CHINA'S ENERGY EFFICIENCY: RE-ESTIMATION INCORPORATING HUMAN CAPITAL AND THE ANALYSIS OF ITS DISTRIBUTION DYNAMICS

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Overview

Energy conservation and carbon emission reduction have recently been important issues for China's low-carbon development. Almost all previous studies on energy efficiency evaluation have focused on the number of employees as the labor input but ignored the qualitative information about laborers, which may induce a biased evaluation. In the present paper, we utilize an SBM model to re-estimate the energy efficiency with CO2 emissions of China's 29 provinces from 2003 to 2011 with a modified labor input—human capital stock. A comparative analysis is first presented to distinguish between energy performance indicators with a traditional labor input (the number of employees), TEPI , and with a modified labor input (human capital stock), MEPI . The efficiency evaluation with the number of employees as the labor input underestimates energy efficiency. The evaluation results indicate that there was a declining trend of energy efficiency with CO2 emissions in China. The eastern area performed the best, and the western area had the worst performance. In addition, the kernel density estimation of MEPI showed that the distribution curves had a left shift overall and in the three regions, which reveals worsening energy efficiency performance in the sample years, and the efficiency distribution displayed differently in the three regions.

The paper is organised as follows: After the introduction the second section proposes an SBM-based evaluation model for measuring energy efficiency incorporating CO2 emissions. Section 3 presents the data and describes the variables in detail. In section 4, the empirical study measures China's energy efficiency performances in different provinces in the sample period. Section 5 concludes this study.

Methods

SBM model and Kernel density estimation

Results

First,the 29 provinces could reduce energy consumption by 49.3% with a modified labor input (human capital stock), and by 51.0% with a traditional labor input (the number of employees) annually.

Second, the average scores of MEPI in the three regions showed that the eastern area had the best energy efficiency performance and that the western area had the worst performance, but the scores displayed a declining trend in efficiency in the three regions.

Third, a non-parametric method, kernel density estimation, was also applied to analyze the distribution dynamics of energy efficiency in China and its three regions. It was found that almost all the distribution curves in the entire country and the three regions had a left-shift.

Conclusions

Firstly,there was a statically significant difference between the evaluation results of MEPI (energy efficiency performance indicator with a modified labor input –human capital stock) and TEPI (energy efficiency performance indicator with traditional labor input –the number of employees), and efficiency would be underestimated with a traditional labor input not only for the entire country but also for the three regions.

Secondly, the energy efficiency in China has not improved substantially and most provinces are quit far away from the production frontier. Chinese government should endeavor to improve energy efficiency and reduce CO2 emissions in order to pursue a sustainable development.

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