

Who is the Better Leader?

Based on Linear Regression and Neural Network Model to Predict the Post Election Performance of the United States

Zeheng Zhang¹, Yi Jing^{2,*}, Weihua Li³, Zenyu Guo⁴, Yixuan Zhao⁵

¹ *International Energy College of Jinan University*

² *School of intelligent science and engineering, Jinan University*

³ *Institute of rail transit, Jinan University*

⁴ *International Energy College of Jinan University*

⁵ *School of intelligent science and engineering, Jinan University*

*Corresponding author. Email: liweihua@jnu.edu.cn

ABSTRACT

The general election of the United States has ended, and Biden has been elected president of the United States. Domestic and international scholars in the United States are studying Biden's economic and political adjustments in different ways, especially the differences compared with Trump's. Who will make greater contribution to the development of the United States?

In this paper, we determine four indicators to measure the performance of leaders: GDP, CPI, trade balance and unemployment rate. By searching the historical data on the relevant official websites of the United States, linear regression model and neural network model are established to predict the ruling data of different leaders in the future. The results were analyzed visually, and the differences of different leaders in the above indicators were discussed, and the relatively reliable judgments were given.

Finally, we analyze the reliability of the prediction, and prove that our prediction has a certain reference value. We also pointed out our shortcomings and proposed to consider the in-depth research direction of the international influence of different US leaders.

Keywords: *American election, linear regression, neural network prediction*

1. INTRODUCTION

In 2020, Biden was officially elected president of the United States on January 20, and delivered his inaugural speech. However, scholars and experts in academic circles have different opinions on what policies Biden will introduce and what impact it will have on the United States and other countries.

The United States implements the electoral system and stipulates that elections should be held every four years. The electoral system in the United States is the embodiment of decentralization and respect for local state power in American democracy.

Because of its strong strength and close international ties, the United States is one of the largest economies in the world. Therefore, with the deepening of economic globalization, the coming into power of leaders of

different parties will affect the future international situation[1].

Different positions of the ruling party and government have different policies and attitudes in various fields, and the national economy and other indicators will have different trends. However, because Biden does not have the relevant data of governance, this paper indirectly predicts the data changes of various indicators that may be caused by Trump's or Biden's governance through the historical data of Trump's governance and previous administrations of the United States, and makes a comprehensive analysis combined with the current epidemic situation.

2. PROBLEM ANALYSIS AND MODEL SELECTION

2.1. problem analysis

The modern economic system is an organic whole composed of various fields of social and economic activities. Combined with the current social environment, this paper mainly makes a relatively reasonable comprehensive evaluation of the economic development of the United States from the areas of the epidemic prevention measures, infrastructure, employment, trade, immigration, education and so on.

2.2. Modeling

As we all know, GDP is an important indicator to measure the economic situation of a country, so we use this indicator to predict the situation of different leaders taking office. And because GDP is a macro indicator, we can use linear regression to predict its GDP[2].

Linear regression equation is a kind of regression analysis that uses least square function to model the relationship between one or more independent variables and dependent variables. When we find a set of (a, b) to minimize the sum of squares of residuals.

$$RSS (SSE) = \sum_{i=1}^n (y_i - \hat{y}_i)^2 = \sum_{i=1}^n [y_i - (ax_i + b)]^2 \quad (1)$$

It means that to some extent, we have found the best simple linear regression model.

In addition, we learned that: there is a complex interaction between several indicators we are concerned about, in order to avoid this problem, we use the neural network algorithm in deep learning to make predictions through a large number of historical data[3].

Neural network is a kind of network, which is divided into three layers: input layer, hidden layer and output layer. It can get its hidden layer through a large number of historical data training, and get the future output layer data through the trained hidden layer. In a special way, the algorithm solves the problem of the interaction between the various indicators.

According to the above principles, we can greatly simplify the complex problems and intuitively predict the different ruling effects of the two leaders.

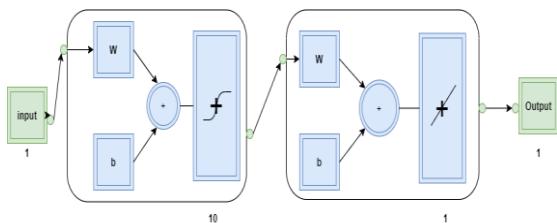


Figure 1. Three layer structure diagram of neural network

3. FORECAST ANALYSIS

3.1. problem analysis

Based on the relevant data collected in Fred from the Bureau of economic analysis, the board of Governors of the Federal Reserve and other authoritative institutions[4]. Based on the analysis of US GDP, we can get the relevant quarterly data from 1992 to 2020. The fitted data in recent 4 years are shown in Figure 2.

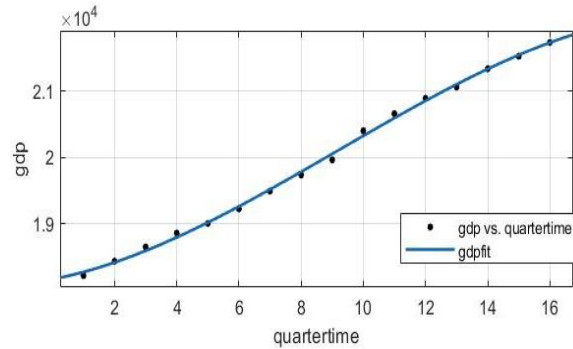


Figure 2. Quarterly GDP data of the United States in recent four years

It can be seen that our fitting effect on historical data is better. We use the fitting function to fit the data of different periods, and use it as the prediction data of trump and the natural development of the United States:

Table 1. GDP predicted value

| time | GDP | GDP predicted value(Trump) | GDP predicted value(America) |
|-----------|---------|----------------------------|------------------------------|
| 2020/1/1 | 21537.9 | 21882 | 21936 |
| 2020/4/1 | 19408.8 | 22006 | 22120 |
| 2020/7/1 | 21157.6 | 22091 | 22286 |
| 2021/1/1 | | 22134.8 | 22435.21605 |
| 2021/4/1 | | 22132.066 | 22567.39392 |
| 2021/7/1 | | 22078.728 | 22683.91619 |
| 2021/10/1 | | 21970.502 | 22785.98361 |
| 2022/1/1 | | 21803.104 | 22874.89069 |
| 2022/4/1 | | 21572.25 | 22951.95777 |
| 2022/7/1 | | 21273.656 | 23018.47989 |
| 2022/10/1 | | 20903.038 | 23075.69076 |
| 2023/1/1 | | 20456.112 | 23124.73949 |

Comparing the above table, we can find that Trump's continued appointment may cause economic downturn, while the overall forecast data of the United States shows steady growth.

3.2. Comprehensive index forecast

As mentioned in 1.1, we avoid the mutual interference of various factors, establish a neural network prediction model by using MATLAB, and use the relevant monthly data from 1992.1 to 2020.10 in the

Federal Reserve database [5] to predict the CPI, trade balance and unemployment rate of the United States, and obtain the relevant prediction results. This paper only shows the CPI and trade balance as shown in Figure 3 and Figure 4.

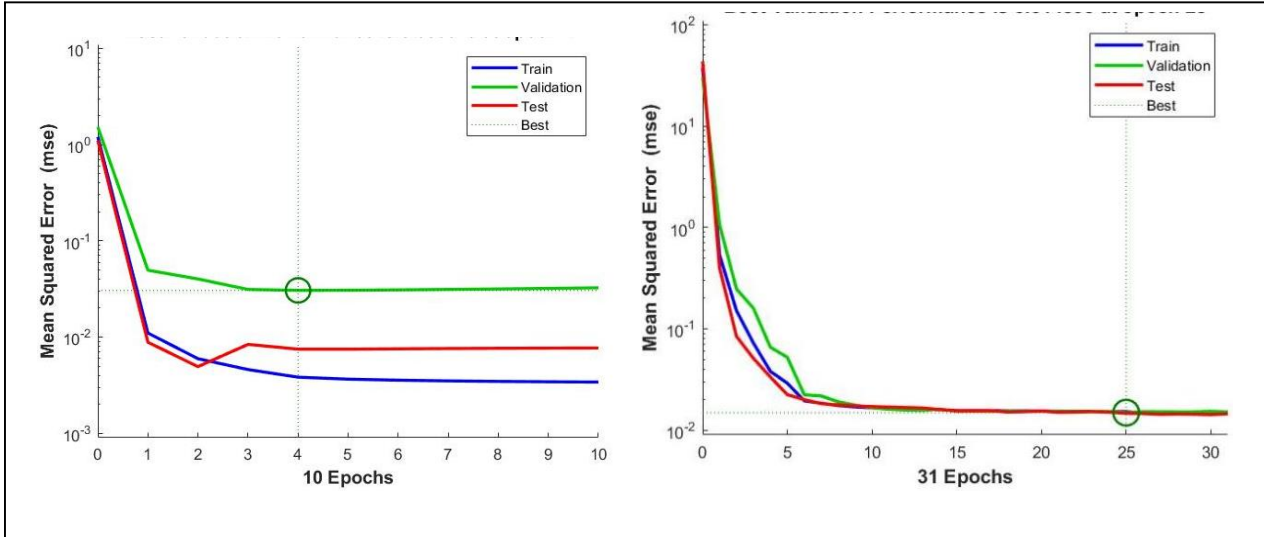


Figure 3. CPI forecast(Left:Trump;Right:comprehensive)

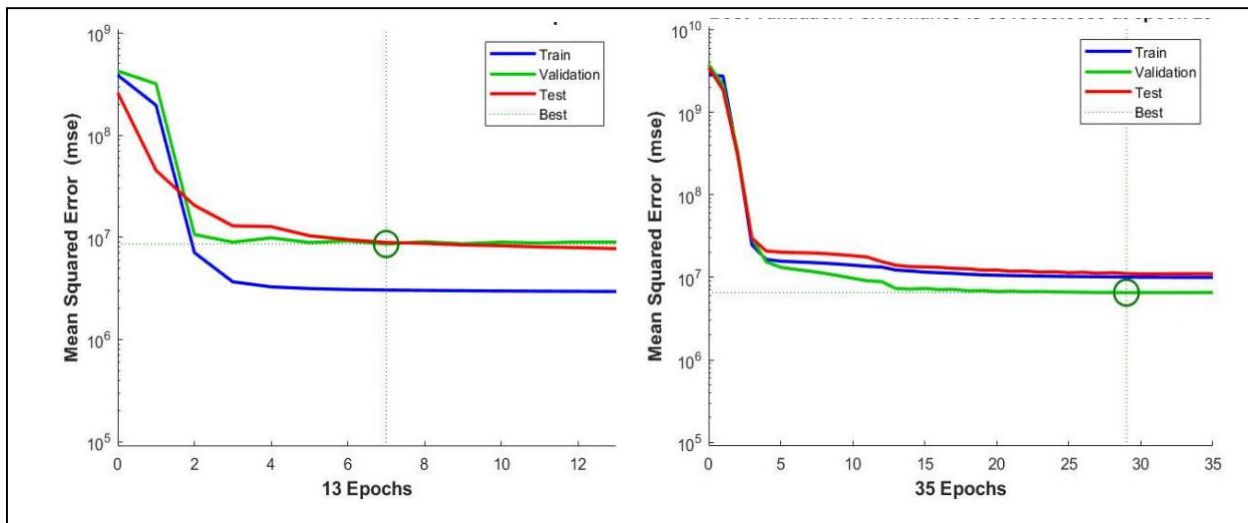


Figure 4. Trade balance forecast(Left:Trump;Right:comprehensive)

Through the prediction data chart, we analyze the trend and value of the image and draw the following conclusions:

We can see that in terms of unemployment rate, Trump's forecast is significantly lower than that of the United States as a whole. Therefore, we believe that trump may be more conducive to the development of the United States in terms of employment.

In terms of price level, Trump's forecast data is significantly lower than that of the United States as a whole. Therefore, trump is more likely to lead to

deflation, factory closure, and even the collapse of capitalism in the United States.

In terms of economy and trade, there is little difference between trump and the United States in the level of historical data, and the overall forecast data of the United States is slightly higher than trump's. Therefore, we judge that Trump's coming to power may slightly reduce the economic and trade level of the United States.

Through the above analysis, we can draw a general conclusion: Trump's re-election may make the economic development of the United States lag behind, on the contrary, it can not be denied that the current President

Biden may bring positive effects to the economic development of the United States.

4. MODEL CHECKING

In order to further illustrate the reliability of our predicted data, we made error statistics on all the data, and displayed and analyzed the test results of one of the indicators (Comprehensive data of CPI) as Figure5 and Figure6.

It can be seen that our experimental results are relatively ideal, the overall error rate remains within 0.4, and the fitting degree of the prediction data is better than the consistency of the overall historical data.

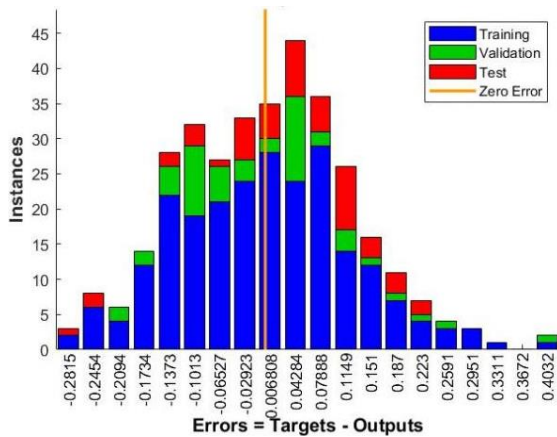


Figure 5. Prediction error analysis chart(America)

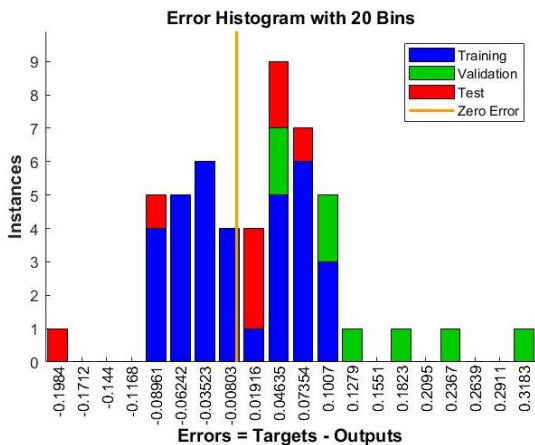


Figure 6. Prediction error analysis chart(Trump)

5. CONCLUSION

Based on the data of the past years in the United States and during Trump’s term of office, we selected four more representative indicators (GDP, CPI, trade balance, unemployment rate), established linear regression model and neural network prediction model, and successfully predicted the trend of each indicator in the future.

Based on the trend of each index and specific data, we come to the conclusion that Biden’s appointment may be more conducive to the social development of the United States. We also verify the reliability of the prediction data, and get a more ideal result, which makes our prediction results have reference and reference.

Of course, there are still deficiencies in our work. All the data we forecast are for the development of the United States itself. However, with the deepening of economic globalization, the United States, as one of the world’s large-scale economies, is bound to have an impact on some aspects of other countries. We need to further study whether the United States will have a positive or negative impact on other countries.

AUTHORS’ CONTRIBUTIONS

Zheng Zhang¹, Yi Jing^{2,*}, Weihua Li³, Zhenyu Guo⁴, Yixuan Zhao⁵

ACKNOWLEDGMENTS

Special thanks for the financial support of "climbing plan" of science and technology innovation strategic fund of Guangdong Province, China.

REFERENCES

- [1] Paul Almeida and Chris Chase-Dunn. Globalization and Social Movements. Annual Review of Sociology 2018 44:1, 189-211.
- [2] Wang Huiwen, Meng Jie. Prediction modeling method of multiple linear regression [J]. Journal of Beijing University of Aeronautics and Astronautics, 2007 (04): 500-504.
- [3] Wu Wei, Chen Weiqiang, Liu Bo. Forecasting the rise and fall of stock market with BP neural network [J]. Journal of Dalian University of technology, 2001 (01): 9-15.
- [4] <https://fred.stlouisfed.org/>.
- [5] <https://www.bea.gov/>.