Research on Trend Forecasting System Utilizing Big Data Network and Information Technology

An Xing¹, Shi Yan¹, Zang Yang², Lu Yan³, Ren Yue⁴

¹College of Science, Lanzhou University of Technology, Lanzhou, Gansu, 730050
²School of Civil Engineering, Lanzhou University of Technology, Lanzhou, Gansu, 730050
³College of Petrochemical Technology, Lanzhou University of Technology, Lanzhou, Gansu, 730050
⁴Faculty of Law, Lanzhou University of Technology, Lanzhou, Gansu, 730050

*Corresponding author: anxing2019@lut.cn

Abstract. In this paper, we take big data, the GDP of the United States from 1992 to 2020 as the research object. Through SPSS software analysis and descriptive statistics, we can compare the GDP of Biden and Trump during their tenure. Using big data's analytical technology, the line chart we get visually shows that the election of different candidates will shape different strategic patterns of global economic and financial development. A new comprehensive factor W is obtained from the data that directly reflect the overall GDP of the United States. Finally, by establishing a forecasting model, we can find out the comprehensive event factors that will occur due to different political positions and policy plans between Biden and Trump in the future. In the end, we use the results of big data's analysis to show that Biden's economic plan may increase US GDP growth by 1.2 percentage points in 2021, push GDP growth to 4.9%, and help the US economy recover the economic losses caused by the epidemic in mid-2021.

Keywords: GDP, SPSS, GM(1,1), Presidential campaign.

1. Introduction

The presidential election in the United States is held every four years. 2020 is the year of the US presidential election, with Republican candidate Donald Trump (Donald Trump) and Democratic candidate Joe Biden (Joe Biden) running for president. Candidates of the two parties have different political positions and policy platforms in finance and trade, economic and financial governance, and other key development areas (such as COVID-19’s countermeasures, infrastructure, taxation, environmental protection, medical insurance, employment, trade, immigration, education, etc.). The election of different candidates will shape different strategic patterns of global economic and financial development, and have a greater impact on the US economy and the global economy, including the Chinese economy. What impact will different policies have on the American economy and the Chinese economy? How should China respond? In this article, we collect the candidates' policy propositions, policy guidelines and related data in different areas, and in this paper, we establish a
mathematical model and use relevant data to quantitatively analyze the possible impact of the election of different candidates on the American economy.

2. Leveling and Modeling of Problem

Look up the data to get the US GDP from 1992 to 2020. GDP (Gross Domestic Product) refers to the market value of all the final results produced by economic activities in a country (or region) within a certain period of time. It is the core indicator of national economic accounting and an important data to measure the economic status and development level of a country or region. Through the correlation analysis and descriptive statistics of the data by SPSS, the GDP comparison between Biden and Trump during their tenure is obtained, which intuitively shows that the election of different candidates will shape the different strategic patterns of global economic and financial development. Construct a new comprehensive factor W, and through the establishment of a predictive model, predict the changes in the comprehensive factors of Biden and Trump during the next ten years due to different political positions and administrative plans.

| N     | Minimum value | Maximum value | Average | Probabilistic deviation |
|-------|---------------|---------------|---------|-------------------------|
| V1   | 15            | 109063.000    | 108739.000 | 586871.873         | 364007.342 |
| GDP-Other services: cumulative value | 15            | 30369.052    | 117468.997 | 88099.297       | 52027.364 |
| GDP-Tertiary industry: cumulative value | 15            | 160225.774   | 143452.123 | 284464.184       | 1138053.252 |
| GDP-Transport, warehousing and postal services: cumulative value | 15            | 7868.242    | 42530.242  | 23532.412       | 11994.817 |
| GDP-Wholesale and retail trade: cumulative value | 15            | 17753.986   | 95845.500  | 49864.359       | 25258.707 |
| GDP Construction: cumulative value | 15            | 8351.354    | 70904.371  | 49864.359       | 25258.707 |
| GDP Financial sector: cumulative value | 15            | 17211.424   | 70904.371  | 49864.359       | 25258.707 |
| GDP Real estate: cumulative value | 15            | 12293.568   | 69035.156  | 56121.860       | 21647.314 |
| GDP Accommodation and catering: cumulative value Effective if (Service) | 15            | 2821.807    | 60940.000  | 9100.17        | 4805.300 |

Figure 1. The correlation of various GDPs during Trump's tenure (2017-2020)

| N     | Minimum value | Maximum value | Average | Probabilistic deviation |
|-------|---------------|---------------|---------|-------------------------|
| V1   | 15            | 112030.000    | 804250.000 | 422047.793           | 218134.000 |
| GDP-Other services: cumulative value | 15            | 22127.574    | 132796.283 | 74894.81           | 4240.064 |
| GDP-Tertiary industry: cumulative value | 15            | 46195.552   | 53315.783  | 18968.12           | 9181.579 |
| GDP-Transport, warehousing and postal services: cumulative value | 15            | 52210.309   | 39422.041  | 199089.42          | 102212.988 |
| GDP-Wholesale and retail trade: cumulative value | 15            | 12982.711    | 71113.800  | 30000.65           | 1870.732 |
| GDP Construction: cumulative value | 15            | 6370.492    | 45212.294  | 23987.78           | 1471.387 |
| GDP Financial sector: cumulative value | 15            | 9390.622    | 42313.501  | 20901.34           | 18221.381 |
| GDP Real estate: cumulative value | 15            | 8830.483    | 48133.347  | 25300.27           | 12364.503 |
| GDP Accommodation and catering: cumulative value Effective if (Service) | 15            | 2599.133    | 13581.378  | 7897.89           | 3098.693 |

Figure 2. Various descriptive statistics of GDP during Trump's tenure (2017-2020)

| N     | Minimum value | Maximum value | Average | Probabilistic deviation |
|-------|---------------|---------------|---------|-------------------------|
| V1   | 15            | 112030.000    | 104623.000 | 422047.793           | 218134.000 |
| GDP-Other services: cumulative value | 15            | 22127.574    | 132796.283 | 74894.81           | 4240.064 |
| GDP-Tertiary industry: cumulative value | 15            | 46195.552   | 53315.783  | 18968.12           | 9181.579 |
| GDP-Transport, warehousing and postal services: cumulative value | 15            | 52210.309   | 39422.041  | 199089.42          | 102212.988 |
| GDP-Wholesale and retail trade: cumulative value | 15            | 12982.711    | 71113.800  | 30000.65           | 1870.732 |
| GDP Construction: cumulative value | 15            | 6370.492    | 45212.294  | 23987.78           | 1471.387 |
| GDP Financial sector: cumulative value | 15            | 9390.622    | 42313.501  | 20901.34           | 18221.381 |
| GDP Real estate: cumulative value | 15            | 8830.483    | 48133.347  | 25300.27           | 12364.503 |
| GDP Accommodation and catering: cumulative value Effective if (Service) | 15            | 2599.133    | 13581.378  | 7897.89           | 3098.693 |

Figure 3. Various descriptive statistics of GDP during Biden's tenure (2009-2017)
2.1. Model introduction

$GM_{(1,1)}$ means that the model is a gray model with a first-order differential equation and only contains one variable. Problem one is to establish a comprehensive factor as a gray model variable for the data that directly reflects the overall GDP of the United States.

Known reference data column $X^{(o)} = \left( X^{(o)}(1), X^{(o)}(2), X^{(o)}(3), \ldots, X^{(o)}(n) \right)$, 1 accumulative generation sequence (1-AGO):

$$X^{(1)} = \left( X^{(1)}(1), X^{(1)}(2), X^{(1)}(3), \ldots, X^{(1)}(n) \right) = \left( X^{(o)}(1), X^{(o)}(1) + X^{(o)}(2), \ldots, X^{(o)}(1) + \ldots + X^{(o)}(n) \right)$$

(1) where: $x^{(1)}(k) = \sum_{i=1}^{k} x^{(o)}(i), k = 1, 2, 3, \ldots, n$. The mean generating sequence of $x^{(1)}$:

$$Z^{(1)} = \left( Z^{(1)}(2), Z^{(1)}(3), Z^{(1)}(4), \ldots, Z^{(1)}(n) \right)$$

(2) where:

$$z^{(1)}(k) = 0.5x^{(1)}(k) + 0.5x^{(1)}(k-1), k = 2, 3, \ldots, n.$$  

Establish grey differential equation:

$$x^{(o)}(k) + az^{(1)}(k) = b, k = 2, 3, \ldots, n$$  

The corresponding whitening differential equation is:

$$\frac{dX^{(1)}}{dt} + aX^{(1)}(t) = b$$

(5)

Referred to as $u = [a, b]^T, Y = \left[ x^{(o)}(2), x^{(o)}(3), \ldots, x^{(o)}(n) \right]^T, B = \begin{bmatrix} -z^{(1)}(2) & 1 \\ -z^{(1)}(3) & 1 \\ \vdots & \vdots \\ -z^{(1)}(n) & 1 \end{bmatrix}$, Then by the least square method, $J(u) = (Y - Bu)^T(Y - Bu)$. The estimated value that reached the minimum is:

$$\hat{u} = \left[ \hat{a}, \hat{b} \right]^T = \left( B^T B \right)^{-1} B^T Y$$

(6)

So, solve the equation (5), get:
\[
\Lambda^{(1)}_x (k + 1) = \left( x^{(0)}(1) - \frac{\Lambda}{a} \right) e^{-\frac{\Lambda}{a}} + \frac{\Lambda}{a}, k = 0, 1, \ldots, n - 1, \ldots
\]

2.2. **GM (1,1) prediction Model and steps**

| Serial number | Integrated factors |
|---------------|--------------------|
| Trump         | Biden              |
| 1             | 535139.75          | 1               | 288014.3925 |
| 2             | 574674.6           | 2               | 368972.3    |
| 3             | 636881.25          | 3               | 430049.9    |
| 4             | 514431.9           | 4               | 494867.75   |

**Figure 5.** Comprehensive factor data during Trump and Biden's tenure (calculated based on various weights)

2.2.1. **Grade ratio test.** Establish a comprehensive factor \( W \) average data time series \( X_A^{(0)} \) (Time series of comprehensive factor \( W \) during Trump's tenure), \( X_B^{(0)} \) (Time series of comprehensive factor \( W \) during Biden's tenure) as follows:

\[
X_A^{(0)} = (x^{(0)}(1), x^{(0)}(2), x^{(0)}(3), x^{(0)}(4)) = (535139.75, 574674.6, 636881.25, 582231.8667)
\]
\[
X_B^{(0)} = (x^{(0)}(1), x^{(0)}(2), x^{(0)}(3), x^{(0)}(4)) = (288014.3925, 368972.3, 430049.9, 494867.75)
\]
(a) Seek grade ratio \( \lambda_k \):

\[
\lambda(k) = \frac{x^{(0)}(k - 1)}{x^{(0)}(k)}, k = 2, 3, 4
\]

Substitute:

\[
\lambda_A = (\lambda(2), \lambda(3), \lambda(4)) = (1.071.10.81)
\]
\[
\lambda_B = (\lambda(2), \lambda(3), \lambda(4)) = (1.281.171.15)
\]

(b) Grade ratio judgment. Due to all \( \lambda_A(k) \in [0.81, 1.11] \), \( \lambda_B(k) \in [1.15, 1.28] \) \( k = 2, 3, 4 \), so you can use \( x^{(0)} \) do satisfactory GM (1,1) modeling.

2.2.2. **GM (1,1) modelling.** (a) Accumulate the original data \( x^{(0)} \) once to get:

\[
x_A^{(1)} = (535139.7, 109814.3, 746695.6261127.3)
\]
\[
x_B^{(1)} = (288014.39, 656986.69, 1087036.59, 1581904.34)
\]
(b) Construct the data matrix \( B \) and data vector \( Y \), get:

\[
B = \begin{bmatrix}
-\frac{1}{2}(x^{(1)}(1)+x^{(1)}(2)) & 1 \\
-\frac{1}{2}(x^{(1)}(2)+x^{(1)}(3)) & 1 \\
-\frac{1}{2}(x^{(1)}(3)+x^{(1)}(4)) & 1
\end{bmatrix}, \quad
Y = \begin{bmatrix}
x^{(0)}(2) \\
x^{(0)}(3) \\
x^{(0)}(4)
\end{bmatrix}
\]

(c) Calculation:

\[
\hat{u}_A = \begin{bmatrix} \hat{a} \\ \hat{b} \end{bmatrix}^T = \left( B^T B \right)^{-1} B^T Y = \begin{bmatrix} 0.42841.906 \\
23201.96+1.117 \end{bmatrix}
\]

\[
\hat{u}_B = \begin{bmatrix} \hat{a} \\ \hat{b} \end{bmatrix}^T = \left( B^T B \right)^{-1} B^T Y = \begin{bmatrix} -0.241536 \\
37949065 \end{bmatrix}
\]

(d) Modeling:

\[
\frac{d\hat{x}^{(1)}}{dt} + \hat{a} \hat{x}^{(1)}(t) = \hat{b},
\]

Solved:

\[
\hat{x}_A^{(1)}(k+1) = \left( x^{(0)}(1) - \frac{b}{\pi} \right) e^{-\frac{\hat{a}}{\pi}} + \frac{\hat{b}}{\pi} = (509016.9368 + 116037.8071i)e^{(-0.4284-1.9030)i} + 2612281321-116037.8071i
\]

\[
\hat{x}_B^{(1)}(k+1) = \left( x^{(0)}(1) - \frac{b}{\pi} \right) e^{-\frac{\hat{a}}{\pi}} + \frac{\hat{b}}{\pi} = 130916.548e^{0.2415367734i} + 157097844z
\]

(e) Seek to generate sequence prediction value \( \hat{x}^{(1)}(k+1) \) and model reduction value \( \hat{x}^{(1)}(k+1) \),

\[k = 1, 2, 3, \] From the time response function of formula (16), it can be calculated \( x^{(1)} \), among them

\[
\hat{x}_A^{(1)}(1) = x^{(1)}(1) = 535139.75, \quad \hat{x}_B^{(1)}(1) = x^{(1)}(1) = 288014.3925 \]

\[
\hat{x}_A^{(1)} = (x_A^{(0)}(1), x_A^{(0)}(2), x_A^{(0)}(3), x_A^{(0)}(4)) = (535140, 604060, 574800, 546950)
\]

\[
\hat{x}_B^{(1)} = (x_B^{(0)}(1), x_B^{(0)}(2), x_B^{(0)}(3), x_B^{(0)}(4)) = (288010, 369320, 427330, 494460)
\]
2.2.3. Model checking

The calculation results of various test index values of the model are shown in Figure 6. 7:

**Figure 6. GM (1,1) Model checklist**

| Serial number | Original value | Forecast | Residual residual | Relative error | Ratio error |
|---------------|----------------|----------|------------------|----------------|-------------|
| Trump 1       | 555139.75      | 555140   | 0                | 0              | 0           |
| 2             | 574674.6       | 604060   | -29381           | 0.0511         | 0.1139      |
| 3             | 636881.25      | 574800   | 62086            | 0.0975         | 0.1414      |
| 4             | 514431.9       | 546950   | 32520            | 0.0832         | -0.178      |

**Figure 7. GM (1,1) Model checklist**

It has been verified that the accuracy of the model is high and can be predicted and forecasted.

3. Conclusion

By comparing the predicted values and relative errors, it is concluded that Trump's political stance and administrative plan are more volatile than Biden's impact on the US economy and the global economy. Biden came to power to help boost the US economy. Biden's fiscal policy proposal will provide a booster for the US economic recovery.

Biden’s US$4 trillion tax increase proposal and US$7 trillion spending plan are unlikely to be passed in the Senate, but the probability of passing the compromise plan is still relatively high. We predict that if Biden can push through most of the tax increase proposals and the $3 trillion spending plan, the US GDP growth rate in 2021 will increase by 1.2 percentage points, and the GDP growth rate will reach 4.9%, and it will recover in mid-2021. Economic losses caused by the epidemic. Biden's tax increase plan is mainly borne by high-income families, and will not significantly curb consumer spending while generating a large amount of revenue for the government. It is estimated that at the end of Biden's four-year term, nominal disposable income will be 1.4% higher than the baseline level, which is equivalent to a nominal disposable income of $3,500 per household; the US unemployment rate will remain at 6.5%.

Trump's re-election will restrain the US economic recovery. Compared with Biden, Trump's re-election may restrain the pace of US economic recovery. The degree of restriction will depend on the control of Congress. According to the policy baseline, assume that Trump is re-elected, the Republicans control the Senate and the Democrats control the House of Representatives. Under the influence of short-term fiscal stimulus policies, the real GDP growth rate of the United States is expected to be 3.7% in 2021.

However, if the Republican Party wins the election and gains control of the Senate and House of Representatives, Trump is expected to forcefully implement his fiscal, immigration, and trade proposals, which will hit the U.S. economic recovery and restrict it. Economic growth prospects. If Trump’s fiscal agenda, immigration restrictions, and protectionist policies are fully implemented, GDP growth in 2021 is expected to be only 2.3%, and by the end of his second term, household disposable income will be reduced by approximately $3,300.

On the whole, although the US general election situation has brought certain fluctuations to the external situation of China's economic operation, the result of the general election will not reverse the tone of the US's competition-oriented policy toward China. At present, China’s economy is still in the
process of recovery. Under the background of building a new development pattern dominated by a large domestic cycle, economic growth is more dependent on the smooth flow of domestic industrial chains, supply chains, and the domestic market. The influence of China’s economy is relatively controllable.

References
[1] Zhang Penghua. Global Times [D].] US General Election Trump Report Nanjing normal University.
[2] Xu Meng Mian. Big Data Predictive Report on the 2016 US Election [D].][1 Anhui University ,2018.
[3] Ren Xiangyu. A Study on the Media Factors of Trump's Winning in the US Election in 2017[ D].; and Inner Mongolia University ,2018.
[4] Chen Yuhang. American Election News Translation Practice Report D].2016 Anhui University ,2017.
[5] Zhao Min, Lu Ye. U.S. election —— in Chinese media [J.] on People's Daily Global Times's election-related content Journalist ,2017(01):28-35.
[6] Zhang Zhian, Cao Xiaojie, Yan Qihong. Big Data and Internet Public Opinion in American General Election [J.] Study Journal of Shantou University (Humanities and Social Sciences Edition),2017,33(01):83-90 7.
[7] Jiaxin. A Study on the 2016 US Election Report from the Perspective of International News Domestication [D.]; and Dalian University of Technology ,2018.
[8] Wang Manqian. [J] Political Cognition of China Topic in US Election Journal of Shandong Youth Institute of Politics (04):25-28.
[9] Gao Jiming. "Change" and "No Change "[J. ] in the Information Dissemination of the US Election Journalists ,2016(11):48-52.
[10] Dai Jianping. Analysis of the People's Daily's U.S. General Election Report in J]. Framework Journal of Hubei Radio and Television University (02):57-58.
[11] dry Yi Tian, Dong Tongtong. A Framework Analysis of US Election Reports by Reference News [J]. Media today ,2013,21(05):38-40.