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# An Empirical Study on Rural Household Energy Consumption Influencing Factors about Migrant Workers in the Country

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**Abstract:** It is of great significance for easing China's energy security and reduce environmental pollution to promoting the optimization of rural energy consumption structure and renewable energy use. Using the relative data of the survey, this study applies the Tobit regression model to analyze the impact of migrant workers' migrant workers on rural household energy consumption, the results show that the increase of migrant workers' income has significantly promoted rural household energy consumption of liquefied gas and electricity consumption and reduce the consumption of biomass energy. In addition, the basic characteristics of the family, the family economic characteristics, consumer preferences and regional factors are important factors that effect on rural household energy consumption.

**Keywords:** Migrant Workers, Rural Family, Life Energy Consumption

## 1. Research Background

With the rapid development of China's industrialization and urbanization, energy demand is rapidly growing, energy security and the use of traditional fossil energy pollution lead to the increasing prominent [1]. The inevitability of industrialization for country's economic take-off has been confirmed by the experience and path of Western developed countries. In the process of industrialization, the transfer of rural labor is a problem that the world face in a long time. At this stage, China's rural labor force outstanding performances for the migrant workers into the city problem [2]. At the same time, with the rapid development of the national economy China's energy consumption demand continues rising, China's agricultural and rural economy have entered a new stage of development, farmers energy consumption and the structure using have undergone great changes, facing the requirements of building a new socialist countryside, there is an urgent need to synchronize rural energy construction to meet the rural residents production and rural sustainable development of energy needs. On the basis of elaborating the research on migrant workers and the energy consumption of rural household living energy, this research puts forward the starting point of this paper:

Firstly, there are many researches on the migrant workers in urban, the current migrant workers basically choose to make money in the city and then back to rural consumption model, "move without moving" phenomenon is obvious. In recent years, the overall level of education in China has improved to a large level, and the increasing of employment opportunities has greatly increased the number of migrant workers. Cheng Mingwang found that the number of the years of education for migrant workers did not significantly affect the income of migrant workers, and the will of migrant workers into the city mainly impact the migrant workers living in the city, the longer education period into the city the more willingness to enter the city and the lower the cost [2]. Cheng Mingwang showed that "coastal" and "inland" migrant workers show not some common trends and laws in the city drivers and obstacles, into the city approach, into the city fees and income, but also show a certain difference [3], Zhao Yingying calculated the contribution of agricultural labor transfer to economic growth [4]. Cheng Liwen found that the income of migrant workers into the city impacts directly on China's rural labor force transferring at quantity and quality [5]. Chen, Hong established multiple Logistic models, and found that age,

educational level, monthly income had a significant effect on migrant workers' choice model [6]. Xiong Ping found that the regional differences of migrant workers is conducive to optimizing the rural labor force orderly transferring, promoting the process of urbanization and regional coordinated development [7], labor transfer is affected by regional human capital level and the level of average education [8]. These studies mainly focus on the impact of migrant workers on the migrant income and the effect of regional differences. However, the study on the impact of migrant workers on individual family members or individual family households is still so less and there is still some room on the energy consumption of rural households for research.

Secondly, there are many researches on the energy consumption of rural households, mainly focusing on the influencing factors, the energy consumption of farmers, the proportion of energy, and the use and development of new energy. Lu Mingming found that the proportion of energy consumption accounted for the top four were straw, electricity, coal and fuel wood [9]. Han Yun found that the growth of household energy consumption mainly comes from solar energy, electricity and biogas and other rural non-traditional energy, and the growth of energy is mainly used for life to enjoy; new energy and renewable energy become a new growth point for rural household energy consumption [10]. Han Yun found that family size, income level, education level and other factors mainly determine the consumption level and consumption structure of the villagers' family energy; regional economic forms, government guidance, energy characteristics, lifestyles and energy awareness also affect the consumption of various household energy [11]. Wang Xiaohua found that the energy consumption and structure of rural households in different regions were very different [12]. Xu Yao found that rural residents living energy consumption has entered the commercial period but non-commodity energy consumption has not stopped; consumption of commercial energy such as coal, electricity and liquefied petroleum gas increases with the increase of income, while non-commodity energy consumption (straw, fuelwood, etc.) decreases with the increase of income; household per capital consumption expenditure of electricity and coal is more; with their own prices increasing, fuel, coal, electricity and liquefied petroleum gas consumption demand are reducing, but the price changes are not very sensitive, there is a complementary relationship between coal, electricity and liquefied petroleum gas and other commodity energy, and there is a clear alternative to fuelwood and other types of energy [13]. Li Gang found that coal has become the largest single energy consumption for farmers, limited by the income level, firewood, cow dung, straw and other traditional energy is also widely used, but with the income level improving farmers' energy consumption and renewable energy consumption will gradually increase, and energy efficiency will gradually increase, income level is an important factor restricting the improvement of household energy use structure [14]. Li, Xue found that coal is still the main source of heating in winter, and also is the largest part of household energy consumption. With the development of renewable energy, coal, liquefied petroleum gas and diesel charcoal has been replaced by renewable energy sources such as biogas and straw, and the calorific value and price of these fuels are also low [15]. Yao Jianping found that farmers in the using of kinds fuels are mainly considered of economy, collection convenience, ease of use, environmental cleanliness and social status and other aspects of the reasons. The most important reason for the use of a variety of energy sources for poor farmers is to save money by minimizing the need to use energy, such as electricity, liquefied petroleum gas, and coal, which are not required to be purchased from the market and without using the energy that is not spent [16]. Because of the seasonal effects of biomass energy such as straw and firewood, the household energy selection of farmers is also obviously seasonal. Farmer's household appliances not only have the actual use of the function, to a large extent, also have a significant symbolic function. Although there are many studies on the influencing factors of energy consumption, there are few studies on migrant workers' influencing factors as influencing factors.

Finally, there is a lack of research on the impact of migrant workers energy consumption in rural households. Migrant workers entering the city bring income growth, the living standards improving, consumer awareness changing, which will directly or indirectly affects and changes the rural people's consumption structure. Combining with migrant workers to migrant workers and the current situation and development trend of energy consumption this paper puts forward: (1) Whether it has an impact on changes of rural household energy consumption by migrant workers? (2) How does migrant workers working in cities affect energy consumption in rural households?

In order to better analyze the impact of migrant workers working in cities on the energy consumption of rural household, this paper will focus on the analysis of liquefied gas, electricity consumption and biomass energy consumption. The specific structure is as following: The first part is the literature review, respectively discusses the research status at home and abroad of migrant workers working in cities and rural household energy consumption, and put forward the significance of this study; The second part is the model and data source; The third part is the empirical analysis and discussion; Finally, the conclusions and policy implications are obtained.

## 2. Data and Model

### 2.1. Data Sources

The data in this paper are mainly from the questionnaire survey conducted by the investigators of Xi'an University of Science and Technology Energy and Economic Management Research Center. The questionnaire is divided into eight parts, the first part is the basic situation of the family, the second part is the family capital situation, the third part is the family's production behavior, the fourth part is the working behavior and working decision, the fifth part is the family energy consumption behavior, the sixth part is the evaluation of

biogas, the seventh part is the evaluation of solar energy, the eighth part is the concept of energy consumption, ideas and behavior. The survey was conducted on rural families in Shaanxi province, and the household as a unit for research. Between May and July 2013, six investigators were organized to conduct a two-week survey of rural households in the rural areas of Shaanxi province. A questionnaire survey was conducted by investigators. Shaanxi province is divided into Southern Shaanxi, Northern Shaanxi and Guanzhong three areas for researching, the various regions randomly selected 100 families, there were 300 questionnaires in Shaanxi province, the questionnaire involved a wide range of places, including Xianyang, Yan'an, Hanzhong, Wuwei, Ji'an, Tongchuan and other parts of the county, township, village, to some extent, it reflects the real situation of Shaanxi province's rural migrant workers and rural families living energy consumption in rural areas. The final valid questionnaires were 289, the effective rate was 96.33%.

### 2.2. Variable Design

In this paper, the main analysis of rural household energy consumption is analyzed in three aspects: liquefied petroleum gas (LNG), electricity consumption and biomass energy consumption, according to the past, the study of household life energy consumption in the study of the various variables are as followings:

(1) The dependent variable, this article will be per capital electricity consumption, per capita biomass energy consumption, per capita liquefied gas consumption as the three dependent variables;

(2) The independent variable, this paper will be migrant workers' income as an independent variable;

(3) Control variables, the main factors of household living energy consumption in this paper are per capita agricultural income, family resident population, head of education, head of age, head of occupation, per capita arable land, consumer preferences, the number of elderly people over 65 years of age in the family.

Among them,

Household education level: respectively, assignment, illiterate semi-literate 0 years, 6 years of primary school, junior high school 9 years, high school 12 years, secondary school 14 years, college and above for 16 years;

Head of household occupation: 1 on behalf of agricultural labor, 2 on behalf of migrant workers, 3 on behalf of local non-farm workers;

Energy prices: the price factors involved in this article are: electricity prices, liquefied gas prices; which is the price of electricity is the price of electricity per household electricity; liquefied petroleum gas is the price of farmers living with liquefied gas per kilogram of price;

Per capita agricultural net income: annual per capital net income of agriculture;

Family size: This paper uses the resident population to measure the size of the family population;

Energy availability: This paper uses the per capita arable land to measure the availability of energy for farmers;

Consumer preference: This article uses the living energy that the respondents most want to measure consumer preferences.

### 2.3. Research Methods and Model Settings

In the course of the investigation, the rural household energy is divided into seven kinds of energy sources: straw, fuelwood, electricity, coal, liquefied petroleum gas, solar energy and biogas. Through the survey of 300 households in rural areas of Shaanxi Province, it was found that the use of electricity was 100% for farmers, and the proportion of other energy consumption was zero in one year. Therefore, this paper uses SPSS19.0 to diversify the per capita electricity consumption of rural households in multiple linear regression analysis [14], using Stata10.0 per capita biomass energy consumption and per capita liquefied gas energy consumption Tobit regression model analysis. Through the survey data found that Shaanxi rural households on electricity, fuelwood, straw and liquefied petroleum gas and the like the proportion of energy consumption more, solar energy, biogas and coal use ratio is relatively small, the consumption ratio of the three are below five percent. Therefore, this paper is mainly on the per capita biomass energy consumption, per capital electricity consumption and per capita liquefied gas energy consumption analysis.

Based on the empirical research of predecessors and the research theory of this paper, this chapter puts forward the multiple linear regression model and the Tobit regression model to analyze the impact of migrant workers' migrant workers on the energy consumption of rural households. The specific empirical models are as follows:

$$Y_1 = \partial_1 + \alpha_1 x_1 + \alpha_2 x_2 + \alpha_3 x_3 + \alpha_4 x_4 + \alpha_5 x_5 + \alpha_6 x_6 + \alpha_7 x_7 + \alpha_8 x_7 + \alpha_9 x_9 + e_1 \quad (1)$$

In the above (1) formula, $Y_1$ represents the per capita electricity consumption of farmers, of which, $\partial_1$ is the intercept, $\alpha_i$ is the coefficient, $e_1$ is the residual value.

$$Y_2^* = \partial_1 + \alpha_1 x_1 + \alpha_2 x_2 + \alpha_3 x_3 + \alpha_4 x_4 + \alpha_5 x_5 + \alpha_6 x_6 + \alpha_7 x_7 + \alpha_8 x_7 + \alpha_9 x_9 + e_1 \quad (2)$$

$$Y_2^* = \begin{cases} 0, \text{if} Y_2^* <= 0 \\ Y_2, \text{if} Y_2^* > 0 \end{cases}$$

In the above (1) formula, $Y_2^*$ is on behalf of farmers per capita biomass energy, liquefied petroleum gas energy use, of which, $\partial_1$ is the intercept, $\alpha_i$ is the coefficient, $e_1$ is the residual value.

In this paper, the regression model is mainly based on the above model, in the text gradually added control variables, omitted here, unified included in the regression equation.

# 3. Empirical Analysis Results and Discussion I

In order to better analyze the impact of migrant workers working in cities on the energy consumption of rural households, the empirical steps of this paper are: First of all, the method of multiple linear regression analysis is used to analyze

the influencing factors of per capita electricity consumption of rural households. Secondly, the variables such as agricultural income and household resident population are used as control variables to study the other influencing factors of rural household electricity consumption. Finally, the Tobit regression analysis model is used to analyze the impact of migrant workers 'income on urban households' per capita biomass energy consumption and energy consumption per capita of liquefied petroleum gas. It also analyzes the variables such as agricultural income and household resident population as control variables.

### 3.1. Descriptive Results

*Table 1. Descriptive Statistical Analysis of Independent Variables (N = 289).*

| Independent variable | Mean | Standard deviation | Minimum value | The maximum value |
|---|---|---|---|---|
| Per capita agricultural income(yuan) | 3054.02 | 7734.13 | 0 | 83333 |
| Per capita migrant workers into the city workers income (yuan) | 5411.36 | 5729.57 | 0 | 50000 |
| Family resident population (person) | 2.96 | 1.20 | 1 | 6 |
| Education level (year) | 8.41 | 3.05 | 0 | 16 |
| Head of household age (year) | 48.58 | 11.04 | 20 | 82 |
| Head of household occupation | 1.31 | 0.55 | 1 | 3 |
| Per capita arable land (mu) | 2.19 | 2.05 | 0 | 22.67 |
| Consumption preferences | 3.64 | 1.70 | 1 | 8 |
| Electricity price (yuan / degree) | 5.12 | 0.16 | 4.9 | 5.4 |
| The number of elderly people over 65 years of age in the family | 1.21 | 1.19 | 0 | 3 |
| Per capita liquefied gas consumption | 0.46 | 1.11 | 0.00 | 7.50 |
| Per capita electricity consumption | 363.52 | 261.30 | 25.00 | 1666.67 |
| Per capita biomass energy consumption | 337.34 | 361.47 | 0.00 | 2750.00 |
| Southern Shaanxi | 0.71 | 2.32 | 0 | 1 |
| Northern Shaanxi | 0.41 | 3.61 | 0 | 1 |
| Middle Shaanxi | 0.39 | 4.41 | 0 | 1 |

Table 1 gives the mean, standard deviation, maximum and minimum values for each variable. According to the results, the income form rural migrant workers in cities accounted for 64% of the total income of rural households, which accounted for a large proportion of rural household income; household education (8.41) Most of the junior high school level, the education level is not high; head of household occupation (1.3) is basically mostly farming, retain the original traditional farming practices; per capital arable land area (2.19) larger, consumption preferences (3.64) are more inclined to electricity; per capita agricultural income, family resident population, household education level, head of household age, head of household occupation, consumption preference, the standard deviation of these variables is large, indicating that the data to a certain extent, large variation.

### 3.2. Regression Analysis Results and Discussion

#### 3.2.1. Regression Results

*Table 2. Analysis on the Return of Migrant Workers' Migrant Workers to Rural Household Energy Consumption (N = 289).*

| Per person | electricity consumption | | biomass energy consumption | | liquefied gas consumption | |
|---|---|---|---|---|---|---|
| variable | modelA$_1$ | modelA$_2$ | modelB$_1$ | modelB$_2$ | modelC$_1$ | modelC$_2$ |
| Constant term | 3.04*** | 4.78*** | -0.68*** | 1.37** | -4.46*** | -1.16$^+$ |
| Ln Migrant workers income 3.22*** | 3.12*** | -3.83* | -1.38* | 3.51*** | 2.83* | |
| Ln Agricultural income | -0.73 | 0.78 | 1.27 | | | |
| Consumption preferences | -1.75$^+$ | -1.69 | 1.01* | | | |
| Family resident population | -4.40*** | -4.61** | -1.60$^+$ | | | |
| Head of education | 1.15* | 1.85$^+$ | 1.68 | | | |
| Head of household occupation | -0.90 | -0.96 | 2.19* | | | |
| Head of household age | -1.87$^+$ | 2.43* | -0.17 | | | |
| Per capita arable land | 0.71 | 0.16 | -1.13 | | | |
| Electricity price | 1.12 | | | | | |
| Liquefied gas prices | -6.97*** | | | | | |
| Number of people aged 65 over in the family | -2.13$^+$ | 1.32* | 3.42$^+$ | | | |
| Southern Shaanxi | 3.78** | -2.18* | 3.09* | | | |
| Northern Shaanxi | -4.12* | 3.69 | 4.13 | | | |
| Middle Shaanxi | 2.67 | 1.87* | 1.99** | | | |
| R$^2$ | 0.326 | 0.835 | 0.395 | 0.752 | 0.332 | 0.786 |

Note: *** $p<0.001$; ** $p<0.01$; * $p<0.05$; +$p<0.1$

Table 2 shows the impact of migrant workers working in cities on rural household electricity consumption, per capita biomass energy consumption and per capita liquefied gas energy consumption, each variable gives two models, Model 1 is only added to the autonomy of migrant workers' income and then analysis of migrant workers into the city of income from electricity, biomass energy and liquefied petroleum gas energy impact, Model 2 adds additional control variables to model 1 and explores the extent to which these factors affect the power, biomass, and liquefied gas. The results show, there is a significant positive correlation between the income of migrant workers and the per capita electricity consumption of rural households, the increase in the income of migrant workers' migrant has significantly increased the per capita electricity consumption of rural households, simultaneously, the increase in the resident population of the household significantly reduces the per capita electricity consumption, the increase in the education level of the head of household has significantly increased the per capita electricity consumption, and the geographical factors also have significant influence on the rural household electricity consumption; There is a significant negative correlation between the income of migrant workers working in cities and the per capita biomass energy consumption of rural households, the increase in the income of migrant workers working in cities significantly reduces the consumption of per capita biomass energy in rural households, at the same time, the increase in the resident population of the household significantly reduces the consumption of biomass energy in rural households, the increase in household age significantly increased the consumption of biomass energy in rural households, the increase in the number of elderly people aged 65 and above in the family has significantly increased the consumption of biomass energy in rural households, and the geographical factors have a significant impact on the biomass consumption of rural households; There is a significant positive impact on the income of migrant workers' migrant workers and the energy consumption of per capita liquefied gas in rural households, the increase in the income of migrant workers working in cities has significantly increased the consumption of per capita liquefied gas energy in rural households, at the same time, the improvement of the head of the household and the improvement of the concept of consumption significantly increased the consumption of rural household liquefied gas energy, the increase in the price of liquefied petroleum gas significantly reduces the consumption of liquefied petroleum gas in rural households, and the geographical factors have a significant impact on the energy consumption of liquefied petroleum gas in rural households.

### 3.2.2. Discussion

This paper discusses the regression results from the following three aspects:

(1) the impact of migrant workers working in cities on rural household electricity consumption.

Model A1 and Model A2 illustrate the impact of migrant workers on rural household electricity consumption and other factors affecting rural household electricity consumption. After

data analysis, first of all, migrant workers have a significant positive impact on the per capita electricity consumption of rural households. On the one hand, with the increase in the number of migrant workers, farmers' income also increased, and thus may promote the rural household electricity consumption increased; on the other hand, with the increase of migrant workers in rural areas, the concept of consumption of rural people will be gradually changed, and the per capita electricity consumption of rural households will be promoted. In addition, the study also found that the family resident population, the head of the education level, the head of the age, per capita arable land area per capita consumption of rural households also have a certain impact. The resident population has a negative impact on the per capita electricity consumption of rural households; the higher the education level of the head of household, the higher the consumption of electricity per capita; household age and household electricity consumption have negative impacts, this is because the older head of the household, the more reluctant to accept new things, the more reluctant to use electricity such as high quality commodity energy.

(2) the impact of migrant workers on urban household biomass energy consumption.

Model B1 and Model B2 illustrate the effect of migrant workers' migrant workers on the per capita biomass energy consumption of rural households. First of all, this paper found that migrant workers have a significant negative impact on the per capita biomass energy consumption of rural households; In addition, the article also found that the resident population, the head of household, the number of elderly people aged 65 and above in the family and the regional variable is also an important factor affecting the per capita biomass energy consumption of rural households. The higher the resident population, the less the per capita biomass energy consumption; The number of elderly people aged 65 and above in the family has a significant positive impact on household per capita biomass energy consumption, this may be more used to the elderly with straw, fuelwood and other biomass energy, electricity, liquefied petroleum gas and other high-quality goods, the use of energy is not very used.

(3) the impact of migrant workers working in cities on the energy consumption of liquefied petroleum gas in rural households.

Model C1 and Model C2 illustrate the impact of migrant workers working in cities on the energy consumption per capita of liquefied gas in rural households and other factors influencing the energy consumption of rural households. First of all, this paper found that migrant migrant workers working in cities have a significant positive correlation with per capita liquefied gas consumption in rural households, that is, the higher the income of migrant workers in urban areas, the higher the per capita liquefied gas consumption in rural households. In addition, this article also found that household occupations, consumer preferences, liquefied petroleum gas prices and regional variables are also affecting rural households per capita liquefied gas energy consumption an important factor. For the head of household occupation, in

general, the head of the household engaged in non-farm employment of the average proportion of households using liquefied petroleum gas; The price of liquefied petroleum gas has a significant negative impact on the energy consumption of per capita liquefied gas in rural households, that is, the higher the price of liquefied petroleum gas, the smaller the consumption of biomass energy per capita, this shows that for the use of energy, the price for rural people have a great impact.

## 4. Conclusion

Based on the actual situation of rural households in Shaanxi Province, this paper analyzes the impact of migrant workers working in cities on the energy consumption of rural households and other factors influencing the energy consumption of rural households, and draws the following conclusions:

(1) The model of migrant workers' income changes after the migrant workers migrate to cities, from the traditional single agricultural income model to the model of the combination of agricultural income and labor income, and the proportion of the income of workers in the total income gradually increased; (2) The increase in the income of migrant workers in urban areas has significantly increased the consumption of per capita electricity and liquefied petroleum gas, and significantly reduced the consumption of per capita biomass energy; (3) the number of resident population, the head of the household, the degree of education, the head of the household, the head of the household, the preference for consumption, the number of the elderly 65 and above in the family and the regional differences, the energy price, have a significant impact on energy on a different family life.

The rural family energy is the basic material to meet the basic living guarantee of the peasants and the important resources of the agricultural production development. It is the material condition basis of the rural well - off society under the socialist market economy. Therefore, in the process of mankind's great pressure on resources, the environment, the population and society, scientific forecast of rural living energy in China, analyzes the impact of migrant workers working in cities on the energy consumption of rural households, for China's rural family life energy long-term development strategy to provide a scientific basis, for China's sustainable development of energy has important practical significance. China is in a critical period of urbanization, only to achieve the sustainable consumption of rural household energy, it is conducive to China, global social, economic, population and energy coordinated development, and is conducive to building a new socialist countryside. The analysis of this paper is based on the data from the rural survey in Shaanxi Province in June 2013. Therefore, it is of little significance to the rural areas of Shaanxi Province, and it does not make sense for the whole country and other regions.

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