Research on the Impact of the Election of Different American Candidates on China's Economy Based on the Perspective of Mathematical Modeling

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Abstract: This article analyzes the impact of the two candidates Trump and Biden on the Chinese economy by establishing a mathematical model for the 2020 U.S. election, and uses the Analytic Hierarchy Process to quantitatively process the relevant policies introduced or proposed by the two, and then adopts TOPSIS the method is used to sort out the policy rankings of the two trends, and establish a set of evaluation models. It is found that China's semiconductor industry is most affected. Finally, the gray prediction algorithm is used to predict the development trend of China's semiconductor industry after the technology blockade policy.

1. Preface

The 2020 US general election is a "closed" competition between the Republican incumbent Trump and the Democratic challenger Biden. Democratic candidate Biden and Republican candidate Trump are evenly matched. Trump and Biden have completely different attitudes towards international trade. Trump's election will reduce the trade surplus of countries that have a large trade surplus with the United States. The most affected may be China and other Asian economies. The election of Biden will have a greater advantage over Trump for the economic development of the United States, and Sino-US trade relations may be eased. The election of Trump and Biden will have a certain impact on the US economy, the Chinese economy and the world economy

2. Research status

Scholars analyzed the impact of the United States on my country’s economy from different perspectives. For example, Zhao Dongxi (2019) analyzed the impact of the normalization of U.S. monetary policy on China’s economy. They believed that U.S. interest rate hikes would have a negative effect on China’s asset prices; the U.S. reduced its balance sheet. The short-term impact on China's output is positive, and the impact is greater than the impact of interest rate hikes. Yu Ziwei (2018) analyzed the impact of technical barriers in the United States on China’s economy from the causes of technical barriers. He believed that the US’s launch of technical barriers would do more harm than good to my country’s export economy, damage my country’s economic interests, and bring my country’s export trade. There are many negative effects. Yu Hongda (2016) analyzed the possible policy trends of Trump after he was elected President of the United States and its impact on my country's economy. It is believed that the election of Trump has increased the uncertainty of US future policies, but the essence of Sino-US relations will not change significantly. Wu Xinbo (2020) believes that the direction of the Biden administration's China policy mainly involves three aspects. One is the focus of its governance, the other is what constraints he will be subject to from home and abroad, and the third is its China policy choices. Weiping Liu (2020) studied the US currency in the post-financial crisis period and found that the implementation of the US quantitative easing monetary policy will eventually lead to a comprehensive decline in the Chinese stock market, a downturn in the bond market, and a complex situation of depreciation of the RMB against the US

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dollar. Li Junjiu (2020) analyzes from six dimensions the economic rationality of open interest groups in the United States, the behavioral orientation of other economies, and China's structural national competitive advantages, which constitute an important constraint on the United States' economic and trade regulations with China. In response, China needs to determine the "whole government" strategic model, understand the scientific connotation of the "double cycle", implement the established policy of reform and opening up, and attach importance to the strategic significance of the "Belt and Road" initiative. Jia Qingguo (2020) analyzes that after the Biden administration takes office, Sino-US relations will most likely have a relationship of competition and cooperation. However, whether the future Sino-US competition is vicious or benign depends largely on the two countries. of interaction. Yu Xiang (2020) believes that the Biden administration will make adjustments to "national security", but generally will not relax. Second, the next U.S. government's policy toward China not only depends on the policy propositions of the new president and the political parties behind him, but is also subject to the overall domestic political environment in the United States. From a deeper perspective, the subsequent changes in Americans' views on China depend more on their domestic social reform processes. Finally, a series of "bad law toolboxes" restricting Chinese companies have certain policy inertia. Li Xiao (2020) believes that the United States tends to use rules and systems to maintain its control and governance of the world. It will take "value demands" and "realistic interests" as the leading factor to influence and control the establishment of new multilateral rules, trying to contain both The opponent maintains hegemony. We cannot ignore or underestimate this. The studies of the above-mentioned scholars all show that the Trump administration has had a huge impact on the Chinese economy during its administration, which has caused considerable pressure on the Chinese economy. And this article aims to study the impact of the Trump administration and the Biden administration on the Chinese economy, especially China's semiconductor industry.

3. The influence of different candidates on China's economy

3.1 Use analytic hierarchy process to quantify influencing factors

Through Trump and Biden’s policies, the following influencing factors were introduced: (1) Allied Russia system plan (2) Strengthening US-Taiwan relations to split China (3) Creating troubles around China (4) Suppressing and hollowing out the Chinese economy (5) Blocking 5G technology and restricting the import of goods into China.

First, the analytic hierarchy process is used to quantify the above six influencing factors, referring to the scale Table 1 of the paired comparison matrix.

Table 1 Analytic hierarchy process used to quantify the six influencing factors

Scale	Meaning
1	Said, compared to two factors have the same importance
3	Said compared to two factors, one factor is slightly more important than another factor
5	Said compared to two factors, one factor than another factor, obviously important
7	Said compared to two factors, one factor than another factor, highly important
9	Said compared to two factors, one factor than the other factors, is extremely important
2,4,6,8	The above two adjacent judgment of values
The bottom	Factor i and j is the judgment of the a_{ij}, the factor j compared to i judgment matrix $a_{ji} = 1/a_{ij}$

The Table 2 obtained by quantifying the six factors is as follows:

Table 2 Obtained by quantifying the six factors

Influence factors figure		With Russia against China	Strengthen the US-Taiwan relations	Makes disturbance around in China the surrounding	Crack down on and empty Chinese economy	The blockade of science and technology	Forcing American companies to withdraw from China
		B1	B2	B3	B4	B5	B6
Trump	A1	7	7	5	9	3	6
Biden	C2	2	2	2	9	4	5

3.1.1 Algorithm implementation

(1) Data standardization.

Use the formula $b_{ij} = \frac{a_{ij} - \mu_j}{s_j}, (i = 1, 2; j = 1, 2, ..., 6)$ to standardize the data in the Table 2, and use the vector normalization method to obtain the standard decision matrix.

In the TOPSIS method, the data matrix $A = (a_{ij})_{2\times 6}$ is also called the decision matrix, which constructs a standardized decision matrix $\tilde{B} = (\tilde{b}_{ij})_{2\times 6}$.

$$\tilde{b}_{ij} = a_{ij} / \sqrt{\sum_{i=1}^{2} a_{ij}^2}, i = 1, 2; j = 1, 2, ..., 6 \quad (1)$$

(2) Determine the positive ideal solution C^* and negative ideal solution C^0. Set positive ideal solution C^* is the j th of attribute values for c_j^*, a negative ideal C^0 is the j th of attribute values for c_j^0, then

$$\textit{Positive ideal} \text{ solution } c_j^* = \begin{cases} \max_i \tilde{b}_{ij}, & x_j \text{For the benefit attribute}, \\ \min_i \tilde{b}_{ij}, & x_j \text{For cost attributes}, \end{cases} \quad j=1, 2, \ldots, 6; \quad (2)$$

$$\textit{Negative} \text{ ideal solution } c_j^0 = \begin{cases} \min_i \tilde{b}_{ij}, & x_j \textit{For} \text{ the benefit attribute} \\ \max_i \tilde{b}_{ij}, & x_j \textit{For} \text{ cost attributes} \end{cases} \quad j = 1, 2, ..., 6 \quad (3)$$

(3) Calculate the evaluation objects to the positive ideal solution and negative ideal solution. The evaluation objects to the positive ideal solution

$$s_J^* = \sqrt{\sum_{j=1}^{6} (\tilde{b}_{ij} - c_j^*)^2}, \quad i = 1, 2, \quad (4)$$

The evaluation objects to the negative ideal solution:

$$s_J^0 = \sqrt{\sum_{j=1}^{6} (\tilde{b}_{ij} - c_j^0)^2}, \quad i = 1, 2, \quad (5)$$

(4) the object of evaluation index (namely evaluation index)

$$f_i^* = s_i^0 / (s_i^0 + s_i^*), \quad i = 1, 2 \quad (6)$$

(5) According to the f_i^* by the order of the pros. Using the LINGO program, the order of the various factors from high to low in turn

Trump (A1): 2 3 5 1 6 4

Joe Biden (C2):6 4 5 1 3 2

3.1.2 Conclusion

Trump's re-election will have a greater impact on China's economy, and Trump has a tougher attitude towards China. Among the above-mentioned factors, the heaviest one is his attempt to unite Russia with China and strengthen US-Taiwan relations to suppress China's economy in order to promote the decline of China's international status. Trump forced U.S. companies to withdraw from China, aimed at China's implementation of a technology blockade policy, the blockade of the semiconductor industry, and even Huawei's 5G technology. These measures have not only affected the development speed of the Chinese economy, but also have a certain impact on the U.S. economy. Trump also tried to cause troubles around China to consume national defense forces and funds in China's border areas. He also formulated a national overall target plan to suppress China's economy in a larger way and even wanted to hollow out the Chinese economy. In summary, it can be seen that Trump’s election will have a greater impact on the Chinese economy and may lead to a substantial decline in China’s economy in North America

The influence of Biden's election on the Chinese economy will be slightly lower than that of Trump. The election of Biden will continue the general direction set by Trump and continue to suppress and hollow out the Chinese economy. But Biden's election will slow the deterioration of Sino-US relations to a certain extent. However, for a long time to come, the main color of Sino-US relations may still be "cold." For American companies in China, Biden is unlikely to force withdrawal from the Chinese market immediately. But in the general direction, Biden will continue Trump's suppression of China and formulate an overall national target plan. Biden’s coming to power will make great progress in the development of high-tech in the United States. Biden will likely carry out a full range of suppression in all fields except the military field, but the degree of restriction on China’s economy is comparable to Trump’s. The tough policy of China is obviously slightly lower.

3.2 Using Grey Forecasting Model to Analyze the Influence of Different U.S. Candidates on China's Economy

3.2.1 Modeling

In conclusion, we can judge that the technological blockade has a greater impact on China's economy, so we choose to solve the problem from a technological perspective. The most obvious blockade in technology is the 5G blockade and the blockade of semiconductor chips. In terms of 5G, Huawei has led Qualcomm to break through the blockade. However, the core lithography machine of the semiconductor still has not broken the blockade, which has serious constraints on the Chinese semiconductor industry. It will also have an impact on 5G. Check the output value of China's semiconductor industry in recent years from the China Economic Network database, extract the data, establish a gray forecast model, and use a series of forecasts to predict the upward trend of the semiconductor industry before the implementation of the technology blockade policy and the upward trend of the semiconductor industry after the implementation of the technology blockade policy.

This article uses the cumulative generation method to generate a series of output value data [1600 1750 1920 2340 2250 2320 2290 2650].

3.2.2 Steps to use grey forecast

(1) Perform a first-order accumulation processing on the time series historical data to get the generated series:

$$x^{(1)} = (x^{(1)}(1), x^{(1)}(2), ..., x^{(1)}(n)) = (\sum_{m=1}^{1} x^{(0)}(m), \sum_{m=1}^{2} x^{(0)}(m), ..., \sum_{m=1}^{n} x^{(0)}(m)) \quad (7)$$

(2)To establish a GM (1, 1) model:

$$\frac{d_{x^{(1)}}}{d_t} + ax^{(1)} = u \quad (8)$$

(3) for “a” value is:

$$\begin{bmatrix} a \\ u \end{bmatrix} = (B^T B)^{-1} B^T Y_1 \quad (9)$$

Among them

$$B = \begin{pmatrix} -\frac{1}{2}(x^{(1)}(1) + x^{(1)}(2)) & 1 \\ -\frac{1}{2}(x^{(1)}(2) + x^{(1)}(3)) & 1 \\ \vdots & \vdots \\ -\frac{1}{2}(x^{(1)}(n-1) + x^{(1)}(n)) & 1 \end{pmatrix}, Y_N = \begin{pmatrix} x^{(0)}(2) \\ x^{(0)}(3) \\ \vdots \\ x^{(0)}(n) \end{pmatrix} \quad (10)$$

(4) Get the value of the “a, u”, generation into the differential equations of time functions:

$$x^{(i)}(k+1) = [x^{(0)}(1) - \frac{\mu}{a}]e^{-ak} + \frac{\mu}{a} \quad (11)$$

As a result, obtained the sequence $X^{(1)}$, then the forecast sequence using the reduction to predict the type:

$$X^{(0)}(k+1) = X^{(i)}(k+1) - X^{(i)}(k) \quad (12)$$

(5) Test predicted value: calculate relative error

$$\varepsilon(k) = \frac{x^{(0)}(k) - \hat{x}^{(0)}(k)}{x^{(0)}(k)}, k = 1, 2, ...n \quad (13)$$

3.3 Screenshot of MATLAB running grey prediction algorithm

Establish a series of output value data for the semiconductor industry and substitute it into MATLAB for gray prediction. The Figure 1 is a screenshot of the operation:

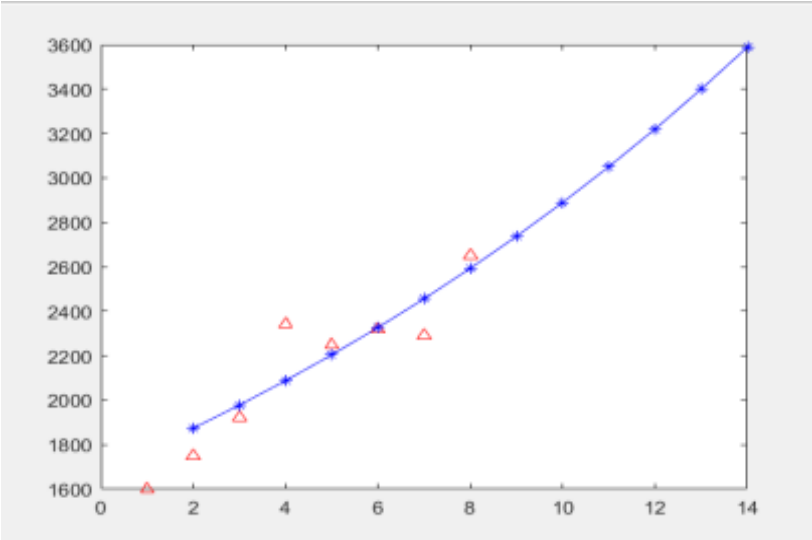

Fig.1 A screenshot of the operation

The percentage absolute error is: 1.621386%

The forecast value is: 2737.2033, 2889.5006, 3050.2717, 3219.988, 3399.1473, 3588.275, 3787.9258, 3998.685

From the above Figure 1, we can intuitively see that if there is no economic blockade, China's semiconductor industry will definitely develop rapidly, showing an exponential rise. However, the technology blockade policy has been implemented, so we need to predict the semiconductor industry after the technology blockade is implemented, see Figure 2:

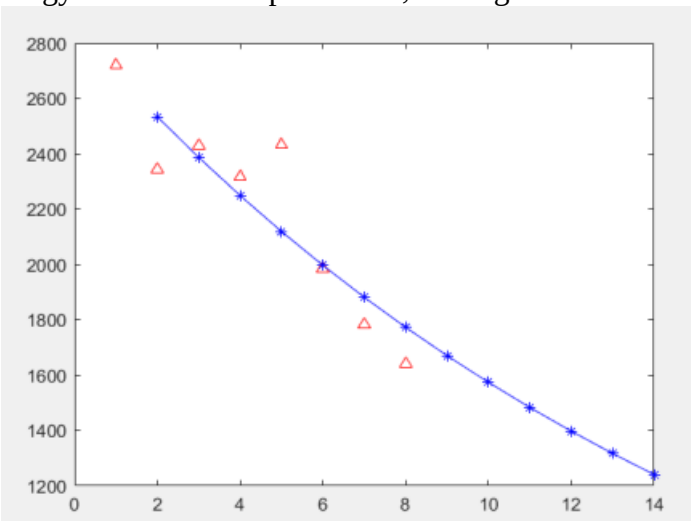

Fig.2 predicting the semiconductor industry after the technology blockade is implemented

The percentage absolute error is: 1.621386%

The forecast value is: 2647.2044, 2456.7049, 2177.4132, 1876.988, 1573.9342, 1483.0303, 1397.3766, 1240.6245

4. Conclusion

Combining the above two forecast results, we can find that if the technology blockade policy is not implemented, the output value of the semiconductor industry will increase exponentially in the next few years. The prediction can be found that after the implementation of the technology blockade policy, the semiconductor industry has fallen sharply. Therefore, the prospects for Trump’s re-election in China’s semiconductor industry are not optimistic. He will encounter a huge waterloo. After Biden takes office, there will be no substantial changes. He will still maintain the suppression policy, but because the Biden government team is composed of professionals, The

behavior is relatively certain and will not implement the maximum pressure of the whole government as during the Trump administration. Rather, it has chosen to increase the blockade. In addition, it does not rule out the possibility of the Biden administration and China developing scientific and technological cooperation in certain areas.

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