Study on the Influence of Household Consumption on Energy Consumption under the Threshold of Rising House Price

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Abstract. In order to understand the impact of residents' consumption on energy consumption in a more comprehensive way, this paper divides the residents' consumption into two dimensions: total consumption and consumption structure, and introduces the house price as the threshold variable, using the provincial data of 2007-2017, constructs the panel threshold model of residents' consumption on energy consumption. The results show that: the total consumption and consumption structure of residents have a double threshold effect on energy consumption; the promotion of total consumption promotes energy consumption, while the upgrading of consumption structure restrains energy consumption; when the rise of house price is in the middle level, due to the "wealth effect" caused by the rise of house price, the rise of total consumption and consumption structure The upgrading of the structure has the strongest effect on energy consumption, but when the house price further rises beyond the maximum threshold, the "crowding effect" brought by the rising house price will significantly weaken the impact of total consumption and consumption upgrading on energy consumption.

1. Introduction

Energy is an important resource to ensure the operation of social economy and the "blood" to support the development of national economy. At present, the global energy consumption is mainly fossil energy. The unlimited demand and the limited resources cause the scarcity of energy. From the perspective of demand, it is particularly important to analyze the social energy consumption and give full play to the maximum economic benefits of energy through the rational distribution of social energy use. As one of the "three carriages" to promote economic development, residential consumption not only promotes economic growth, but also drives energy consumption, and the increase of residential consumption level and the change of consumption structure will have an important impact on the energy consumption of the whole society.

The existing research on the consumption of residents and energy consumption is mainly measured from the perspective of consumer behavior and total consumption[1]. It should be noted that the consumption behavior of residents is affected by income level, consumption habits, macroeconomic environment and other factors[2]. As an important industry supporting the economic development of our country, the real estate industry is an important expenditure of residents. The fluctuation of house price will not only affect the regional macroeconomic environment, but also affect the disposable income and capital stock of residents, and then affect other consumption expenditure of residents.

The effect of house price on household consumption is mainly embodied in "wealth effect" and
"crowding out effect". "Wealth effect" reflects the capital goods attribute of real estate. With the rise of house price, the wealth of the house holder has been increased, and the consumer confidence has been enhanced, thus promoting the consumption of the residents[3]. On the other hand, the excessive rise of real estate price will make some residents who are willing to buy houses unable to bear their costs, and then turn to non housing consumption, which will affect the consumption structure of residents[4]. The "crowding out effect" reflects the consumer property of real estate. The rise of house price makes the buyer need to pay more savings, overdraft the future income in advance through loans, and compress the daily consumption of consumers. Through the empirical analysis of four municipalities in China, Zhou Xiaokun and others found that the high house price significantly inhibited the daily consumption expenditure of residents and reduced the quality of life of residents[5]. Wang Xueqi found that the fluctuation of house price had a significant inhibitory effect on the expenditure of health care, but promoted the consumption of housing and household equipment[6]. In addition, some scholars think that the relationship between real estate prices and urban residents' consumption is not a simple linear influence, which is shown as the mutual transformation between positive and negative directions in different situations[7].

To sum up, we can conclude that the fluctuation of house price will affect the consumption of residents, and the change of consumption will affect the energy consumption. This paper creatively brings the three into the same analysis framework, takes the total consumption and the upgrading index of the consumption structure as the main explanatory variables, takes the house price as the threshold variable, explores the role of the rising house price in the relationship between the consumption and energy consumption, and provides a theoretical basis and policy suggestions for reducing energy consumption through targeted guidance of the consumption of residents.

2. Research design and empirical analysis

2.1 Variable selection and data source

Due to the lack of some data, this paper selects panel data of 29 provinces and municipalities except Tibet and Xinjiang. The time span is from 2007 to 2017. The relevant data are from China energy statistical yearbook and China Statistical Yearbook. Descriptive statistics of each variable are shown in the table below.

| Variable category            | Variable name                     | Variable code | mean value | standard deviation | minimum | Maximum |
|------------------------------|-----------------------------------|---------------|------------|--------------------|---------|---------|
| Explained variable           | Total energy consumption          | energy        | 13162.04   | 8210.48            | 920     | 38899   |
| Explanatory variable1        | Final consumption expenditure     | custom        | 11055.13   | 9429.73            | 273.64  | 28285.51|
| Explanatory variable2        | Consumer structure upgrading index| Custom-2      | 0.31       | 0.05               | 0.24    | 0.37    |
| Threshold variable           | House price income ratio          | pri           | 10.46      | 4.20               | 6.04    | 32.47   |
|                             | Regional technological progress level | tech         | 0.47       | 0.81               | 0.19    | 0.61    |
| control variable             | Population size (10000)           | people        | 4529.95    | 2682.71            | 548     | 10999   |
|                             | GDP (100 million yuan)            | Gdp           | 4095.13    | 3845.06            | 144.32  | 23379.67|
|                             | industrial structure              | industry      | 1.95       | 0.89               | 0.49    | 2.38    |

2.2 Empirical analysis

2.2.1 Threshold effect test of total consumption on energy consumption. Using the software of stata14.0, taking the ratio of house price to income as the threshold variable, the bootstrap (BS) method was used to carry out 500 times of self sampling, and then the hypothesis of single threshold, double threshold and triple threshold was tested in order to analyze whether there is threshold effect of the ratio of house price to income on the impact of total consumption and consumption structure on
energy consumption. The results show that the two thresholds of total consumption to energy consumption are 9.43 and 15.89, and the two thresholds of consumption structure to energy consumption are 9.59 and 14.21.

2.2.2. Regression results of threshold model. The thresholds obtained from the two tests were included in Stata for regression. The regression results of the total consumption of residents show that: on the whole, the increase of the total consumption of residents can significantly promote the increase of regional energy consumption. When the ratio of house price to income is at the lowest level, the regression result of the increase of household consumption to energy consumption is 0.17 at the significance level of 5%. If the ratio of house price to income increases to the middle range, the "wealth effect" brought by the rise of house price is more significant at this time. The expectation of the continuous rise of house price by the residents releases the consumer enthusiasm of the residents. The consumer demand of the residents rises. In recent years With the rapid development of communication and e-commerce technology, the consumption of residents has experienced explosive growth, which has stimulated the consumption of energy to a certain extent. Within this threshold, the role of residents' consumption in promoting energy consumption has increased to 0.58. When the ratio of house price to income exceeds the maximum threshold, because the house price is too high, most of the savings of residents are used for house purchase, the disposable income is reduced, which seriously weakens the consumption of residents in other fields. At this time, the coefficient of action of residents' consumption on energy consumption is reduced to 0.19.

The threshold regression results of the upgrading of the consumption structure are shown in column 2 of table 2. The table shows that in general, the upgrading of the consumption structure of residents has a significant inhibitory effect on energy consumption. When the ratio of house price to income is in the minimum range, the structural upgrading of household consumption has a significant inhibitory effect on energy consumption, and the correlation coefficient is -0.09 at the significance level of 5%.

When the ratio of house price to income is in the middle range, that is, when the ratio of house price to income is greater than 9.59 and less than 14.21, the inhibition coefficient of the upgrading of consumer structure to energy consumption is -0.23. Similar to table I, the moderate rise of house price promotes the upgrading of the consumption structure of residents, the appreciation of the self-owned property of residents increases the consumption confidence of residents, the consumption of high value-added services such as medical treatment, education, entertainment, etc. with high prices increases, while the energy use intensity of related industries is low, and the energy consumption per unit consumption is less, so it will slow down the whole social energy consumption of the source. If the house price rises further on this basis, the consumption level of residents will fall again. At this time, the impact coefficient of the upgrading of the consumption structure on energy consumption is -0.06, which is significant at the level of 10%. With the further development of the economy, the total consumption of residents is bound to increase. We should fully recognize the inhibition of the upgrading of the consumption structure of residents on energy consumption, and take into account the impact of the macroeconomic background of rising house prices. By formulating more scientific policies to guide residents' consumption appropriately, we should encourage residents to pay attention to themselves while meeting their basic living needs To cultivate and invest in health, education, culture and other fields, to improve the consumption structure of residents, and to slow down the consumption of energy at a certain level. The regression results of other variables are consistent with the existing research conclusions.

| Table 2 Threshold regression results |
|--------------------------------------|
| Housing price threshold of total      |
| consumption to energy consumption    |
| The threshold of energy consumption  |
| for the upgrading of consumption      |
| structure                            |
| Threshold | r≤9.43 | 9.43<r≤15.89 | r>15.89 | r≤9.59 | 9.59<r≤14.21 | r>14.21 |
| Explanatory variable | 0.17** | 0.58* | 0.19*** | -0.09** | -0.23* | -0.06* |
| (2.88) | (1.10) | (1.93) | (-0.79) | (0.87) | (0.02) |
Regional technological progress level 0.01 0.18**
Population size (10000) 0.35** (2.13) 0.14* (0.75)
GDP 0.55*** (10.49) 0.51*** (20.90)
industrial structure -0.16*** (-1.23) -0.14*** (2.45)
Constant term 2.59*** (3.66) 4.07*** (4.01)

Note: *** means significant at 1%, ** means significant at 5%, and * means significant at 10%.

3. Conclusions and suggestions
Based on the panel data of 29 provinces and cities in China, this paper discusses the threshold effect of the total consumption and the upgrading of consumption structure on the house price to income ratio of energy consumption in each province based on Hansen’s panel threshold model and threshold estimation method, and draws the following conclusions: (1) both the total consumption and the upgrading of consumption structure have the double threshold effect on the house price to income ratio of energy consumption. The threshold value of house price income ratio of total consumption to energy consumption is 9.43 and 15.89, and the threshold value of house price income ratio of consumption structure to energy consumption is 9.59 and 14.21. (2) The rise of the total consumption of residents will promote energy consumption. When the house price income ratio is in the middle range, the "wealth effect" of the rising house price on the consumption of residents is greater than the "crowding effect". At this time, the promotion effect of the consumption of residents on energy consumption is the strongest. When the house price income ratio is greater than the highest threshold, the excessive rise of the house price leads to the "crowding effect" greater than the "wealth effect", At this time, the promotion of energy consumption will be slowed down. (3) the upgrading of consumption structure will restrain energy consumption. As above, the inhibition of consumption structure upgrading is the strongest when the price income ratio is at the middle level.

In this regard, this paper puts forward the following suggestions: (1) at present, the living needs of Chinese residents have been basically met. In the face of the increasing and diversified consumption trend, we should increase the publicity of low-carbon consumption concept and enhance the energy-saving awareness of residents. We can eliminate high energy consumption household equipment by giving corresponding subsidies, promote energy-saving household electrical appliances at low cost, and promote their residential consumption And transportation to a low-carbon lifestyle. On the premise of meeting the basic needs of life, encourage residents to upgrade to knowledge intensive industries and service industries, improve the consumption structure of residents, and then control the consumption rate of energy. (2) The government should strengthen the control of the real estate market, improve the down payment ratio and tax intensity of purchasing the second and third commercial housing, strictly curb the "speculation" behavior, and regulate the development of the real estate industry. We will build diversified real estate products and accelerate the construction of low-cost housing, low rent housing and other supporting projects. The government should reduce its dependence on land finance, strive to develop the real economy, cultivate new economic growth points, and prevent the negative impact of the excessive rise of real estate prices on Residents’ consumption. (3) Adjust the industrial structure, guide the transformation and upgrading of the resource intensive industries with high pollution and emission to the technology intensive low-carbon industries as soon as possible, and promote the development of the tertiary industries with low energy consumption elasticity. To increase regional R & D investment and cultivate innovative technical talents, the government should guide enterprises to carry out production university research cooperation, so as to enhance the actual implementation of R & D achievements and promote the accelerated utilization of "energy saving and emission reduction" technologies.
References

[1] Y M Li, L Zhang. Structural decomposition analysis of indirect energy consumption of Chinese Residents[J]. Resource Science, 2008(06):92-97.

[2] L L Li, Y H Zhang. The impact of consumer behavior on energy consumption from the perspective of income gap[J]. Economic management, 2013(4):1-10.

[3] J Y Li. Does the "housing slave effect" lead to the low consumption of residents?[J]. economics, 2018( 01):405-430.

[4] H Niu. An analysis of "crowding out effect" of housing price fluctuation on Residents' consumption[J]. consumer market, 2020( 01):41-43.

[5] X K Zhou, X Yang. An empirical analysis of the influence of house price on the consumption of residents in China: a case study of Beijing, Tianjin, Shanghai and Chongqing[J]. Price theory and Practice, 2010(7): 40-41.

[6] X Q Wang, Y Y Zhao, and F Chao. A study on the influencing factors and trends of consumption structure of urban residents in China[J]. Statistical research, 2016(2):61-67.

[7] W G Xiao, J G Yuan and W Yuan. The nonlinear characteristics of the influence of house price on consumption[J]. Economic Review, 2014(5):16-26.