

New Economic Forecasting Method based on Grey Prediction

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Abstract

2020 is the year of the U.S. presidential election. Republican candidate Donald Trump and Democratic candidate Joe Biden will run for president. However, the candidates of the two parties have different political positions and policy programs in such key development fields as finance and trade, economic and financial governance, prevention and control measures, infrastructure, taxation, environmental protection, medical insurance, employment, trade and immigration. Therefore, we analyzed the policies and relevant data of the two parties, hoping to put forward reasonable suggestions for the development of China's economy in the United States. First, we used the least square curve to fit the data curves of the two candidates, and then used the analytic hierarchy process (AHP) to construct a model to analyze the weight of the influencing factors of the U.S. economy. Finally, in order to quantitatively analyze the possible impact of the election of different candidates on China's economy, we selected the export volume of China to the United States during the two presidents (trump 2016-2020, Biden 2011-2015) as the research data to analyze the change law of China's commodity export volume to the United States when they were in power. Finally, based on the results of these two models, we put forward some suggestions for the economic development of China and the United States.

Keywords

Analytic Hierarchy Process; Least Square Method; Curve Fitting.

1. Introduction

The US presidential election is held every four years. 2020 is the year of the U.S. presidential election. Republican candidate Donald Trump and Democratic candidate Joe Biden will run for president. The candidates of the two parties have different political positions and policy programs in such key development fields as finance and trade, economic and financial governance, prevention and control measures, infrastructure, taxation, environmental protection, medical insurance, employment, trade and immigration.

2. Model Establishment

2.1. Least Squares Method

The least square method (also known as the least square method) seeks the best function matching of data by minimizing the sum of squares of errors. By using the least square method, unknown data can be easily obtained, and the sum of squares between the obtained data and the actual data is minimized. In this paper, the least square curve fitting method in excel is used to process the discrete data of trump and Biden. A certain model (or equation) is used to fit a series of data into smooth curves, so as to observe the internal relationship between the two groups of data, understand the change trend between the data, and get a continuous function, so that the curve of experimental data and equation can be maximized According to the curve

equation, the data are calculated mathematically, the experimental results are analyzed theoretically, and the results after the two people are in power in 2021 are estimated.

2.2. Analytic Hierarchy Process

(1) Basic idea of analytic hierarchy process

Analytic hierarchy process (AHP) is a decision-making method that decomposes the elements related to decision-making into objectives, criteria, schemes and other levels. On this basis, it makes qualitative and quantitative analysis on some complicated and fuzzy problems. It is especially suitable for those problems that are difficult to be fully quantitative analyzed.

(2) Calculating weight coefficient by analytic hierarchy process

In order to know the importance of each index system in the comprehensive evaluation, we give a certain weight coefficient to the value of each evaluation objective to the total evaluation objective in the same level of evaluation objectives.

a. Establish hierarchical structure model

The continuous decomposition of the overall evaluation objectives is carried out to obtain the evaluation objectives of different levels, and the target tree diagram is established to express the evaluation objectives of each level, as shown in the figure

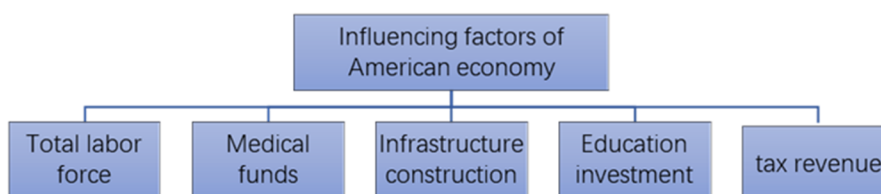


Figure 1. Influencing factors of American economy

b. The judgment matrix is constructed

Compare and score the target tree from top to bottom one by one, and establish a pair comparison judgment optimization matrix. The scoring criteria are shown in the table:

Table 1. Scoring criteria

Comparative scoring	Relative importance	Explain
1	equally important	Both contribute the same to the goal
3	Slightly more important	According to experience, one evaluation is slightly better than the other
5	Basic importance	According to experience, one evaluation is more advantageous than the other
7	really important	According to experience, one evaluation is more favorable than the other, and it has been proved in practice
9	Absolutely important	The importance is obvious
(2, 4, 6, 8)	the intermediate value of two adjacent programs	Use when compromise is needed

First, the judgment is made

- ① Because taxation is the only source of government revenue in this system, it should be of the highest importance.
- ② Due to the impact of the new epidemic, it is expected that there will be a greater outbreak stage in 2021, so the medical expenses will account for the second highest proportion.
- ③ The impact of the total labor force on the U.S. economy has been very high, but because of the epidemic, its importance will decline a lot, so it ranks third.
- ④ Investment in infrastructure can stimulate employment growth in the United States, and has a certain reference role in the impact of the U.S. economy.
- ⑤ Education has a relatively higher impact on the U.S. economy than infrastructure, so the score gap is small.

c. Calculate the normalized weight coefficient

According to the calculation formula

$$w_i' = \sqrt[m]{a_{i1}a_{i2} \cdots a_{im}}$$

Calculate the initial weight coefficient w_j'

According to the formula

$$w_i = \frac{w_i'}{\sum_{i=1}^m w_i'}$$

Finally, the normalized weight coefficient is calculated w_i

d. Whether the weight coefficient conforms to the logic is tested.

Note: C and D are calculated by MATLAB algorithm. See Appendix for specific program.

3. Experiment

3.1. The Fitting Curve is Obtained by Least Square Method

The development of five major indicators of the U.S. economy during Trump's administration:

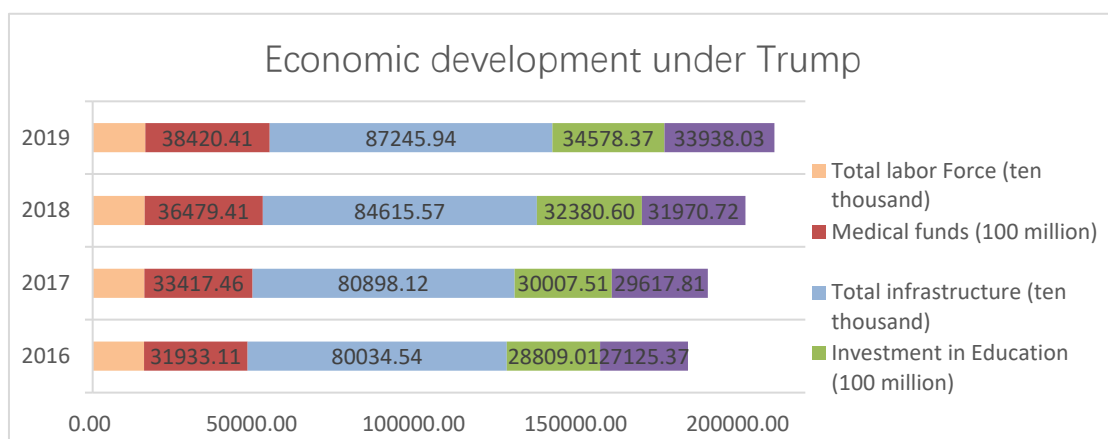


Figure 2. Economic development in Trump period

The development of five major indicators of American economy during Biden's administration:

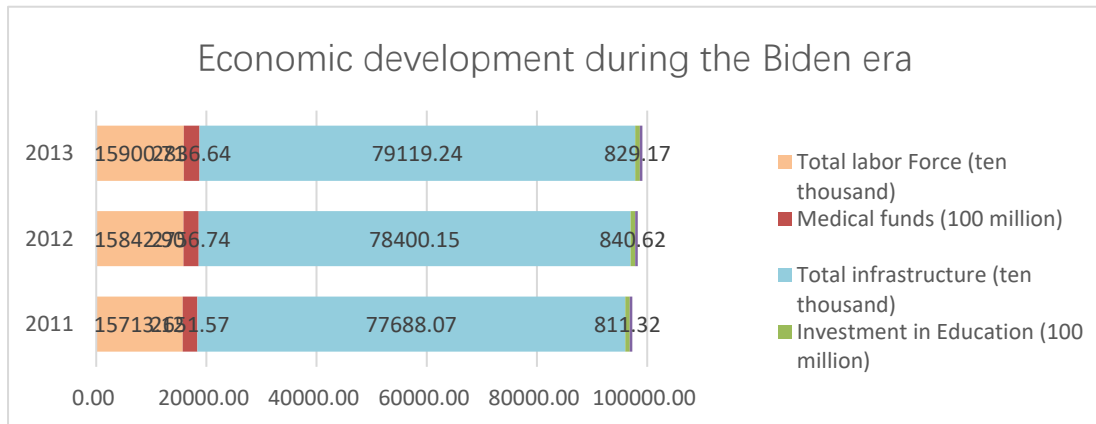


Figure 3. Economic development in Biden period

Labor Force Forecast in trump period:

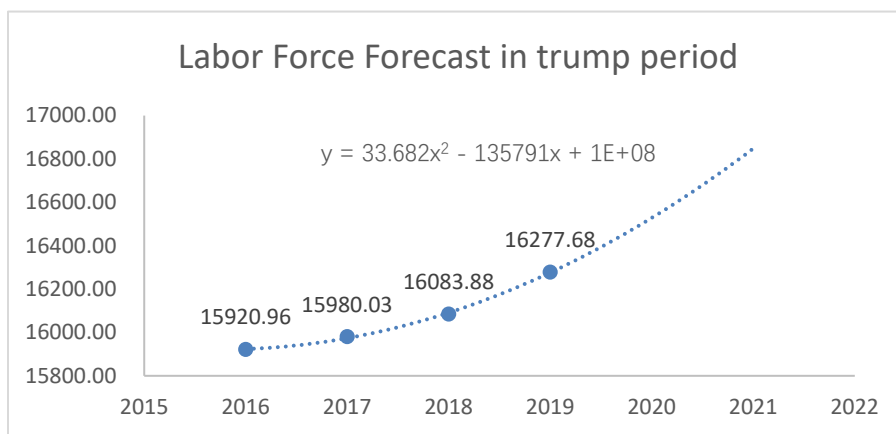


Figure 4. Labor Force Forecast in trump period

Medical fund forecast in trump period:

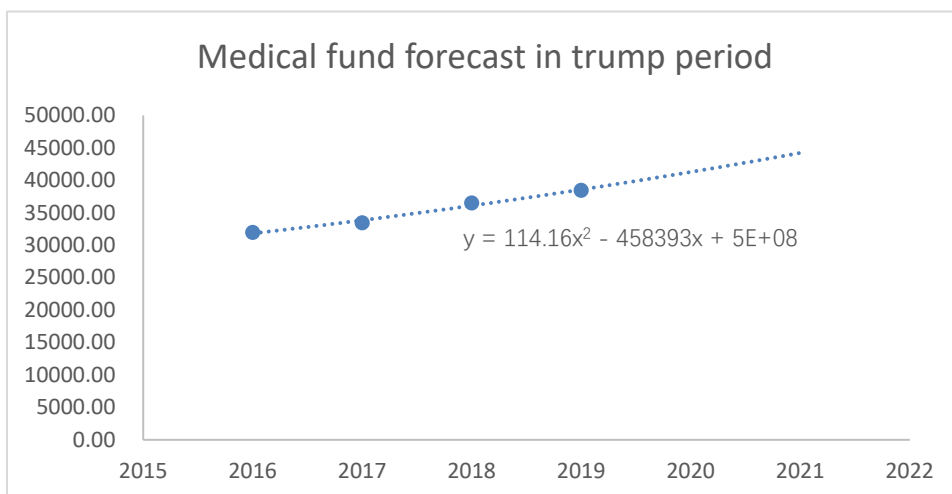


Figure 5. Medical fund forecast in trump period

Total infrastructure forecast in trump period:

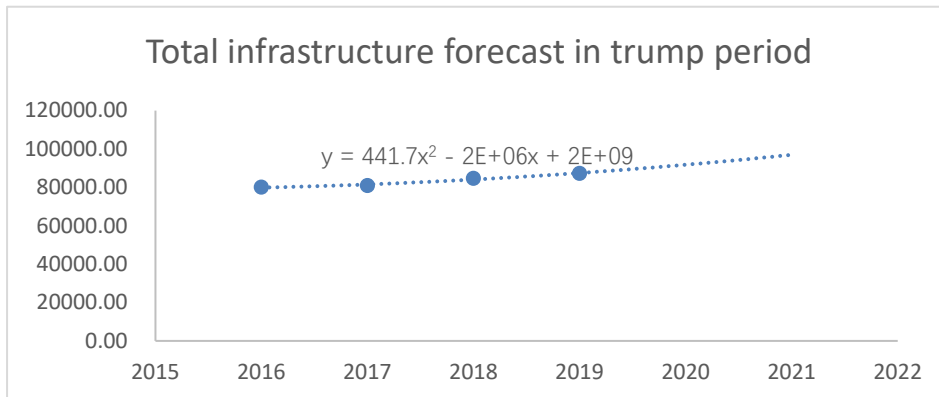


Figure 6. Total infrastructure forecast in trump period

The forecast of investment in education in trump period:

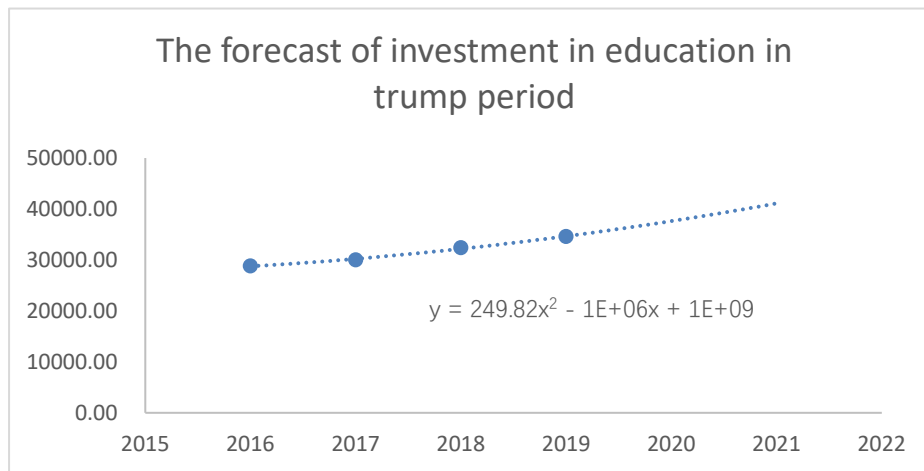


Figure 7. The forecast of investment in education in trump period

Tax forecast in trump period:

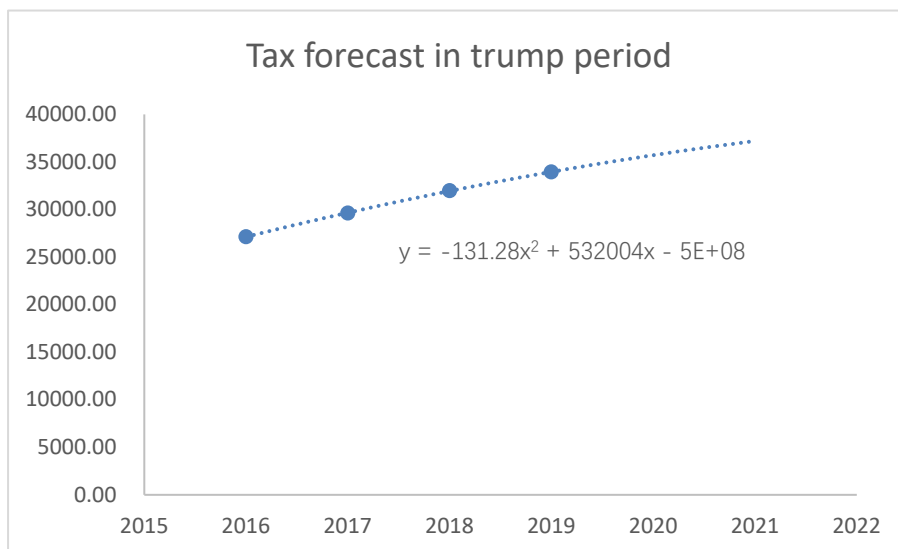


Figure 8. Tax forecast in trump period

3.2. Analytic Hierarchy Process (AHP) was Used to Calculate the Weight Coefficient

The two layers are target layer o and criterion layer C in turn.

The order of level C is tax > medical capital > total labor force > total infrastructure > education investment.

C1: medical funds; C2: taxes; C3: total infrastructure; C4: education investment; C5: total labor force.

Establish judgment matrix:

Table 2. Establish judgment matrix

O-C	C1	C2	C3	C4	C5
C1	1	1/2	4	3	3
C2	2	1	7	5	5
C3	1/4	1/7	1	1/2	1/3
C4	1/3	1/5	2	1	1
C5	1/3	1/5	3	1	1

The maximum eigenvalue J (C-O) = 5.037

According to the maximum eigenvalue method, the weight vector is obtained:

$$\begin{cases} (BW_B)_i = \lambda_{\max}(W_B)_i \\ \sum_{i=1}^n W_{Bi} = 1 \quad (i = 1, 2, \dots, n) \end{cases}$$

Weight vector W (c-o) = [0.263,0.475,0.055,0.090,0.110]^T;

CI= (5.037-5)/ (5-1) =0.018

RI=1.12(check the table)

CR=CI/RI=0.018/1.12=0.016<0.1; So, it passed the consistency test.

4. Conclusion

From from the economic perspective, Trump's re-election in 2021 will have a higher promotion effect on the U.S. economy in the short term, but Biden will have more advantages in the long run. After the successful prevention and control of the epidemic, the United States will usher in a major economic recovery. Trump will lose a lot of labor due to the lack of medical investment, and will not be able to grasp the opportunity. Biden laid a good foundation during the outbreak, which will make the U.S. economy recover rapidly and take it to a higher level.

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