Research and dynamic analysis based on nonlinear identification of sports goods Econometrics

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Abstract. On the basis of literature research, this paper analyses the sports econometric analysis method, discusses the contribution of sports goods sales and economic growth in China, and analyses the dynamic relationship between them. In this paper, a nonlinear identification algorithm based on the econometric economics of sporting goods is proposed, and a nonlinear identification model based on the econometrics of sporting goods is established. Finally, through the MATLAB simulation analysis, the results show that: sports goods econometric nonlinear identification method is suitable for the coordinated development of regional economy, social environment and sports industry. The simulation results verify the feasibility and effectiveness of the nonlinear identification method of sports econometrics, and provide reference for the stable development of sports economy.

Keywords: Sports goods econometrics, nonlinear identification, MATLAB simulation, dynamic analysis.

1. Introduction
Sports products are the most basic unit of sports industry. With the continuous integration of China's sports goods sales with the international standards, the sales scope is also facing the world, which also brings unprecedented development opportunities to the sports industry [1-3]. It is also an urgent problem to explore the relationship between sports goods sales and economic growth in China. Based on this, on the basis of literature research, this paper discusses the contribution of sports econometric analysis method and modeling euiew6.0 software from the Econometric Relationship between sports goods sales and economic growth in China, and analyzes the dynamic relationship between them [4-18]. The author obtains 48 monthly statistical data from 2008 to 2011 from China Statistical Yearbook, official website of the National Bureau of statistics of the people's Republic of China, China economic special network and China industry analysis platform [19-26]. The research scope is narrowed down, and the third industry represents the absolute gross domestic product (GDP) and China's sports goods sales income (CPXs) More accurate comparison, reduce the impact of multivariate fluctuations [27-36]. It is helpful to eliminate or reduce the influence of heteroscedasticity and reduce the fluctuation between the data by
using logarithmic form to standardize the monthly sales volume and economic growth data of sports products in China from January 2008 to December 2011 with InCpxs and lnGDP respectively.

On the whole, with the promotion of national attention to sports, the influencing factors of sports economic growth also show a diversified trend [37-42]. In addition to the general economic factors, the change of consumption concept and the improvement of cultural level also affect the sustainable growth of sports economy. However, the systematic research on sports economic growth factors is relatively less, and many studies mainly explore from some aspects such as economy or consumption, and the effectiveness of the research results needs to be studied. Based on the exploratory factor analysis of the expected indicators affecting sports economic growth [43-47], this paper empirically analyzes the influence of various factors on sports economic growth with the help of GMM model, so as to provide reference for the stable development of sports economy [48-57].

In this paper, a nonlinear identification algorithm based on the econometric economics of sporting goods is proposed, and a nonlinear identification model based on the econometrics of sporting goods is established. Finally, through the MATLAB simulation analysis, the results show that: sports goods econometric nonlinear identification method is suitable for the coordinated development of regional economy, social environment and sports industry. The simulation results verify the feasibility and effectiveness of the nonlinear identification method of sports econometrics, and provide reference for the stable development of sports economy.

2. Sports economic model
This paper proposes a GMM model identification algorithm for sports economic growth, and establishes a GMM model model identification algorithm for sports economic growth.

The actual system can be described by the following model:

\[
\begin{align*}
    z(k) &= \frac{B(z^{-1})}{A(z^{-1})} u(k) + n(k)
\end{align*}
\]

In the formula: \( u(k) \) and \( z(k) \) are the input and output variables of the system; \( n(k) \) is the additional noise of the system; and

\[
\begin{align*}
    A(z^{-1}) &= 1 + a_1 z^{-1} + a_2 z^{-2} + \ldots + a_{n_s} z^{-n_s} \\
    B(z^{-1}) &= b_1 z^{-1} + b_2 z^{-2} + \ldots + b_{n_s} z^{-n_s}
\end{align*}
\]

Let \( n_s \) and \( n_s \) are the input and output variables of the system; \( n \) is the additional noise of the system; and

\[
\begin{align*}
    \theta_0 &= \left[ a_0^T, b_0^T \right]^T = \left[ a_1, \ldots, a_{n_s}, b_1, \ldots, b_{n_s} \right]^T \\
    h(k) &= \left[ -z^T(k), u^T(k) \right]^T = \left[ -z(k-1), \ldots, -z(k-n), u(k-1), \ldots, u(k-n) \right]^T
\end{align*}
\]

In the formula: \( \theta_0 \) is the identification parameter of the \( a_1, \ldots, a_{n_s}, b_1, \ldots, b_{n_s} \) fixed model, and \( z \) is the output of the corresponding \( k \) th fixed model.

3. Nonlinear identification of sports goods Econometrics
The reference model can be written in the least square format:
\[ z(k) = \Theta_{0}^{t} \cdot h(k) + e(k) \quad (4) \]

\( e(k) \) is colored noise, which can be expressed as:

\[ e(k) = A(z^{-1}) \cdot n(k) \quad (5) \]

For convenience, the case of \( n(k) = 0 \) is considered first. According to the theoretical analysis, the result is also applicable to the case of \( n(k) \neq 0 \).

\[ Z_{m}(k) = \frac{\hat{B}(z^{-1})}{\hat{A}(z^{-1})} u(k) \quad (6) \]

In the formula: \( u(k) \) and \( Z_{m}(k) \) are adjustable model input and output variables. Set

\[ \begin{align*}
\hat{\Theta}(k) &= [\hat{\Theta}^{t}(k), \hat{\Theta}^{p}(k)]^{T} \\
\hat{h}_{m}(k) &= [-Z_{m}(k), u^{T}(k)]^{T} = [-z_{m}(k-1), \cdots, -z_{m}(k-n_{s}), u(k-1), \cdots, u(k-n_{s})]^{T}
\end{align*} \quad (7) \]

In the formula:

\[ \begin{align*}
\begin{cases}
\Theta_{\hat{E}}(k) = \hat{\Theta}^{t}(k) + \hat{\Theta}^{p}(k) \\
\Theta(k) = \alpha \Theta_{\hat{E}}(k), \alpha \geq -0.5 \\
\Theta^{0}(k) = z(k) - \left[ \hat{\Theta}^{t}(k-1) \right]^{T} \cdot \bar{h}_{m}(k) + \left[ \hat{\Theta}^{p}(k-1) \right]^{T} \cdot Z_{m}(k) \\
\hat{\Theta}^{t}(k) = \hat{\Theta}^{t}(k-1) + \frac{P(k-1) \cdot \bar{h}_{m}(k) \cdot \Theta^{0}(k-1)}{1 + \bar{h}_{m}^{T}(k) \cdot [\bar{P}(k-1) + \bar{\Theta}(k-1)] \cdot \bar{h}_{m}(k)} \\
\hat{\Theta}^{p}(k) = \frac{\bar{\Theta}(k-1) \cdot \bar{h}_{m}(k) \cdot \Theta^{0}(k)}{1 + \bar{h}_{m}^{T}(k) \cdot [\bar{P}(k-1) + \bar{\Theta}(k-1)] \cdot \bar{h}_{m}(k)} \\
\bar{P}(k) = P(k-1) + \frac{\bar{P}(k-1) \cdot \bar{h}_{m}^{T}(k) \cdot \bar{h}_{m}(k) \cdot P(k-1)}{1 + \bar{h}_{m}^{T}(k) \cdot \bar{P}(k-1) \cdot \bar{h}_{m}(k)}, \bar{P}(k-1) > 0
\end{cases}
\end{align*} \quad (9) \]
Using the formula (3)- (9) iteration, the model parameter estimate can be obtained.

4. Experimental analysis and research
A nonlinear identification algorithm based on the econometric economics of sporting goods is proposed, and a nonlinear identification model based on the econometrics of sporting goods is established. Finally, through the MATLAB simulation analysis, the results show that: sports goods econometric nonlinear identification method is suitable for the coordinated development of regional economy, social environment and sports industry.

![Figure 1. Model system parameter identification laboratory.](image)

Through MATLAB simulation analysis, the results show that GMM model identification method is suitable for sports economic growth. Nonlinear identification of sports goods Econometrics GMM model 1, as shown in Fig.2.

![Figure 2. Nonlinear identification of sports goods Econometrics GMM model 1.](image)

Nonlinear identification of sports goods Econometrics GMM model 2, as shown in Fig.3.
Through, through MATLAB simulation analysis, the results show that GMM model identification method is suitable for sports economic growth. GMM model identification method 3, as shown in Fig. 5.

Nonlinear identification of sports goods Econometrics GMM model 3, as shown in Fig. 5.

Nonlinear identification of sports goods Econometrics GMM model 4.
In Figure 2, 3, 4 and 5, through the MATLAB simulation analysis, the results show that: sports goods econometric nonlinear identification method is suitable for the coordinated development of regional economy, social environment and sports industry. The simulation results verify the feasibility and effectiveness of the nonlinear identification method of sports econometrics, and provide reference for the stable development of sports economy.

5. Summary
In this paper, a nonlinear identification algorithm based on the econometric economics of sporting goods is proposed, and a nonlinear identification model based on the econometrics of sporting goods is established. Finally, through the MATLAB simulation analysis, the results show that: sports goods econometric nonlinear identification method is suitable for the coordinated development of regional economy, social environment and sports industry. The simulation results verify the feasibility and effectiveness of the nonlinear identification method of sports econometrics, and provide reference for the stable development of sports economy.

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