The impact of the development strategy of the Maritime Silk Road on imports and exports of China-ASEAN industrial Raw Material

Abstract

This paper mainly studies the development strategy of the Maritime Silk Road on the impact of China-ASEAN Industrial raw materials import and export trade, and we establish a reasonable model for different problems: trade gravity model, analytic hierarchy process, gray forecasting model, linear fitting and other methods. 总体概括文章，所用模型

For the problem one: Firstly, we analyzed the historical background of the Silk Road in twenty-first Century, and used the trade gravity model to study the impact of China and Southeast Asian countries to enhance the economic output, investment, etc.We have collected data on the trade between China and ASEAN in the last ten years, as well as ASEAN countries' foreign trade data, and used MATLAB to draw the corresponding curve by data fitting method, obtained the conclusion that in the first ten years of the twenty-first Century Maritime Silk Road, China and Southeast Asian countries had a qualitative leap in the economic exchanges. 思路、

Next we took advantage of the trade gravity model which proposed by Tinbergen and Poyhonen. The empirical results show that the rapid economic growth, ASEAN' investment in China continues to increase, China as a supplier of ASEAN products market position in the rise, in twenty-first Century the implementation of the maritime silk strategy will continue to develop the trade market of China and ASEAN.

For the problem two: In this paper, we have done more in-depth research on the impact of the development strategy of the Maritime Silk Road on imports and exports of China-ASEAN industrial Raw Material. The definition of the influence is that if not proposed of the Maritime Silk Road in 2013 and proposed in 2013 China-ASEAN Industrial raw materials import and export trade development to do comparison, then explore the related indicators of industrial raw materials in the 21st Century Maritime Silk Road strategy of industrial raw materials (mineral fuels, lubricants and related materials, textile products, rubber products, mining products and products and miscellaneous products)the three indexes of the import and export of weight.

Through the relevant literature, we find some data, because the data is more and more complex, so we first use linear fitting method to fitting China - ASEAN Industrial raw material industry import and export volume for quantitative analysis, but the method is too ideal, the forecast results did not meet our expectations, in order to predict the reliability, we full use of gray forecast. Firstly, we used the real data of 2005 to 2011 to predict data of 2012, and then used the real data of 2005 to 2012 to predict data of 2013, and so on.

Finally, we used the 1-9 scale method of AHP, the results show that the real data industrial raw material export trade volume in 2013,2014 is the largest, and obtain the conclusion that the implementation of the 21st Century Maritime Silk Road strategy have a positive impact on China - ASEAN Industrial raw material exports.

KEY WORDS: trade gravitation model AHP (1-9 scale method) gray Forecasting Model linear fitting

1 Restatement of the problem

1.1 Background

In September and October 2013, Chinese President Xi Jinping respectively proposed the strategic concepts of constructing the Silk-Road Economic Belt and the Maritime Silk Road in 21st Century. One Belt and One Road is not an entity or mechanism, but the concept and advocation of cooperation and development. With the existing effective regional cooperation platform, it relies on the existing bilateral and multilateral mechanism between China and relevant countries to use the historical symbol of the ancient Silk Road, hold high the banner of peaceful development, take the initiative to develop the economic partnership with the countries along the line, and to create a community of interests, destiny and responsibility with political mutual trust, economic integration and cultural inclusion.

1.2 Statement of problem

1. Research the historical background of proposing Maritime Silk Road in the 21st century.

2.Research the strategic impact that Maritime Silk Road make on China-ASEAN based on the industrial raw materials and export industries and economic indicators of China-ASEAN.

1.3 Related data

Question One: Diversification of the trades in ASEAN during 2000 to 2012, China-ASEAN and the ratio of the amount of China's foreign trade volume during 1994 to 2011, China's direct investment in ASEAN flows and stocks during 2000 to 2012 (Found in Appendix).

Question Two: China-ASEAN industrial raw materials industry and export data during 2000 to 2015(Found in Appendix).

1.4 The problem to be solved

According to the information given topic, this article will issue subdivided into the following questions, and build mathematical models for analysis and research.

Question One: Select representative ASEAN economic indicators over years to assess. try to analysis the background of restarting the Maritime Silk Road in the 21st Century.

Question Two: According to import and export value of China-ASEAN industrial raw materials during 2005 to 2011 in annex (1. Mineral fuels, lubricants and related materials 2. Textile products, rubber products, mining products and their products 3. Miscellaneous manufactured articles), Forecast import and export amount of 2012 to 2015, then make a comparison with true data and analysis.

Question Three: Based on the conclusion of Question Two, judge the impact that the Maritime Silk Road in 21st Century make on the import and export value of China-ASEAN industrial raw materials (1. Mineral fuels, lubricants and related materials 2. Textile products, rubber products, mining products and their products 3. Miscellaneous manufactured articles).

2 Problem analysis

2.1 Introduction of relevant background knowledge

2.1.1 Historical background

Since the beginning of the Maritime Silk Road on Qin and Han Dynasties, it has always been the important bridge between the East and West Economic and cultural exchanges. And Southeast Asia area is the important part of the Maritime Silk Road. China looks at the new historical starting point for the establishment of strategic partnership with ASEAN in 10th year. The rapid development of China-ASEAN bilateral trade in the early ten years at the beginning of the 21st century， economic and trade exchanges are increasingly frequent, and cooperation has deepened， which is commonly called by the community of nations the golden age or golden decade .In order to further deepen cooperation between China and ASEAN, the Maritime Silk Road in 21st Century was put forward.

2.1.2 International background

After entering the new century, especially after the 2008 global financial crisis, China's role in the global economy has begun to highlight, and the political status has been significantly improved, and has been considered as the next superpower. As a result, the United States turning to implement the "return to Asia," or "to Asia" (pivot) after the desire of establishing the "two groups" (G2) or Chimerica failed， and adjust to “Asia Pacific rebalancing” in 2013[1].

2.1.3 Domestic background

1 Overcapacity, excess foreign exchange assets；

2 Chinese oil and gas resources, mineral resources have a high dependence on foreign [2];

3 Chinese industrial and infrastructure are concentrated in the coastal areas, if encountered outside strikes, it is easy to lose core facilities。

4 The overall situation of China's border region is at the best period in history, and the willingness to strengthen cooperation between neighboring countries and China is generally increased [3].

2.2 Analysis and handling method of problem

2.2.1 Analysis of problem one

To analyze why China put forward the Maritime Silk Road in 21st Century in 2013, Firstly we should know that the history background of Maritime Silk Road in 21st Century. A major strategic proposed will certainly consider every aspect of national development， because of the large amount and the difficulty of getting relevant data, and get more difficult, So we decided to find out the related data from and closely related to the maritime silk road in the 21st century in south-east Asian nations (ASEAN) ,analysis in the "golden decade" trade between China and southeast Asian countries, and introduces the trade gravity model, study if to strengthen economic ties with its neighboring countries of Chinese impact on China's economy.

2.2.2 Analysis of problem two

According to the subject requirements, the maritime Silk Road in twenty-first Century has a certain impact on many industries, we consider in order to calculate the error of the results, data collection and processing convenience, we chose the twenty-first Century Maritime Silk Road, China-ASEAN industrial raw materials import and export situation, because the industry less

affected by the national policy and other natural factors. To study the impact of the Maritime Silk Road in 21st Century. Firstly, we should predict the situation of China-ASEAN Industrial raw materials import and export of raw materials and without the case of the twenty-first Century maritime silk road. The methods of data prediction include linear fitting, regression analysis, time series forecasting, gray system forecast, etc. We choose the method of linear fitting, it is found that there is a big error. For the problem of the relevant data is less, that is, the small sample, non-regular data characteristics, gray system prediction method is the most appropriate. We selected a number of representative indicators of industrial raw materials (1. mineral fuels, lubricants and related materials. 2 textile products, rubber products, mining products and their products. 3. miscellaneous products) of gray GM (1,1) model.

2.2.3 Analysis of problem three

Question three requests us to determine the impact of the twenty-first Century Maritime Silk Road to China-ASEAN Industrial raw materials exports of various specific products. As a result of the impact of industrial raw material exports data is not easy to find, so our article only select three more desirable indicators, the model to solve the problem by using the analytic hierarchy process(AHP), the specific product of the pairwise comparison matrix according to the AHP1-9 standard method, next we flexibly apply MATLAB to calculate the weight of the right vector and through the consistency test, finally we concluded the twenty-first Century Maritime Silk Road has positive impact on China -ASEAN industrial raw materials exports in a short term.

3 Assumptions of the model

（1） Now assume that the source of information in the literature are true and reliable;
（2） Changes of statistics each year are caused by China-ASEAN Regional Economic directly or indirectly;
（3） In the defined years, statistics are not affected among other specific event;
（4） Assuming that the impact of policy changes adopted by the hysteresis can be ignored.

4 Description of Symbol

$X^{(0)}$	the modeling sequence of GM(1,1)
$X^{(1)}$	the sequence of $X^{(0)}$ 的 1-AGO (Accumulated generating once)
$Z^{(1)}$	the ***MEAN*** of $X^{(1)}$
a	***Development Index***
b	***Gray Intention***
$\hat{\alpha}$	as ***Vector Parameters*** to be estimated
$\lambda_{\max}$	maximum eigenvalue
CI	consistency indicator
CR	consistency ratio
R^2	coefficient of determination

5 The establishment and solution of the model

5.1 The specific analysis and solving of problem one

5.2 The specific analysis and solving of problem two

Maritime Silk Road of the 21st century, is a strategic vision proposed in October 2013 when General Secretary Xi Jinping visited ASEAN .The year 2013,as China-ASEAN cooperation on the occasion of the tenth anniversary, this opportunity was taken to restart the Maritime Silk Road is a reasonable idea and scheme of regional economic development in the global economic integration, based on the proposed intended to point to the line in line with the surface, in order to launch the development of regional economic development in the world. Below, we will analysis feasibility of this program and forecast its future. Taking into account the need for two, the necessary data we have to be retrieved has been proposed the data portion corresponding maritime Silk Road Strategy China-ASEAN export value of industrial raw materials (Here we set to Table 1), Maritime Silk Road Strategy China-ASEAN amount of imports of industrial raw materials (Here we set as table 2), based on these data, we begin the following analysis and modeling.

The whole export value of industrial raw materials of China–ASEAN Before/After Maritime Silk Road of the 21st century			
Year	Mineral fuels, lubricants and related materials	Textile products, rubber products, mining products and their products	Miscellaneous manufactured articles
2005	176. 22	1291. 21	1941. 83
2006	177. 7	1748. 16	2380. 14
2007	199. 51	2198. 77	2968. 44
2008	200. 75	2623. 91	3359. 59
2009	203. 74	1848. 16	2997. 47
2010	266. 73	2491. 08	3776. 52
2011	259. 8	2604. 8	4153
2012	260. 8	2746. 9	4357
2013	322. 76	2913. 5	5032. 6
2014	356. 8	3200. 12	5876
2015	390. 3	3365. 21	6758

5.2-1: The whole export value of industrial raw materials of China-ASEAN Before/After Maritime Silk Road of the 21st century

The whole import value of industrial raw materials of China–ASEAN Before/After Maritime Silk Road of the 21st century			
Year	Mineral fuels, etc	Textile products, etc	Miscellaneous manufactured articles

2005	43. 29	15. 84	11. 88
2006	43. 56	14. 38	11. 8
2007	44. 17	14. 43	12. 28
2008	45. 7	14. 91	12. 68
2009	42. 8	14. 86	11. 9
2010	43. 56	14. 74	11. 8
2011	43. 54	14. 90	12. 43
2012	45. 32	15. 01	12. 64
2013	42. 14	14. 97	13. 24
2014	40. 36	14. 76	14. 24
2015	39. 87	14. 43	14. 73

5.2-2: The whole import value of industrial raw materials of China–ASEAN Before/After Maritime Silk Road of the 21st century

5.2.1 Linear Fitting Method

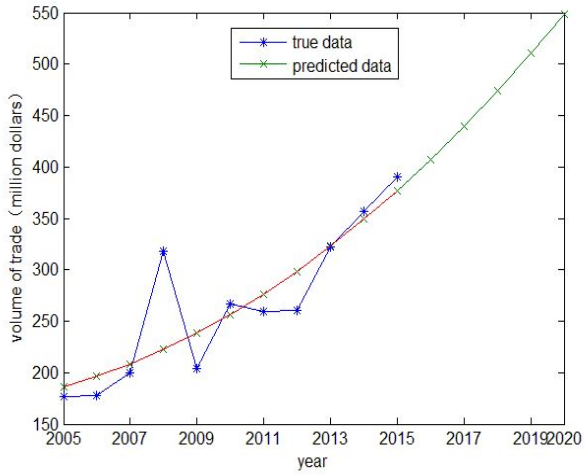
We know that in numerical analysis, curve fitting approach is to apply the analytic expressions of discrete data, name the formulation of discrete data. Discrete point data to be set or a variety of physical problems and multiple observations or statistical issues related to the amount of experimental values, which are fragmented, not only difficult to handle, and always not accurate and fully reflects its inherent laws.

Data provided is relatively fragmented, reason, economic development has many factors. Here we consider only the impact of cooperation China -ASEAN. Such defects can be positive to make the appropriate analytical expressions.

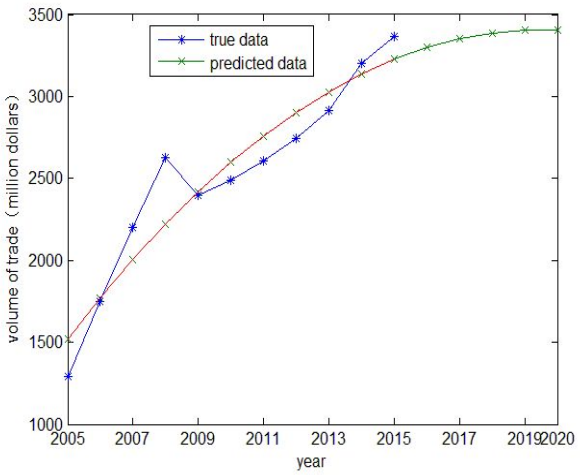
First, we use linear fitting method to preliminary data processing, before the 21st century, according to proposed Maritime Silk Road on the value of industrial raw materials in the 21st century after a predictor of the Maritime Silk ASEAN impact of industrial raw materials. In 2005 on the basis of real data - 2015 were fitted on our initial forecast 2016 to 2020, to get some indicators roughly.

Here is comparison of the true data from 2005 to 2015 between the predicted data from 2005 to 2020

Export of Mineral fuels, etc: Export of Textile products, etc:

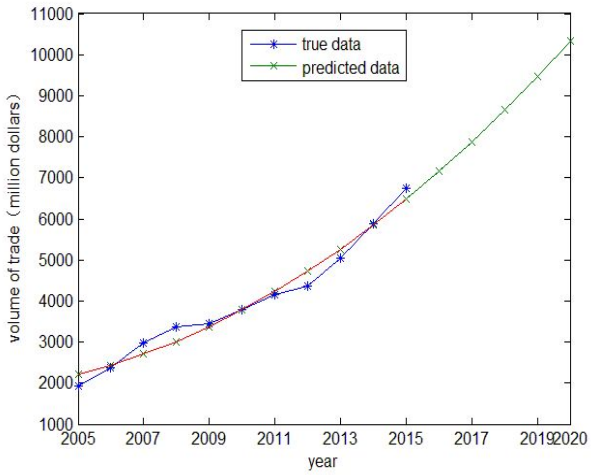


5.2.1-1



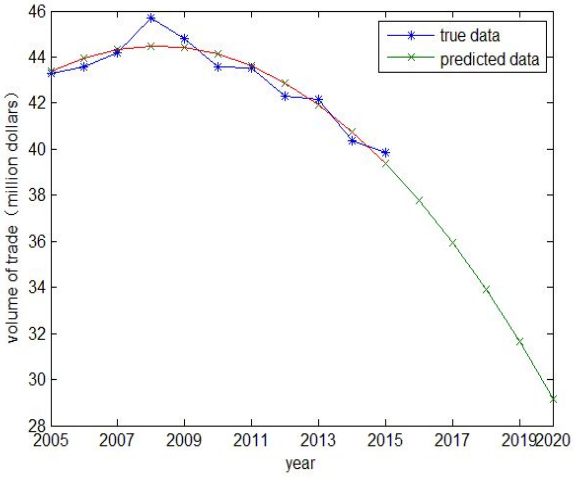
5.2.1-2

Export of Miscellaneous manufactured articles：



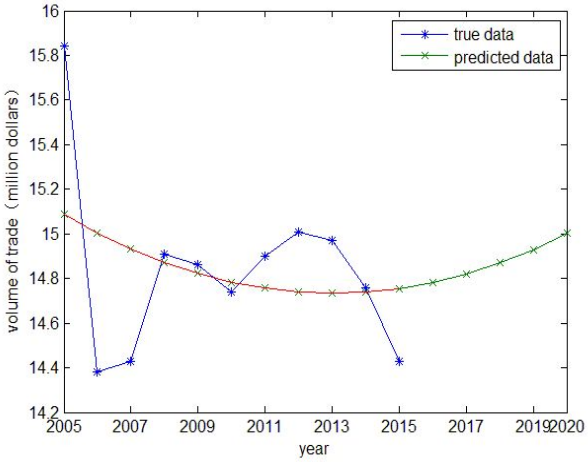
5.2.1-3

Import of Mineral fuels, etc:

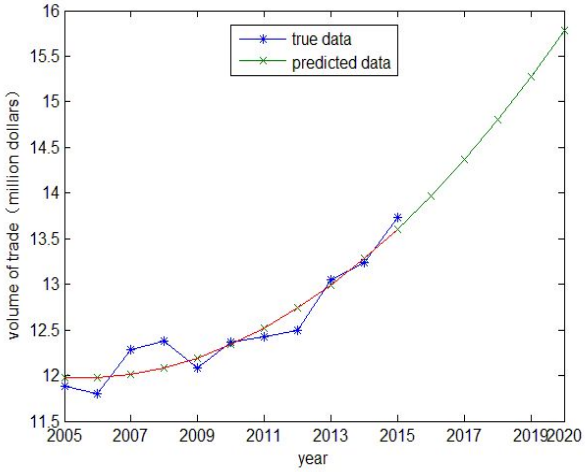


5.2.1-4

Import of Textile products, etc:



Import of Miscellaneous manufactured articles:



5.2.2 Gray Forecast Model GM (1,1)

After analyzing the problem, in order to assess the influence of industrial raw materials import and export trade the 21st century the Maritime Silk Road to China-ASEAN, we must firstly put forward before the 21st century, according to the Maritime Silk Road China-ASEAN put forward 21 indicators forecast the impact of industrial raw materials the index value of industrial raw materials after century maritime Silk Road. In order to predict the reliability of the full use of the advantages of gray prediction, first to 2005 to 2011 actual data forecast 2012 data, and then to 2005 to 2012 the real data to predict in 2013, and so, in turn predicted in 2015.

According to relevant knowledge model in gray prediction, the prediction model for a particular year should be the first order, and only one variable, so you can use GM (1,1) model is solved.

Establishing methods and procedures of GM (1,1) model:

Set $X^{(0)}$ as the modeling sequence of GM(1,1),

$$X^{(0)} = (x^{(0)}(1), x^{(0)}(2), ..., x^{(0)}(n)),$$

$X^{(1)}$ is the sequence of $X^{(0)}$ 的 1-AGO (Accumulated generating once)，

$$X^{(1)} = (x^{(1)}(1), x^{(1)}(2), ..., x^{(1)}(n)),$$

$$x^{(1)}(k) = \sum_{i=1}^{k} x^{(0)}(i), k = 1, 2, ..., n$$

Set $Z^{(1)}$ as the ***MEAN*** of $X^{(1)}$,then get a new sequence:

$$Z^{(1)} = (z^{(1)}(2), z^{(1)}(3), ..., z^{(1)}(n))$$

$$z^{(1)}(k) = 0.5\, x^{(1)}(k) + 0.5\, x^{(1)}(k-1)$$

That is the definition: ***GM (1,1) model of gray differential equation***

$$x^{(0)}(k) + az^{(1)}(k) = b$$

In the equation, we define a as ***Development Index***，define b as ***Gray Intention***. Assume $\hat{\alpha}$ as ***Vector Parameters*** to be estimated, that is $\hat{\alpha} = (a, b)^T$ .Therefore, Least squares estimation parameters fit the Gray Column Differential.

$$\hat{\alpha} = (B^T B)^{-1} B^T Y_n$$

By

$$B = \begin{bmatrix} -z^{(1)}(2) & 1 \\ -z^{(1)}(3) & 1 \\ \cdots & \cdots \\ -z^{(1)}(n) & 1 \end{bmatrix}, \qquad Y_n = \begin{bmatrix} x^{(0)}(2) \\ x^{(0)}(3) \\ \cdots \\ x^{(0)}(n) \end{bmatrix}$$

Define $\frac{dx^{(1)}}{dt}+ax^{(1)}=b$ as the ***Albino equation*** of Gray Differential $x^{(0)}(k)+az^{(1)}(k)=b$， also called ***Shadow equation***

As following,

5) Solution of Albino equation $\frac{dx^{(1)}}{dt}+ax^{(1)}=b$ (***Time response function***) are,

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

2)***Time response sequences*** of GM(1,1) $x^{(0)}(k)+az^{(1)}(k)=b$ are

$$\hat{x}^{(1)}(k+1)=[x^{(1)}(0)-\frac{b}{a}]e^{-ak}+\frac{b}{a},\quad k=1,2,...,n$$

3)Value $x^{(1)}(0)=x^{(0)}(1)$,then

$$\hat{x}^{(1)}(k+1)=[x^{(0)}(1)-\frac{b}{a}]e^{-ak}+\frac{b}{a},\quad k=1,2,...,n$$

4)Restored Valuation

$$\hat{x}^{(0)}(k+1)=\hat{x}^{(1)}(k+1)-\hat{x}^{(1)}(k)$$

The formula is the ***Prediction Equation***.

The true& forecast of the whole export value of industrial raw materials of China-ASEAN Before/After Maritime Silk Road of the 21st century			
Year	Mineral fuels, etc	Textile products, etc	Miscellaneous manufactured articles
2005 Forecast	176.22	1291.2	1942
2005 True	176.22	1291.21	1941.83
2006 Forecast	176.3859	1903.1	2550
2006 True	177.7	1748.16	2380.14
2007 Forecast	191.3114	2006.6	2800
2007 True	199.51	2198.77	2968.44
2008 Forecast	207.4998	2230.7	3074
2008 True	200.75	2323.91	3359.59
2009 Forecast	225.058	2352	3374
2009 True	203.74	2397.16	3452.47
2010 Forecast	244.102	2497.8	3704
2010 True	266.73	2491.08	3776.52
2011 Forecast	264.7574	2614.7	4066
2011 True	259.8	2604.8	4153
2012 Forecast	287.1607	2756.8	4464
2012 True	260.8	2746.9	4357
2013 Forecast	311.4597	2906.7	4900
2013 True	322.76	2913.5	5032.6
2014 Forecast	337.8148	3064.7	5379
2014 True	356.8	3200.12	5876
2015 Forecast	336.40000	3231.3	6483
2015 True	390.3	3365.21	6758

5.2.2-1

The true& forecast of the whole import value of industrial raw materials of China-ASEAN Before/After Maritime Silk Road of the 21st century			
Year	Mineral fuels, etc	Textile products, etc	Miscellaneous manufactured articles
2005 Forecast	43.29	15.84	11.88
2005 True	43.29	15.84	11.88
2006 Forecast	44.45	14.35	12.17
2006 True	43.56	14.38	11.8
2007 Forecast	44.59	14.25	12.13

2007 True	44.17	14.43	12.28
2008 Forecast	44.74	14.64	12.1
2008 True	45.7	14.91	12.68
2009 Forecast	43.91	14.73	12.05
2009 True	42.8	14.86	11.9
2010 Forecast	43.1	14.74	12.02
2010 True	43.56	14.74	11.8
2011 Forecast	42.28	14.86	11.98
2011 True	43.54	14.90	12.43
2012 Forecast	41.49	14.94	11.94
2012 True	45.32	15.01	12.64
2013 Forecast	40.72	14.85	11.91
2013 True	42.14	14.97	13.24
2014 Forecast	39.96	14.77	11.87
2014 True	40.36	14.76	14.24
2015 Forecast	38.49	14.29	11.83
2015 True	39.87	14.43	14.73

5.2.2-2

Analysis of the results of Grey prediction model:

Export of Mineral fuels, etc:

Export of Textile products, etc:

5.2.2-3

5.2.2-4

Export of Miscellaneous manufactured articles:

Import of Mineral fuels, etc:

5.2.2-5

Import of Textile products, etc：

5.2.2-6

Import of Miscellaneous manufactured articles：

5.2.2-7

5.2.2-8

5.3 The specific analysis and solving of problem three

AHP (1-9 scale method)

The question is to determine the impact of the twenty-first Century Maritime Silk Road to China-ASEAN Industrial raw materials in the export of various products, so we decided to use the analytic hierarchy process to establish the model; the specific method is as follows:

(1) Making a hierarchical structure model for the evaluation of the scheme

Assuming the highest level of the model is the overall goal O：Industrial raw material export trade is max;

The second layer is designed as a rule layer, which contains three-criteria. (Since it is not easy to find the impact of industrial raw material export trade volume of data, so this article only select three of the more desirable indicators, data see table 5.3-1):

A1：Mineral fuels, etc.

A2： Textile products, etc.

A3: Miscellaneous manufactured articles

The whole export value of industrial raw materials of China-ASEAN Before/After Maritime Silk Road of the 21st century			
Year	Mineral fuels, etc.	Textile products, etc.	Miscellaneous manufactured articles
2005	176.22	1291.21	1941.83
2007	199.51	2198.77	2968.44
2009	203.74	2397.16	3452.47
2011	259.8	2604.8	4153
2013	322.76	2913.5	5032.6
2015	390.3	3365.21	6758

5.3-1

The lowest layer is the schematic layer; it contains 5 years from P1 to P5,

The total hierarchical structure model is constructed as shown in the following diagram(5.3-2):

5.3-2

(2) Structure matrix for comparison and judgment

Assume O as comparison criteria, A levels of the two-two comparison matrix is O—A; Similarly, Take each Ai(i =1,2,3） as a criterion for comparison . B levels of the two-two comparison matrix is Ai—B. It is available to get 4-comparison judgment matrix:

For the general objective O:

$O—A_i$	A1	A2	A3
A1	1	1/9	1/9
A2	9	1	1/2
A3	9	2	1

5.3-3

The third relative to the second layer of the comparison judgment matrix:

The criterion A_1：

A1—B	B1	B2	B3	B4	B5	B6

B1	1	1/3	1/3	1/5	1/5	1/8
B2	3	1	1/2	1/6	1/5	1/5
B3	3	2	1	1/6	1/5	1/5
B4	5	6	6	1	1/3	1/4
B5	5	5	5	3	1	1/2
B6	8	5	5	4	2	1

5.3-4

The criterion A_2：

A2-B	B1	B2	B3	B4	B5	B6
B1	1	1/6	1/5	1/7	1/8	1/9
B2	6	1	2	1/2	1/3	1/3
B3	5	1/2	1	1/3	1/4	1/4
B4	7	2	3	1	1	1/2
B5	8	3	4	1	1	1
B6	9	3	4	2	1	1

5.3-5

The criterion A_3：

A3-B	B1	B2	B3	B4	B5	B6
B1	1	1/4	1/4	1/7	1/7	1/9
B2	4	1	1	1/3	1/4	1/4
B3	4	1	1	1/3	1/4	1/4
B4	7	3	3	1	1/2	1/2
B5	7	4	4	2	1	1
B6	9	4	4	2	1	1

5.3-6

(3) Calculate weight vector and consistency check

For the above comparison judgment matrix, Using MATLAB to find the maximum eigenvalue and its eigenvector.

After Normalizing feature vector, we can get the corresponding weight vector, the consistency indicator CI and the consistency ratio CR, as shown in table 5.3-7:

matrix	**The corresponding weight vector**		**CI**	**RI**	**CR**
0—A	**（0.051328，0.36665，0.58202）**	**3.0536**	**0.026811**	**0.58**	**0.046225**
A1—B	**(0.032357,0.052664,0.065674 0.19012,0.27231,0.38688）**	**6.5718**	**0.11437**	**1.24**	**0.092233**
A2-B	**(0.025615，0.11707，0.077429，0.20695, 0.26756,0.30537）**	**6.1508**	**0.030167**	**1.24**	**0.024328**

A3-B	**(0.028596，0.080955，0.080955 0.19432，0.30291，0.31227）**	**6.1128**	**0.022556**	**1.24**	**0.01819**

5.3-7

Seen from the table:

The CR values for all six levels of the single ordered are satisfying by the conformance check.

(4) Overall ranking levels

The second layer (A layer) with respect to the overall goal (O layer) of sorting vector:

$W^{(2)}=(0.051328，\ 0.36665，0.58202)^T$

The third layer (B layer) with respect to criterion layer (A_i layer) of sorting vector:

$= (0.032357, 0.052664, 0.065674\ 0.19012, 0.27231, 0.38688)^T$

$= (0.025615，0.11707，0.077429，0.20695，0.26756，0.30537)^T$

$= (0.028596，0.080955，0.080955\quad 0.19432，0.30291，0.31227)^T$

∴The third layer (B layer) with respect to the overall goal (O layer) of sorting vector:

$=（\ 0.0277, 0.0927,0.0789,0.1987,0.2884,0.3136）$

(5) Consistency check of compound weight vector

∵ $= (0.11437, 0.030167, 0.022556),$

$= (1.24,1.24,1.24),$

∴ $= 0.0301$

$=1.2400$

$=0.046225+\qquad =0.0705$

∵ $=0.0705<0.1$，∴The evaluation model achieves local satisfactory consistency in the third level.

(6) Model results analysis

Considering carry out this strategy of 21st Century Maritime Silk Road before/after, six relative priority order is that:

①2014, weight: 0.3136

②2013, weight: 0.2884

③2011, weight: 0.1987

④2009, weight: 0.0789

⑤2007, weight: 0.0927

⑥2005, weight: 0.0277

These results show that the export trade of industrial raw materials in 2013, 2014 years is the largest in China-ASEAN, and the strategy for the implementation of the maritime Silk Road in 21st Century has positive impact on China ASEAN Industrial raw material exports. It is beneficial to

strengthen the cooperation between China and ASEAN, and accelerate the bilateral trade between China and ASEAN. According to the 2015 first 6 months of the description, in accordance with the growth trend of our forecast growth, China's foreign trade will increase rapidly, the trade status in the ASEAN countries will continue to upgrade.

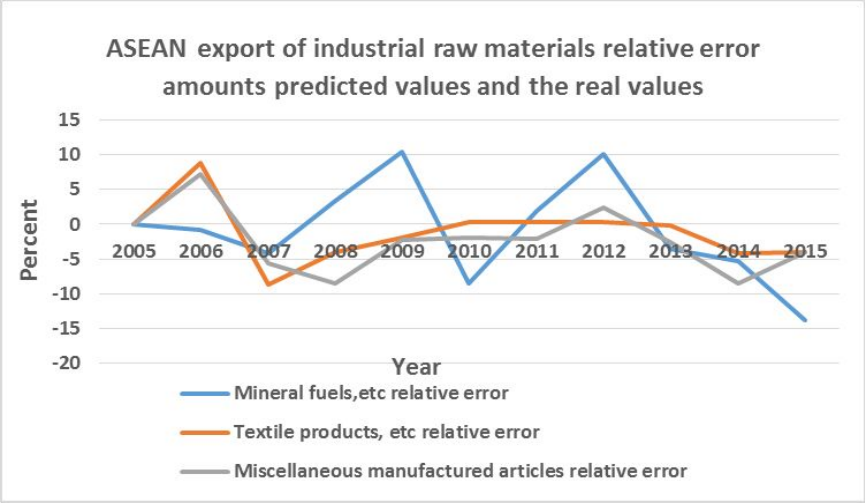
6 Error Analysis

Compare the real value of the raw material exports with data of grey prediction between 2005 and 2015. Using Excel to calculate the relative error, the result will be shown in the following diagram (6-1):

ASEAN export of industrial raw materials relative error amounts predicted values and the real values									
	Mineral fuels, etc			Textile products, etc			Miscellaneous manufactured articles		
Year	True	Predicted	Mineral fuels, etc relative error	True	Predicted	Textile products, etc relative error	True	Predicted	Miscellaneous manufactured articles relative error
2005	176.22	176.22	0.000	1291.21	1291.20	-0.001	1941.83	1942	0.009
2006	177.70	176.39	-0.740	1748.16	1903.10	8.863	2380.14	2550	7.137
2007	199.51	191.31	-4.109	2198.77	2006.60	-8.740	2968.44	2800	-5.674
2008	200.75	207.50	3.362	2323.91	2230.70	-4.011	3359.59	3074	-8.501
2009	203.74	225.06	10.463	2397.16	2352.00	-1.884	3452.47	3374	-2.273
2010	266.73	244.10	-8.483	2491.08	2497.80	0.270	3776.52	3704	-1.920
2011	259.80	264.76	1.908	2604.80	2614.70	0.380	4153.00	4066	-2.095
2012	260.80	287.16	10.108	2746.90	2756.80	0.360	4357.00	4464	2.456
2013	322.76	311.46	-3.501	2913.50	2906.70	-0.233	5032.60	4900	-2.635
2014	356.80	337.81	-5.321	3200.12	3064.70	-4.232	5876.00	5379	-8.458
2015	390.30	336.40	-13.810	3365.21	3231.30	-3.979	6758.00	6483	-4.069

6-1

Its relative error line chart is as follows (6-2):



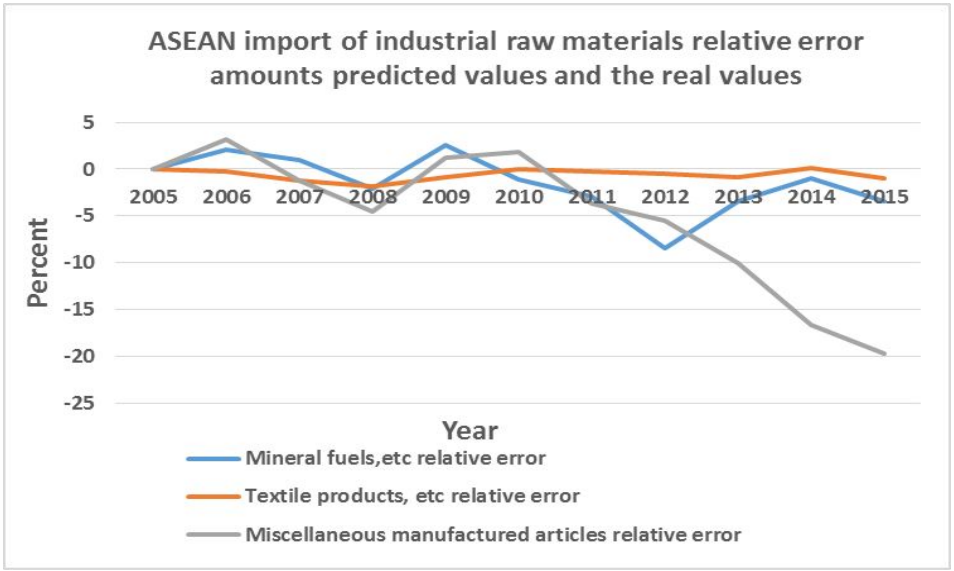
6-2

Compare the real value of the raw material imports with data of grey prediction between 2005 and 2015. Using Excel to calculate the relative error, the result will be shown in the following diagram (6-3):

ASEAN import of industrial raw materials relative error amounts predicted values and the real values									
	Mineral fuels, etc			Textile products, etc			Miscellaneous manufactured articles		
Year	True	Predicted	Mineral fuels, etc relative error	True	Predicted	Textile products, etc relative error	True	Predicted	Miscellaneous manufactured articles relative error
2005	43.29	43.29	0.000	15.84	15.84	0.000	11.88	11.88	0.000
2006	43.56	44.45	2.043	14.38	14.35	-0.209	11.80	12.17	3.136
2007	44.17	44.59	0.951	14.43	14.25	-1.247	12.28	12.13	-1.221
2008	45.70	44.74	-2.101	14.91	14.64	-1.811	12.68	12.1	-4.574
2009	42.80	43.91	2.593	14.86	14.73	-0.875	11.90	12.05	1.261
2010	43.56	43.10	-1.056	14.74	14.74	0.000	11.80	12.02	1.864
2011	43.54	42.28	-2.894	14.90	14.86	-0.268	12.43	11.98	-3.620
2012	45.32	41.49	-8.451	15.01	14.94	-0.466	12.64	11.94	-5.538
2013	42.14	40.72	-3.370	14.97	14.85	-0.802	13.24	11.91	-10.045
2014	40.36	39.96	-0.991	14.76	14.77	0.068	14.24	11.87	-16.643
2015	39.87	38.49	-3.461	14.43	14.29	-0.970	14.73	11.83	-19.688

6-3

Its relative error line chart is as follows (6-4):



6-4

The coefficient of determination: $R^2 = 1 - \frac{\sum_i (y_i - \hat{y}_i)^2}{\sum_i (y_i - \bar{y}_i)^2}$

	export	import

goods	Mineral fuels, etc	Textile products, etc	Miscellaneous manufactured articles	Mineral fuels, etc	Textile products, etc	Miscellaneous manufactured articles
R^2	0.9277	0.9770	0.9879	0.5736	0.9612	0.4409

6-5

According to the charts(6-5), we can know that the export section of R^2 is very big and the relative error is floating in the horizontal coordinates, and the distribution is uniform. This suggests that the error is very small. On the whole,
We can know the curve fitting degree is very good, the reliability is strong.

For the import part, a set of data is expected, but the error of the other two groups is relatively large, which shows that the curve fitting degree is not satisfied.

7 References

[1] Twenty-first Century construction of the maritime Silk Road and the new situation in the South China Sea (2015), the Chinese Academy of Social Sciences.
[2](July,2015)The investment bank "detailed The Belt and Road" policy of the affected area, global vision.
[3](July,2015)Border cooperation to help "along the way" building (International Forum).People's daily.
[4]Wang Xinzhe ,Liu Zhixiong.Research on the Market Provider and the status of China on ASEAN[M].Beijing:Beijing Institute of Technology press.
[5]Han Zhonggeng.mathematical modeling contest:winners papers[M].Beijing:Thomson Learning Press, 2013.
[6]Zhuo jinwu.Application of MATLAB in mathematical contest in model[M].Beijing:Beijing Aeronautics and Astronautics University Press, 2014.
[7]national Bureau of Statistics, China National Statistics Yearbook, 2011.
[8]Shi Zhaoxing: the theoretical basis of the application of gravity model in international trade[J].Nankai Economic Studies,2005(02):39-44.
[9]Viner,Jacob.Studies in the theory of Customs Unions: A Genery Survey[J].Economic Journal,1960(70):496-513.
[10]The historic background of Maritime Silk Road of the 21st century from:http://baike.sogou.com/v75655967.html.

8 Appendix

Software

Matlab 2014a;
Microsoft Office Word 2016;
Microsoft Office Excel 2016;

Programs and codes

% The export of Mineral fuels, lubricants and related materials of China-ASEAN

```
Year=[2005,2006,2007,2008,2009,2010,2011,2012,2013,2014,2015];
Yuanliao=[176.22,177.7,199.51,317.73,203.74,266.73,259.8,260.8,322.76,356.8,390.3];
Year1=2005:2015;
Year2=2005:2020;
[P2,S2]=polyfit(Year,Yuanliao,2)
Yuanliao1=polyval(P2,Year1);
Yuanliao2=polyval(P2,Year2);
plot(Year,Yuanliao, '-*',Year2,Yuanliao2, '-X',Year1,Yuanliao1);
legend('true data','predicted data')
xlabel('year');ylabel(' volume of trade（million dollars）')
```

```
P2 =

    1.0e+06 *

    0.0000   -0.0041    4.0688


S2 =

        R: [3x3 double]
       df: 8
    normr: 113.4910
```

% The export of Textile products, rubber products, mining products and their products of China-ASEAN

```
Year=[2005,2006,2007,2008,2009,2010,2011,2012,2013,2014,2015];
Qingfang=[ 1291.21,1748.16,2198.77,2623.91,2397.16,2491.08,2604.8,2746.9,2913.5,3200.12,3365.
21];
Year1=2005:2015;
Year2=2005:2020;
[P2,S2]=polyfit(Year,Qingfang,2)
Qingfang1=polyval(P2,Year1);
Qingfang2=polyval(P2,Year2);
plot(Year,Qingfang, '-*',Year2,Qingfang2, '-X',Year1,Qingfang1);
legend('true data','predicted data')
xlabel('year');ylabel(' volume of trade（million dollars）')

P2 =
```

```
    1.0e+07 *

    -0.0000        0.0036      -3.6737


S2 =

            R: [3x3 double]
           df: 8
      normr: 591.4941
```

% The export of Miscellaneous manufactured articles of China-ASEAN

```
Year=[2005,2006,2007,2008,2009,2010,2011,2012,2013,2014,2015];
Zaxiang=[ 1941.83,2380.14,2968.44,3359.59,3452.47,3776.52,4153,4357,5032.6,5876,6758];
Year1=2005:2015;
Year2=2005:2020;
[P2,S2]=polyfit(Year,Zaxiang,2)
Zaxiang1=polyval(P2,Year1);
Zaxiang2=polyval(P2,Year2);
plot(Year,Zaxiang, '-*',Year2,Zaxiang2, '-X',Year1,Zaxiang1);
legend('true data','predicted data')
xlabel('year');ylabel(' volume of trade（million dollars）')
P2 =

    1.0e+07 *

     0.0000      -0.0091        9.1057


S2 =

            R: [3x3 double]
           df: 8
      normr: 736.0580
```

% The import of Mineral fuels, lubricants and related materials of China-ASEAN

```
Year=[2005,2006,2007,2008,2009,2010,2011,2012,2013,2014,2015];
Yuanliao=[ 43.29,43.56,44.17,45.7,44.8,43.56,43.54,42.32,42.14,40.36,39.87];
Year1=2005:2015;
```

```
Year2=2005:2020;
[P2,S2]=polyfit(Year,Yuanliao,2)
Yuanliao1=polyval(P2,Year1);
Yuanliao2=polyval(P2,Year2);
plot(Year,Yuanliao, '-*',Year2,Yuanliao2, '-X',Year1,Yuanliao1);
legend('true data','predicted data')
xlabel('year');ylabel(' volume of trade（million dollars）')
```

```
P2 =

    1.0e+05 *

   -0.0000    0.0044   -4.4257


S2 =

         R: [3x3 double]
        df: 8
     normr: 1.7082
```

% The import of Textile products, rubber products, mining products and their products of China-ASEAN

```
Year=[2005,2006,2007,2008,2009,2010,2011,2012,2013,2014,2015];
Qingfang=[ 15.84,14.38,14.43,14.91,14.86,14.74,14.90,15.01,14.97,14.76,14.43];
Year1=2005:2015;
Year2=2005:2020;
[P2,S2]=polyfit(Year,Qingfang,2)
Qingfang1=polyval(P2,Year1);
Qingfang2=polyval(P2,Year2);
plot(Year,Qingfang, '-*',Year2,Qingfang2, '-X',Year1,Qingfang1);
legend('true data','predicted data')
xlabel('year');ylabel(' volume of trade（million dollars）')
```

```
P2 =

    1.0e+04 *

    0.0000   -0.0022    2.2354
```

```
S2 =

           R: [3x3 double]
          df: 8
      normr: 1.2126
```

% The import of Miscellaneous manufactured articles of China-ASEAN

```
Year=[2005,2006,2007,2008,2009,2010,2011,2012,2013,2014,2015];
Zaxiang=[ 11.88,11.8,12.28,12.38,12.08,12.36,12.43,12.50,13.05,13.24,13.73];
Year1=2005:2015;
Year2=2005:2020;
[P2,S2]=polyfit(Year,Zaxiang,2)
Zaxiang1=polyval(P2,Year1);
Zaxiang2=polyval(P2,Year2);
plot(Year,Zaxiang, '-*',Year2,Zaxiang2, '-X',Year1,Zaxiang1);
legend('true data','predicted data')
xlabel('year');ylabel(' volume of trade（million dollars）')
P2 =

    1.0e+04 *

     0.0000      -0.0073       7.3094


S2 =

           R: [3x3 double]
          df: 8
      normr: 0.5449
```

%Gray Forecast Model

```
 function[X,c,error1,error2]=huiseyuce(X0,k)
format long;
n=length(X0);
X1=[];
X1(1)=X0(1);
for i=2:n
      X1(i)=X1(i-1)+X0(i);
end
```

```
for i=1:n-1
    B(i,1)=-0.5*(X1(i)+X1(i+1));
    B(i,2)=1;
    Y(i)=X0(i+1);
end
alpha=(B'*B)^(-1)*B'*Y';
a=alpha(1,1);
b=alpha(2,1);
d=b/a;
c=X1(1)-d;
X2(1)=X0(1);
X(1)=X0(1);
for i=1:n-1
    X2(i+1)=c*exp(-a*i)+d;
    X(i+1)=X2(i+1)-X2(i);
end
for i=(n+1):(n+k)
    X2(i)=c*exp(-a*(i-1))+d;
    X(i)=X2(i)-X2(i-1);
end
for i=1:n
    error(i)=X(i)-X0(i);
    error1(i)=abs(error(i));
    error2(i)=error1(i)/X0(i);
end
c=std(error1)/std(X0);
```

% The export of Mineral fuels, lubricants and related materials of China-ASEAN

```
 >> k=5;
>> X0=[176.22,177.7,199.51,317.73,203.74,266.73,259.8];
>> [X,c,error1,error2]=huiseyuce(X0,k)

X =

    1.0e+02 *

  Columns 1 through 4

    1.762200000000000   2.053884853941839   2.173184387315751   2.299413412689146

  Columns 5 through 8
```

2.432974428361995 2.574293311675829 2.723820676981195 2.882033312482381

Columns 9 through 12

3.049435700540962 3.226561626286084 3.413975879660284 3.612276056328728

c =

0.549440807340400

error1 =

Columns 1 through 4

0 27.688485394183857 17.808438731575052 87.788658731085434

Columns 5 through 7

39.557442836199471 9.300668832417159 12.582067698119488

error2 =

Columns 1 through 4

0 0.155815899798446 0.089260882820786 0.276299558527950

Columns 5 through 7

0.194156487858052 0.034869226680228 0.048429821778751

%The export of Textile products, rubber products, mining products and their products of China-ASEAN

```
k=5;
X0=[1291.21,1748.16,2198.77,2623.91,1848.16,2491.08];
[X,c,error1,error2]=huiseyuce(X0,k)
```

X =

1.0e+03 *

Columns 1 through 4

1.291210000000000 1.969018694546990 2.070173076862586 2.176524062486220

Columns 5 through 8

2.288338616479807 2.405897418699416 2.529495568365128 2.659443324827087

Columns 9 through 11

2.796066886386558 2.939709209127752 3.090730867815037

c =

0.373981386329535

error1 =

1.0e+02 *

Columns 1 through 4

0 2.208586945469895 1.285969231374142 4.473859375137799

Columns 5 through 6

4.401786164798065 0.851825813005835

error2 =

Columns 1 through 4

0 0.126337803488805 0.058485845785332 0.170503537664699

Columns 5 through 6

0.238171271145251 0.034195040424468

% The import of Mineral fuels, lubricants and related materials of China-ASEAN

```
>> k=5;
X0=[43.29,47.56,43.17,46.70,42.80,43.56];
[X,c,error1,error2]=huiseyuce(X0,k)

X =

   Columns 1 through 4

   43.289999999999999   46.456793805311428   45.590675709941934   44.740705103318305
A=[1941.83,2380.14,2968.44,3359.59,2997.47,3776.52,4100.76]
   Columns 5 through 8

   43.906580939435116   43.088007784843285   42.284695714013196   41.496360206647296

   Columns 9 through 11

   40.722722046908530   39.963507224522345   39.218446837733154


c =

    0.437064565734940


error1 =

   Columns 1 through 4

                        0    1.103206194688575    2.420675709941932    1.959294896681698

   Columns 5 through 6

    1.106580939435119    0.471992215156718


error2 =
```

Columns 1 through 4

0 0.023196093244083 0.056073099604863 0.041954922841150

Columns 5 through 6

0.025854694846615 0.010835450302037

% The import of Textile products, rubber products, mining products and their products of China-ASEAN

```
>> k=5;
X0=[15.84,14.38,14.43,13.91,15.04,13.64];
[X,c,error1,error2]=huiseyuce(X0,k)

X =

   Columns 1 through 4

   15.840000000000000   14.452970022639565   14.365945731351985   14.279445431137901

   Columns 5 through 8

   14.193465966940039   14.108004202696975   14.023057021232944   13.938621324137785

   Columns 9 through 11

   13.854694031660529   13.771272082592532   13.688352434158787


c =

    0.407524749732130


error1 =

   Columns 1 through 4

                    0   0.072970022639565   0.064054268648015   0.369445431137901
```

```
   Columns 5 through 6

    0.846534033059960      0.468004202696974


error2 =

   Columns 1 through 4

                        0      0.005074410475630      0.004438965256273      0.026559700297477

   Columns 5 through 6

    0.056285507517285      0.034311158555497
```

% Gray Forecast

```
clear
syms a b;
c=[a,b]';
A=[1291.21,1748.16,2198.77,2323.91,1848.16,2491.08];
B=cumsum(A);
n=length(A);
for i=1:(n-1)
C(i)=(B(i)+B(i+1))/2;
end
```

% Calulator relevant data

```
D=A;D(1)=[];
D=D';
E=[-C;ones(1,n-1)];
c=inv(E*E')*E*D;
c=c';
a=c(1);b=c(2);
```

% Predicted data values

```
F=[];F(1)=A(1);
for i=2:(n+10)
F(i)=(A(1)-b/a)/exp(a*(i-1))+b/a;
end
G=[];G(1)=A(1);
for i=2:(n+10)
```

```
G(i)=F(i)-F(i-1);
end
t1=2005:2010;
t2=2005:2021;
G
  plot(t1,A,'*',t2,G);
legend('true data','predicted data')
xlabel('year');ylabel(' volume of trade（million dollars）')
```

% Compare true and forecast value of the export of Mineral fuels, lubricants and related materials of China-ASEAN in 2005-2015

```
clear all
x=[2005;2006;2007;2008;2009;2010;2011;2012;2013;2014;2015];
Y1=[176.22,177.7,199.51,200.75,203.74,266.73,259.8,260.8,322.76,356.8,390.3];
YYY=[176.22,176.3859,191.3114,207.4998,225.058,244.102,264.7574,287.1607,311.4597,337.814
8,336.40000];
plot(x,Y1,'-g*');
hold on
plot(x,YYY,'-b.');
xlabel('year');ylabel('volume of trade（million dollars）');
legend('true value','predicted value',2);
```

% Compare true and forecast value of the export of Textile products, rubber products, mining products and their products of China-ASEAN in 2005-2015

```
clear all
x=[2005;2006;2007;2008;2009;2010;2011;2012;2013;2014;2015];
Y1=[1291.21,1748.16,2198.77,2623.91,2397.16,2491.08,2604.8,2746.9,2913.5,3200.12,3365.21];
YYY=[1291.2,1903.1,2006.6,2230.7,2352,2497.8,2614.7,2756.8,2906.7,3064.7,3231.3];
plot(x,Y1,'-g*');
hold on
plot(x,YYY,'-b.');
xlabel('year');ylabel('volume of trade（million dollars）');
legend('true value','predicted value ',2);
```

% Compare true and forecast value of the export of Miscellaneous manufactured articles of China-ASEAN in 2005-2015

```
clear all
x=[2005;2006;2007;2008;2009;2010;2011;2012;2013;2014;2015];
Y1=[1941.83,2380.14,2968.44,3359.59,3452.47,3776.52,4153,4357,5032.6,5876,6758];
YYY=[1942,2550,2800,3074,3374,3704,4066,4464,4900,5379,6483];
plot(x,Y1,'-g*');
hold on
plot(x,YYY,'-b.');
xlabel('year');ylabel('volume of trade（million dollars）');
legend('ture value','predicted value',2);
```

% Compare true and forecast value of the import of Mineral fuels, lubricants and related materials of China-ASEAN in 2005-2015

```
clear all
x=[2005;2006;2007;2008;2009;2010;2011;2012;2013;2014;2015];
Y1=[43.29,43.56,44.17,45.7,44.8,43.56,43.54,42.32,42.14,40.36,39.87];
YYY=[43.29,44.45,44.59,44.74,43.91,43.1,42.28,41.49,40.72,39.96,38.49];
plot(x,Y1,'-g*');
hold on
plot(x,YYY,'-b.');
xlabel('year');ylabel('volume of trade（million dollars）');
legend('ture value','predicted value',2);
```

% Compare true and forecast value of the import of Textile products, rubber products, mining products and their products of China-ASEAN in 2005-2015

```
clear all
x=[2005;2006;2007;2008;2009;2010;2011;2012;2013;2014;2015];
Y1=[15.84,14.38,14.43,14.91,14.86,14.74,14.90,15.01,14.97,14.76,14.43];
YYY=[15.84,14.35,14.25,14.64,14.73,14.74,14.86,14.94,14.85,14.77,14.29];
plot(x,Y1,'-g*');
hold on
plot(x,YYY,'-b.');
xlabel('year');ylabel('volume of trade（million dollars）');
legend('ture value','predicted value',2);
```

% Compare true and forecast value of the import of Miscellaneous manufactured articles of China-ASEAN in 2005-2015

```
clear all
x=[2005;2006;2007;2008;2009;2010;2011;2012;2013;2014;2015];
Y1=[11.88,11.8,12.28,12.38,12.08,12.36,12.43,12.50,13.05,13.24,13.73];
```

```
YYY=[11.88,12.17,12.13,12.1,12.05,12.02,11.98,11.94,11.91,11.87,11.83];
plot(x,Y1,'-g*');
hold on
plot(x,YYY,'-b.');
xlabel('year');ylabel('volume of trade（million dollars）');
legend ('ture value','predicted value',2);


clear all
>> A=[1,1/9,1/9;9,1,1/2;9,2,1];
>> [n,n]=size(A);>> [v,d]=eig(A);
>> r=d(1,1);
>> CI=(r-n)/(n-1);
>> RI=[0 0 0.58 0.90 1.12 1.24 1.32 1.41 1.45 1.49 1.52 1.54 1.56 1.58 1.59];>> CR=CI/RI(n);
>> if CR<0.10
CR_ Result ='pass';
else
CR_ Result='cannot pass';
end
>> % % Calculate weight vector
>> w=v(:,1)/sum(v(:,1));
>> w=w';
>> % % put out results
disp('The judgment matrix weight vector calculation report:');
'The judgment matrix weight vector calculation report:
disp([' Consistency Index:' num2str(CI)]);
Consistency Index:0.026811
disp([' Consistency test results:' CR_ Result]);
Consistency test results: pass
disp([' Eigenvalues:'    num2str(r)]);
Eigenvalues:3.0536
>> disp([' Weight vectors:'    num2str(w)]);
Weight vectors:0.051328          0.36665          0.58202
```