The Difference of Development Mode Between Global GDP and Green GDP Based on Factor Analysis

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Abstract: Based on the internationally accepted GGDP accounting method and the improvement of scholars' research, this paper proposes a new GGDP calculation model, which is mainly divided into two parts: the loss of natural resources and the loss of environmental pollution, which are respectively divided into two first-level factors.we use GGDP calculation model to show the development patterns and differences between global GDP and green GDP, and examine the relationship between eco-efficiency, GGDP and global mean temperature. We choose Brazil as our research pair, and use GGDP model to give a reasonable analysis and solution.

Key words: GGDP、Model difference, factor analysis

1. Introduction

GDP is the best known and most commonly used indicator of a country's economic health. However, because it does not include natural resources, GDP does not take into account environmental protection and resource use. Therefore, green GDP should be regarded as the main indicator of a country's economic health.Based on the established GGDP model, we use GGDP calculation model to show the development patterns and differences between global GDP and green GDP, and examine the relationship between eco-efficiency, GGDP and global mean temperature. Futher, On the basis of the previous model, the values of each part in Brazil are determined, and the reasonable analysis and solution are given.

2. Data Preprocessing

(1) Cost reduction in energy consumption

Firstly, three indexes of coal, crude oil and natural gas are selected. Energy costs are calculated by multiplying energy consumption for the year by the unit price of energy for the year. Finally, the energy consumption cost is calculated by adding the average cost of each

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index. This is the cost of energy consumed=∑minus - annual consumption of various energy sources * the average price of resources for the year[1]

(2) Carbon dioxide carbon neutralization

Among the factors for waste gas treatment, carbon dioxide, a greenhouse gas with representative benefits, is mainly selected, because it is closely related to the global average temperature and is the main factor affecting the global

temperature. It can also represent polluting gases. The cost of treatment is calculated by multiplying CO2 consumption in the current year by the World Bank's carbon pricing. Finally, calculate the total cost.[2]

(3) Sewage and solid waste calculation and treatment

The cost of sewage and solid waste is calculated by multiplying each type by the unit price of treatment for the same type in the same year. The sum of the two is the total cost of treating discharged waste. That is, waste disposal cost = ∑ amount of waste of different nature per year * average unit price of that nature in that year.

3. Robustness evaluation of GGDP model

3.1 Carbon Global GGDP accounting results and analysis

To better reflect and study the relationship between various indicators in GGDP and traditional GDP, this paper calculates the ratio between each indicator and GDP, as well as the average annual difference between GDP and GGDP from 1990 to 2010 and shows the comparison chart as follows Fig.1.

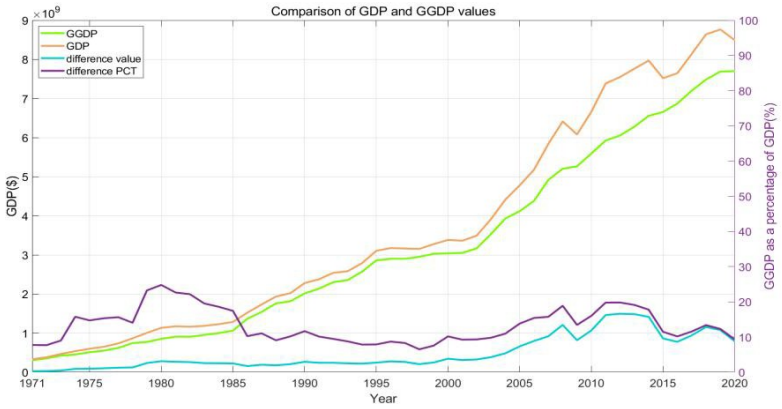

Fig.1 Economic health of GDP versus GGDP from 1970 to 2020 and their difference value

Global sustainable development level is measured from economic and environmental dimensions, and sustainable development evaluation system is established based on energy theory to evaluate the global sustainable development level. The results show that:

(1) Green GDP and total GDP continue to grow, and the growth rate of green GDP is much

lower than that of GDP, indicating that the economic development mode that excessively relies on the consumption of natural resources leads to the widening gap between GDP and total green GDP, which affects the improvement of sustainable development level.

(2) The consumption and pollution of natural resources increased year by year, while the overall ecological efficiency decreased year by year. Rapid economic development has led to increasing energy consumption, expanding urban built-up areas, increasing pressure on the ecological environment, and decreasing potential for sustainable development.

3.2Comparison between GGDP and traditional GDP

3.2.1Advantages

(1) More comprehensive: Green GDP takes into account factors such as the environment and resource consumption, and more comprehensively reflects the impact of economic development on the environment.

(2) More accurate: Green GDP can more accurately reflect the relationship between economic development and environmental resource consumption and provide a more accurate data basis for policy formulation.

Figure 2 shows a more complete and accurate GGDP framework.

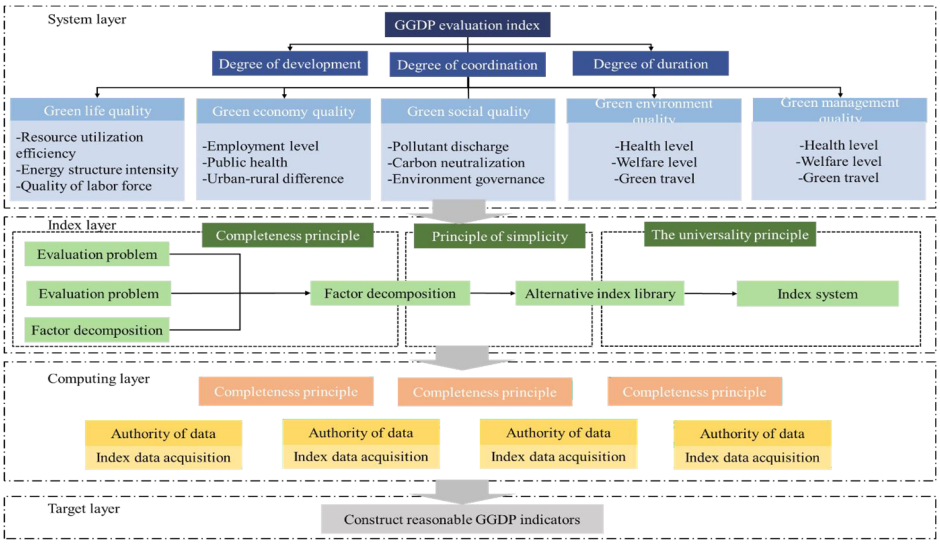

Fig.2 The framework of GGDP

However, according to our findings and alone the way we research, we witnessed that green GDP also has some disappointing features.

3.2.2 Disadvantages

(1) Calculation is difficult: Due to the need to consider factors such as the environment and resource consumption, the calculation of green GDP is more difficult than traditional GDP and requires more data support.

(2) Difficulty in data acquisition: It is relatively difficult to obtain data on factors such as the environment and resource consumption, and data comparability among different countries and regions is also limited, which makes the comparison and evaluation of green GDP more difficult.

- **A case study of GGDP in Brazil**

At present, Brazil's economic growth and development is heavily dependent on its natural resources, and its employment growth has two characteristics: first, the trade agricultural employment, which can be regarded as non-agricultural employment, has a rapid growth, accounting for 10.2% of the total employment in 2011; Second, the tertiary industry is the main force of employment growth, accounting for 74.2% of non-agricultural employment in 2011. The country's GDP calculations do not consider the consumption of natural resources or the costs of environmental degradation, which may have long-term negative effects on the country's economic health and well-being.

As Brazil is a country that relies more on natural resources, this section explores the impact of Brazil's changes in CO2 concentration, temperature, moisture, etc. on GGDP and GDP over the last 50 years, and describes how such changes may affect them, as well as the specific changes available.

3.3 Establishment of GGDP accounting model in Brazil

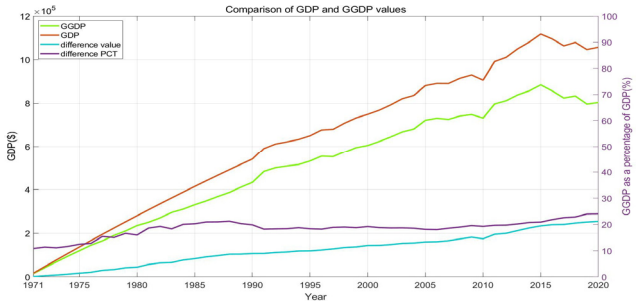

Fig.3 GDP and GGDP comparison and difference comparison

Figure 3 depicts the comparison between GGDP and GDP. The blue line is GGDP, the orange line is GDP, the yellow line shows their difference, and the purple line shows the ratio of GGDP to GDP. It can be seen that the proportion of GGDP in GDP is decreasing, which indicates that the consumption of natural resources is increasing, which also implies that with the passage of time, human beings are more and more determined to destroy the environment in order to pursue development.

During 2005-2010 and 2015-2020, Brazil's GDP and green GDP index continued to decline. In the first period, GDP and GGDP decreased by $1.292*105 trillion and $1.462*105 trillion respectively, which coincided with the surplus period of forest resource use in Brazil. In the second period, GDP and GGDP decreased by 0.692*105 trillion USD and 0.783*105 trillion USD respectively, which corresponded to the overuse of water resources and forest resources in Brazil. Generally speaking, the ratio of the energy monetary value of natural resources to GDP showed a slight rise, while the ratio of the energy monetary value of environmental

resources to GDP was not high and remained relatively stable. However, the ratio of the energy monetary value of imported resources to GDP grew rapidly and exceeded the ratio of environmental resources after 2006.[3]

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It shows that the reduction of Brazil's green GDP index has a great relationship with the consumption of imported resources, and also reflects that raw coal, crude oil, fertilizer and other resources play an important role in the economic development of Shaanxi Province, affecting the improvement of the level of sustainable economic development.

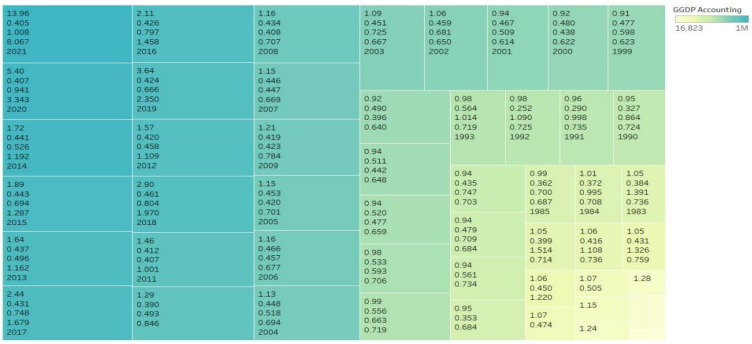

Fig.4 Each factor accounts for GGDP ratio

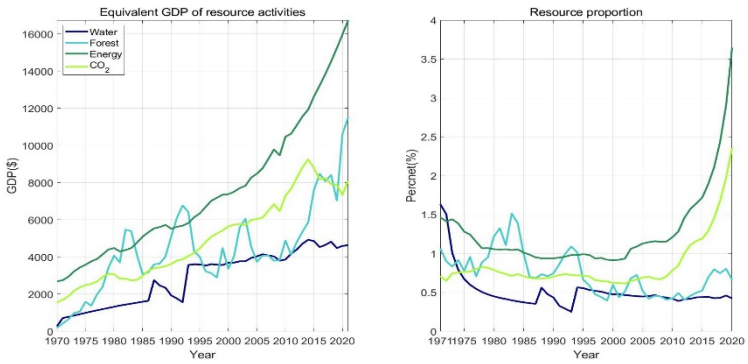

Fig.5 The proportion of each main factor in GDP and the development of resource value

Figure 4 and Figure 5 depicts the four factors in our model that may have an impact on GDP, which are changes in the four main factors: water resources, forest land area, energy use and consumption, and carbon dioxide emissions. Among them,we can clearly see that, over time, carbon dioxide emissions and energy use have the most obvious impact on GGDP growth, and

consumption gradually increases. Overall, it can be seen that Brazil's energy productivity is declining while the environmental load ratio is increasing, reflecting the increasing environmental pressure in the country's economic development. Meanwhile, the energy sustainability index (ESI) and improved energy sustainability index (improved ESI) have been declining from 1970 to 2020, and the overall trend gradually tends to be consistent, and maintains a high similarity with the development trend of energy productivity.[5]

The ESI value was high from 2010 to 2015, with both values greater than 10, indicating that Brazil's comprehensive sustainable development was poor during this period. However, the ESI and improved ESI values decreased to less than 10 in 2013 and 2011, respectively, and then gradually decreased to 3.848 and 2.225 in 2019, indicating that Brazil's sustainable development is in good shape and still has the potential to transform to a more sustainable development direction.[6]

3.4 Results and analysis

(1) Brazil is one of the world's largest producers and exporters of soybeans, which contributes significantly to the country's economic growth. However, soy production also leads to deforestation, which has negative impacts on the environment, including reduced biodiversity and increased greenhouse gas emissions. Therefore, it can be seen from the above results that reducing carbon dioxide emissions will effectively increase GDP growth; And if Brazil is to adopt

GGDP, it will need to reduce its reliance on unsustainable agricultural practices such as monoculture and transition to more sustainable agricultural practices that protect and regenerate natural ecosystems.

(2) In addition, Brazil is home to a large portion of the Amazon rainforest, which provides important ecosystem services including carbon sequestration, water regulation and biodiversity conservation. The depletion of the rainforest can have a long-term negative impact on the economic health and well-being of the country. If Brazil is to adopt IWI, it needs to prioritize the conservation and regeneration of natural ecosystems, including the Amazon rainforest, and invest in sustainable land-use practices that support the country's natural capital.

(3) Energy sustainable indices (ESI) and Improvement ESI are in continuous decline, which are 3.848 and 2.225 respectively by 2019.Energy Sustainable Indices (ESI) integrated economic and ecological sustainable development research.

In conclusion, if Brazil adopts the GGDP index as the primary measure of economic health, it will need to shift its economic policies towards more sustainable development practices that prioritize the conservation and regeneration of natural ecosystems. While this transition may require short-term investment, in the long run it could lead to more sustainable and resilient economic growth for the benefit of present and future generation

4. Conclusion

This paper examines whether a country's economic development is efficient and healthy and how dependent it is on natural resources from three perspectives: equivalent GDP ratio of various resources, environmental change range and economic development status. A universal

green development evaluation model, GGDP, has been established. Taking Brazil as an example, the paper analyzes the advanced nature of GGDP model, which can better evaluate the economic development status of a country.

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