Beyond GDP: A New Way of Sustainable Future Leaded by Green GDP

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Abstract: Since the Industrial Revolution, global development and progress have caused serious environmental damage and resource consumption. It is not in line with the concept of sustainable development to measure the economic level solely by GDP. Therefore, GGDP was introduced as an alternative. To evaluate the global impact of GGDP replacing GDP, we have constructed a GGDP multiple linear regression model. This model takes into account GGDP in different countries at different times and incorporates multiple influencing factors. Additionally, we introduce the grey prediction model to demonstrate that GGDP can serve as a suitable measure of economic development level. This supports the idea that promoting GGDP is applicable on a global scale. Furthermore, we introduce five natural resource indicators and conduct a Spearman correlation analysis between GGDP, GDP, and these five natural indicators. To illustrate this, we take the United States, a representative developed country, as an example.

Keywords: GGDP, sustainable development, multiple regression model, grey prediction

1. Introduction

1.1. Background

GDP is a calculation of the total output of a country within its borders, which is regarded as an important comprehensive index of the System of National Accounts (SNA) by countries around the world. As countries around the world pursue a high GDP value at the expense of the environment to determine their own international status, many environmental problems such as global warming, serious soil and water desertification, industrial wastes piled up mountains and other environmental problems have affected modern lifestyles and material resources, and further economic development has been restricted by the natural environment. Because GDP only focuses on the measurement of economic indicators, ignoring the impact of environmental and resource factors, it does not conform to the concept of sustainable development.

At this time, GGDP, as an economic accounting index, comes into being. When GGDP is used as a standard to measure national economic indicators, countries around the world will pay attention to resource and environmental costs of economic development, which will help correct the situation that GDP as a measurement standard ignores potential disadvantages of economic development, accelerate the construction of green ecological economic circle, strengthen the protection of ecological civilization, and realize sustainable development. Therefore, it has become an urgent issue

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to determine a reasonable measurement standard of GGDP and discuss its impact on climate mitigation instead of GDP and its advantages and disadvantages after conversion.

1.2. Literature Review

In recent years, the research on GDP and GGDP evaluation system has gradually deepened. Scholars have formed a multi-dimensional evaluation system on the disadvantages of GDP index in considering economic development and the advantages of GGDP in promoting economic green development. Mincui Li et al. believed that GDP accounting had a certain misleading effect on the behaviors of economic subjects, and some countries and government officials overdrew resources and environment to develop economy regardless of future development [1]. Nan Li found that with the rapid growth of GDP, the extensive economic growth mode had an increasingly serious impact on national resources and environment [2]. Xiaoyan Shen et al. believe that GDP accounting exaggerates national economic indicators and ignores the influence of industrial structure system on the level of economic development, especially in regions with large economic dependence on resources and environment [3]. On the contrary, GGDP can better guide the sustainable development of national economy and solve the problem of coordinated development of population, resources and environment [4]. GGDP index supplements GDP accounting and provides basis for the formulation and adjustment of national welfare policies and resource and environmental protection policies [5]. Hongxian Shen demonstrated the positive correlation between GGDP growth and clean energy based on the path model [6].

However, there are still deficiencies in the realistic analysis of replacing GDP with GGDP. This paper takes into account the potential advantages and disadvantages of such transformation in different global GDP levels and countries in different geographical locations, and then determines that it is worthwhile to replace GDP with GGDP. The impact of this shift on climate mitigation was analyzed using quantitative models.

2. Climate Mitigation Measurement Model

2.1. Model 1: K-Means Clustering Model

There are more than 200 countries in the world. In order to measure the impact of GGDP instead of GDP on global climate mitigation, we need to classify countries according to the level of GDP, and analyze representative countries among them. In the global GDP data set $D = \{x_1, x_2, \cdots, x_n\}$, the least square error is divided into $C = \{c_1, c_2, \cdots, c_k\}$.

$$E = \sum_{i=1}^{k} \sum_{x \in c_i} (x - u_i)^2 \tag{1}$$

Where $u_i = \frac{1}{c_i} \sum_{x \in c_i} x$ is the mean indec vector of the cluster c_i.

Put into the global GDP data set, and output the cluster scatter plot and the cluster number comparison plot. According to the elbow rule, when the clustering number is equal to 3, the basic conditions of clustering have been satisfied. Observing the coordinates of the cluster center points, we can see that the three countries are Kazakhstan, Malaysia, Israel. However, these three countries as representatives have the following two deficiencies.

The GDP level of these three countries is at or below the 20th place in the global GDP level, which cannot represent some countries with relatively high GDP level, such as the United States and China.

The geographical distribution of these three countries is not divergent in the world, so they cannot represent the countries with large differences in geographical location level.

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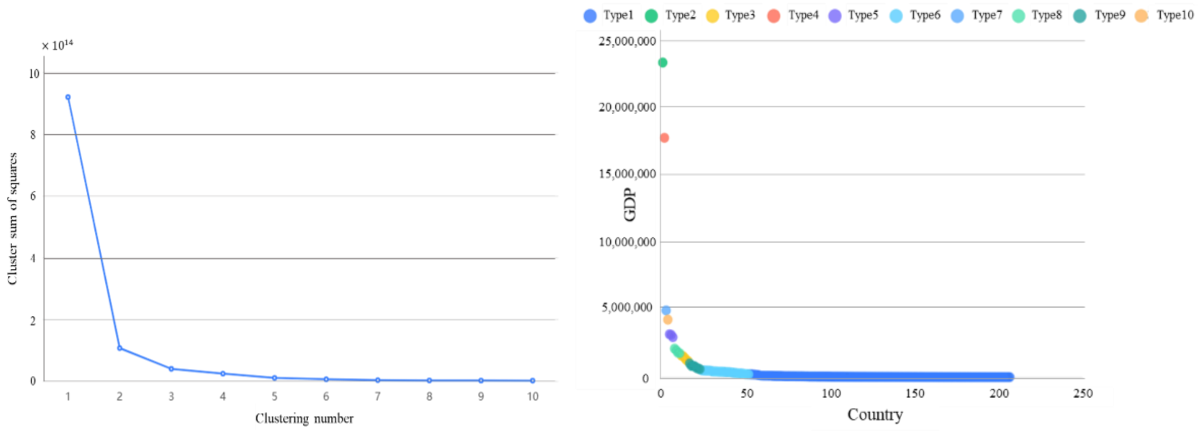

Figure 1: Cluster analysis schematic.

Based on the number of clustering and the GDP and geographical location information of the corresponding countries, we finally determine the number of clustering to be 10, which are China, India, Israel, Japan, Kazakhstan, Malaysia, South Africa, United States, France and the Netherlands. Their corresponding geographical locations are shown in the Figure2, satisfying the restriction conditions.

Figure 2: Geographical distribution of samples.

2.2. Model 2: GGDP Multiple Linear Regression Model

As a comprehensive index, climate is often measured by a single index such as carbon dioxide emission, which will cause certain errors. Traditional GDP accounting model introduces two first-level indexes of natural resource depletion costs and environmental governance inputs, under which a second-level index is also introduced. According to the instructions issued by the National Bureau of Statistics, five indicators that have a great impact on climate change are determined in the secondary indicators, namely freshwater resources, farmland area, forest area, carbon dioxide emissions, and particulate matter less than 2.5 microns in the air.

According to the data collected from 10 representative countries, the scatter plot is drawn. From the scatter plot, it can be seen that the ten countries randomly selected have the same trend of climate indicators and GGDP, with a high degree of coincidence. Therefore, we infer that these five indicators can be linearly combined into the final GGDP regression curve.

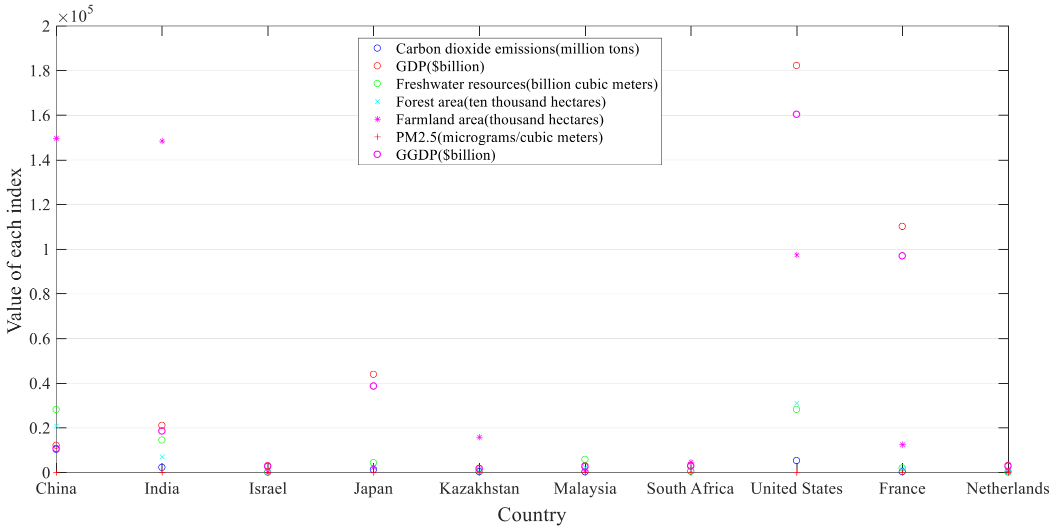

Figure 3: Scatter chart.

According to the fitting results of the output, the goodness of fit $R^2 = 0.98$, so the model fits well. The regression prediction curve of GGDP is made, as shown in Figure 4.

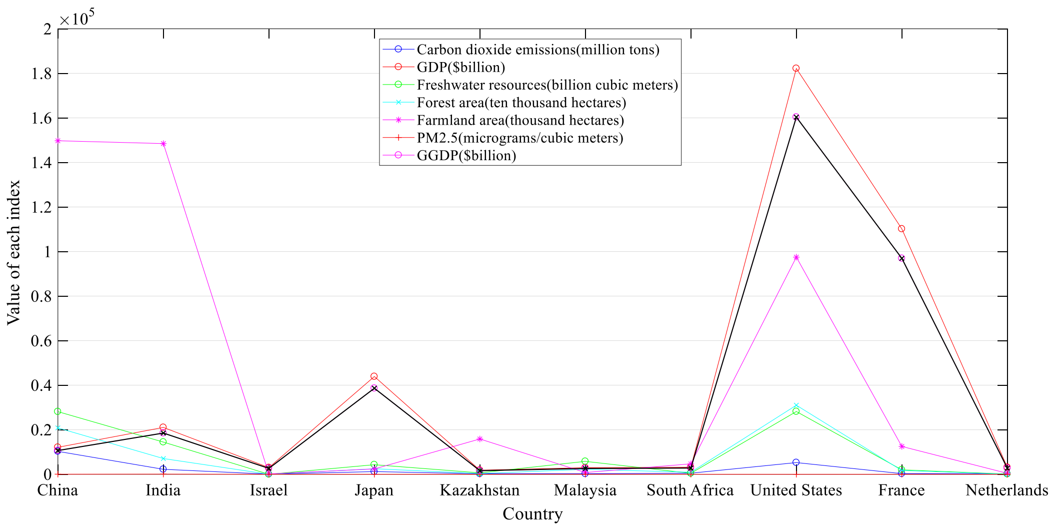

Figure 4: GGDP regression curve.

The black curve is the multiple linear regression fitting curve of GGDP, and the following conclusions can be drawn：

- The GGDP results fitted by the regression prediction model are very close to the actual GGDP of the country, which proves the feasibility and accuracy of the regression prediction.
- The GGDP growth rate of each country is consistent with the GDP growth rate, reflecting the feasibility of using GGDP instead of GDP.
- The change rate of GGDP among countries is greater than that of each index, indicating that GGDP is obviously affected by various factors, and thus the change of GGDP has obvious benefits for climate regulation.

- The linear relationship between GGDP and various factors in most countries is the same, so the regression model has universal applicability worldwide.

In order to further analyze the relationship between GGDP and various indicators, the effect of GGDP on global climate mitigation was measured. We establish a multiple regression model between the five indicators and GGDP.

$$\begin{cases} y_{GGDP} = k_0 + k_1\gamma_1 + k_2\gamma_2 + k_3\gamma_3 + k_4\gamma_4 + k_5\gamma_5 + e \\ \varepsilon \sim N(0, \ \sigma^2) \end{cases} \tag{2}$$

Where γ_1 represents the content of freshwater resources, γ_2 represents the farmland area, γ_3 Represents forest area, γ_4 represents CO_2 emissions, $\gamma_5$represents the content of particulate matter (PM2.5) less than 2.5 microns in the air.$k_0$represents a constant term, $k_1, k_2, \cdots k_5$represents the regression coefficient, e represents random error.

Suppose that the pair has made n observation of y_{GGDP}, γ_1, $\cdots$, γ_5, and the observed value is y_i, γ_{i1}, $\cdots$, $\gamma_{i5}(i = 1, \cdots, 5)$.

$$\begin{cases} y_i = k_0 + k_1\gamma_{i1} + k_2\gamma_{i2} + k_3\gamma_{i3} + k_4\gamma_{i4} + k_5\gamma_{i5} + e \\ e_i \sim N(0, \ \sigma^2), i = 1, \cdots, n \end{cases} \tag{3}$$

Simplify to $\begin{cases} y = K\gamma + e \\ e \sim N(0, \sigma^2 E_n) \end{cases}$。 Where E_n is a unit matrix of n-order.

Then use the least squares estimation to estimate the parameters$k_0, k_1, \cdots, k_5$,

$$Q(k) = \sum_{i=1}^{n} \varepsilon_i{}^2 = \sum_{i=1}^{n} (y_i - k_0 - k_1\gamma_{i1} - \cdots k_5\gamma_{i5})^2 = (y - K\gamma)'(y - K\gamma) \tag{4}$$

Select estimates $\widehat{k_j}$, so that error sum of squared Q (k) is minimized when $k_j = \widehat{k_j}$, $j = 0,1,2, \cdots ,5$.

2.3. Model Test

Put each index into the multiple regression equation:

$$\hat{y}_{GDDP} = -0.219\gamma_1 + 1.402\gamma_2 + 0.777\gamma_3 - 0.956\gamma_4 - 1.025\gamma_5 \tag{5}$$

Then the significance test is carried out, and the test in Table 1 is obtained. The following table reflects the specific influence relationship between the independent variable and the dependent variable. First, look at the significance level, the P values of all factors are greater than the significance level of 0.05, indicating that these indicators have significant effects on the GGDP value.

Table 1: Parameter list.

Models	Standard coefficient	t	Sig.
(Constant)		1.441	.223
Farmland area（10^3 hm^2）	1.402	.907	.416
Forest area（10^4 hectares）	.777	.477	.659

Table 1: (continued).

Carbon dioxide emissions（megaton）	-.956	-1.442	.223
PM2.5（Micrograms / cubic meter）	-1.025	-.966	.389
Fresh water resources (billion cubic meters)	-.219	-.115	.914

The regression coefficients of farmland area and forest area were 1.402 and 0.777, respectively. The regression coefficients of carbon dioxide emissions, PM2.5 and freshwater resources were -0.956, -1.025 and-0.219. Farmland area, forest area and freshwater resources play a positive role in climate mitigation, while PM2.5 content and carbon dioxide emissions play a negative role in climate mitigation. As the regression coefficient of freshwater resources is small and the feasibility of resource improvement is relatively low, its impact can be ignored. Therefore, the regression coefficients of the remaining indicators that play a positive role in climate mitigation are positive, and vice versa.

When GGDP replaces GDP as a measure of national economic standards, in order to maintain the country 's international status, The growth rate of GDP and GGDP are both generally showing a growth trend, the growth difference part requires checks and balances between the five indicators. The favorable indicators and unfavorable indicators for GGDP growth and mitigation environment correspond to each other, so when global countries balance each other, they play a role in promoting global climate mitigation.

3. GGDP Prediction Model

3.1. Model 3: Grey Prediction Model

When GGDP is used to replace GDP as the main measurement index of economic health, the growth trend of GGDP and GDP should be consistent in order to keep the country's international status unchanged. Based on the significance test of the regression coefficient of Model 2, fresh water resources, farmland area, forest area, carbon dioxide emissions, and particulate matter content of less than 2.5 microns in the air have significant impacts on GGDP. Therefore, a GM (1,6) model is established according to these five climate influencing factors. To ensure the global universality of the model, data from high income, middle income and low income countries from 2017 to 2021 were selected for analysis. The change curve of GGDP fitted by GDDP and climate influencing factors is compared with the results of grey prediction model.

Suppose there are 6 series, which are a sequence of characteristic data and a sequence of 5 correlation factors. For characteristic data series: $Y^{(0)} = \{y^{(0)}(1), y^{(0)}(2), \cdots y^{(0)}(n)\}$. It has 5 influence factors: $X_i{}^{(0)} = \{X_1{}^{(0)}, X_2{}^{(0)}, \cdots X_N{}^{(0)}\}, i = 1,2, \cdots N; N = 1,2, \cdots 5$.

$$\begin{cases} X_1{}^{(0)} = \{X_1{}^{(0)}(1), X_1{}^{(0)}(2), \cdots X_1{}^{(0)}(n)\} \\ X_2{}^{(0)} = \{X_2{}^{(0)}(1), X_2{}^{(0)}(2), \cdots X_2{}^{(0)}(n)\} \\ \vdots \\ X_N{}^{(0)} = \{X_N{}^{(0)}(1), X_N{}^{(0)}(2), \cdots X_N{}^{(0)}(n)\} \end{cases} \tag{6}$$

Where, n is the number of time samples, i.e., the selected time samples from 2017-2021; N is the number of impact factors, i.e., the five climate impact factors.

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The feature data sequence and the number of influence factors are generated by the first order accumulation respectively to obtain a new series ${X_i}^{(1)}, Y^{(1)}, Z^{(1)}$.

$$\begin{cases} {X_i}^{(1)} = \{{X_i}^{(1)}(1), {X_i}^{(1)}(2), \cdots {X_i}^{(1)}(n)\}, i = 1,2,\cdots,N; {X_i}^{(1)} = \sum_{j=1}^{k} {X_i}^{(0)}(j), k = 1,2,\cdots,n \\ Y^{(1)} = \{y^{(1)}(1), y^{(1)}(2), \cdots y^{(1)}(n)\}, Y^{(1)}(k) = \sum_{j=1}^{k} y^{(0)}(j), k = 1,2,\cdots,n \\ Z^{(1)} = \frac{1}{2}(Y^{(1)}(k) + Y^{(1)}(k-1)), k = 2,3,\cdots,n \end{cases} \tag{7}$$

The series $Y^{(1)}$ of different years $k = 1,2,\cdots,n$ is regarded as a continuous variable t, and the series ${X_i}^{(1)}$ is regarded as a function of year t. If the series ${X_1}^{(1)}, {X_2}^{(1)}, \cdots {X_N}^{(1)}$ has an effect on the change of $Y^{(1)}$, the GM(1, N) model is established.

$$\begin{cases} y^{(0)}(k) + \alpha {Z_1}^{(1)}(k) = \sum_{i=1}^{N} b_i {X_i}^{(1)}(k), k = 2,3,\cdots n; i = 1,2,\cdots,N-1 \\ \sum_{i=1}^{N} b_i {X_i}^{(1)}(k) = b_1 {X_1}^{(1)}(k) + b_2 {X_2}^{(1)}(k) +, \cdots, + b_N {X_N}^{(1)}(k), k = 2,3,\cdots,n \end{cases} \tag{8}$$

Where， α is the development coefficient, b_i is the driving coefficient, and $b_i{X_i}^{(1)}$ is the driving term.

Divide countries around the world into three broad categories based on known GDP levels: high-income countries, middle-income countries, and low-income countries. Based on the fitting results of the regression model established in the second problem, calculate the average GDP of these three categories of countries for the five years from 2017 to 2021. Then, using a gray forecasting model, calculate a forecast curve to obtain the forecasted GDP values of these three categories of countries for the next five years.

As shown in the figure 5 below, taking high-income countries as an example, the forecast curve of the average GDP level of high-income countries in the next five years is made based on the collected known data. Compared with the forecast of GGDP, it is known that both of them will show an increasing trend in the next few years. Although the values are different, the growth rate will gradually approach with time.

3.1.1. High income country

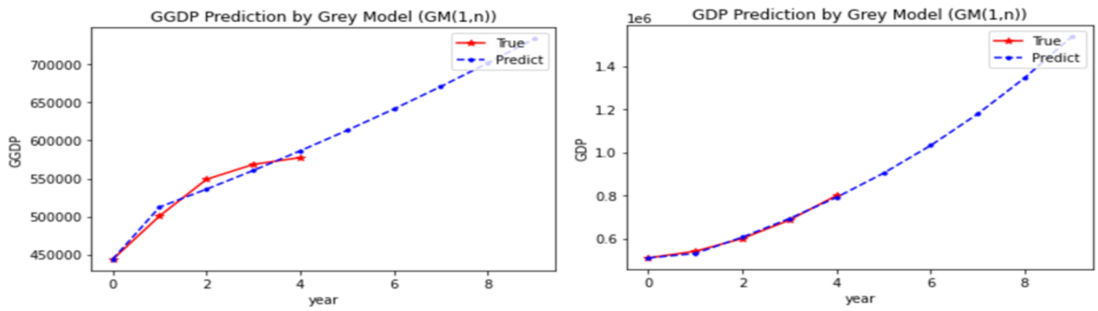

Figure 5: High income country regression prediction chart.

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By the same token, GGDP and GDP forecast curves of middle-income countries and low-income countries can be made, as shown in the figure 6 and figure 7 below. The predicted values are closer to the actual values and the growth rate is closer. If GDP is replaced by GGDP, the overall development level of each country in the world will not change, and GGDP can be a good measure of economic development level. So the promotion of GGDP is applicable globally.

3.1.2. Middle-income country

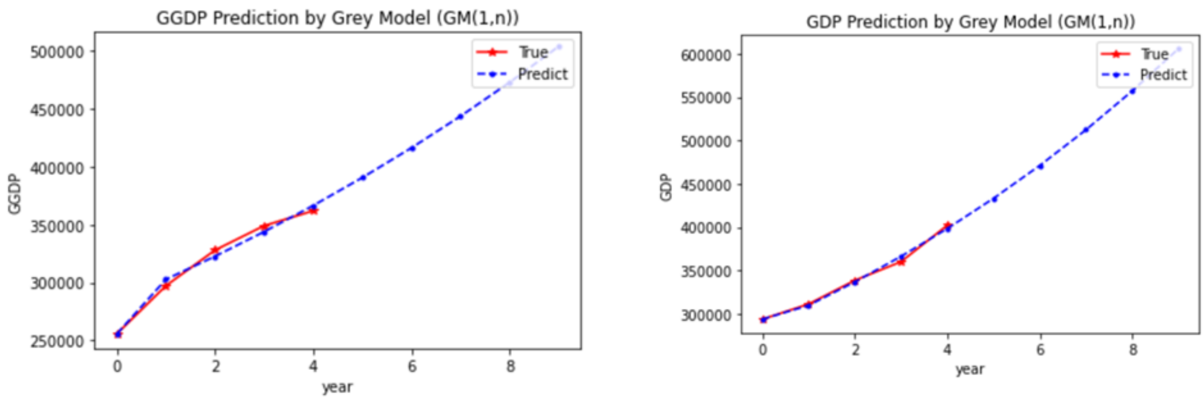

Figure 6: Middle-income country regression prediction chart.

3.1.3. Low-income country

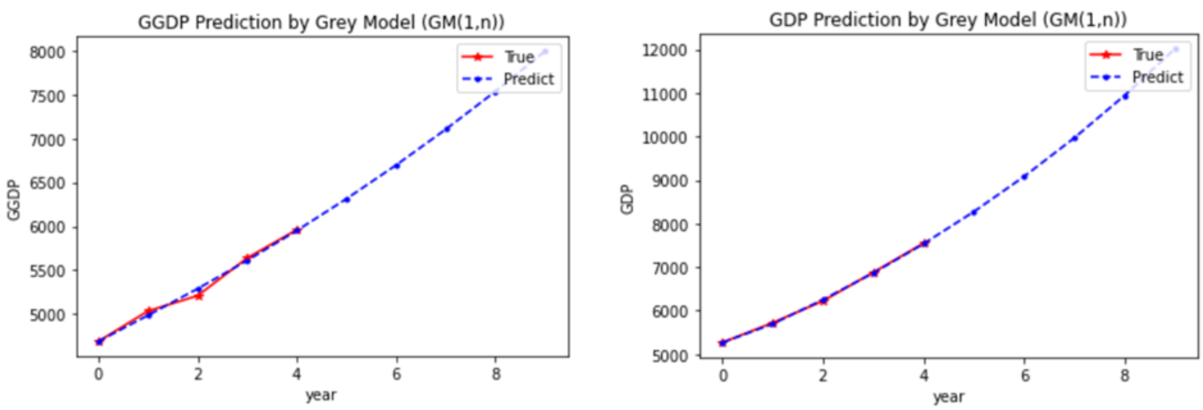

Figure 7: Low-income country regression prediction chart.

3.2. Comparison of Potential Advantages and Disadvantages

The correlation coefficient is obtained according to the fitting equation in Model 2. Taking forest resources, energy resources and carbon dioxide emissions as examples, by estimating their values after using GGDP and comparing them with the values when using GDP, as shown in the figure 8 below, it can be seen that the net loss of forest resources, energy consumption, carbon dioxide emissions have been reduced to varying degrees.

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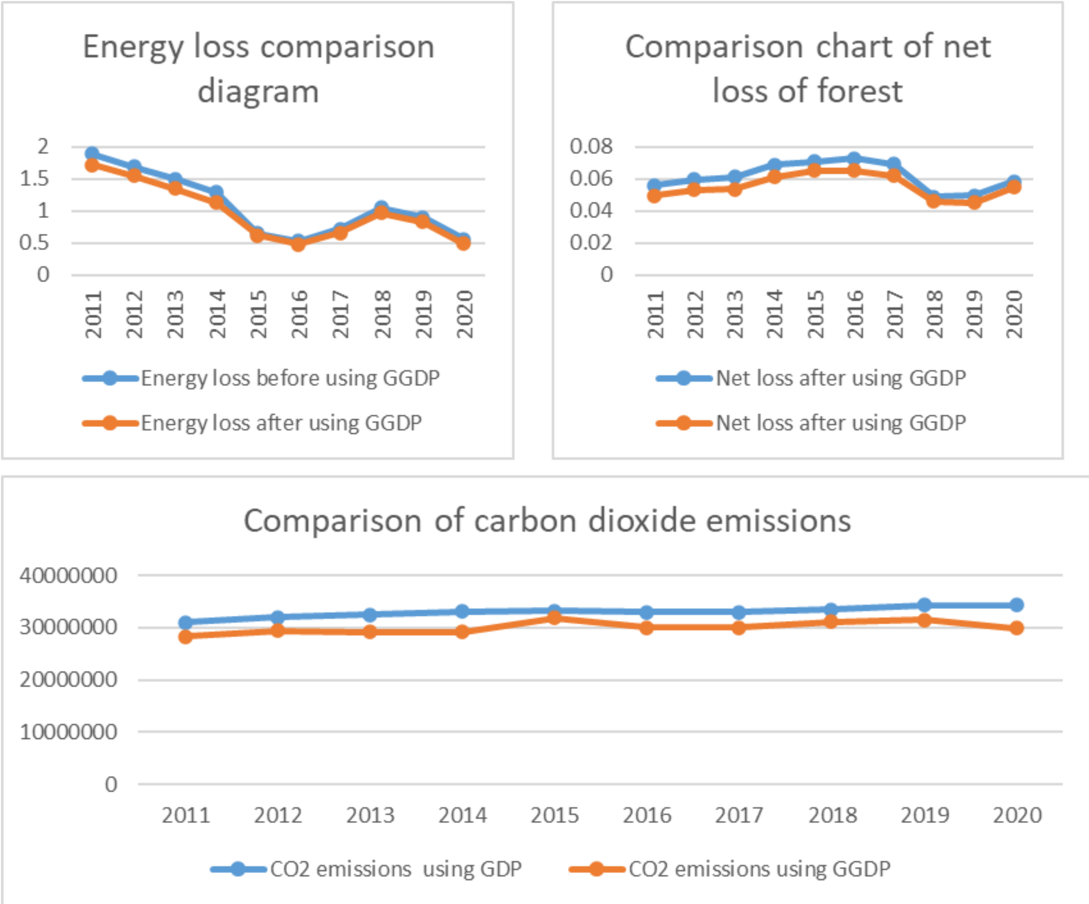

Figure 8: Comparison chart.

The obvious benefit of using the GGDP, therefore, is a more realistic assessment of the actual level of economic growth. Since GGDP reflects the consumption of natural resources and the damage to the environment caused by artificially promoted economic growth, in order to improve the level of GGDP, people will reduce the production and business activities that damage the environment, so as to mitigate climate change and energy waste. Avoid excessive reduction of forest area; Protect freshwater resources; Reduce harmful gas emissions, reduce the level of air pollution, improve people's quality of life. This way of economic accounting also combines economic development and environmental protection, changes the past thought of economic supremacy, enhances the environmental awareness of all levels of society, is conducive to sustainable development, and establishes the concept of harmonious coexistence between man and nature.

Although the use of GGDP can bring many positive impacts on the environment, it is undeniable that there are some drawbacks in the process of using GGDP to calculate economic development.

- First, the accounting of GGDP is complicated. There are many types of natural resources that have an impact on GGDP. In the process of accounting, it is not always possible to ensure that the data cover all types of resources, and there is no clear standard to measure the consumption and loss cost of many resources. For example, when the regrowth rate of renewable resources exceeds the loss rate, the total amount of resources will not be reduced, but it does not mean that this resource loss does not exist in the economic development, and the reduction of renewable resources will also reduce the related economic and social benefits, and the loss of this part of benefits is not easy to accurately estimate.

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- Second, there is no clear price system for some natural resources, so it is impossible to estimate their value. For example, most of the mined ore resources are directly used for production rather than sales, so there is only the amount and cannot be calculated cost value.
- Third, there is no unified and perfect accounting system for GGDP in the world, and many estimation methods for resource loss and environmental costs are still immature. It is still a long way to go to use GGDP as development accounting.

4. Index Transformation Analysis

4.1. Model 4: Correlation Analysis Model

The prediction results of Model 3 prove the applicability of the GGDP index on a global scale. We choose the United States as a representative from high-income developed countries to analyze the actual economic development and social development of the country.

In order to further analyze the impact of the transformation of GDP into GGDP on the natural resources of the United States, we introduce five natural resource sample indicators, namely: total natural resource consumption, renewable energy consumption, fossil fuel energy consumption, coal consumption and oil consumption. Taking the data from 1990 to 2017 as an example, combined with the collected annual GDP data of the United States, the corresponding GGDP value is calculated according to the accounting method selected by the first question, and the correlation between GDP and GGDP and these indicators is compared to obtain the impact of the transformation.

Firstly, X and Y are used to define the relationship between the five natural resource indicators. The variables X and Y are ranked from small to large, and expressed by rank R_X and R_Y Secondly, the relationship between the five natural resource indicators is defined. Calculate Spearman correlation coefficient：

$$r_s = \frac{\sum(R_X - \overline{R_X})(R_Y - \overline{R_Y})}{\sqrt{\sum(R_X - \overline{R_X})^2 \sum(R_Y - \overline{R_Y})^2}} = \frac{\sum \boldsymbol{R_X R_Y} - \frac{(\sum \boldsymbol{R_X})(\sum \boldsymbol{R_Y})}{\boldsymbol{n}}}{\sqrt{(\sum \boldsymbol{R_X}^2 - \frac{(\sum \boldsymbol{R_X})^2}{\boldsymbol{n}})(\sum \boldsymbol{R_Y}^2 - \frac{(\sum \boldsymbol{R_Y})^2}{\boldsymbol{n}}}} \tag{9}$$

Then, the zero hypothesis test is performed on whether the overall correlation coefficient ρ_s is 0. From the sample size n = 28 < 50, the r_s boundary value table is checked according to the sample content 28. Because $|r_s| \geq r_s(0.05{,}28)$,, then P ≤ 0.05, the two variables are related.

Spearman correlation analysis method with a wide range of application is used to calculate the correlation coefficient of the pin-two data. According to the model test, the P values of all variables are significant, indicating that there is a correlation between all natural environment indicators, GDP and GGDP. The thermal map of correlation coefficient is made to intuitively show the value of correlation coefficient, and the color depth represents the value, as shown in the figure 9.

Figure 9: Correlation analysis chart.

- As can be seen from the figure 9 above, the correlation coefficients of GGDP, GDP and five natural resources are greater than, equal to and less than, and the changes of resource consumption are as follows.
- The correlation coefficient between GGDP and oil consumption and renewable energy consumption is larger than GDP, so in these two aspects, using GGDP index can reduce resource consumption.
- The correlation coefficient between GGDP and fossil fuel consumption is the same as GDP, so in terms of fossil fuel use, fossil fuel consumption is basically unchanged after GGDP index is adopted
- The correlation coefficient between GGDP and coal consumption is larger than GDP, so in terms of coal consumption, the consumption of coal resources will increase after the adoption of GGDP index.
- The correlation coefficient between GGDP and the total consumption of natural resources is larger than GDP, so in terms of the total consumption of natural resources, using GGDP index can reduce resource consumption.

4.2. Economic Indicators Change the Impact

The quality of people's life comprehensively reflects the economic development level and sum of a country or region. Therefore, the influence of the economic status of the United States after the transformation of economic indicators can be reflected by the change of the happy life index of American residents. The ability to support offspring can be analyzed in terms of population density.

4.2.1. Changes in residents' happiness index

According to the changes of the Happy Life Index of American residents from 2006 to 2021, as shown in the figure 10 below, the happy life index of American residents generally decreases year by year and fluctuates around 7 in the past five years.

Residents' happiness index is one of the important indicators to measure a country's modernization degree and livelihood development, among which the impact of resources and environment occupies a large proportion. In the case of rapid GDP growth in the United States, the American Happy Life Index shows a decreasing trend, which reflects that people not only pay attention to the growth of

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GDP, but also pay more attention to the living environment and quality of life. It is one-sided to measure national development level by GDP alone, which is not conducive to resource storage and environmental protection. Therefore, it is necessary to combine GGDP level, establish the concept of sustainable development from the perspective of humanity and nature, and improve the quality of life system, which is conducive to providing adequate resources and a better living environment for the survival of future generations, so as to improve residents' happiness of life.

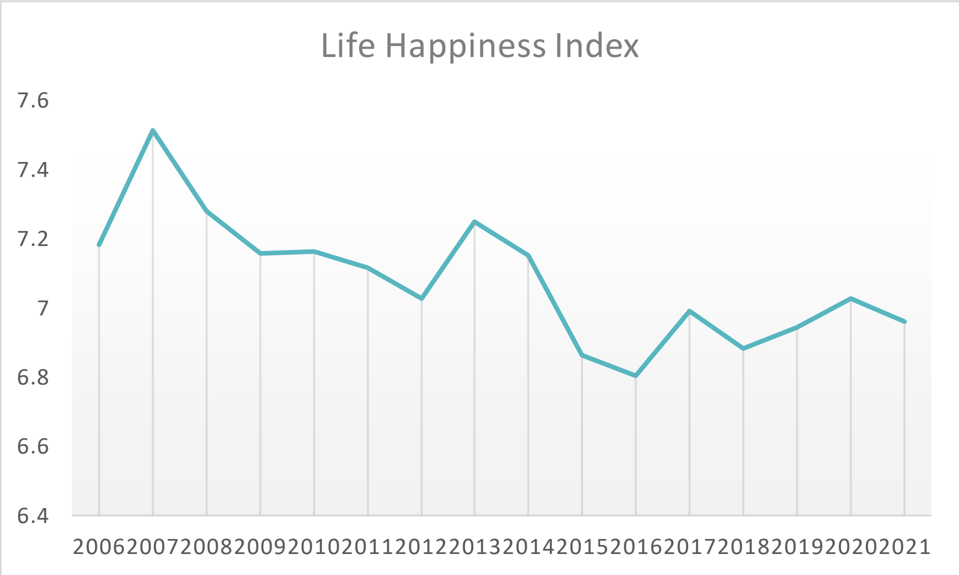

Figure 10: The annual change in the Happiness Index of American residents.

4.2.2. Population density change

Population growth is closely related to natural resources. Rapid population growth is likely to lead to the overexploitation and utilization of natural resources, damage the ecosystem, cause environmental pollution, and reduce people's quality of life.

The United States is a typical developed country with a small population density. The change and growth trend of population density in the United States from 1991 to 2019 is shown in the figure 11 below. It can be seen from the figure 11 that population growth is slow and the growth rate is on a downward trend. The consumption of land, fresh water, forest, minerals and other natural resources is low, and the utilization rate of natural resources will be greatly improved under the condition of continuous progress of science and technology. If the United States adopts the GGDP standard to measure national economic development, the GGDP will still be at a high level under the condition of high GDP, minus the low natural resource loss and environmental governance investment. While maintaining the national status, it can indirectly optimize the industrial structure and promote the development of social green economy. Therefore, from the perspective of economic situation, the adoption of GGDP is very beneficial to the development of the United States.

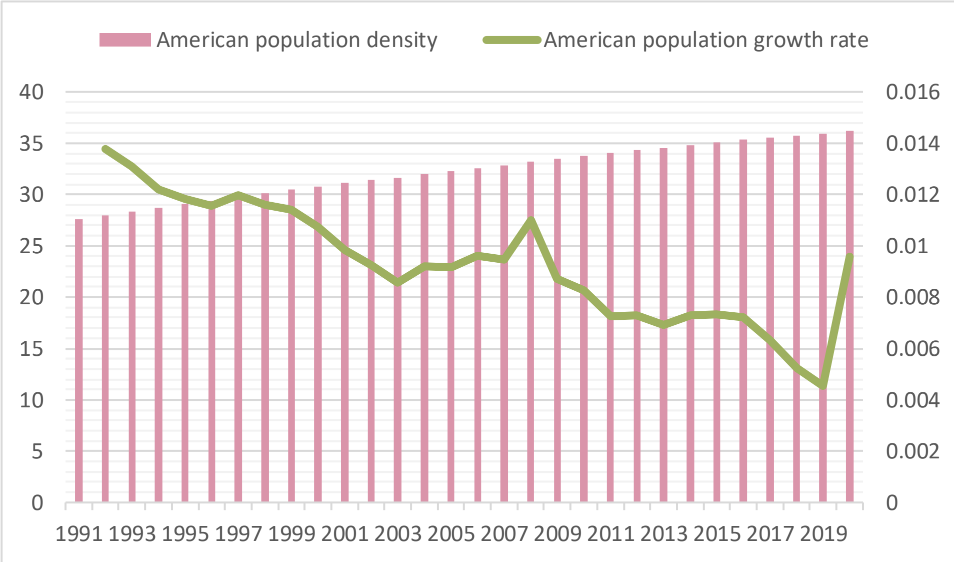

Figure 11: Year by year map of population density in the United States.

5. Conclusion

According to the study, the change range of oil consumption, renewable energy consumption and total natural resource consumption is larger than GDP under GGDP. It shows that GGDP. as an indicator to measure the economy, has a stronger easing effect on some resource consumption than GDP. On the contrary, only coal resource consumption has a worse mitigation effect than GDP. Then, by comparing the change in the happiness index in the United States over a 16-year period, with the change in GDP, it is found that while GDP shows an increasing trend. The residents' happiness life index shows a decreasing trend. Combined with the actual national conditions, the rapid GDP growth of the United States is at the cost of the environment, and the impact on resources and environment is becoming more and more serious. Then, combined with the increasing trend of population growth in the United States. It is demonstrated that only by transforming GGDP can be the per capita resources of future generations be increased, which is conducive to the development of future generations.

Therefore, there are some suggestions on how to make GGDP better. First, Ensure that basic data can be obtained, on the other hand, ensure the consistency of statistical caliber of data; Second, Improve the comprehensive accounting of environmental economy in the United States by referring to SEEA, and calculate GDP and green GDP in a unified framework; Third, promote the concept of green development and raise the awareness of enterprises and citizens as the main body of pollution prevention and control; Fourth, deepen ecological protection system construction and actively participate in international exchanges and cooperation; Fifth, adjust our present industrial structure, improve the proportion of service industry.

References

[1] Mincui Li, Jinzhu Hou. Research status and Countermeasures of green GDP [J]. Journal of Hebei Teachers University of Science and Technology,2005(02):62-65.

[2] Nan Li. Realistic dilemma and path choice of establishing green GDP2.0 accounting system [J]. Search,2015(10):29-33.

[3] Shen X Y, Wang G H, Huang X J. Calculation and spatial-temporal pattern of green GDP in China from 1997 to 2013 [J]. Journal of Natural Resources,2017,32(10):1639-1650.

[4] Wenyan Liu, Cuiwei Deng. Objective understanding of GGDP[J]. Shopping Mall Modernization,2007(33):46.

DOI: 10.54254/2754-1169/43/20232135

[5] [Jia H, Yu X L. Non-monetization green GDP accounting system based on MCDM and numerical examples of six provinces and cities [J]. Journal of Arid Land Resources and Environment,2013,27(08):6-13.

[6] X. Hongxian, “Influences Energy Consumption has on Green GDP Growth in China,” IOP Conf. Ser.: Earth Environ. Sci., vol. 113, p. 012125, Feb. 2018.