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Statistical and econometric analysis of the impact of China's energy, environment on the economic development

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Abstract

Through statistical description and analysis of econometric models of energy consumption, environmental conditions, and their impact on economic development, we draw conclusions that present China's economic growth is at the cost of the huge energy consumption and environmental pollution. To maintain long-term sustainable economic development, and achieve intensive economic growth, it is necessary to take industrial ecology and green GDP accounting approach of management targets.

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1. Introduction

China's rapid economic growth since the reform and opening up to world catches the world attention. China's energy consumption is also rising dramatically, and as a result the environmental pollution problem is more and more serious. Economic growth, the environmental pollution and energy consumption issues become the focus of attention, and environmental and energy constraints on the problem of long-term economic growth is the key to solving the current problems, empirical research for this issue has very important theoretical Value and practical significance.

2. On the description of China's economic development, energy consumption and environmental pollution

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30 years of reform and opening up, China's economy is developing at an unprecedented pace, GDP in 1978 was 364.5 billion yuan and in 2009 it increased to 34.0506 trillion yuan. Calculated at comparable prices, the average annual growth rate was 9.9%, while China's energy consumption increased from 5.7 million tons of coal in 1978 to 30.7 million tons of coal in 2009, an annual increase was 5.6%, lower than the GDP growth rate, which shows lower energy consumption in China sustained a higher economic growth. But it is worth mentioning that in the years of 1995-2000, China's energy consumption first decreased and then increased, it totally remained unchanged, and since its rise after 2001 was very large, from 2001-2009, the average annual energy consumption increased by 9.3% on average, while GDP growth rate over the same period basically unchanged, which is closely related to the rapid industrialization in China and urbanization these years. China is the world's largest developing country, and the largest energy consumer second to the U.S.A. If energy consumption continues growing at this rate, we are afraid that China's energy supply and demand gap will be increased, thus affecting the national economic and social development. Figures 1 and 2 are China's GDP and energy consumption changes in 1985 ~ 2009.

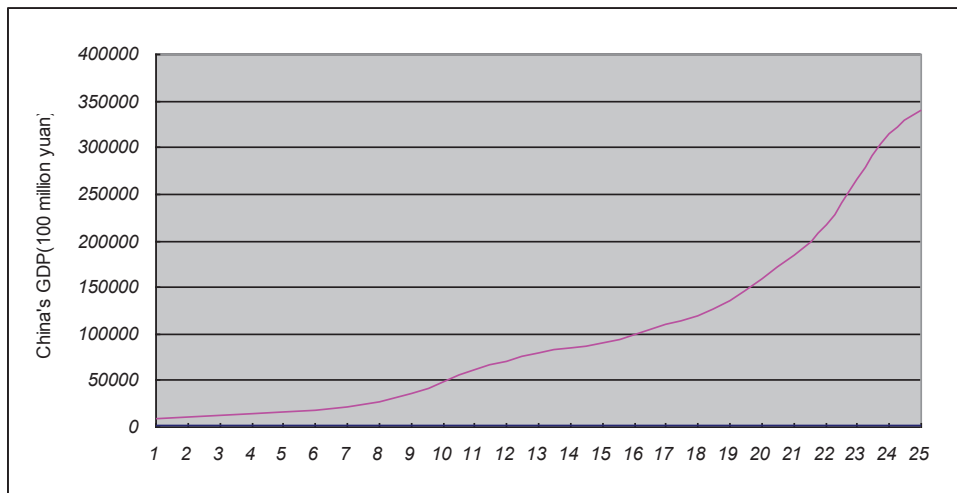


Fig.1: China's GDP from 1985 to 2009

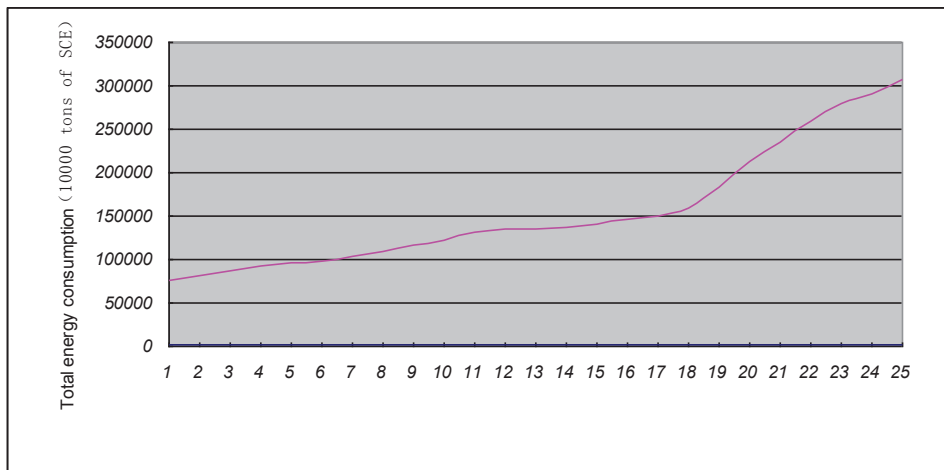


Fig.2: Total energy consumption from 1985 to 2009

In the respect of environmental pollution, this is mainly to discuss the discharge of industrial wastewater, with limited data collection difficulty. Generally speaking, industrial wastewater emissions decreased over time, there was a rise afterwards. Figure 3, the changes of Total Volume of Industrial Waste Water Discharge 1985 - 2009.

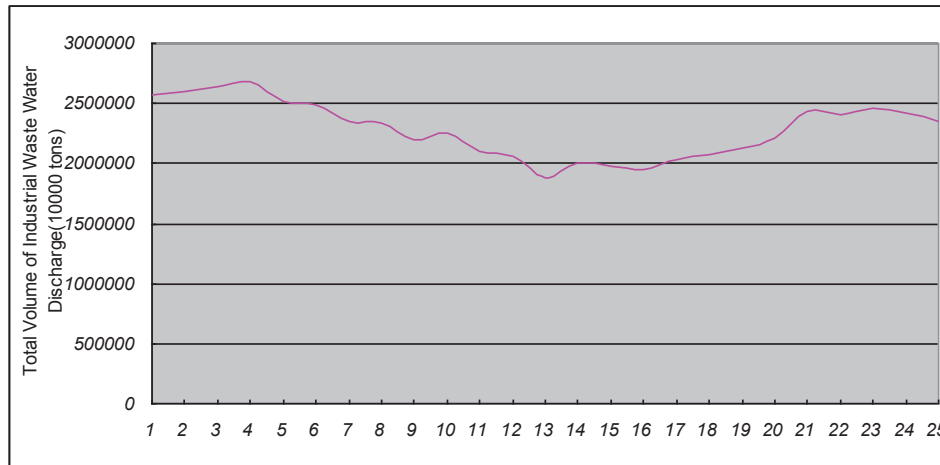


Fig.3: Total Volume of Industrial Waste Water Discharge from 1985 to 2009

3. Empirical analysis of the impact of economic growth in China's energy consumption and environmental conditions

3.1. Data and model selection

Despite many different types of social energy, in an economic system of a variety of energy inputs, the initial state is usually Coal, Crude oil, Natural gas and Hydro-power. Nuclear Power, wind power four energies. And in view of the difficulties of data collection. environmental pollution includes air pollution, water pollution, solid waste pollution, noise and vibration and other hazards. This collection includes the country's GDP (RMB 100 million yuan), total energy consumption (10000 tons of SCE), industrial waste water (10000 tons) and other relevant data from 1985 to 2009, from the 1986-2010 annual "China Statistical Yearbook". Here the amount of industrial wastewater (IWW) shows environmental pollution, and the energy consumption (EC) and wastewater discharge are the independent variables, and gross national product (GDP) as the dependent variable, the model is built. In the establishment of the model, we take into account of potential of the heteroscedasticity, with these three numerical values, we build their log model:

$$Y = \beta_1 + \beta_1 X_1 + \beta_2 X_2 + \mu \quad (1)$$

Where, Y , X_1 , X_2 represent respectively $\ln(\text{GDP})$, $\ln(\text{EC})$, $\ln(\text{IWW})$, μ is a random variable.

3.2. Regression Analysis

- Statistical and econometric tests

Based on the above necessary data for data processing, data collected on the use of SPSS16.0 linear regression in order to establish the following regression equation and test statistics:

$$Y = 22.706 + 2.47X_1 - 2.801X_2 \quad (2)$$

$$T \ (7.77) \ (52.291) \ (-14.906)$$

$$F=1721.118 \ R^2=0.994 \ D.W=1.757$$

From the regression results, the goodness of fit $R^2 = 0.994$ close to 1, the model is matched on the whole very well. Also, given the 5% significance level, each variable parameter estimation through the t test, F value is also larger than the critical value, the model also passed the D.W = 1.757 test, indicating that the regression equation of the overall significance relatively high, fitting very well, and there are significant variables in the linear relationship. Therefore, the overall linear regression equation is significant. It can accurately reflect our energy and environment on economic growth.

- **Economic Significance**

It can be seen from the regression equation, $\beta_1 = 2.47$, shows the same situation in other cases, as the energy input increases, China's GDP is growing exponentially, one percentage point of energy consumption increase, GDP growth at 2.47 percentage points. This positive relationship also is in line with reality. Energy is a country's economic growth on the most important material basis, without energy supply and use of no economic growth and development, not to mention the social development and human progress. On the other hand, our country's economic development is heavily dependent on energy supplies. We all know, China is a populous country, per capita amount of resources in the world living in backward position, high energy model of industrial and economic structure is not suitable for long-term economic development, so we need to adjust the economic structure.

In addition, $\beta_1 = -2.801$, indicates that China's economic development has been constrained by environmental pollution. In the early stages of China's economic development, environmental issues were not as focused attention, economic development was under consideration at the expense of the environment obtained. GDP in China has been widely used to evaluate their growth in a region in its development, with production value and economic growth to all levels of government performance evaluation. This led to the economic development of the extreme deterioration of the environment. The consequences will certainly result in the economic environment, "retaliation." Environmental pollution has become an important restricting factor in China's economic growth. Meanwhile, high energy consumption is an important factor in causing environmental pollution. To improve the environment, to improve energy efficiency, so as to better promote economic growth. UNEP Executive Vice President said that China's economic development needs energy saving urgently.

4. Conclusions and recommendations

China's GDP has been in the forefront of the world, but the resources are not. Short-term resources will be the bottleneck of China's rapid economic development, and environmental pollution on China's economic development has brought the impact that can not be ignored. Therefore, China's economic development needs the energy saving, environmental protection and sustainable development.

4.1. Optimize the industrial economy structures to promote the coordinated development between energy, environment and economy

To promote industrial upgrading, industrial restructuring, vigorously develop the low-power industries, especially high-tech and emerging technology industries. Limit the high energy consumption, high supplies, high water consumption industries. Standardization of the industry needs to develop a standard quantitative technical indicator, and eliminate backward production methods in some sectors.

4.2. Optimize China's energy structure, improve the efficiency of economic development and reduce environmental pollution

Nationally, promote the clean energy such as wind, hydro and so on. Strengthen the scientific and technological research, develop new energy utilizations and improve coal utilization efficiency of primary energy.

4.3. Rely on technological progress, develop vigorously low-carbon economy and the circular economy, promote economic growth pattern

The so-called low-carbon economy is the new economic development model with characteristics of low power consumption, low emission, low pollution, which is the essence of the efficient use of energy, development such as water, wind, solar, biomass, nuclear energy, clean energy, the core is a technology innovation of new energy technologies and energy saving, industrial structure, institutional innovation and fundamental change of the concept of human survival and development. Development of the low-carbon economy is an effective way of restructuring, speed up economic development pattern to keep the more economic competitive and improve the quality of economic operation in the post-crisis era

The whole economic process of circular economy will be organized into a circular process, thereby maintaining efficient material and sustainable use of energy, reducing pollution and to clean production, resource utilization, integration of ecological design and sustainable consumption. New economic growth mode is the development of a harmonious society in China as required and sustainable development is inevitable for economic development.

4.4. Improve the system of green GDP index

This is a reasonable standard measure of economic development, Improving the standard will change the levels of government and regional development concept, which is the basis of the sustainable economic development.

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