinese basketball reformation status", he thought Chinese basketball achieved high effective advancement since reformation for five years, but it still had great gap with European and American some basketball strong teams, in order to propel to Chinese basketball reserve talents cultivation further reformation and development, we should learn modern basketball event status and its development status, made objective analysis of Chinese basketball reserve talents cultivation reformation. According to statistics, Chinese sports schools reserve talent amount reduced 40%, and coaches numbers reduced 28% in 1980-1993, national each kind of sports schools are decreasing at the speed of 22.7% per year. Each level each kind of sports schools is main base for Chinese basketball reserve talents cultivation, the reduction will surely lead to Chinese basketball development to have unoptimistic prospect.

Gao Zhi, Xu Wei-Hong in the article "Chinese basketball reserve talents sustainable development countermeasure study", they pointed out that by far Chinese basketball sports level still kept bigger paces with European and American some basketball developed countries, and basketball reserve talents strength had even bigger gap with basketball developed countries' reserve talents, domestic basketball talents scale prediction result was not going well, it should urgently take actions to propel to basketball talents development.

The paper on the basis of analyzing Chinese basketball reserve talents cultivation status, applies time series, studies each school (take Hebei as an example) every year enrollment status, and makes comparative analysis of coaches' job titles, ages and education background levels as well as youth cultivation funds, so as to get better basketball reserve talents cultivation path.

MODEL ESTABLISHMENT

For time series analysis, firstly comprehend following model:
AR (p) model:

$$\begin{cases} x_t = \Phi_0 + \Phi_1 x_{t-1} + \Phi_2 x_{t-2} + ... + \Phi_p x_{t-p} + \varepsilon_t \\ \Phi_p \neq 0 \\ E(\varepsilon_t) = 0 \square Var(\varepsilon_t) = \sigma_\delta^2, E(\varepsilon_t \varepsilon_s) = 0, s \neq t \\ Ex_s \varepsilon_t = 0, \forall s < t \end{cases}$$

Model with above structure is called p order auto regression model, we record it as AR (p) here.
MA (q) model

$$\begin{cases} x_t = u + \varepsilon_t - \theta_1\varepsilon_{t-1} - \theta_2\varepsilon_{t-2} - \ldots - \theta_q\varepsilon_{t-q} \\ \theta_q \neq 0 \\ E(\varepsilon_t) = 0, Var(\varepsilon_t) = \sigma_\delta^2, E(\varepsilon_t\varepsilon_s) = 0, s \neq t \end{cases}$$

Model with above is called q order auto regression model, record it as MA (q) here.
ARMA (p, q) model

$$\begin{cases} x_t = \Phi_0 + \Phi_1 x_{t-1} + \Phi_2 x_{t-2} + \ldots + \Phi_p x_{t-p} + \varepsilon_t - \theta_1\varepsilon_{t-1} - \theta_2\varepsilon_{t-2} - \ldots - \theta_q\varepsilon_{t-q} \\ \Phi_p \neq 0, \theta_q \neq 0 \\ E(\varepsilon_t) = 0 \ , \ Var(\varepsilon_t) = \sigma_\delta^2, E(\varepsilon_t\varepsilon_s) = 0, s \neq t \\ Ex_s\varepsilon_t = 0, \forall s < t \end{cases}$$

Time series analysis of the model with above structure is called p, huyq order auto regression model, record it as ARMA (p, q).

Stationary sequence modeling

Modeling steps: according to China 2007 to 2012 six years' each sports school basketball aspect enrollment amount as initial data, it lists out following flow: The correlation coefficient calculation sample, Model identification, Parameter estimation, Model test, model optimization, Series Forecasting model flow as Figure 1 :

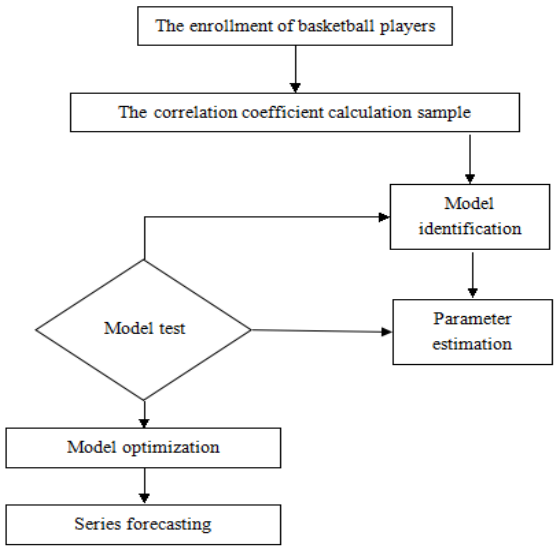

Figure1 : Model of the process

Calculate sample correlation coefficient:

$$\hat{\rho}_k = \frac{\sum_{t=1}^{n-k}(x_t - \bar{x})(x_{t+k} - \bar{x})}{\sum_{t=1}^{n}(x_t - \bar{x})^2}$$

Partial correlation coefficient (sample):

$$\hat{\Phi}_{kk} = \frac{\hat{D}_k}{\hat{D}}$$

Model recognition basic principles are as TABLE 1:

TABLE 1 : Basic principles

$\hat{\rho}_k$	$\hat{\Phi}_{kk}$	Select model
Tailing	P order tailing	AR (p)
q order tailing	Tailing	MA (q)
Tailing	Tailing	ARMA (p, q)

Sample correlation coefficient approximate distribution:
Barlett:

$$\hat{\rho}_k \sim N(0, \frac{1}{n}), n \to \infty$$

Quenouille:

$$\hat{\Phi}_{kk} \sim N(0, \frac{1}{n}), n \to \infty$$

Parameter estimation: Parameters to be estimated have $p+q+2$ pieces unknown parameters.

Common used estimation methods are : moment estimation, maximum likelihood estimation, and least square estimation.

Model significance test:

Purpose: test model's validness (whether sufficiently extract information or not)

Test objects: Residual sequence

Evaluation principle:It should be able to extract observed value sequence samples correlation information that residual sequence should be the data that needs to discuss, on the contrary, it needs to distinguish according to cases.

Hypothesis condition:

Null hypothesis: The number of volleyball papers in sports core journals

$$H_0: \rho_1 = \rho_2 = ... = \rho_m = 0, \forall m \geq 1$$

Alternative hypothesis: Corresponding residual sequence is data that needs to discuss

$$H_1: \rho_k \neq 0, \exists m \geq 1, k \leq m$$

Test statistics:

LB statistics

$$LB = n(n+2)\sum_{k=1}^{m}(\frac{\hat{\rho}_k^2}{n-k}) \sim \chi^2(m)$$

Parameters significance testing:

Purpose:Test corresponding every unknown parameter value is zero or not. Delete these insignificant parameters.

$$H_0 : \beta_j = 0 \qquad H_1 : \beta_j \neq 0$$

Test statistics

$$T = \sqrt{n-m}\,\frac{\hat{\beta}_j - \beta_j}{\sqrt{a_{jj}Q(\tilde{\beta})}} \sim t(n-m)$$

Model optimization:

Problem posing: Here, we assume that model passes corresponding tests, which shows data is in certain feasible intervals, the model can effective get corresponding results.

Optimization purpose: Select relative optimal model

Sequence forecasting:

Linear prediction function: $x_t = \sum_{i=0}^{\infty} C_i x_{t-1-i}$

Minimum forecasting variance principle: $Var_{\hat{x}_{t(l)}}\left[e_t(l)\right] = \min\left\{Var\left[e_t(l)\right]\right\}$

Take it as factor in next model analysis.

Non-stationary sequence modeling

Firstly, it needs to do stationary operation on data, and furthermore we establish ARIMA (p, q) model to solve the process, in the following introduce the model

Model structure usage occasion is difference stationary sequence fitting:

Model structure: $\begin{cases} \Phi(B)\nabla^d x_t = \Theta(B)\varepsilon_t \\ E(\varepsilon_t) = 0\ ,\ Var(\varepsilon_t) = \sigma_\varepsilon^2, E(\varepsilon_t\varepsilon_s) = 0, s \neq t \\ Ex_s\varepsilon_t = 0, \forall s < t \end{cases}$

Modeling steps are: The observed sequence value obtained——Stationary test ——Difference operation——Variables test ——Fitting ARMA model——Analysis result. Non stationary sequence modeling flow chart is as Figure 2.

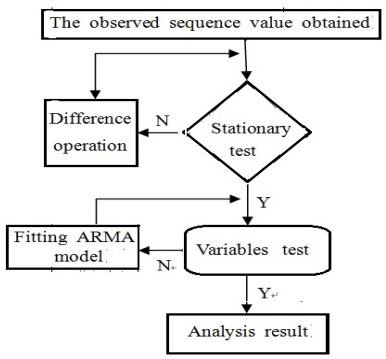

Figure 2 : Non stationary sequence modeling flowchart

DATA AND RESULT ANALYSIS

By referencing lots of literatures, it summarizes Chinese basketball reserve talents cultivation path, it mainly includes three kinds of paths, as TABLE 2.

TABLE 2 : Chinese basketball reserve talents cultivation path

Type		Cultivation path
First type	Sports colleges training system	Sports school General amateur sports school Key amateur sports school
Second type	School training system	Each sports reserve talents experimental school Traditional basketball event school Each elementary and secondary school basketball teams composed schools
Third type	Amateur training system	Three troops youth basketball clubs Private youth basketball clubs Youth basketball clubs that privately run under state-subsidized

Basketball reserve talents status as TABLE 3.

TABLE 3 : Sports school recruited basketball reserve talents amount

Unit	Year 2007	Year 2008	Year 2009	Year 2010	Year 2011	Year 2012
Shijiazhuang city sports school	12	11	10	9	8	7
Tangshan city sports school	12	10	8	8	6	5
Qinhuangdao city sports school	8	7	8	6	8	7
Handan city sports school	10	11	8	9	7	7
Lang fang city sports school	9	7	9	7	7	7
Baoding city sports school	10	11	8	9	7	6
Xingtai city sports school	10	8	9	5	6	5
Cangzhou city sports school	6	5	7	5	4	5
Hengshui city sports school	8	5	6	7	5	5
Chengde city sports school	8	5	6	7	5	4
Zhangjiakou city sports school	10	8	5	6	5	5
Sum total	104	86	84	76	71	63

Correspond to above each sports school corresponding time changes, it makes time series analysis, intuitional analysis result is as Figure 3.

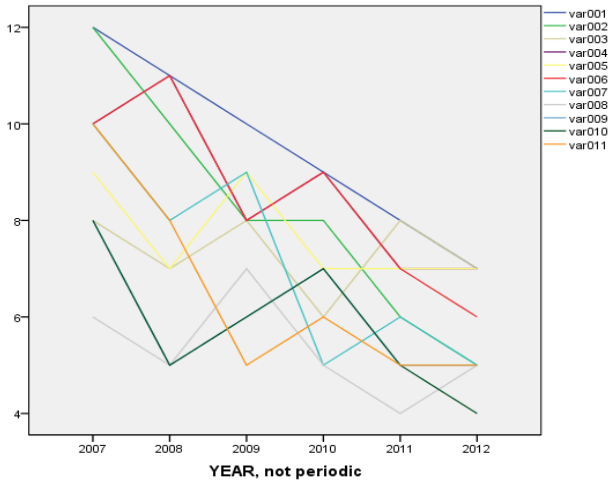

Figure 3 : Visual analysis chart

According to Figure 3 analysis result, the series have remarkable tendency, and have no outliers and missing value.

Take Shijiazhuang sports school as an example, it makes correlation analysis, result is as Figure 4.

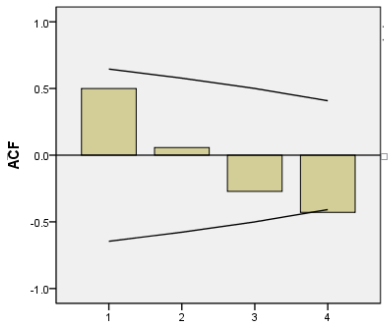

Figure 4 : Correlation analysis chart

According to standard error value and Box-ljung Statistic accompanied probability, it proves the time series is not white noise but has correlations.

Each school basketball reserve talents average daily learning and training time-table is as TABLE 4.

TABLE 4 : Basketball reserve talents average daily learning and training time-table

Field	Learning time h	Training time h
Sports school	2.8	4.5
Basketball base	2.1	4.7
Basketball experimental senior high school	4.5	3.1
Sum total	9.4	12.3

From above TABLE 4, it can get sports school and basketball base training time is far longer than learning time, and basketball experimental senior high school learning time is longer than training time.

Coaches status

Make statistics analysis of Chinese youth coaches' job titles, ages and education background status as TABLE 5, TABLE 6, TABLE 7.

TABLE 5 : Coaches' job titles statistical table

Job title	Percentage
Senior professional title	18.5%
Intermediate title	30.7%
Junior title	41.8%
Without title	5%
Others	4%

TABLE 6 : Front-line coaches' ages' status table

Age group	Percentage
20-30 years old	8%
30 -40 years old	33%
40 -50 years old	40%
50 -60 years old	14%
Above 60 years old	5%

TABLE 7 : Coaches' education background investigation table

Education background level	Number of people	Percentage
Graduate student	13	3.63%
Bachelor's degree	265	74.02%
Junior College	78	21.79%
Under	2	0.56%

In order to more intuitional see basketball coaches' education background distribution status, we use pie chart to express TABLE 7 data, as Figure 5

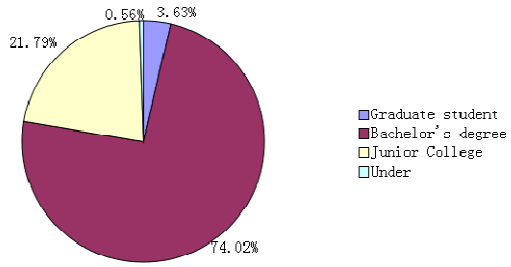

Figure 5 : The coach degree distribution

From above three tables, it is clear that coaches are most with junior titles, the amount in 40-50years old age group is the largest, and they are most with Bachelor's degree. It is clear that coaches' job titles and education background are to be improved.

Athletes cultivation funds status

Status of national funds on Chinese basketball reserve youth cultivation is as TABLE 8.

TABLE 8 : Chinese youth cultivation funds investment status

Amount of money	Percentage
Below ten thousand	41%
Ten thousand to twenty thousand	39%
Twenty thousand to thirty thousand	15%
Above thirty thousand	5%

From above TABLE 8, it is clear that national emphasis on Chinese basketball reserve youth is not enough, it should improve funds investment.

CONCLUSION

According to Chinese basketball development and basketball reserve talents cultivation status, the paper applies time series to study each sports school (take Hebei as an example) every year basketball aspect enrollment status, and make comparative analysis of Chinese basketball coaches' job titles, ages and education background levels and youth cultivation funds. It gets enrollment is constantly decreasing, we must focus on the phenomenon, increase enrollment; Chinese basketball coaches' education background level and job titles are to be improved so as to let basketball reserve talents to get better education; nation should also improve emphasis on Chinese basketball reserve talents cultivation, and improve funds input.

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