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Study on Low-carbon Economy and the Transformation of Economic Development Pattern in China

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Abstract: A low-carbon economy plays an important role in promoting the transformation of economic development pattern in China. The article analyses the Chinese economic data from “the ninth five-year plan” to “the 11th five-year plan”, found that the low-carbon economy and transformation of economic development pattern have significant correlation and the high levels of carbon emissions and high consumption of non-clean energy are important factors impeding the transformation of economic development pattern. The author suggests from three aspects, including government, enterprises and society to inhibition the growth of carbon emissions, the specific measures include optimizing energy structure, researching and developing low-carbon technologies, implementing low-carbon management and advocating low-carbon life.

Key words: China, low-carbon economy, economic development pattern

INTRODUCTION

Traditional high pollution, high energy consumption and high emission economic development pattern has been unable to meet the requirements of Chinese economic development. Low-carbon economic development pattern increasingly won the attention of the government and become the strategic choice of the country. In accordance with the instructions of central spirit, unswervingly implement low-carbon economic development strategy, improve the current situation of energy depletion and ecological deficit and improve the quality and efficiency of economic development, are the most important for China to realize the transformation of economic development pattern. From the perspective of low-carbon economy, this study analyzed the transformation of economic development pattern. This perspective is rare to see in previous studies. Based on the empirical analysis of economic data from “the ninth five-year plan” to “the 11th five-year plan”, the author revealed the relationship between Chinese low-carbon economy and the transformation of economic development pattern and put forward policy recommendations, analyzed the mutual relation between low-carbon economy and the transformation of economic development pattern and provided valuable thinking orientation for Chinese economic development pattern.

EMPIRICAL ANALYSIS

Index selection: According to the carding and summary of related literature, the indicator that weighing low-carbon economic development mainly includes two dimensions: Decreasing greenhouse gas emission and reducing high carbon energy consumption (Li *et al.*, 2011; Li, 2011; Zhou and Wang, 2011; Zhuang, 2007; Wang *et al.*, 2010; Li, 2010). This study made carbon emission and energy consumption as the pointcut of research. Carbon emission includes per capita carbon dioxide emission and carbon dioxide emission of each unit GDP. Energy consumption indicator mainly includes the consumption proportion of gas, hydropower, nuclear power, wind power, coal and oil. This study divided the above indicators from the two dimensions of clean energy and non-clean energy. Clean energy refers the energy that does not let off harmful substances in the process of production and use. Among them, compared with other primary energy, natural gas can significantly reduce the emissions of CO_2 in the process of combustion. According to statistics, carbon dioxide emission of consuming natural gas is only 85.5% of liquefied petroleum gas and 12.4% of coal (Li, 2011). At present, although the consumption ratio of hydropower, nuclear power and wind power is less than 10%, new energy will be the key area of energy development in the future. Non-clean energy is relative to clean energy. It is an energy that lets

off harmful substances in the process of production and use, mainly including coal, oil and other traditional non-renewable energy. The use and consumption of these energies is the main source of carbon dioxide and other emissions.

In terms of transforming the pattern of economic development, there are many indicators can be considered. Economic development indicator is selected to analyze in this study. The first is economic growth. Use gross domestic product and per capita gross domestic product to reflect the level of Chinese economic development; the second is industrial structure optimization, including the proportion of the tertiary industry in gross domestic product, the contribution rate of the tertiary industry and the proportion of the gross output value of high technology industries in gross industrial output value, to study the impact of low-carbon economic development on industrial structure optimization and upgrading. It is worth mentioning that the four indicators such as per capita carbon dioxide emissions, carbon dioxide emissions of per unit of GDP, consumption proportion of coal and oil are inverse indicators. The author handles them positively.

Principle component analysis: Analyze every indicator of carbon emissions, energy consumption, economic growth and industrial structure optimization with the method of principal component analysis. First, make KMO test and Bartlett sphere test to per capita carbon dioxide emissions

and carbon dioxide emissions of per unit of GDP. Test results are shown in Table 1. KMO value is 0.5 which shows that the result is acceptable. The significance of Bartlett test Sig <0.01 which shows that there is significant correlation between the two indicators, suitable for principal component analysis. Through analysis, a common factor is obtained as shown in Table 2, namely “carbon emission” and accumulated explanation population variance reached 93.470% and can contain most information of the original index. Similarly, make principal component analysis on other indicators. The results as shown in Table 3. The data in the table shows that all KMO values achieve the acceptable level. In terms of significance, the Sig. of each group of indicator is less than 0.01 which shows that there are significant correlations between variables in indicators, suitable for principal component analysis. All accumulated explanation population variances are over 84% which can well explain the information contained in original indicators.

Correlation analysis: Make correlation analysis on the five indicators such as carbon emissions, clean energy consumption, non-clean energy consumption, economic growth and industrial structure optimization respectively and analyze the degree of correlation and the level of significance between various factors with Pearson correlation coefficient. The results as shown in Table 4.

Table 1: KMO and bartlett test of carbon emission

| Variable | Parameter | Result |
|-----------------|---|--|
| Carbon emission | Kaiser-meyer-olkin measure of sampling adequacy | 0.500 |
| | Bartlett's test of sphericity | Approximate chi-square Sig. 19.035 0.000 |

Table 2: Principal component analysis of carbon emission

| Common factor | Indicator | Component 1 |
|-----------------|---|-------------|
| Carbon emission | Per capita carbon dioxide emissions | 0.967 |
| | Carbon dioxide emissions of per unit of gdp | -0.967 |
| | Accumulated explanation population variance | 93.470% |

Table 3: Principal component analysis of energy consumption, economic growth and industrial structure optimization

| Common factor | Indicator | Component 1 | KMO | Sig. | Total variance explained (%) | | |
|-----------------------------------|---|--|--------|-------|------------------------------|--------|-------|
| Energy consumption | Consumption proportion of clean energy | Natural gas | 0.966 | 0.500 | 0.000 | 93.313 | |
| | | Hydropower, nuclear power and wind power | 0.966 | | | | |
| Economic growth | Consumption proportion of non-clean energy | Coal | -0.934 | 0.500 | 0.001 | 87.280 | |
| | Gross domestic product | Oil | 0.934 | | | | |
| | | Per capita gross domestic product | | | | | 0.999 |
| Industrial structure optimization | Proportion of tertiary industry in gross domestic product | | 0.999 | 0.500 | 0.000 | 99.825 | |
| | | Contribution rate of tertiary industry | | | | | 0.938 |
| | | Proportion of the gross output value of high technology industries | | | | | 0.935 |
| | | in gross industrial output value | | | | | 0.888 |

Table 4: Correlation analysis of low-carbon economy and transformation of economic development pattern

| Influence factor | | Transformation of economic development pattern | |
|--------------------|--|--|-----------------------------------|
| | | Economic growth | Industrial structure optimization |
| Low-carbon economy | Carbon emissions | -0.985** | -0.607* |
| | Consumption proportion of non-clean energy | 0.090 | -0.677** |
| | Consumption proportion of clean energy | 0.914** | 0.711** |

**Statistical significance at the 0.01 level (two-sided test), *Statistical significance at the 0.05 level (two-sided test)

The data in Table 4 shows that the correlation coefficients of carbon emissions and economic growth show significant negative correlation on the significance level of 0.01 (two-sided test). Thus it can be verified theoretically that the increase of carbon emissions can significantly inhibit the level of economic development and the correlation coefficients of carbon emissions and industrial structure optimization show significant negative correlation on the significance level of 0.05. This result can theoretically explain that unreasonable industry structure is an important factor of sharp increase of carbon emissions.

In terms of energy consumption proportion, natural gas, hydropower, nuclear power and wind power, as ideal clean energies, are the key areas to support and develop in national strategic planning and are also the growth engines of future economy. This conclusion can be verified by the positive correlation between clean energy and economic growth, industrial structure optimization in Table 4. In addition, the consumption proportion of non-clean energy shows weak correlation with economic growth. Because the consumption of non-clean energy can only sustain economic prosperity on the surface, but cannot drive the benign development of economy actually. Although non-clean energy is still in great demand and has certain living room in the short term, with the mature and popularization of clean energy and clean technology, there are only two roads in front of it: being eliminated badly or upgrading and transformation. This conclusion can be supported by negative correlation between the consumption proportion of non-clean energy and industrial structure optimization in Table 4.

CONCLUSION

Developing low-carbon economy, on the one hand, conforms to China’s development goal of building a resource-conserving and environmentally friendly society; on the other hand, in dealing with key issues such as climate change and human survival, can fully show the image of China as a responsible great power. In principle or in affection, developing low-carbon economy is the only choice of China in dealing with current situation. Through above analysis, we can get to know that developing low-carbon economy is mainly by

reducing carbon emissions, decreasing consumption proportion of non-clean energy and promoting consumption proportion of clean energy which plays a positive role in promoting the transformation of economic development patterns and economic structure adjustment.

Optimize energy structure: As is known to all, the reason why some countries are able to smoothly develop non-clean energy is that they have their unique natural resources, for example, Brazil has the most abundant water power resource in the world, while Russia has the most abundant natural gas reserves in the world. So, the two countries have the congenital advantage that can’t be matched by other countries in developing clean energy; in addition, Germany has considerable results in the field of renewable energy, French has a widespread application in the field of nuclear energy and other countries also speed up technology research and development and application in their own advantageous energy fields. However, China is a country with “more carbon, less oil, no gas”, more than seventy percent of domestic energy supply depends on coal. Thus if China wants to create her own advantageous energy industry, she must transform and update coal industry through researching and developing acquired technological advantage such as Clean Coal Technology (CCT). The transformed coal industry can realize coal’s processing, combustion, conversion and pollution control and effectively reduce carbon dioxide emissions. In addition, introduce and develop clean energy technologies actively, increase policy support to emerging energy industries such as wind energy, nuclear energy and biomass, comprehensively promote clean energy industry to develop rapidly and distribute rationally, realize the optimization and adjustment of energy consumption structure as soon as possible.

Research and develop low-carbon technologies: Vigorously develop Carbon Capture and Sequestration (CCS) technology and carbon recycling and utilization technology, to store and transport the carbon dioxide generated in the process of manufacturing for recycling. China’s carbon dioxide emission has been the highest in the world and carbon emissions of per unit of GDP are also much higher than other countries. The objective fact

makes China often in a passive position in international political negotiations. However, if China can further develop and utilize carbon capture and sequestration technology and carbon recycling and utilization technology and put the captured carbon dioxide back into productions such as production of carbonated drinks, food preservation, crop nutrients, oil field injection agent, etc., it is possible to transform the carbon dioxide that originally consumes ecological cost to the resource that produces economic and environmental benefits and even transform China's international political pressure to endless force of economic development.

Implement low-carbon management: Speed up low-carbon tax measures and mandatory industrial carbon emission standards. As the main body of market economy activity, enterprises shoulder the social responsibility of low-carbon management and green production in the process of low-carbon economic development. But due to cost considerations, they usually do not incorporate low-carbon technology into production and operation initiatively. So preferential low-carbon tax measures combined with the policy of mandatory industrial carbon emission standards is the powerful tool that ensures the enterprise to be responsible for low-carbon responsibility. Industrial carbon emission standards can test and measure the carbon emissions of enterprise and thus determine whether the enterprise achieve the requirement of low-carbon management. For the enterprises that achieve carbon emission standards, the government can give proper discount of tax and finance to them, to encourage them to take low-carbon responsibility actively; for the enterprises that failing to meet carbon emission standards, the government can reduce or even cancel their fiscal subsidies, to urge them to implement low-carbon operation as early as possible. Policy mix, work along both lines, make enterprises spontaneously use low-carbon energy and reduce carbon emissions in the process of production and operation, consciously assume the social responsibility of low-carbon production and green management.

Advocate low-carbon life: The public is the most positive and active factor in the process of low-carbon economic development. It is necessary to guide the public to shift to low-carbon lifestyle for social economy achieving low-carbon transformation smoothly. Therefore, the

government should spare no effort to use administrative resources and legal means, constantly raise the cognitive level of the public to low-carbon economy. Through popular science and education of low-carbon knowledge, guide the public to set up civilized practice that proud of low-carbon, environmental protection and resource conservation and ashamed of damage to environment and waste of resources, make green and environmental protection low-carbon idea enjoy popular support, vigorously promote and advocate low-carbon life and low-carbon consumption patterns. On the basis of people having formed conscious behavior of low-carbon life and low-carbon consumption, inspire and cultivate supervision consciousness of the public. Encourage the public to inform against and disclose enterprise conducts such as damage to the environment, waste of resources, support the government to further standardize and control enterprise mess, supervise and urge enterprises to implement social responsibility, thus promote social economy stride forward to low-carbon gradually and steadily.

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