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Study on the Population Structure Threshold Effect from the Perspective of Oil Consumption Intensity with Urbanization

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Abstract: This paper constructs aims to show that the associated nonlinear panel threshold model of economic growth and changes in population structure, on the basis of this model focuses on the nonlinear relationship between oil consumption and economic growth between the efficiency. And through the regression of the intensity of oil consumption and related influencing relationship between variables are analyzed. The results of the study found that, during the study period, the threshold of population structure on oil energy consumption intensity is affected not only by economic growth variables play a role, on the other variables also have the transformation mechanism of effect in the population structure, the impact of each variable on oil consumption across the threshold intensity significantly different before and after, and the effect of different direction. Therefore we drew conclusions and provide the following policy recommendations: economic development policy should suit one's measures to local conditions; in the long run, technological progress is the fundamental solution to energy efficiency; combined with the present environmental pressure, improve the efficiency of energy use is a priority.

Keywords: oil consumption intensity, the level of economic development, urbanization, urban and rural population structure

1 Introduction

Along with the economic development, highlighting the bottleneck effect of China's energy supply problems within a short period of time, due to the energy cannot be changed, therefore the use of energy efficiency has become a concern of the industry, has become the focus of research in theoretical circles. The structure characteristics of Chinese energy "rich in coal, oil, less gas" based on efficiency of energy consumption, it is particularly important. But for now, the academic community on the single study of petroleum energy efficiency is rarely reported. Eighteen after China put forward to speed up the process of urbanization, along

with the acceleration of urbanization process, the change of the population structure is bound to have an impact on economic development, and further affect the energy consumption quantity and consumption efficiency including oil. In terms of the number of energy consumption caused by the change of the population structure changes, understanding the theory is consistent, Li Yanmei^[1], Liu Yaobin^[2], Stan^{[3][4]}, He Xiaoping, Wang Huogen, Shen Lisheng^[5], Liang Jinshe, Hong, Cai Jianming^[6] et al published articles that rise in the city, the proportion of the population, to promote economic development and at the same time, due to changes in the standard of living and industrial structure, demand structure and demand from energy consumption. Although the economic development of every area of our country is different, it can be expected that the absolute amount of growth of energy consumption.

2 Literature review

Currently, the existing problems of urbanization and the energy consumption of concentrated in the relationship, urbanization, energy consumption and urbanization and the change of energy structure, urbanization and energy consumption demand changes.

Hiroyuki^[7] et al. analyses of national data found a positive correlation between the percentage of urban population and energy consumption per capita. Wei^[8] on the process of urbanization in China on the relationship between energy consumption is studied. The results show that the urbanization to promote China's economic development and at the same time, increase the energy consumption of the total demand, but to improve the efficiency of the energy demand and energy saving effect to. Zhang Xiaoping^[9] through the analysis of energy consumption in China in twentieth Century since the 90's of the temporal and spatial characteristics show that the changes of macroeconomic, industry structure, urbanization level and the consumption structure is the main influencing factors of China's energy consumption growth and the energy consumption of regional differences. Wang Xiaoling^[10] by using statistical data

from 1990 to 2009 based on comprehensive method with interaction effect on the relationship between urbanization and energy intensity analysis, research shows that the reverse between the urbanization rate and the changes of energy intensity trend, relying solely on the energy system to improve energy efficiency and lack of sustainability. The improvement of the level of urbanization the decline in energy intensity has a strong role in promoting, and energy intensity is reduced and the main power is the urbanization rate increased. The study concluded that, by optimizing the development and system construction of the city, can effectively promote the sustainable use of energy.

Sathaye and Meyers^[11] study shows that, with the development of urbanization, the process of developing countries oil instead of coal consumption in the acceleration of the process of. Dzioubinski and Chipman^[12] found in the study, the urbanization has changed people's way of life, because the change of life style and the way of energy consumption and the consumption structure change, energy consumption by organic matter consumption to the consumption of electricity increased. Gates and Yin^[13] studied the differences between urban and rural residents of consumer appliances China shows the expansion of urbanization, the demand for electricity. With the advance of urbanization, the daily life of residents in the consumption structure of energy from coal to electricity, and organic matter in natural gas conversion.

Zheng Yun He^[14] by establishing the regression model between Chinese energy consumption and industrialization, urbanization and marketization, the industrialization and urbanization leads to the increase of energy consumption, and promote the process of marketization will result in lower energy consumption. Changes of Liang Jin society^[15] in 1985 - 2006 years Chinese energy consumption decomposition and time sequence comparison analysis showed that, the consumption of energy production in recent 20 years Chinese in the process of urbanization has always been dominant, but the rise of energy consumption increases gradually.

Through the study of the literature can be seen, for the process of urbanization has made a lot of work on the impact of energy consumption theory, greatly enriched the study of the relationship between economic development and energy issues in china. But there are also some shortcomings, clear first; the existing researches are based on the urbanization and the total energy consumption problem. The research on energy structure of our country is lack of pertinence. China's current energy structure, oil, natural gas problem is the priority among priorities, is a strategic issue related to China's energy security. Secondly, to explore the existing studies are on changes in absolute amount of total energy in the process of urbanization; and the research about the problems of urbanization and the energy efficiency is still relatively rare. The absolute amount of energy consumption problem from the historical experience of

the developed countries has been able to get the basic rules. Therefore, has the practical significance to study the trend of changes in the intensity of oil consumption in the development of urbanization in china.

3 Variable selections

In this study according to the theory of energy economics and the focus of this paper is as follows: the oil terminal, select the variable quantity of consumption and GDP ratio of oil consumption intensity (QD). Per capita GDP represents the level of economic development (rjchzh), second of industrial output value accounted for the proportion of gross national product as the industrial structure variables (erch), transportation, storage and postal industry is a typical industry variables account for the proportion of GDP (JT). Coal consumption accounts for the proportion of total energy consumption to represent the energy structure change (nyjg), in the city the population proportion of representatives of the population structure (rkjg).

Tab.1 Descriptive statistics of variables

qd	Strength	Pro tons / million	0.167	0.068	0.061	0.481
rjchzh	Per capita output	Million yuan / person	1.519	1.108	0.253	6.4
nyjg	The energy structure/coal accounted	%	0.629	0.158	0.214	0.983
jt	Transportation, postal service output value accounted	%	0.071	0.014	0.043	0.117
sanch	Third industries accounted	%	0.391	0.07	0.286	0.761
rkjg	The proportion of the population structure	%	0.414	0.169	0.153	0.893
erch	Second industries accounted	%	0.469	0.075	0.198	0.615
qd	strength	Tons / million	0.167	0.068	0.061	0.481

The sample used for the 1999 to 2011 period, China's mainland except Tibet in 30 provinces, municipalities and autonomous regions, the sample data for annual data. The basic data in the oil terminal consumption, coal consumption rate for each year "energy source" statistical yearbook of China, other sources of data in the network database. Calculation, involving the GDP index of per capita GDP and oil

consumption intensity variable data for the base year 1999 price deflator, other structural indicators did not change.

4 Model introduction

In the real economy, the economic variables often exhibit a nonlinear relationship; this nonlinear relationship indicates a change in the economic operation mechanism. Study on the nonlinear relationship between the models used is the regime switching model, including the threshold model, Markov regime switching model, smooth transition regression model. Threshold regression model can explain at some point or a variable reaches a certain critical value, the phenomenon of variable coefficient model of turning changes produced, and the reality of the situation of economic operation is similar. In view of economics to explain the model of rich connotation, in the study of nonlinear relationship between economic problems has been paid more and more attention. Description at some point mutation model called "structure change model" proposed by Tong in 1978, a description of the explanatory variables reaches a certain critical value of the mutation model is called the "threshold" model, proposed by Hansen in 1999, he believes that the threshold model is extended form of packet inspection. In this paper, using the Hansen development "the panel threshold model" of data automatically search recognition to determine the threshold value, the model has good characteristics of panel regression model, and nonlinear characteristic of threshold structure mutation capture long-term economic system.

The basic form of the threshold model:

$$\begin{cases} y_{it} = \mu_{it} + \beta_1 x_{1it} & q_{it} > \gamma \\ y_{it} = \mu_{it} + \beta_2 x_{2it} & q_{it} \leq \gamma \end{cases} \quad (1)$$

Among them: the explanatory variables y_{it} , explanatory variables x_{it} , q_{it} as the threshold variable, μ_{it}

γ as the threshold value, said individual characteristics. Think in the threshold model, explanatory variables by the influence of explanatory

variables, as the threshold variable, the variable y_{it} has a threshold, the threshold variable or, explained variables to explain the influence of significant differences. A dummy variable value is 0 or 1, known as the display function, then the formula (1) can be reduced to a single equation.

$$y_{it} = \mu_i + \beta_1 x_{1it} I(q_{it} \leq \gamma) + \beta_2 x_{2it} I(q_{it} > \gamma) + \beta_3 x_{3it} + \varepsilon_{it}$$

The threshold test is divided into two steps: first, the inspection threshold effect is significant; second, the inspection threshold estimation value is equal to the true value. Hansen (1999) proposed the use of Bootstrap method, asymptotic critical values for the F distribution

statistics, test the null hypothesis and alternative hypothesis is that the F statistics, when the original assumption does not hold, then based on the likelihood ratio test (Likelihood Ratio, LR) P. When the P value is small enough to reject the null hypothesis, it indicated that the existence of significant threshold effect.

The method is based on the assumption of single threshold, multi threshold may practice. The hypothesis that specific forms of multi threshold:

$$y_{it} = \mu_i + \beta_{11} x_{1it} I(q_{it} \leq \gamma_1) + \beta_{21} x_{2it} I(\gamma_1 < q_{it} \leq \gamma_2) + \beta_{31} x_{3it} I(q_{it} > \gamma_2) + \beta_4 x_{4it} + \varepsilon_{it}$$

In the formula. Both the threshold value $\gamma_1 < \gamma_2$, x_{3it} for the relevant variables as independent variables, and (2) the same. The two threshold is the first in the

search to find the first threshold (X_{4it}) on the basis of the first second fixed threshold to find

($F_2 = (s_1(\hat{\gamma}_1) - s_2(\hat{\gamma}_2)) / \hat{\delta}^2$) method to determine the threshold, and the minimum residual sum of squares. Then the fixed second threshold is used to revise the first threshold. Then, the establishment of F (second) statistics to determine the threshold is significant, if the second threshold to reject the hypothesis that. The search and inspection of other multi threshold and for the same reason, this will not repeat them.

5 Empirical analysis

The purpose of this study is to investigate the relationship between energy consumption and economic growth, the strength of the terminal structure of the population changes between the first search, nonlinear relationship between oil consumption and economic growth between the change of structure, divided by region, and on the basis of the division of the interval of the interval by regression.

5.1 The threshold test

Looking at the changes in the structure of the Hansen (1999) based on the threshold search method. The use of Hansen (1999) proposed by Bootstrap numerical simulation method to simulate the critical values of F by sampling statistics. In the double threshold effect in the identification, Bai Jushan (1997) [] pointed out that the double threshold and double threshold has the same asymptotic distribution, so the structure of double threshold F statistics and single threshold, in the test to determine the model of double threshold model of double threshold estimation model from a new threshold condition next, in order to obtain the minimum residual sum of squares of the double threshold estimation.

Thus, according to the test method to estimate the threshold model and threshold in the above described, with the change of population structure (rkjg) as the threshold, the output value per person (rjchzh) as

variables, using petroleum energy intensity (QD) as the independent variable, the proportion of the second industry output value (erch), the typical industry (JT), the structure of energy (nyjg), population structure (rkjg) as the control variables, according to equation (2) to construct threshold model, the single threshold model (5), and the model (5) for threshold estimation and test results as shown below:

$$qd_u = \mu_u + \beta_1 rjchzh_u I(rkjg \leq \gamma) + \beta_2 rjchzh_u I(rkjg > \gamma) + \beta_3 nyjg_u + \beta_4 ersch_u + \beta_5 jt_u + \beta_6 rkjg_u + \varepsilon_u$$

According to figure 1 and table 2, table 3 shows, is seen in LR close to 0, the threshold parameter is 0.451, the threshold value of 95% confidence interval is [0.226, 0.799]. The estimation of the F statistic was 8.632, P value is 0.097, significant at the 10% level. Multi threshold test does not pass, the threshold for a single threshold, the threshold value is 0.451.

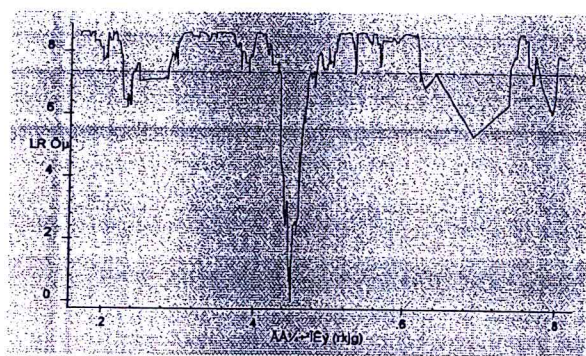


Fig.1 Threshold test

Tab.2 Threshold estimation

	Threshold estimation	95% Confidence interval
Single threshold model:	0.451	[0.226, 0.799]
double threshold model		
Ito1	0.532	[0.167, 0.805]
Ito2	0.451	[0.437, 0.504]

Tab.3 The threshold test results table

model	F value	P value	BS	1% critical value	5% critical value	10% critical value
Single threshold	8.632	0.097	300	18.12	11.219	8.389
double threshold	3.97	0.247	300	23.76	13.015	8.611

5.2 Model estimation and analysis

Study on the idea of threshold model according to the set threshold value perspective, according to a certain variable sample data, to abandon the timing characteristics, arranged in order from large to small, the threshold for reference, the original samples are divided into higher than the threshold value is lower than the threshold value and the two interval, then the division in

different interval sample piecewise regression, were studied and the explained variables to explain the influence in the two interval, by comparing the differences between the two interval regression coefficient test threshold effect.

So far, empirical analysis of the existing threshold model, are established by the threshold effect in the relevant variables, there is a nonlinear relationship, the other exogenous control variables and explanatory variables were based on the assumption of linear relationship. In this paper, the explanatory variables and the threshold variables cannot separate from the economic environment, so the threshold effect between them affects other variables, it is assumed that the other exogenous variables and explanatory variables should be relaxed linear relationship. From the changes in the structure of model, and Hansen (1999) proposed a threshold model is the idea of packet inspection, this paper using the method of regression coefficient estimates in the process, according to the model (1) the relationship between the variables is extended to (6).

$$\begin{cases} qd_u = \mu_u + \beta_1 rjchzh_u + \beta_2 nyjg_u + \beta_3 ersch_u + \beta_4 jt_u + \beta_5 rkjg_u + \varepsilon_u & q_u > \gamma \\ qd_u = \mu_u + \beta_1 rjchzh_u + \beta_2 nyjg_u + \beta_3 ersch_u + \beta_4 jt_u + \beta_5 rkjg_u + \varepsilon_u & q_u \leq \gamma \end{cases}$$

The difference between mutation model and the threshold of this model and the structure is characterized in that: the structure change model is expressed, structural changes in temporal dimension variables, and the basic hypothesis of the threshold model is a variable structural changes, and the relationship with other variables and the independent variables are a linear relationship.

It seems from the regression results, the proportion of urban population, accounting for second industries and typical industry factors within the interval of two-to pull the oil and energy intensity. Per capita output variables and the representatives of economic development structure of the sources of energy of coal energy is to reduce oil consumption intensity ratio in the range of two.

Effect of different interval variables influence, effect of population structure is gradually widening, reduction of industrial structure and industry factors effect. Per capita GDP and energy structure on oil consumption intensity and negative effect along with the population structure is higher than the threshold decreases. Below the threshold of demographic changes compared with the threshold at two intervals, demographic factors effect increased by 51.8%, per capita output effect is reduced by 15.79%, the energy structure effect is reduced by 29.88%, second industrial structure factors industry factors reduced 51.94%, reduced by 36.22%. These changes indicate that more than 0.451 of the threshold in our city the proportion of the population, the effect of various variables impact on oil consumption intensity in China is undergoing structural changes, so the subsection regression analysis to a profound understanding of the population structure changes on oil consumption intensity.

In the sample interval, the population structure

factors driving the trend of petroleum energy consumption intensity, caused by the change of the efficiency of oil consumption is mainly reflected in the changes of population structure, energy consumption and change the way of life brought about by the result, when the transformation of the rural population to the city, all the transformation of life style, consumption patterns and consumption structure to the city life this way, the one hand: to enhance the transformation of the direct consumption of petroleum products, on the other hand, because of the other commodity, service consumption caused by indirect demand, increased the demand caused by the oil consumption strength improvement. In the study period in the sample, when the city population is less than the threshold, the 1 units of changes of population structure, the oil intensity increased by 0.29 units in the city, and the proportion of the population is greater than the threshold conditions, oil consumption intensity of 0.4402 units.

Per capita output changes during the sample interval decreased the intensity of oil consumption to promote the role of the characteristics of China's energy consumption and economic growth in recent years. Over the years, with the development of economy, the energy efficiency in China is increasing, this change also shows China's energy policy and technology to enhance the management level. But in the structure of the population exceeds the threshold point, China's per capita GDP on oil consumption intensity of pulling down to reduce the action. The reason is there is a big difference in the economic development of every area of our country, in the economic base is relatively good area, economic development is sustainable development oriented, performance of energy utilization in these areas in order to improve the utilization efficiency of energy with the development of economic. In the economic foundation is weak areas, due to the lack of technical innovation and market efficiency and the system of division of labor, energy use is extensive, the efficiency is relatively low, the proportion of urban population will increase the intensity of oil consumption rose \square . At the same time, because the change of life style, the substitution effect between life energy decreases and the effect of energy structure on oil consumption will weaken the strength of pulling down.

Along with the change of population structure in the western city of china, the energy structure factors on oil consumption intensity downward pulling effect decreased from 0.1148 to 0.08 units before the threshold. At present, China's energy intensity is relatively low in provinces, the number of provinces in economic underdeveloped regions is more, and the population structure of these provinces across the threshold time relatively late, some provinces have not reached the threshold during the study period. The population structure of these provinces is higher than when the threshold value, the intensity of oil consumption will further enhance.

The change of the population structure is the

process of resource allocation, a large number of rural population transfer to the city, leading to changes in the overall structure of the economy of our country, the production data from rural to city, relatively high-end industry human capital to the city's economy to down regulate the function, promote technical innovation, information exchange, and promote the expansion of industries and enhance the efficiency of \square , economic development and at the same time the oil consumption to improve the efficiency of transportation and telecommunications industries, impacts on energy intensity by city population ratio is lower than the threshold of 1.072, dropped to 0.6837. Second effect of the proportion of output value of energy intensity from below the threshold before the upward pull is decreased from 0.237 to 0.114 higher than the threshold.

6 Conclusions and policy recommendation

Using the framework of nonlinear threshold model, using the 1999-2011 provincial panel data, empirical analysis of the change of population structure in China under the impact of economic growth on oil consumption intensity effect, the population structure, industrial structure, energy structure, typical of the industry and other factors affected by the change of population structure impact on oil consumption intensity effect. The study found that, when the proportion of urban population across the 0.451 threshold, the variables impact on oil consumption role change greatly, enhanced the effect factors of population structure on oil consumption strength improvement. The energy structure factors and factors of economic development, the oil consumption intensity effect is still downward pulling effect, effect of the two variables in the population structure is higher than the threshold. The industrial structure of petroleum energy consumption intensity and uplifting of the effect is gradually weakened in the population structure is higher than the threshold. So the effect of China's population structure changes on oil consumption strength significantly, and now it seems that China's population structure change is still in the initial stage, the population structure in some provinces have not yet been crossing the threshold, therefore, along with China's urbanization process, influence of population structure changes on energy consumption intensity is the long oil the.

From the point of view of the research conclusion of this paper, to improve the efficiency of China's oil consumption is a long-term and arduous task. From the point of improving the efficiency of energy use, saving oil petroleum energy use perspective, put forward the following policy suggestions as the conclusion of this study:

6.1 Economic development policy should suit one's measures to local conditions

In the economic development of our country in the process of economy of our country, has a strong

imitative, and gradually expand the pilot began to economic development to the area, the development mode of China economy, especially in the aspect of macro development model has played a very good role model. But when involved in the implementation of specific methods to various regions according to the economic basis of characteristics and stage of development characteristics of their own arrangements to adapt to their own development demand, to avoid blindly copy the successful experience of the so-called success, it is the right direction and is suitable for the characteristic of the method is effective with.

6.2 In the long run, technological progress is the fundamental solution to energy efficiency

Therefore using a variety of methods to promote technology innovation and new technology application is the fundamental guarantee to change the current situation of high carbon economy. For the protection of intellectual property rights, the introduction of a variety of technical quality standards, strict market access restrictions and various kinds of information disclosure system, the implementation of the survival of the fittest, promote enterprises to carry out energy saving and pollution control. To strengthen the construction of market mechanism, encourage and support the development of emerging technologies is necessary, can take to increase technology development funds, to take tax, subsidies and other preferential measures to the development of new technology enterprises, in order to promote the development of new technology. At the same time, to promote the application of new technology products, adopt corresponding to encourage the use of new technology products, to the enterprise incentive measures, to promote the use of new technology.

6.3 Perspective of industrial structure

Extensive development of the third industry to speed up the process of urbanization is inevitable, however, some of the lower threshold of the industry, large consumption of energy, so the lifting chain of the third industry, the third industry development of the service industry to the professional, high technical content of the consulting industry, not only can improve the the level of output at the same time help to reduce oil consumption intensity. To strengthen the adjustment of the structure of high energy consuming industries, rely on the elimination of obsolete equipment, backward technology, reduction of pollution sources, small, scattered, promotion of high and new technology, to improve energy efficiency and economic efficiency, control the growth of total energy consumption. High energy consuming industry structure adjustment mainly through the adjustment of product structure and the promotion of major energy-saving technology, vigorously improve the efficiency of energy use and efficiency, control the growth of energy consumption, to achieve energy saving, saving, emission growth rate to slow.

6.4 Combined with the present environmental pressure, improve the efficiency of energy use is a priority

Compared with the energy of coal, electricity, oil, natural gas and other traditional energy is clean energy, in the view of the perspective of China's energy structure, coal accounted for a large proportion in the future for a long time is difficult to change. Therefore, to optimize the use of the process of coal energy new energy development at the same time, improve the efficiency of coal use, from the perspective of environmental and reduce oil use will yield strength of terminal.

The process of urbanization is the strategic basis of China 30 years of reform and opening up the development of economy and the international competition pressure on the restructuring of the economy slowed down, its implementation and implementation will completely change the two yuan of economic system in China has existed for a long time and large economic situation is not strong, by this, it will be in China Development for a long period of time in the direction of economic reform. During this period, all regions, departments will use the appropriate direction, allocation of resources in the overall national macro guidance of the overall adjustment of the economic structure, the developed areas of the new stage of development will thus embarked on, backward areas will begin leaping over.

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