Research on the impact of Technology Trade on Energy efficiency

Jiachao PENG [1], Shuke FU [2]✉, Yalu LIU [3]
1. School of Economics and Management, China University of Geosciences, P.R. China
2. School of Law and Business, Wuhan Institute of Technology, P.R. China
3. Tax Bureau of Dengfeng City, P.R. China
1pengjiachao@cug.edu.cn, 2sk@wit.edu.cn, 31558806081@qq.com

Abstract： Technology trade, also known as international technology transfer, it is an important means for a country to achieve technological progress. Technology trade is developing continuously, and people pay more attention to it. Because the economic level, original technology level and absorptive capacity of countries in technology trade are different, so the impact of technology trade on energy efficiency is also The influence of technology trade on energy efficiency remains to be confirmed. The limited energy and the sustainability of economic development require us to pay attention to energy efficiency at all times. To promote energy conservation and emission reduction in key industries is the issue emphasized in the 2018 government work report. The energy supply can be sustainable, and the energy problem is becoming more and more serious. On the one hand, the energy supply and demand gap is large, the energy utilization efficiency is low, the per capita resource is low, on the other hand, the high input and low output energy use way has aggravated the environmental pollution. The supply of resources can not be greatly expanded. In order to solve the energy problem, it is necessary to continuously improve the efficiency of energy use and give full play to the role of energy.
Keywords: Data envelopment analysis; Technology trade; Energy efficiency

1.Introduction

Environmental problems and economic development problems make energy efficiency more and more attractive. Energy is a very important material foundation to promote economic development, and countries all over the world are also very concerned about energy issues. In the process of energy use, a lot of waste is produced. Low energy efficiency causes greenhouse gases such as carbon dioxide, waste water and waste residue, which brings pressure to the natural environment. The consequence of extensive industrial production is serious energy waste, environmental pollution deterioration and increasing dependence on external energy, which poses a serious threat to the sustainable development of our economy and society[1].Scholars at home and abroad have also conducted extensive research on energy efficiency issues Tishaw and Schipper adopted the "top down" (bottom-up) efficiency calculation model to calculate the energy efficiency index in the United States from 1988 to 1998. The conclusion is that the institutional transformation of energy service demand is the main reason for the rapid decline of the energy / energy ratio index[2].Lin Boqiang through the three factors of production function empirical study, economic reform and industrial structure adjustment can save energy, "economic development, electricity must first" development strategy is still effectiv [3]. The prevailing idea is that technological progress can improve energy efficiency. Jiang Lei and Ji Min he (2011) study found that technological advances can significantly improve energy efficiency[4].Dong Feng, Tan Qingmei et al. (2010) obtained that the contribution rate of scientific and technological progress to energy efficiency improvement is the largest, the contribution rate of pure technical efficiency and scale efficiency is about the same[5]

It can be seen that the progress of energy efficiency is closely related to the technological innovation, and the technological innovation, in addition to its own original technology, is largely derived from the introduction of foreign technology. At the same time, the export enterprises will also raise their technical level because of the pressure of competition. Therefore, there is a certain connection between technology trade and energy efficiency.

2. The impact of Technology Trade on Energy efficiency

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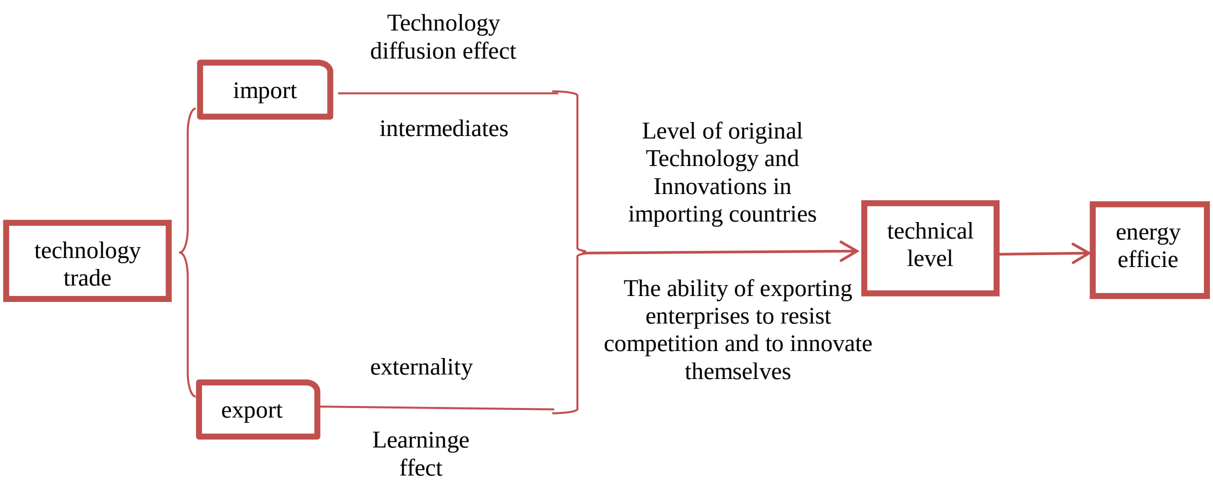
2.1 impact mechanism of technology trade on energy efficiency

This paper analyzes the influence of technology trade energy efficiency from two aspects of technology trade, namely technology import and technology export. The introduction of technology is mainly based on the technology diffusion effect and intermediate product. The existence of technology diffusion effect and intermediate product theory makes the technology trade have positive influence on technology water level. Technology export is mainly based on externality theory and learning effect, and technology trade has a positive effect on energy efficiency. In terms of technology introduction, the difference in the original technology level of the importing country and the difference in the ability of the technology exporting country to resist competition may lead to the adverse effects of technology trade. The effects of production



technology and energy efficiency are different.

Figure 1 Attachment: The picture shows the mechanism of the impact of technology trade on energy efficiency

2.2 Measurement of the impact of technology trade on energy efficiency

This paper uses the data envelopment analysis method to measure the total factor energy efficiency of each province under the Malmquist index method through DEAP software. Secondly, using the 2010-2015 China technology trade dependence data and energy efficiency data, empirically analyze the impact of technology trade on China's energy efficiency by establishing an econometric model.

2.2.1 Estimation of China's energy efficiency

Through the DEAP software, tfpch is calculated to represent the total factor energy efficiency. The total factor energy efficiency of 28 provinces in China is as follows:

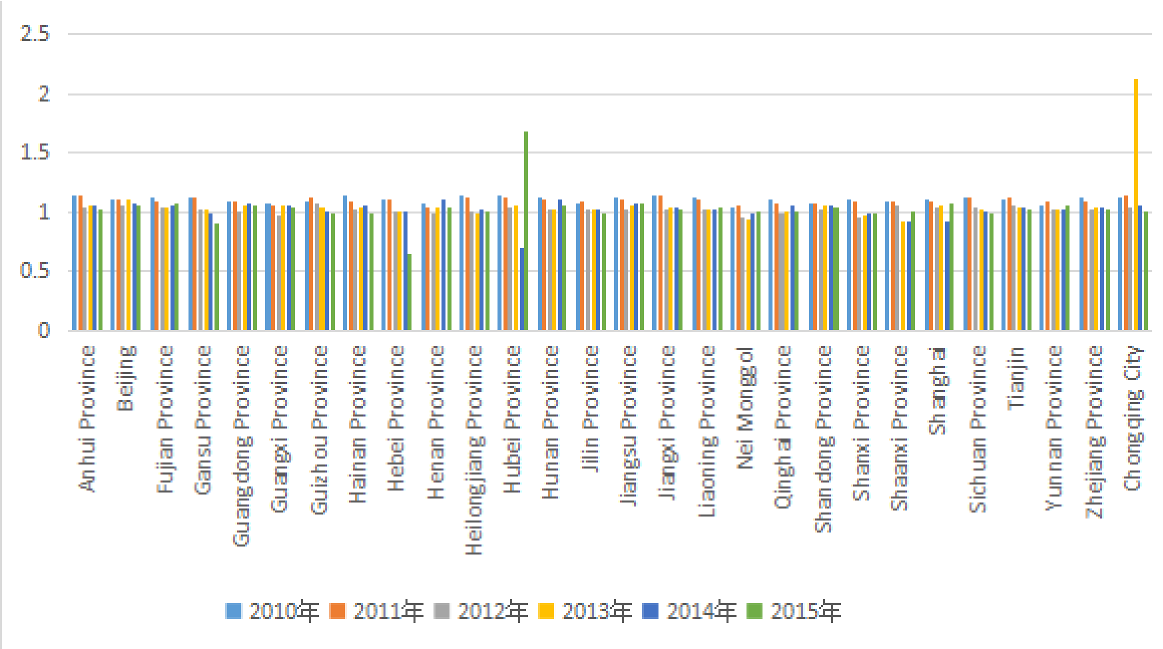


Figure 2 In order to more intuitively study the total factor energy efficiency of China's provinces, we averaged the total factor energy efficiency of each province, and obtained the TFP average of 28 provinces representing the overall factor energy efficiency of China, and the data are in line graph. The form is expressed:

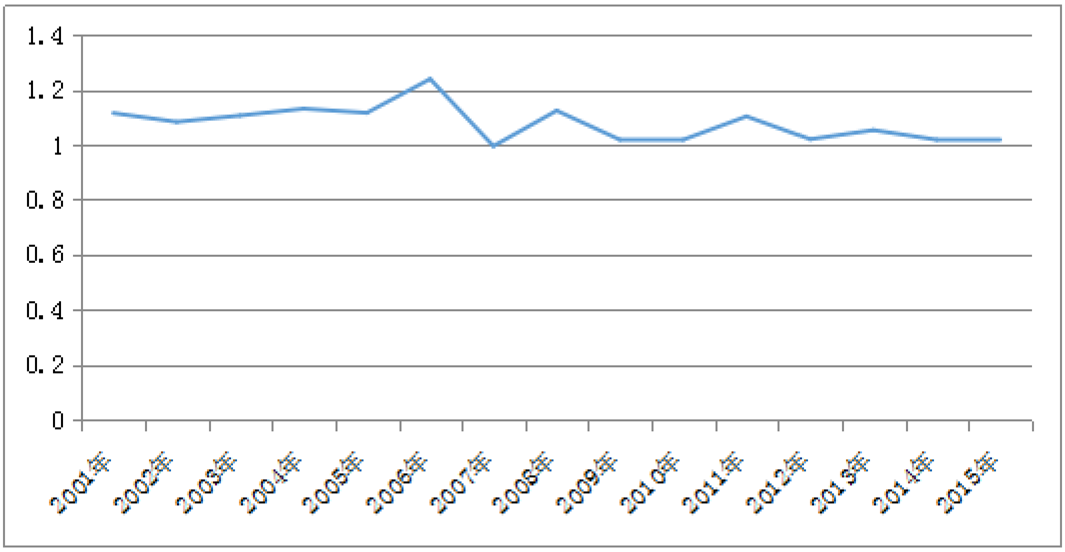


Figure 3 China's total factor energy efficiency

Figure 4 It can be seen that China's total factor energy efficiency is basically greater than 1, only in 2007,the total factor energy efficiency ratio is smaller than 1.China's total factor energy efficiency belonged to the overall rising and upgrading stage before 2006.It began to fall briefly in 2007 and then entered a tortuous development stage. Since the TFP value calculated by the DEAP software reflects the total factor energy efficiency compared to the growth rate of the previous year, Figure 3 reflects the trend of China's total factor energy efficiency development. In general, China's energy efficiency is The speed of improvement has increased after a rapid progress. After a brief period of decline, the trend of total factor energy efficiency has gradually stabilized, focusing on one.

From Figure 4, we can see that the total factor energy efficiency of the economically developed regions is relatively high, and the total factor energy efficiency of the central and western regions is relatively low. Therefore, the total factor energy efficiency of the eastern, central and western regions is separately described statistically. The divisions in the eastern, central and western regions are divided according to the general concept:11provincesinBeijing,Fujian,Guangdong,Hainan,Hebei,Jiangsu,Liaoning,Shandong,Shanghai,Tianjin ,and Zhejiang are classified as eastern regions; Anhui, Henan, Heilongjiang, Hubei, The eight provinces of Hunan ,Jilin, Jiangxi and Shanxi are classified as central regions; nine provinces of Gansu, Guangxi, Guizhou, Inner Mongolia, Qinghai, Shaanxi, Sichuan, Yunnan and Chongqing are classified as western regions.

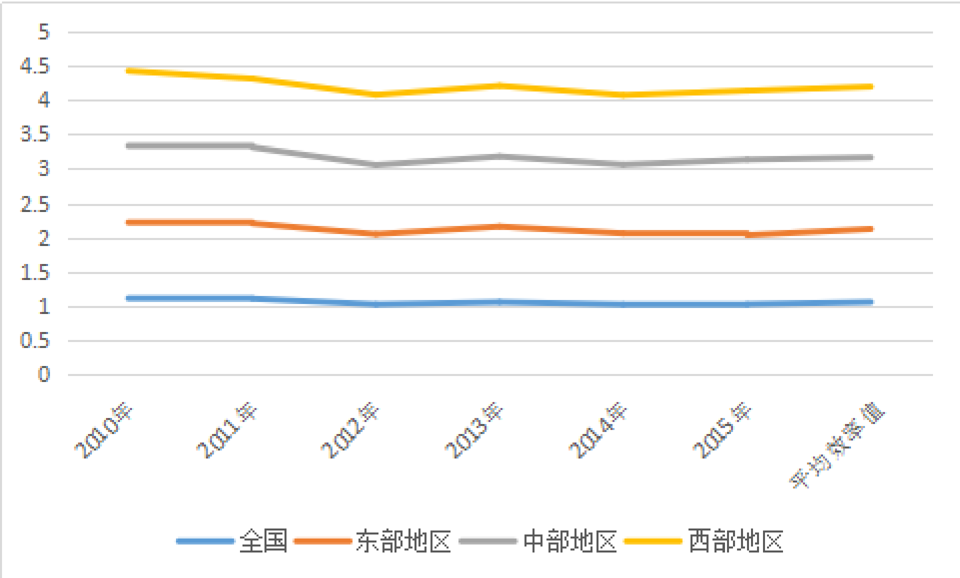


Figure 4 Total factor energy efficiency in the eastern, central and western regions from 2010 to 2015

As can be seen from Figure 4, the highest average efficiency value is in the eastern region, followed by the central region, and the lowest is in the western region, which is consistent with our expected results, in which the eastern region is higher than the national average of energy efficiency, while the central and western regions are Both are lower than the national average.

2.2.2 Establishment of an econometric model

When performing regression analysis on panel data, there are two models of fixed effect model and random effect. If the research data is all units in the whole, the fixed model is more suitable; if the research object is randomly selected from a large population and used to estimate the general law, the random effect is more suitable. Since the cross-section data of this paper selects all provinces in China, and does not speculate the whole by sample, this paper adopts the fixed effect model. Regression analysis of the sample data, the measurement model is set to:

$$TFit=\beta_0+\beta_1 TDit+\beta_2 INIT+\beta_3 EIT+\beta_4 elite+\mu \quad (2.1)$$

Among them,β_0 represents the common intercept; TFit represents the energy efficiency of the i region at t time; TDit represents the technical trade dependence of the i region at t time; INit represents the added value of the secondary industry at the time t in the t region. Eit represents the proportion of power consumption in the total energy consumption of the i region in the t period; ELit represents the proportion of the total number of employees in the state-owned unit at the end of the t-year period; μ represents the random disturbance.

2.2.3 Estimation results and analysis

In the measurement process of panel data, there are two cases of fixed effect and random effect. In the previous paper, the reason why the model is selected as a fixed effect is discussed. However, for the rigor of the research, the Hausman of the selected panel data is modeled. test

The Hausman test procedure is divided into two parts:

1.Estimation of the random effects model. The null hypothesis of the Hausman test is a random effect.

2.Hausman test statistic and estimation of adjoint probability. The correlation statistics and accompanying probabilities are calculated by the Hausman test module built into the Eviews software.
The calculation results show that the Hausman test has a test statistic of 121.59 and an accompanying probability of zero. Therefore, we reject the null hypothesis of the Hausman test: there are no systematic differences between fixed effects and random effects. It is more appropriate to verify that a fixed effect model is established. After determining the establishment of the fixed-effects model, the panel data is estimated by fixed-effects using eometrics.

Fixed effect estimation result

Variable	Coefficient	Std. Error	the Statistics	Prob.
C	51.65728	35.57381	1.452115	0.1488
D?	1.92474	0.826529	2.32870	0.8162
I?	-1.636473	0.364512	-4.489495	0.0000
E?	11.1975 8	1.933924	5.790084	0.0000

The estimation results can be concluded that the model has good goodness of fit, and the F-value test is used to make the model overall. The explanatory variables TD,IN,E, and EL all pass the t-test at a significant level of 5%. There is a significant impact on the variables being interpreted. After the above analysis, this paper determines the fixed effect model, and the model results are
TFit=51.657+1.924TDit-1.636INit+11.1976Eit-8.963ELit (2.2)
It can be seen from the regression results that there is a positive correlation between the total factor energy relative efficiency (TF) and the technology trade dependence (TD) in China's provinces, and a significant test is passed in the fixed effect model, indicating that technology trade can be improved. The current energy efficiency of various provinces in China.

3.Summary

In this paper, we find that there are significant regional differences in energy efficiency in different regions of China, but we can improve the energy efficiency of our country through technology trade, thus improving this kind of regional difference; the adjustment of industrial structure, the change of property right system, The adjustment of energy consumption structure and other variables have obvious influence on the energy efficiency of all factors, thus improving the efficiency of resource development.

4.Countermeasures and suggestions

Based on the previous conclusions of this paper, in order to improve energy efficiency in China, the following suggestions are put forward:
(1) Deepening technology trade: on the one hand, technology trade can improve the level of domestic technology through the way of technology introduction, and then improve energy efficiency; on the other hand, it will improve energy efficiency through internal optimization because of productivity advantage. The above empirical research also proves this conclusion. Expanding the scale of technology trade is more important for improving the energy efficiency in the western region than in the eastern region.
(2) To promote industrial reform: the industrial reform of "retreating from the second to the third" advocates that some enterprises with no market for their products or bad prospects for development should withdraw from the secondary industry and turn to the tertiary industry. We can rely on this idea to promote the optimization and upgrading of the industrial structure on the basis of ensuring economic development, minimize heavy chemical industries with high energy consumption, high pollution, and low output, and reduce the proportion of secondary industries. We will strive to develop the tertiary industry and reduce the demand for energy consumption.
(3) Optimizing energy consumption structure and property right system: energy consumption structure and energy efficiency are of great importance. From the previous research, we can see that the rational adjustment of energy consumption structure plays an important role in energy efficiency, and consummates the renewal energy policy. To increase support for the development of renewable energy, to plan from a national perspective the routes to support the development of renewable energy, to promote the sustainable and healthy development of renewable energy, and to implement incentives for the implementation of renewable energy policies, That is, according to the national conditions of our country, we should further implement a number of incentive policies, such as electricity price, subsidies, taxation, etc.[6] the reform of property rights

structure can fully mobilize the enthusiasm of the market. We should continue to deepen the reform of the state-owned economy, reduce the proportion of the state-owned economy in the regional economy, lower the threshold of market access, clear the way for the improvement of energy efficiency from the institutional aspect, and establish an incentive mechanism for enterprises at the micro level.

(4)Cultivating high-tech talents and enterprises: training the main body of high-tech industry competition is the key to enhance the international competitiveness of technological trade. In the aspect of talent training, we should adhere to the idea that talent is the first driving force. On the one hand, it is necessary to actively train and introduce the backbone of professional technical talents, train new types of specialized talents who understand international laws and policies and internationalize management talents, and improve the reward mechanism for technical talents. On the other hand, it is necessary to create a good environment for innovation, encourage innovation, perfect fault-tolerant mechanism, learn the concept of good social environment of tolerance and failure, and guide scientific professionals to dare to do so. Innovation, dare to innovate.

5.Bibliography

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