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Analysis and Decision-making of Regional Economic Vitality and Its Influencing Factors

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ABSTRACT. *We first use linear regression model to study the relationship between regional economic vitality and related factors. However, the model fails the variance inflation factor (VIF) test, so we established a grey relational analysis (GRA) model. Next, we selected Zhengzhou as the research object then established a time series and autoregressive integrated moving average (ARIMA) model to predict the GDP of Zhengzhou after the "Twelfth Five-Year Plan" economic transformation and the long-term impact of economic policy transformation on Zhengzhou. Finally, we use the entropy method to determine the weight of indicators we collect and rank some cities. Based on those weight, previous analysis and models, we put forward development suggestions for Zhengzhou to enhance regional economic vitality.*

KEY WORDS: *VIF test, GRA, Time Series, ARIMA, Entropy Method*

I. Introduction

With the continuous development of the times, for a country, economic level is a very important measure of national comprehensive competitiveness. Similarly, for a region, regional economic vitality is also an important component for a region's comprehensive competitiveness. If a region can guarantee good economic vitality, after continuous development and innovation, all aspects of the industry will achieve a good development, and the level of science and technology and education will continue to improve, then the development of this region will be much better, and the people's quality of life will be guaranteed. Therefore, the economic vitality of a region is crucial for development.

In view of the importance of economic vitality, in order to improve economic vitality, managers in various regions have introduced some preferential policies to improve the economic vitality of their own regions. For example, reducing the approval steps for investment promotion, providing funding support for start-ups, and lowering the entry threshold for attracting talent. However, due to the different allocation of urban resources, these policies have different roles in different regions.

ISSN 2616-7433 Vol. 2, Issue 14: 50-73, DOI: 10.25236/FSST.2020.021409

How to grasp the key factors and effectively improve the vitality of the regional economy is a subject worthy of study.

The main body of the market is the main creator of social wealth and an important supporting force for economic development. The key to grasp the economy is to grasp the main players in the market, especially the cultivation of enterprise groups . One thing that developed countries and domestically developed regions have in common is that, based on a strong group of enterprises, large enterprises are gaining ground and small enterprises are overwhelming. Devising strategies to improve regional vitality become an important support to enhance strength and accelerate development.

Relationship between Regional Economic Vitality and Related Factors

Establishment of linear regression model

First we try the multiple linear regression equation[1]

$$y = k_0 + k_1 x_1 + k_2 x_2 + k_3 x_3 + \varepsilon$$

(1)

where y represents the regional GDP, x1, x2, and x3 represent the number of regional enterprises, the number of regional populations, and the output value of regional enterprise GDP respectively; k0 is a constant term, k1, k2, and k3 are explanatory variable coefficients, and ε is a random error.

Use Python 3.7 to fit and calculate the model (1), and the result is shown in table 1.

Table 1. Linear regression model calculation results

Coefficient	Value
k0	-2575.834389
k1	0.002432
k2	0.13155
k3	0.97327
Test statistics	**Value**
R-squared	1.000
Adjusted R-squared	0.999
F-statistic	1.19E+04
Prob (F-statistic)	5.49E-27

ISSN 2616-7433 Vol. 2, Issue 14: 50-73, DOI: 10.25236/FSST.2020.021409

Log-Likelihood	-134.26
AIC	276.5
BIC	280.5

On the surface, the model seems to be more appropriate (R2=0.999). However, the model does not consider the possibility of multicollinearity in the independent variables. If the independent variables have multicollinearity, then the model will appear ill and will not be convincing. Therefore, we need to test the multicollinearity of the model.

Model testing for linear regression

Regarding the multicollinearity test, we can use the Variance Inflation Factor (VIF) to identify. If the VIF is greater than 10, it means that there is multicollinearity between the variables; if the VIF is greater than 100, there is serious multicollinearity between the independent variables.

We need to construct a linear regression model of each independent variable and other independent variables. Assuming that there are p variables in the data set, the linear combination of the first independent variable and the remaining independent variables can be expressed as

$$x_1 = c_0 + a_2 x_2 + \ldots + a_p x_p + \varepsilon$$

(2)

According to the decision coefficient R2 obtained in the model (1), we can calculate the variance expansion factor VIF of each variable according to the following formula.

$$VIF = \frac{1}{1 - R^2}$$

(3)

The statsmodels module in Python provides a function to calculate the VIF of the variance expansion silver. Use it to calculate the VIF value of the two variables as shown in table 2.

Table 2. VIF test results

features	VIF factor
regional_GDP	9013.732327

ISSN 2616-7433 Vol. 2, Issue 14: 50-73, DOI: 10.25236/FSST.2020.021409

number_of enterprises	284.463139
population	330.305112
regional_ enterprises_GDP	8639.571706

From table 2 we can see that the VIF values of all variables far exceed 100, indicating that the independent variables have extremely serious multicollinearity. Therefore, the model (1) we established is invalid and we need to consider rebuilding the model.

Establish grey relational analysis model

By analyzing the problem, we found that our goal is to find the correlation between the dependent variable (regional GDP) and several influencing factors. For this goal, we may wish to consider the use of grey relational analysis model (GRA). It can analyze the degree of influence of various factors on the results, and can also solve the comprehensive evaluation problems that change with time. Its core is to establish a parent sequence that changes with time according to certain rules, and take the change of each evaluation object with time as a sub-sequence. The degree of correlation between each sub-sequence and the parent sequence is determined according to the correlation.

The establishment of GRA model can follow the steps below:

Determine the reference sequence (mother sequence) Y=Y(k) | k=1,2,..n and the comparison sequence (subsequence) Xi=Xi(k) | k=1,2,..m.

Dimensionless processing of variables

$$x^* = \frac{x - x_{mean}}{x_{\max} - x_{\min}}$$

(4)

where x* is the processed data, x is the original data, xmean is the sample mean, xmax is the maximum value of the sample, and xmin is the minimum value of the sample.

Calculate relational coefficient

$$\xi_i(k) = \frac{i_{\min} k_{\min} \left| y(k) - x_i(k) \right| + \rho i_{\max} k_{\max} \left| y(k) - x_i(k) \right|}{\left| y(k) - x_i(k) \right| + \rho i_{\max} k_{\max} \left| y(k) - x_i(k) \right|}$$

(5)

Mark $\Delta_i k = \left| y(k) - x_i(k) \right|$ then the above formula can be changed to

ISSN 2616-7433 Vol. 2, Issue 14: 50-73, DOI: 10.25236/FSST.2020.021409

$$\xi_i(k) = \frac{i_{\min} k_{\min} \Delta_i(k) + \rho i_{\max} k_{\max} \Delta_i(k)}{\Delta_i(k) + \rho i_{\max} k_{\max} \Delta_i(k)}$$

(6)

Among them, $\rho \in (0,\infty)$ becomes the resolution coefficient. The smaller the ρ, the greater the resolution. Generally, the value interval of ρ is (0,1), and the specific value depends on the situation. When $\rho \leq 0.5463$, the resolution is the best, usually $\rho=0.5$.

Calculate the degree of relevance

Because the correlation coefficient is the value of the correlation between the comparison series and the reference series at each time (that is, each point in the curve), it has more than one number, and the information is too scattered for overall comparison. Therefore, it is necessary to concentrate the correlation coefficients at each moment (that is, each point in the curve) into one value, that is, to find the average value, as a quantitative expression of the degree of correlation between the comparison series and the reference series, the correlation degree ri formula is as follows:

$$r_i = \frac{1}{n} \sum_{k=1}^{n} \xi_i(k), k = 1,2,...n$$

(7)

We use Python to analyze the GRA model according to the above four steps and formulas (4)~(7), and obtain the correlation between the four variables(regional GDP，number of enterprises，population，regional enterprises GDP).These correlations are visualized using heat maps, and the results shown in figure 1 are obtained.

ISSN 2616-7433 Vol. 2, Issue 14: 50-73, DOI: 10.25236/FSST.2020.021409

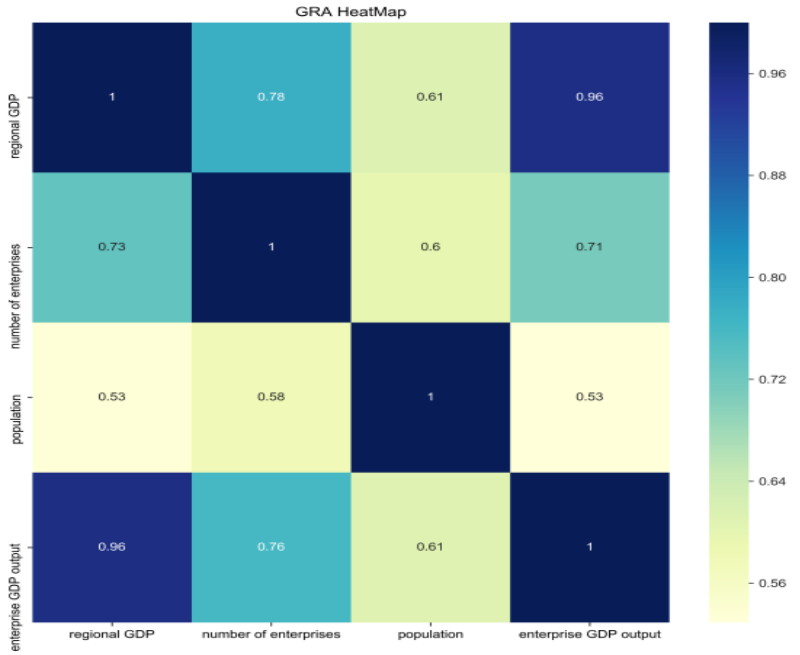

Fig 1. Correlation matrix heat map of each variable

From figure 1, we can see that the correlation between regional GDP and enterprise GDP output value is the highest (0.96). The correlation between regional GDP and the number of enterprises is also relatively high (0.73), while the relationship between regional economic vitality and population is generally (0.53).

Time Series Analysis and Forecasting for Zhengzhou's GDP

Preparation of the model

We collected data on the regional GDP (gross domestic product) of Zhengzhou for 35 years from 1981 to 2015. The twelfth five-year planning period of Zhengzhou's national economic and social development is from 2011 to 2015, and this period is the stage of economic policy transition. We establish a time series model to make short-term predictions for these five years and compare the actual situation to prove the correctness of the model, and then make long-term predictions for the Zhengzhou area.

ISSN 2616-7433 Vol. 2, Issue 14: 50-73, DOI: 10.25236/FSST.2020.021409

Test critical values	t-Statistic

Analysis of Zhengzhou GDP Time Series

In the ARMA model, a time series is generated in a random process. The random nature is unchanged in these years. On the graph, all sample points randomly float up and down on a specific horizontal line. If the time series is not stable, then we need to do differential smoothing and zero mean processing in advance.

Stationary test

First, we use Python to draw the GDP time series figure 2. From figure 2, we can consider that there is an upward trend. Further ADF unit root test is performed. As can be seen from table 3 (ADF t-Statistic value is 6.523907), the test failed, so the original GDP series is non-stationary.

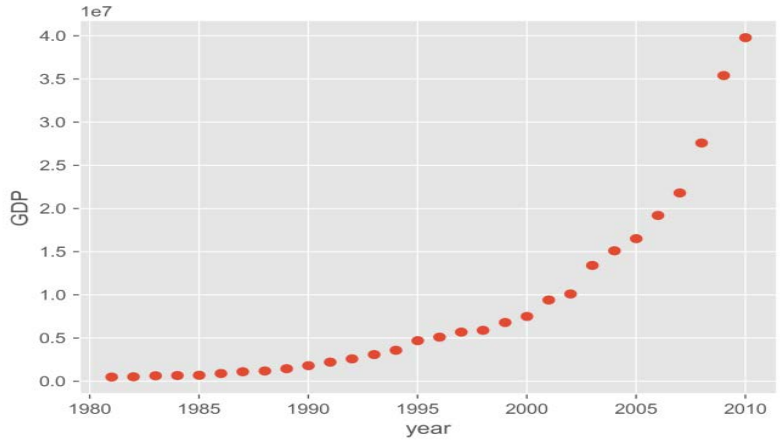

Fig 2. Timing chart of GDP

Table 3. ADF test of GDP

ISSN 2616-7433 Vol. 2, Issue 14: 50-73, DOI: 10.25236/FSST.2020.021409

1% level	-4.309824
5% level	-3.574244
10% level	-3.221728

In order to analyze the data sequence, we use the logarithmic method and the difference method to smooth the sequence.

Smoothing Process

First logarithmically process the Zhengzhou GDP data, draw the time series figure 3 and perform the stability verification table 4 (ADF t-Statistic value is -7.259967):

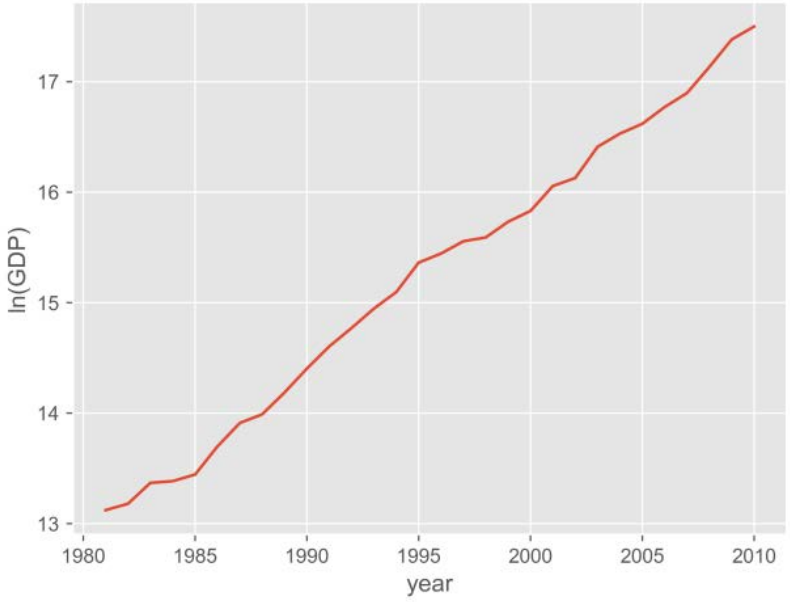

Fig 3. the timing chart of ln(GDP)

Table 4. timing ADF test of ln(GDP)

Test critical values	t-Statistic

ISSN 2616-7433 Vol. 2, Issue 14: 50-73, DOI: 10.25236/FSST.2020.021409

1% level	-2.653401
5% level	-1.953858
10% level	-1.609571

Obviously, the processed logarithmic series still has a clear upward trend. So we continue to use the second-order difference to extract the influence of the curve trend. We take the logarithmic data and make a second-order difference and verify its stability and draw figure 4 and get table 5 (ADF t-Statistic value is -3.485841).

DY is the first-order difference value and DZ is the second-order difference value of ln(GDP).

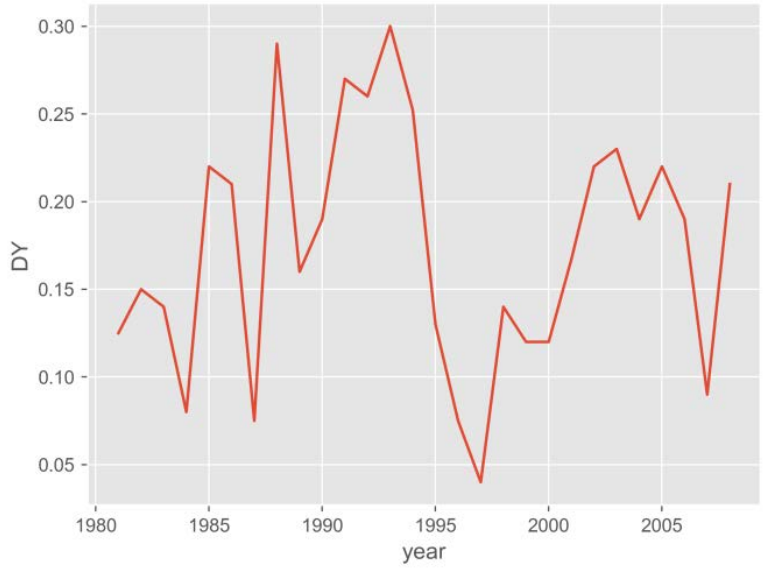

Fig 4. First order differential timing figure of ln(GDP)

Table 5. First-order differential ADF test of ln(GDP)

Test critical values	t-Statistic
1% level	-4.323979
5% level	-3.580623
10% level	-3.225334

ISSN 2616-7433 Vol. 2, Issue 14: 50-73, DOI: 10.25236/FSST.2020.021409

It can be seen from the figure and table above that the first-order difference is still non-stationary. The test results in table 5 show that the T statistics are less than 1%, 5%, and 10%, and the p value is greater than 0.05, so we clearly determine the difference after the sequence is still non-stationary, and the difference is performed again in figure 5. The ADF detection result is shown in table 6 (ADF t-Statistic value is -7.259967).

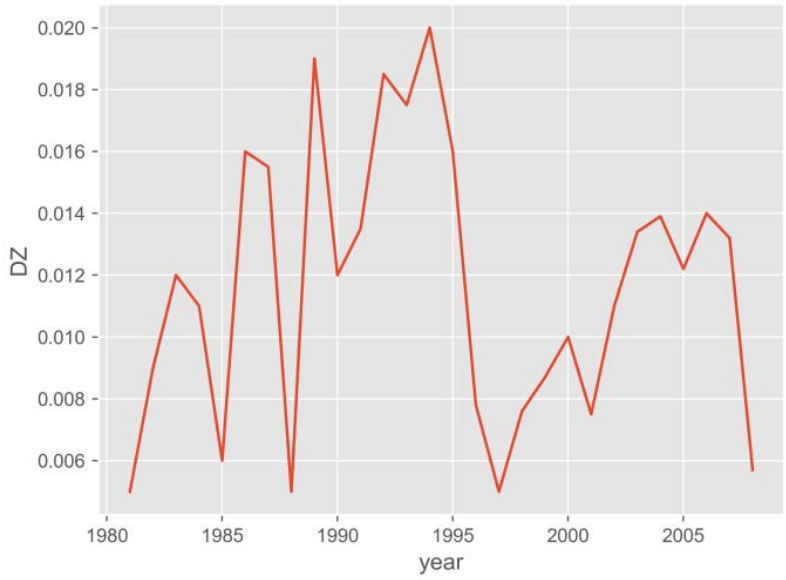

Fig 5. Second-order differential timing diagram of ln(GDP)

Table 6. Second-order difference ADF test of ln(GDP)

Test critical values	t-Statistic
1% level	-2.653401
5% level	-1.953858
10% level	-1.609571

From the timing figure 5, the sequence can basically be considered to be stable. Further unit root test is performed. The test results from table 6 prove that the second-order difference sequence is only if the null hypothesis is rejected at the significance level of 1%. Accepting the balance without unit root, the p value is much less than 0.05, so it is determined that the sequence is stationary after the

ISSN 2616-7433 Vol. 2, Issue 14: 50-73, DOI: 10.25236/FSST.2020.021409

second order difference. Therefore, it is determined that the sequence is a second-order single integer sequence. ln(GDP)~I(2).

It is assumed that the random error terms are statistically independent at different times and conform to a normal distribution. We first determine the order and estimate the parameters once to ensure the optimality of the model.

Model Identification

The identification and order of the model ARMA(p,q)[2] can be obtained by observing the autocorrelation and partial autocorrelation functions of the samples. The coefficients of autocorrelation and partial autocorrelation for ln(GDP) after second-order difference are shown in table 7.

Table 7. Autocorrelation result after second-order difference for ln(GDP)

AC	PAC	Q-stat
1 -0.342	-0.342	3.6358
2 -0.118	-0.267	4.0889
3 -0.272	0.158	6.5794
4 -0.263	-0.158	9.0082
5 -0.014	-0.122	0.0204
6 -0.014	-0.211	9.0276
7 -0.029	-0.063	9.0619
8 0.034	0.048	9.1102
9 -0.141	-0.211	9.9894
10 0.222	0.071	12.294
11 -0.053	-0.028	12.43
12 0.029	0.129	12.476

It can be obtained from the table that the autocorrelation coefficient of the second-order difference post-sequence shows a decreasing trend after the lag period of four and approaches zero, realizing the tailing; in the way of partial autocorrelation analysis, the partial autocorrelation coefficient of lag period two It also has tailing, so the order p can be determined by the number of partial autocorrelation coefficients that are significantly non-zero. The observation graph

ISSN 2616-7433 Vol. 2, Issue 14: 50-73, DOI: 10.25236/FSST.2020.021409

can be 1 or 2. In order to test whether the selected model is suitable, the AIC rule is used to identify the optimal model.

Table 8. AIC rule model identification order table

p	q	AIC	SC	Model Stationary Test
1	0	-2.79	-2.74	F(Failed)
2	0	-2.7	-2.61	F
3	0	-2.67	-2.53	F
1	1	-2.89	-2.8	P(Pass)
1	2	-2.84	-2.7	F
1	3	-2.87	-2.68	P
2	1	-2.73	-2.59	F
2	2	-2.88	-2.69	F
2	3	-2.78	-2.54	F
3	1	-2.67	-2.48	F
3	2	-2.72	-2.48	F
0	1	-2.83	-2.78	F
0	2	-2.87	-2.78	F
0	3	-2.89	-2.76	F

As can be seen from table 8, in all ARMA(p,q), ARMA(1,1) is the most optimal, ARMA(1,3) secondly. We need to make parameters estimations respectively for ARIMA(1,2,1) and ARIMA(1,2,3). The estimations model is shown in table 9 and table 10.

Table 9. ARIMA(1,2,1) parameters estimation

Variable	Coefficient	Std.Error	t-Statistic
AR(1)	0.340936	0.181569	1.877724
MA(1)	-0.950941	0.042684	-22.27872
Test statistics		Value	

ISSN 2616-7433 Vol. 2, Issue 14: 50-73, DOI: 10.25236/FSST.2020.021409

R-squared	0.28308
Adjusted R-squared	0.254403
S.E. of regression	0.068742
Sum squared resid	0.118135
Log likelihood	35.01745
Durbin-Watson	1.974907
Mean dependent var	0.002958
S.D. dependent var	0.07961
Akalke info criterion	-2.445737
Schwarz criterion	-2.349749
Hannan-Quinn criter.	-2.417195

Table 10. ARIMA(1,2,3) parameters estimation

Variable	Coefficient	Std.Error	t-Statistic
AR(1)	-0.306747	0.762965	-0.402046
MA(1)	-0.267222	0.726487	-0.367827
MA(2)	-0.624371	0.538469	-1.15953
MA(3)	-0.10355	0.457252	-0.226462
Test statistics		Value	
R-squared		0.315503	
Adjusted R-squared		0.22622	
S.E. of regression		0.070029	
Sum squared resid		0.112793	
Log likelihood		35.64222	
Durbin-Watson		2.043809	
Mean dependent var		0.002958	
S.D. dependent var		0.07961	
Akalke info criterion		-2.343868	
Schwarz criterion		-2.151892	

ISSN 2616-7433 Vol. 2, Issue 14: 50-73, DOI: 10.25236/FSST.2020.021409

Hannan-Quinn criter.	-2.286784

As can be seen in table 9 and 10, after adjustment, ARIMA(1,2,1) of Adjusted R2 value ratio to ARIMA(1,2,3) of Adjusted R2 value is large, and ARIMA(1,2,1) AIC value and SC value is small respectively with comparison to ARIMA(1,2,3), so ARIMA(1,2,1) is more suitable.

Model Checking

ARIMA(1,2,1) can be tested and selected for analysis and prediction of Zhengzhou GDP. In order to better compare the pros and cons of the model, ARIMA(1,2,3) is also tested. The residual sequence test table of ARIMA(1,2,1) and ARIMA(1,2,3) is shown in table 11 and table 12 respectively.

Table 11. ARIMA(1,2,1) residual table

AC	PAC	Q-stat
1 -0.342	-0.011	0.0038
2 0.028	-0.028	0.0288
3 0.192	0.195	1.2568
4 -0.293	-0.3	4.1837
5 -0.144	-0.17	4.9248
6 -0.164	-0.207	5.9284
7 -0.197	-0.094	7.4497

Table 12. ARIMA(1,2,3) residual table

AC	PAC	Q-stat
1 0.037	-0.037	0.0438
2 0.011	-0.11	0.4288
3 0.165	0.195	1.3268
4 0.293	-0.3	3.5537

ISSN 2616-7433 Vol. 2, Issue 14: 50-73, DOI: 10.25236/FSST.2020.021409

5 0.144	-0.17	4.4148
6 0.164	-0.207	5.2984
7 0.197	-0.094	7.3997

The results in table 12 show that the Q values of the test statistics are less than the test values of the chi-square distribution of the corresponding degrees of freedom, and for Prob column, the probability of the column readout rejecting the original hypothesis is large, all are greater than 0.05, so the residual sequence is a white noise sequence, that is ARIMA(1,2,1) passed the test. And the results in table 11 show that the statistic Q values are greater than the test value of chi-square distribution of the corresponding degrees of freedom. The probability that the column Prob readout rejects the original hypothesis is very small, and does not exist less than 0.05, so the residual sequence is a non-white noise sequence, that is, ARIMA(1,2,3) model test failed, so finally we choose ARIMA(1,2,1) to analyze and predict the Zhengzhou GDP. Therefore, from table 9 ARIMA(1,2,1), it can be known from the model parameter estimation, ARIMA(1,2,1) is

$$\Delta^2 \ln(GDP)_t = 0.340936\Delta^2{}_{t-1} + \mu_t - 0.98094\mu_{t-1}$$

(8)

the model obtained by removing the difference form is:

$$\ln(GDP)_t = 3.146721\ln(GDP)_{t-1} - 2.523482\ln(GDP)_{t-2} + 0.340936\ln(GDP)_{t-3} + \mu_t - 0.98094\mu_{t-1}$$

(9)

by exponentializing the logarithmic form, the final model is:

$$GDP = e^{3.146721\ln(GDP)_{t-1} - 2.523482\ln(GDP)_{t-2} + 0.340936\ln(GDP)_{t-3} + \mu_t - 0.980491\mu_{t-1}}$$

(10)

Make a short-term and long-term forecast and analysis of Zhengzhou's economic vitality

The GDP of Zhengzhou from 2011 to 2012 can be calculated, as shown in table 13.

Table 13. Forecast and Actual GDP of Zhengzhou

years	Forecast amount **(ten thousand yuan)**	Actual **value (ten thousand yuan)**	Relativ e error

ISSN 2616-7433 Vol. 2, Issue 14: 50-73, DOI: 10.25236/FSST.2020.021409

2011	48603292	49798455	-2.42%
2012	56774376	55476233	2.34%

The MAE and MAPE values of the prediction model are small, indicating that the prediction model is good. By verifying the data from 2011 to 2012, the relative error of the prediction result is less than 3%, indicating that the prediction result is good. Therefore, a short-term forecast for the "Twelfth Five-Year" reform is shown in table 14.

Table 14. Forecast and Actual GDP of Zhengzhou(during "Twelfth Five-Year" reform)

years	2013	2014	2015	2016	2017
Forecast GDP (ten thousand yuan)	61023856	66831123	73902308	81781516	89649668
Actual GDP (ten thousand yuan)	62067128	67939212	73153712	79943201	91302913

So we can make a long-term forecast after the "12th Five-Year Plan": Zhengzhou City's GDP will continue to grow for a period of time, and it is conservatively expected that Zhengzhou's GDP will reach 1.25 trillion yuan in 2020 and more than 3 trillion yuan in 2035.

Determination of Indexes Weight and Cities' Economic Vitality Rankings

Preparation and establishment of economic vitality evaluation model based on entropy method

Principle of entropy method

Use the information entropy[3] value of a specified indicator to judge the validity and value of the indicator. It can deeply reflect the utility value of the information entropy value of the indicator. The analysis method has high credibility, so we use the entropy method for comprehensive evaluation of regional economic vitality.

Determination of information entropy and weight in comprehensive evaluation

Adding the need to evaluate the economic vitality of an area for m years, the evaluation index system has n evaluation indicators, which are composed of m

ISSN 2616-7433 Vol. 2, Issue 14: 50-73, DOI: 10.25236/FSST.2020.021409

samples and use n indicators for comprehensive evaluation. The following mathematical model can be established:

The sample (evaluation object) set is:

$$U = \{u_1, u_2, u_3, ..., u_m\}, i = 1,2,3,...,m$$

(11)

The data set[4] of each sample (evaluation object) corresponding to n evaluation indicators is:

$$U_j = \{u_{i1}, u_{i2}, ..., u_{in}\}, j = 1,2,3,...,n$$

(12)

Then get the initial data matrix of the evaluation system{xij}m*n. Among them xij represents the value of the i-th sample and the j-th evaluation index, and the economic vitality evaluation index system is shown in table 15.

Table 15. Economic vitality evaluation index system

main target	Subsystem	First-level indicators	Secondary indicators
Evaluation of regional economic vitality	Economic and social system	Comprehensive economic and social development level	Net increase in number of businesses
			Enterprise size
			Regional GDP per capita
	Environmental system	Pollution reduction	Per capita wastewater discharge (reverse standard)
		Ecological environment quality	Domestic waste treatment rate
	Resource	Resource recovery	Public green space per capita

ISSN 2616-7433 Vol. 2, Issue 14: 50-73, DOI: 10.25236/FSST.2020.021409

	system	and reuse	Nature reserve area as a percentage of land area
			Urban water penetration rate

Data standardization

Some indicators are forward indicators, some indicators are reverse indicators, and the dimensions of each indicator are different. Therefore, we should forward these indicators before conducting regional economic vitality assessment. At the same time, in order to eliminate the impact of dimensions, we must conduct dimensionless processing on all indicators.

(a) Index forward processing method

According to the indicators we choose for the evaluation of regional economic vitality, these indicators cannot be set to zero, so we forward-process the reverse indicators, the formula is as follows:

$$x^* = \frac{1}{x'}$$

(13)

x' is the original value of the inverse indicator; x* is the forward indicator of the indicator. For the treatment of moderate indicators, we can use the following formula for forward processing:

$$x^* = \sqrt{\left(x' - x^0\right)^2}$$

(14)

x0 is the moderate value of the index, and other indexes have the same meaning as above. Through the above positive processing, all of our indicators reflect the larger the value of the indicator, reflecting the law of the higher level of regional economic development of the indicator.

(b) Dimensionless processing of indicators

Through the forward processing of the regional economic development evaluation indicators, the degree of discreteness of each indicator has changed greatly. At the same time, due to the different dimensions between the indicators, that is, the value of each indicator lacks variability. In order to make the values of each index comparable, all the evaluation indexes are dimensionlessly processed here. In view of the small number of regions we evaluated, the use of standardized

ISSN 2616-7433 Vol. 2, Issue 14: 50-73, DOI: 10.25236/FSST.2020.021409

processing related parameters while dimensionless also obliterated the differences in the degree of variation between the various indicators, so it is not suitable for the comprehensive evaluation of multiple indicators. Therefore, we choose the min-max normalization method for dimensionless processing of the index.

$$x = \frac{x' - \min(x')}{\max(x') - \min(x')}$$

(15)

x is the normalized index of the index; max(x') and min(x') are the maximum and minimum values of each evaluation individual in the index area, and other meanings are the same as above.

Find the extreme value of the evaluation index from the initial data matrix X as the ideal value; you can also obtain the ideal value of the evaluation index from other channels based on the horizontal comparison.

For positive indicators

$$x_{ij}' = x_{ij} / x_j^{\max}$$

(16)

For negative indicators

$$x_{ij}' = x_{j\min}^{*} / x_{ij}$$

(17)

Define its standardized value

$$y_{ij} = x_{ij}' / \sum_{i=1}^{m} x_{im}', \left(0 \le y_{ij} \le 1\right)$$

(18)

The resulting data is a normalized matrix Y={yij}m*n.

Calculating Index Information Entropy and Information Utility

The information entropy of the j-th index is:

$$e_j = -K \sum_{i=1}^{m} y_{ij} \ln y_{ij}$$

(19)

Among them, for a system with disordered information, the degree of ordering is zero, and its entropy value is the largest. e=1, When m samples are completely out of order yij=1/m at this time, K=1/ln m.

ISSN 2616-7433 Vol. 2, Issue 14: 50-73, DOI: 10.25236/FSST.2020.021409

The information utility value of the j-th index is the difference between the information entropy and 1: dj = 1 - ej

Evaluate index weight

The entropy method is used to estimate the weight of each index. Its essence is calculated by using the value coefficient of the index information. The higher the value coefficient, the more important it is to the evaluation. Finally, the weight of the j-th index can be obtained:

$$W_j = d_j / \sum_{j=1}^{n} d_j$$

(20)

Comprehensive assessment method of regional economic vitality

When constructing the index system model, we proposed some indicators that can comprehensively reflect the economic vitality of many regions, that is, the three major systems of economic society, resources, and the environment. The particularity of economic vitality indicators is reflected in many economic development and structural indicators. There is a strong correlation between them, so our team evaluates the following three aspects. For the i-th sample:

$$F_{ki} = \sum_{j=1}^{P} W_j x'_{ij}$$

(21)

In the formula, Fki is the corresponding index of the i-th sample, and k=1,2,3,4 respectively represents the four subsystem indexes of the i-th sample. Wj is the weight of the j-th index; xij' is the proximity of the j-th indicator in the i-th sample; p is the number of indicators included in each index.

Regional economic vitality coefficient

This is an indicator of the status and level of the regional economy[5]. Continuously observing the index changes in the evaluation area over a period of time can grasp the direction of regional economic vitality.

$$S_i = \sum_{j=1}^{n} W_j x'_{ij}$$

(22)

ISSN 2616-7433 Vol. 2, Issue 14: 50-73, DOI: 10.25236/FSST.2020.021409

In the formula, n is the number of indexes included in the economic development coefficient of regional training. In this index system, n=3, which is the regional economic index of the nth sample.

Affected by the standardization of indicators, the value of the regional economic vitality index Si ranges from 0 to 1. The value of Si comprehensively reflects the level of regional economic vitality. The larger Si is, the higher the regional economic vitality; the closer the sample index value is to the target value, the closer the score according to the indicator value to 1, the higher the ranking. When all the index values of the samples are relatively close to the corresponding target values, the sample's economic vitality development coefficient is at a relatively high level.

Suggestions for Improvement

Because the consistency matrix analysis method can not only reduce the workload of re-constructing the judgment matrix, but also can ensure the consistency of the matrix, it is considered that the compatibility matrix analysis method in the subjective weighting method and the entropy in the weighting method can be overcome The value method is combined to determine the weight. Such a model can better reflect the ability of sustainable development, and then better reflect regional economic vitality.

Regional economic vitality coefficient

Table 16. Regional economic vitality ranking

region	Regional economic vitality index	City Ranking
Shanghai	0.404	3
Shenzhen	0.437	1
Beijing	0.405	2
Guangzhou	0.400	4
Chongqing	0.356	12
Chengdu	0.389	5
Nanjing	0.376	6
Hangzhou	0.363	9
Suzhou	0.369	8
Tianjin	0.360	10

ISSN 2616-7433 Vol. 2, Issue 14: 50-73, DOI: 10.25236/FSST.2020.021409

Qingdao	0.357	11
Dongguan	0.329	16
Zhengzhou	0.328	17
Wuhan	0.375	7
Xian	0.316	18
Ningbo	0.346	14
Changsha	0.352	13
Shenyang	0.338	15
Kunming	0.306	19

Conclusions and Suggestions

The regional vitality of a region is affected by several factors. From the analysis of the above issues, the following suggestions are made for the development of Zhengzhou:

From the perspective of comprehensive economic and social development

The Zhengzhou government can formulate policies to retain local talents and attract external talents to increase the number of talents in Zhengzhou. With talents, a region's economy does not need worry about its rapid development and improvement.

In order to effectively introduce outstanding talents for a long time, it is necessary to build a platform for talents to realize their ideals. The first is to establish an effective incentive mechanism to enhance the enthusiasm of existing talents. An effective incentive mechanism can attract and retain outstanding talents, develop the potential of employees, create a healthy competitive environment, and introduce incentives that are conducive to releasing the enthusiasm and creativity of introducing talents. Through material rewards, the value of talents can be reflected, while non-material rewards can be emphasized and improve treatment and experience a sense of identity.

The second is to improve services and constantly optimize the environment for talent service. We will conscientiously implement various talent service guarantees to provide a quality environment for all types of talents to live and work. Unblock the green channel for high-level talent officers to start business, and provide comprehensive and efficient services for talents.

The government can implement some incentive support policies for enterprises of all sizes. For large enterprises, measures should be taken to attract foreign investment, and based on local development, strengthen economic exchanges and

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cooperation between Zhengzhou and abroad, and even overseas. For small and medium-sized enterprises, financial support can be increased to encourage small and medium-sized enterprises to become bigger and stronger and enter the world's top 500.

To implement and improve preferential tax policies, the government must first attach great importance to providing organizational guarantees to promote the implementation of preferential tax policies. It is necessary to further strengthen the promotion and guidance of tax preferential policies for taxpayers, according to the characteristics of taxpayers, subdivide the types of taxpayers, connect industrial policies, increase support for the development of small and micro enterprises, support R&D investment and independent innovation, and support the development of high-tech enterprises encourage the promotion of preferential tax policies such as entrepreneurship and employment, while highlighting the interpretation of policies and the promotion of tax processing procedures to help taxpayers understand and fully enjoy the relevant preferential tax policies.

Enterprises should also actively implement technological innovation strategies and continuously enhance their competitiveness. At the same time, relevant incentive policies must be adopted to attract and retain outstanding talents. You can refer to the measures proposed by the government above.

From the perspective of environment

According to wastewater discharge and domestic garbage treatment rate, the government should increase local environmental protection. First of all, the government must increase the publicity of environmental protection-related knowledge, increase people's awareness of environmental protection, let people start from small things, do not arbitrarily discharge domestic sewage and randomly discard domestic garbage, and do reasonable treatment of domestic sewage and separate waste. Go to the trash can, make sure the resources are used reasonably and recycle.

The government should also increase the supervision of factories and the formulation of some rules and regulations, and strictly control the discharge of factory wastewater. It must not allow wastewater to pollute people's living environment, pollute people's domestic water, and then endanger human health.

The people themselves must also be aware of environmental protection. They must know that environmental protection is not the responsibility of one person. It is the unshirkable responsibility of each of us. Each of us must take the initiative to take responsibility for protecting the environment and jointly maintain our beautiful home.

The government should lead the people, focus on solving outstanding ecological and environmental issues, and take the obvious improvement of air quality as a rigid requirement to resolutely win the defense of the blue sky; implement the co-governance of the“three waters” of water environment, water resources, and

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water ecology, and strive to fight clear water Defence war; focusing on agricultural land and key industries and key enterprise land, solidly promote the defense of pure land.

It is necessary to promote the formation of green development methods and green lifestyles, turn the basis of development to innovation, accelerate the establishment of a green low-carbon recycling industrial system, and vigorously carry out actions for all people on ecological and environmental protection. It is necessary to establish and improve a long-term mechanism for the construction of ecological civilization, speed up the construction of an ecological civilization system, speed up the improvement of the ecological environment risk prevention system, and accelerate the reform of the mechanism and mechanism of ecological civilization.

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