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Empirical study on cultural industry and its structure in China based on time series model

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ABSTRACT

We according to the proportion of data from 1952 to 2008 of the cultural industry output value accounted for the GDP time series, ARIMA model is established through the concrete data by using comprehensive analysis. Through model analysis, the conclusion is: since 1952, the cultural industry output value of the proportion of fluctuations in GDP is larger. In a period around 1978, culture industry proportion reached trough; but after 1984 the situation improved and the proportion is increasing year by year, the implementation and the policy after the reform and opening up of China's cultural industry rapid economic development coincide; and in recent years the proportion of the cultural industry in the national total production value in the stable. And according to the change trend of cultural industry production value proportion and proportion on the cultural industry output value analysis, understand the industry structure to our country's culture industry should be optimized, to vigorously develop the cultural industry at the same time, should pay attention to the adjustment of industrial structure, promote cultural industry better and faster development.

KEYWORDS

Cultural industry; Cultural structure; ARIMA model; Proportion; Empirical study.

INTRODUCTION

At present, China's per capita GDP exceeded 2000 dollars, city gasification rate reached 47%, is in the industrialization accelerating to in the late stage, from the international experience, the stage of culture industry driven collaborative economic growth strengthens day by day, and gradually become the main body of the modern industrial system. However, from the overall supply of culture industry, the total amount is obviously insufficient, the service level is low, competition ability is not strong; from the internal structure of cultural industry, the traditional service industry is developed, the modern service industry, the emerging service industry, logistics industry lags far behind; proportion from the Perspective of cultural industry output value accounted for GDP, in last few years development in the same state, the cultural industry output value proportion to be improved. In 2007 March, the State Council issued "several opinions on accelerating the development of service industry" put forward clearly, to 2010, and strive to make the service industry added value accounted for the proportion of GDP than in 2005 increased by 3 percentage points; the industrial structure based on service economy form conditional and medium-sized city[1]. In this context, to speed up the development of service industry becomes our country faces a major and a long-term strategic task, which has significant and profound realistic significance[2]. In particular, for many years China's economy has sustained rapid growth, however, the unreasonable industrial structure, the extensive mode of economic development, resources and environmental constraints exacerbate such problems still exist, these are must study seriously and need to be addressed effectively. So the research on the development of the cultural industry production value proportion is very necessary[3].

In the prediction of the development trend of the research on data and data problems on time series model is a better model, and compared before papers in cultural industry proportion predicted this aspect mostly choose a model, but a single model has limitations, so in the specific to the identified delay variable Auto-regressive non stable time series model based on the ARIMA model, and then, according to the empirical data in China, what kind of model is better is our research direction, but also to the analysis of the data before breakthrough[4]. At the same time, we will culture industry production value proportion and relative growth speed in the same picture visual comparison, further illustrates the current situation of cultural industry structure is not reasonable[5].

RESEARCH STATUS AND PROBLEMS

Since the reform and opening up the development of Chinese culture industry is divided into two periods. The first period: 1978~1991 year, the recovery of the high growth period. Its characteristics are: high growth rate of culture industry, increase the proportion of fast, but the structure improvement is not big, the cultural industry growth mainly rely on traditional service industries. The second period: 1992~2006 year period, structure improvement. Its characteristics are: the growth rate slowed down the cultural industry, the proportion of basic stability, structure improved significantly, emerging industries and high value-added industry a good momentum of development.

The characteristics of the development of China culture industry since the reform and opening up: one is the proportion of the culture industry in the national economy (current prices) increased greatly; the two is the rapid growth of cultural industries, the early growth rate showed sharp peaks and valleys, anaphase situation; three is the development of cultural industry absolute level increases rapidly, the gap with the world is narrow; four is the evolution of the internal structure of cultural industry, presents the obvious upgrading trend; five is the cultural industry has become the fastest growing industry labor; six is the culture industry's contribution to GDP growth rate rose in the twists and turns in the national economy, has become the second driving force; seven is the growth rate of labor productivity of modern service industry is obviously higher than that of the traditional service industry eight East Midwest; cultural industries accounted for convergence, but the level of development in a rapidly widening the gap.

In promoting cultural industry in the process of market reform, some of the details of the problem especially in the first regulation system perfect aspect to consider careful. Compared China and developed countries, in the cultural industry market-oriented reform, the reform of property rights, common manifestation in emphasize services of natural monopoly enterprises to attract private capital. The difference is reflected in the following two aspects: one is the developed countries in the monopoly service enterprises to break the natural, to emphasize the importance of competition and benefit principle, and to pay more attention to Chinese introduce competitive mechanism and the latter to concern. The implementation of the reform from the monopoly effect, ignore the benefits produced more serious consequences. The two is that the developed countries are often the first to formulate laws and regulations, and then on the basis of marketing reform. While promoting market-oriented reform of cultural industry China usually is "crossing the river by feeling the stones", not a set of mature management system, often there will be some contradictions and difficulties contrary to expectation, but also to make some policy is often due to a lack of laws and regulations to support and lead to inadequate.

Preparation on model construction
Certain assumptions

We make the following assumptions from the nature of the economic development trend in recent years as well as the data itself:

The 1 development trend of China's cultural industry output value proportion can be used ARMA (P, q) or ARIMA (P, D, q) model to fit, may the better, but can not explain the economic significance.

   The decomposition of theorem 2 can use time series: decomposition and Wold decomposition theorem or Cramer decomposition theorem of the calendar year of cultural industry output value proportion data uncertainty and random effects. And autocorrelation test in order to test the effect of extract of random uncertainty whether full effect.

   In the following analysis, modelling, we separately these two assumptions on the cultural industry output value proportion data, proposed in 1973 by Japanese statistician Akaike AIC criterion and the Schwartz in 1978 according to the Bayes theory put forward by SBC criterion to evaluate the obtained fitting and the merits of the model, using the AIC criterion and SBC criterion, can effectively make up for according to the autocorrelation and partial autocorrelation graph diagram to determine the order of the subjectivity, in all through the tests of the model makes the AIC or SBC function reaches the minimum model for the relative optimal model. At the same time, assisted with the rationality of model fitting effect diagram and the prediction results to evaluate the merits of the model.

Theoretical basis of model building

   In the statistical research, a set of random variables commonly used in chronological order to indicate the time sequence of a random event, called or.

   Since the proportion of output value of cultural industry every year since 1952 in line with the definition of time series prediction, in order to study discovered the law of development, China's cultural industry development present situation and the future development trend of the time series, we analyse from the perspective of the use of the method of time series analysis, statistical modelling. At the same time, the establishment of different model fitting and forecasting of time series have different effects, here we used two different statistical models of our modelling and analysis the data obtained were. On unilabiate time series analysis model has the following two kinds of commonly used:

   (a). has the following structure model called autoregressive integrated moving average model, called ARIMA (P, D, q) model

$$
\begin{cases}
\phi(B)\nabla^d x_t = \Theta(B)\varepsilon_t \\
\mathrm{E}(\varepsilon_t) = 0, Var(\varepsilon_t) = \sigma_\varepsilon^2, \mathrm{E}(\varepsilon_t \varepsilon_s) = 0, s \neq t \\
\mathrm{E}\, x_s \varepsilon_t = 0, \forall s < t
\end{cases}
$$

   Type in $\phi(B) = 1 - \phi_1 B - \cdots - \phi_p B^p$ as stationary reversible ARMA (P, q) autoregressive coefficient polynomial model; $\Theta(B) = 1 - \theta_1 B - \cdots - \theta_q B^q$ is ARMA (P, q) mobile smoothing coefficient polynomial model.

   (b) autoregressive (Auto-Regressive) model construction thought is the first information to identify the main decomposition method to extract the sequence by uncertainty factors:

$$x_t = T_t + S_t + \varepsilon_t$$

   T_t is the trend effect fitting, S_t fitting for the seasonal effect. While the extraction factor decomposition method for uncertainty information may not be sufficient, the need for further testing autocorrelation of residuals of the $\{\varepsilon_t\}$ sequence.

   If the inspection result shows no significant autocorrelation, the deterministic regression model to illustrate the extraction of information more fully, can stop the analysis. If the test results showed that residual autocorrelations significantly, this description information,

   Extracting enough, consider the establishment of the residual sequence fitting autoregressive model:

$$
\begin{cases}
x_t = T_t + S_t + \varepsilon_t \\
\varepsilon_t = \phi_1 \varepsilon_{t-1} + \cdots + \phi_p \varepsilon_{t-p} + a_t \\
E(a_t) = 0, Var(a_t) = \sigma^2, Cov(a_t, a_{t-i}) = 0, \forall i \geq 1
\end{cases}
$$

   The following two kinds of commonly used trend fitting model of the effect of practice:

   (c)autoregressive (Auto-Regressive) model, the power function as the independent variable of time t

$$T_t = \beta_0 + \beta_1 t + \cdots + \beta_k t^k + \varepsilon_t$$

   (d)autoregressive (Auto-Regressive) model, the independent variables to observe the value of $\{x_{t-1}, x_{t-2}, \cdots x_{t-k}\}$ for the history

$$T_t = \beta_0 + \beta_1 x_{t-1} + \cdots + \beta_k x_{t-k} + \varepsilon_t$$

Construction of ARIMA model
Sequence diagram

First of all, to our country since 1952, culture industry output value accounted for the proportion of gross domestic product to draw a sequence diagram, as shown in Figure 1.
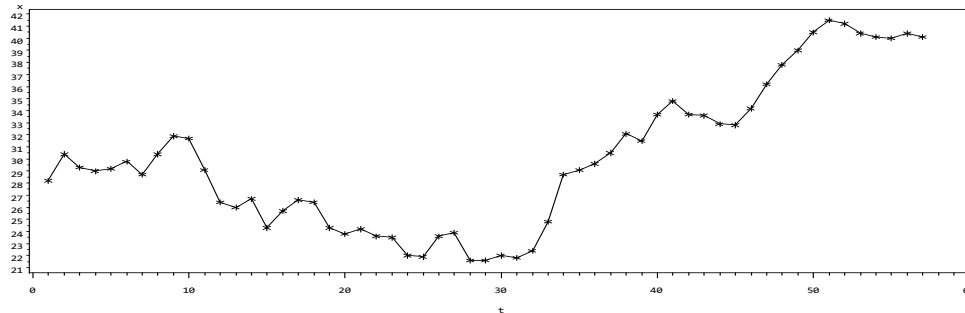
Figure 1 : Cultural industries accounted for the proportion of the total output value of the timing diagram

Differential operation and pure random inspection

By the sequence diagram can be seen, the series is non-stationary, therefore cannot use ARMA (P, q) model. And it can be seen that the sequence contains a significant trend curve, we can use the low order (2 or 3 order differential effects) to extract the curve trend, to realize the sequence trend stationary, in actual operation, the two order differential ideal, get the timing diagram of two order difference such as shown in Figure 2.
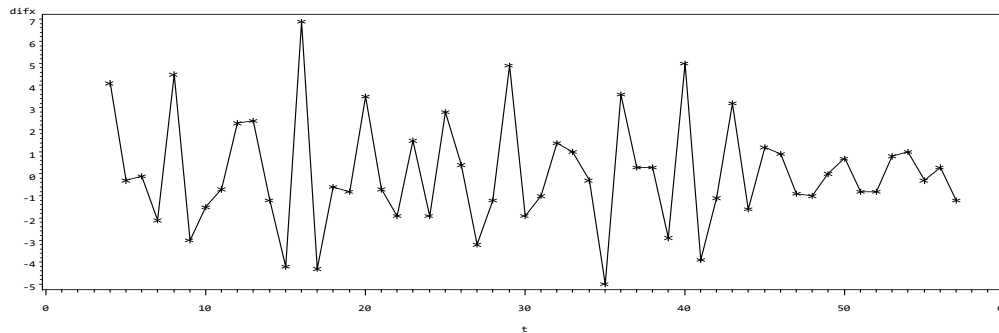
Figure 2 : Cultural industries accounted for the proportion of the total output value of the timing diagram

You can see the two order difference sequence in the near the mean relatively stable fluctuation, full extraction of the long-term trend contained in sequence, the differential sequence showed no deterministic trend. Sequence of smooth, we have to do the pure random testing on the sequence, the test results are shown in TABLE 1. We took a significant level of 0.05, due to the 6 order, 12 order delay of P value is less than 0.0075 and 0.0233 respectively, less than the level of significance, can reject the sequence as the original hypothesis of randomness, i.e. the time sequence is non-random, that data continue to study is meaningful.

TABLE 1 : White noise test results

To Lag	Chi-Square	DF	Pr> ChiSq	--------Autocorrelations---------------------					
6	17.52	6	0.0075 -0.242	-0.312	-0.002	0.257	-0.204	-0.163	
12	23.57	12	0.0233	0.115	0.196	0.025	-0.160	-0.074	0.073

Determine the difference model structure after

Since the correlation diagram of an observed sequence (Figure 3) and the partial autocorrelation graph (Figure 4) to determine the structural difference stationary after the model.

Since the correlation diagram in the vast majority of the autocorrelation coefficients are two times the standard deviation within, further illustrates the two order difference of culture industry output value accounted for the proportion of GDP series smoothly. The autocorrelation graph display in addition to delay self correlation coefficient of 2 order difference in the range of 2 times the standard, the autocorrelation coefficient of the rest of the fluctuations in 2 times the standard deviation within, according to the characteristic of self correlation coefficient can determine the sequence with short term correlation, also can think the sequence from the correlation coefficient of 2 order truncation.

Partial correlation diagram showing sequence has obvious tailing. The integrated autocorrelation and partial autocorrelation properties, for fitting the model order is MA (2) model, namely, the original time series ARIMA (0,2,2) model.
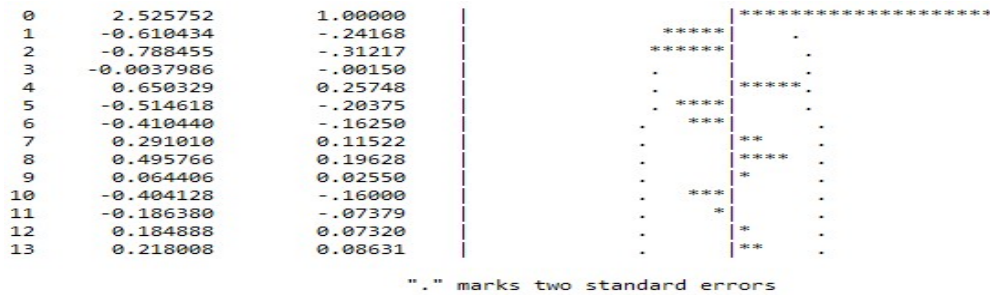
```
 0      2.525752      1.00000     |                    |********************|
 1     -0.610434      -.24168     |                *****|         .          |
 2     -0.788455      -.31217     |               ******|         .          |
 3     -0.0037986     -.00150     |                .    |         .          |
 4      0.650329      0.25748     |                .    |*****.              |
 5     -0.514618      -.20375     |             .  ****|         .          |
 6     -0.410440      -.16250     |                ***|          .          |
 7      0.291010      0.11522     |                .    |**       .          |
 8      0.495766      0.19628     |                .    |****     .          |
 9      0.064406      0.02550     |                .    |*        .          |
10     -0.404128      -.16000     |                . ***|         .          |
11     -0.186380      -.07379     |                .   *|         .          |
12      0.184888      0.07320     |                .    |*        .          |
13      0.218008      0.08631     |                .    |**       .          |

              "." marks two standard errors
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Figure 3 : Sequence autocorrelation graph

```
 1     -0.24168     |                   *****|         .         |
 2     -0.39357     |                *******|         .         |
 3     -0.25355     |                   *****|         .         |
 4      0.06182     |                .       |*        .         |
 5     -0.20470     |                . ****|         .         |
 6     -0.24709     |                *****|         .         |
 7     -0.17177     |                .  ***|         .         |
 8     -0.01632     |                .     |         .         |
 9      0.18027     |                .     |****.              |
10      0.05543     |                .     |*        .         |
11     -0.10839     |                .  **|         .         |
12     -0.11494     |                .  **|         .         |
13      0.04874     |                .     |*        .         |
```
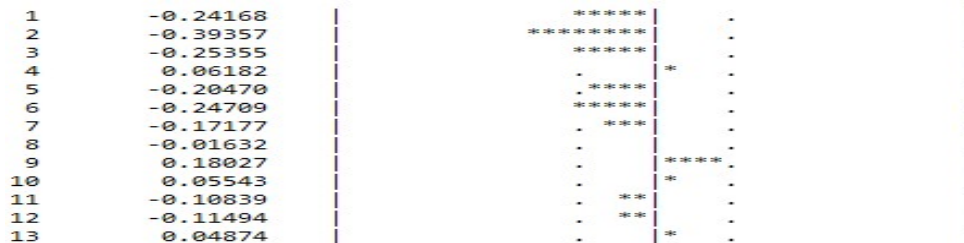
Figure 4 : Partial correlation diagram

Significant test

TABLE 2 : Conditional least squares estimation

Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	-0.01958	0.04663	-0.42	0.6763	0
MA1,1	0.48242	0.13320	3.62	0.0007	1
MA1,2	0.28748	0.13338	2.16	0.0358	2

Results show that the constant p value is 0.6765 larger than the significant level (0.5), that is, MU is not significant, other parameter p values were less than the level of significance (0.5), which were significantly. The removal of the constant term, again carries on the parameter estimation, as shown in TABLE 3.

Test of significant model parameters need to be estimated and the parameters determined after SAS operation, the obtained results are shown in TABLE 2.

Obviously, the two parameter p value is very small, two parameters were significantly. Significant test for the whole model.

TABLE 3 : Conditional least squares estimation

Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MA1,1	0.47993	0.13216	3.63	0.0006	1
MA1,2	0.28603	0.13234	2.16	0.0352	2

We can see that the delay of each order LB statistics for P values significantly greater than 0.05, so the fitting model significant vertical.

Specific form fitting model

The specific form fitting model for:

Factor 1: 1 - 0.47993 B**(1) - 0.28603 B**(2)

That is, $\nabla^2 x_t = \dfrac{\varepsilon_t}{1 - 0.47993B - 0.28603B^2}$

Or the equivalent in mind for: $x_t = 2.47993x_{t-1} - 1.67383x_{t-2} - 0.09213x_{t-3} + 0.28603x_{t-4} + \varepsilon_t$

Using the fitting model to predict the sequence of x_t, as shown in TABLE 4.

TABLE 4 : Predicted ARIMA model

Obs	Forecast	Std Error	95% Confidence	
58	40.0642	1.3885	37.3428	42.78
59	40.2244	2.5264	35.2728	45.1760
60	40.3846	3.5092	33.5066	47.262
61	40.5447	4.4649	31.7937	49.2958
62	40.7049	5.4273	30.0676	51.3423

We can see that in the next five years, the cultural industry output value accounted for the proportion of GDP does not have too big change.

RESULT AND DISSCUSS

After analyzing the each year for cultural industries accounted for the proportion of the development trend of GDP, we found that the cultural industries in the proportion increased rapidly in 1978 after the reform and opening up, more and more fast growth trend. The cultural industry is an important part of the national economy, its development level is an important sign to measure the level of economic and social development[6]. At present, China is in the middle stage of industrialization, the development of the social economy rapidly into the city, the market, the internationalization of the track. Accelerate the development of cultural industries, improve the proportion of the cultural industry in the three industry structure, is an important way to promote the adjustment of industrial structure, a fundamental change of the mode of economic growth; is the overall enhancement of comprehensive competitiveness, improve the overall quality of the national economy and the residents quality of life in an effective way; is the inevitable choice to promote economic health, coordination, sustainable development; is the effective guarantee to promote sound and rapid development of the national economy[7].

CONCLUSIONS

A period of time in the "Twelfth Five Year Plan" period and even longer, the important task of China's economic development is to change the development mode, adjust the economic structure. Therefore, to strengthen and improve the statistics of the service industry is the urgent need to change the development mode, adjust the economic structure[8]. According to the data analysis of actual situation in our country with the development of the logistics, financial, cultural industry focus on the development of the two major production service industry, promoting tourism catering entertainment traditional advantages of the service industry, foster the development of business and technology two emerging service industry[9].The development of cultural industry policy recommendations:

(1) to speed up the development of the financial services industry: see only accounts for about 15% of China's financial service industry from the above data, the development of space is still very great, we should vigorously the introduction of foreign well-known financial institutions, the positive development of the insurance industry, vigorously develop the capital market, and guide financial institutions to enterprises financing service.

(2) to speed up the development of modern logistics industry: logistics industry is the underlying connection development of all trades, to speed up its pace of development, we have to build a modern logistics service system layout is reasonable, strong competitiveness, build the logistics management of public information platform, the implementation of industrial interaction, with large logistics market openness, cultivate large logistics companies, to build a bridge for the coordinated development of various industries.

(3) to enhance the development of tourism, catering entertainment industry: the proportion of tourism catering services industry as a traditional industry in cultural industry has not greatly increased, which is the development of vulnerability.

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