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DETERMINANTS OF ENERGY POVERTY IN RUSSIA

Master's thesis

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I have written this master's thesis independently. All viewpoints of other authors, literary sources and data from elsewhere used for writing this paper have been referenced.

Abstract

The development of the energy sector, its transformation can hardly be underestimated due to the enormous influence of energy on our everyday life. In this paper, the author reveals the problem of energy poverty. The purpose of this study is to complement regional studies on this topic and to form a general understanding of the situation with energy poverty on the example of the Russian Federation. The study uses econometrics methods, logit models in particular, to analyze a sample of almost 30,000 observations for each period under consideration. The results obtained determine a set of factors affecting energy poverty in the region with climatic diversity, which has a wide practical focus both in the field of social, regional research, and economic policy, business.

Keywords: energy, energy poverty, multidimensional energy poverty index, Russia, logit model.

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1 Introduction

In the XXI century energy becomes one of the most important factors influencing the mode of life for people from all over the world. It is embodied in fact that a lot of things that surrounds us depend on energy. In the morning we cook breakfast and drink coffee, and how we do it is determined by type of energy we use: in developed countries people mostly use gas or electricity, in less developed coal firewood can be taking to make a bonfire. In winter it is vitally important to keep dwelling warm. This process also has a lot of alternatives regarding the type of used energy. Living in global world people have to travel time to time. In that case it is also possible to use several alternatives: the distance from New York to Sidney can be travelled by plane or by yacht. In this case there are also two different types of energy were considered. It might seem that it is very easy to choose an optimal type of energy and make life comfortable and with the lowest possible cost. But in reality, the world is very uneven. People from different parts of the world do not have equal access to energy resources because of a wide range of reasons. Taking into account the fact, that our everyday life depends on energy, that equal access to energy is one of the most important challenge to societies and governments of all the countries and world's regions.

Nowadays there are a lot of different organizations in the world, whose main purpose is to regulate energy policy of different countries in the world, determine energy sphere development direction. One of such organizations is the International Energy Agency. This institution regularly publishes World Energy Outlet, that can be considered as the forecast of further energy development. In October 2020 IEA has published an actual research devoted to the situation in energy sector, taking COVID-19 into account. According to World Energy Outlook (IEA, 2020) unfavorable epidemiological situation led to increase in number of people who suffer from lack of clean and affordable energy. That happened mostly because of the new problems with energy supply chains. However, such a situation is typical not for all the countries and regions in the world. The greatest difficulties in this area were faced by African countries. One of the main objectives that is very actual for the world is to understand reasons of energy poverty for all the regions to be able to predict potential crises, that is important for the world energy stability, and also designate specific factors that influence energy poverty, specific groups of population affected the most by this phenomenon. All these can help to improve living standards in the world. Right now, this task is highly actual as a lot of energy types are well known and possibilities of managing this is becoming higher and higher every day.

Such a topic has become relevant relatively recently. It can be proved by the fact, that most of the researches were published in the period from 2010 to 2020 and devoted to different sides of the problem in question: defining the concept of energy poverty that differs from country to country (Thomson, Snell, Liddell (2016)), measuring energy poverty considering it as an abstract term that does not have a quantitative indicator by default (Nussbaumer, Nerini, Onyeji, Howells (2013)), estimating determinants of energy poverty (Bouzarovski, Tirado Herrero (2017)), evaluating impact of this phenomenon (Mzavanadze (2018)), looking for a dependence on other concepts (Bouzarovski, Petrova (2015)). It is necessary to note that all these aspects are connected with each other and should be taking into account to get a full-fledged understanding of the situation regarding energy poverty in the region. Being a new a concept of energy poverty has become popular among many scientists from different countries. Contribution of European Union to this problem is highly noticeable (Team, Baffert (2015)). Having such a huge variety of opinions regarding this concept European scientist have conducted several researches gave approaches to energy poverty aspects that help to understand its trend, what can be applied in further scientific researches. Having a significant impact on developing countries this problem was also raised by scientists from Africa and South America, who researched this problem taking all the features of their countries. But there still a lot of countries and regions, where the energy poverty problem exists, but not well explored. Such regions are Asia, Post-Soviet countries, Oceania. A number of researches, conducted in these countries, is quite small.

But as it was noted the problem of energy poverty is very important nowadays, so it is necessary to fill this research gap in to grasp the reasons and determinants of this problem in all regions. In my opinion, one of the most noteworthy case is a situation with energy poverty in Russia. Having a huge area, unevenly dispersed population, living in different climate zones from Subtropical to Arctic, where more than 60 per cent of the territory is covered by permafrost and the average annual temperature is about -6°C (Climate Change Knowledge Portal), Russia can be considered as one of the coldest countries in the world. Therefore, all the issues connected with energy and energy poverty are very important for understanding Russian economy and social development features. The most energy studies about Russia give an overview of the geopolitical aspect of the development and functioning of the energy sector in the country (Christie (2009)). Those studies that consider social aspect of energy consumption do not give a deep perception of the energy impact on society, so this problem need to be researched.

Considering the above, a purpose of this study is to define determinants of energy poverty in Russia and their impact on the general state of energy poverty in the region to have a necessary complex understanding regarding this problem. This goal requires several steps to be passed. These steps are: to examine available scientific literature corresponding to the energy poverty problem, what gives an objective overview of effective methods and possible nuances of problem in question; to designate methods of data analysis and data source, applicable for such analysis, what will be used to get an expected result; to conduct econometric analysis and present an obtained result; to describe the results obtained, including context where they can be further used, and general meaning of these results for the economy and social sphere; to make conclusions.

The main part of the thesis consists of several parts. In the Literature Review detailed review of relevant literature is provided with focus of energy poverty indicators and examples of researches devoted to econometrics analysis, that can be taken into account for analysis. Methods and data part specifies methods that are used for analysis conducting with description of data taken for the research. All the main analysis steps and results are provided in Results and analysis. Discussion and implications give an overview of how results can be applied in real economy. Conclusion gives all final remarks.

More detailed consideration of the energy poverty problem is provided below.

2 Literature Review

2.1 Definition of concepts

In fact, the term “energy poverty” began to spread widely among different countries relatively recently. This follows from the fact that absolute majority of researches were published in 2010s. The definition of “energy poverty” was supported by European Union and nowadays it is one of the most important concepts related to problems with energy consumption (Oliveras et al. (2021). At the same time such issues originally were declared by scientists from the United Kingdom, where the term “fuel poverty” was used (Bouzarovski, Petrova (2015)). At the first glance, it seems that these terms belong to the same problem. But in reality “energy poverty” and “fuel poverty” can be connected with completely different issues. These two concepts were compared by Thomson, Snell and Liddell (2016). They found that fuel poverty became a subject of science at the beginning of the XXI century. Taking all the aspects of common definition choice, authors affirm, that the single definition is a necessity, emphasizing that at the moment a universal definition was not developed. Thus, it is obligatory to define the term taking this problem into consideration.

The difference between these two concepts was described in the paper written by Bouzarovski and Petrova (2015). Scientists conducted a versatile analysis of approaches to fuel and energy poverty in various regions of the world and made a conclusion: taking into account the gap between these definitions, both of them converge to the lack of energy that does not allow to lead a normal lifestyle. At the same time this paper includes the deep consideration of relation between energy poverty and a set of socio-economic factors common to any society such as ecology, labor, safety, income. Also, it is worth to pay attention to a research, conducted by Elias and Victor (2005), that is dedicated to study of relationship between energy and economic development. Initially scientists claim that there is no obvious dependence between these two concepts, at the same time analyzing several studies that consider this relationship in details. It was found in this study that such factors as income, climate, geographical location (of the country or region under consideration) and stock of natural resources influence the structure of energy consumption, that affects the social welfare (expressed in income), safety (that depends on the used type of energy), labor efficiency (time spent at production and at home depends on the structure of energy consumption). Hereby, it is a problem of a great importance to understand the factors that affect the energy poverty, factors influence the human development. By returning to the previous study, it is necessary to note, that energy itself can be perceived as a subject of demand. Society needs to have warm house, heating or cooling,

lightning, ability to use household appliances. All these needs are very subjective and it is impossible to calculate the effect of energy and its determinants using common rules and methods. The only way is to take variables that reflect social subjectiveness into account. Among these are ecological, technical, geographical, cultural factors. These findings are supported and complemented by research conducted by Stoerring (European Parliament, 2017). Thus, according to the Energy Poverty Report the problem of energy poverty is caused not only by general factors, such as income level, remoteness from energy resources location, but also by less trivial determinants. Among the latter are the size of a household, number of children, employment status, social status of a family or individual, place of residence (urban area or countryside), presence of a mortgage, that limits the choice of place of residence or its quality, type and characteristic of an apartment (used system of ventilation and heating, wall thickness, floor, type of roof), climatic conditions.

2.2 Measurement

Analysis of the causes and consequences of energy poverty is inextricably linked to the conduct of econometric analysis. Econometric tools allow to construct a regression model of the dependence between factors influencing the development of energy poverty and the level of energy poverty itself. This process involves working with data and, as a result, requires all indicators to be numerical. But the concept of energy poverty itself is theoretical and is defined by scientists verbally. For example, there are several alternative definitions of energy poverty. But all these concepts can be reduced to the fact that energy poverty is a state of a household in which it cannot provide itself with affordable and high-quality energy. But this definition does not contain any information on how this phenomenon can be measured. To analyze energy poverty, it is necessary to move from the verbal definition of the concept to its mathematical expression. A similar problem is considered in the study by Culver (2017). Her research provides insight into the understanding of energy as it is. Since households consume many different types of energy in different forms, the concept of "energy" becomes very broad, which makes it impossible to use a universal quantitative characteristic to measure it. In addition, there are no universal standards for the consumption of certain types of energy. This study contains a detailed description of various approaches to measuring energy, indicating the positive and negative features of each of them. Separately, all these approaches cannot fully reflect the characteristics of household energy consumption, and, as a consequence, the assessment of the determining factors and consequences cannot be considered objective. For this reason, the author considers several concepts of energy measurement separately using a

composite index, which makes it possible to take into account many factors of energy consumption.

At the moment there are several researches devoted to measuring of energy poverty. Their purpose is to create an index of energy poverty. One of the first and the most fundamental studies on this topic is the work of Alkire, Foster (2009), who were one of the first scientists in the world, pay attention to the multidimensional nature and complexity of "poorness".

In the real-world studying issues connected with poverty can be accompanied by difficulties that arise on the step of research methodology formation, as a term "poor" has a fair amount of abstraction and it is not always possible to unequivocally answer the question, who is poor. Formally speaking, it is necessary to determine which indicator or which indicators define poorness and under which conditions it is possible to classify the subject under consideration as poor. On these questions scientists Alkire, Foster (2009) answered, described in their study the process of several indicators application that influence poorness with their further aggregation for a single complex index creation. In their research several examples were given, which prove applicability and efficiency of such approach.

As it was noted, this research can be considered as fundamental, that's why scientists take this study as basic for their researches. Concepts of energy poverty and general poverty are similar to each other in many ways; thus, the concept of general poverty can be also applied in case of problem consideration, connected with energy poverty. As in case of general poverty, the issue of energy poverty measuring is still open. At the moment there are several points of view on which indicator is more objective. Often disagreements arise between scientists, studying energy poverty in different regions, where determining factors are very different. As a result, at the moment there is no general opinion about which measurement reflects the energy poverty indicator objectively. Also, several articles on the measurement of energy poverty were taken into account, of which the work of Nussbaumer, Nerini, Onyeji and Howells (2013) stands out the most accurately reflecting the problem and giving concrete results. In this research a special attention is pay to a consideration of society, as a complex structure. Its development is understood as a complex phenomenon, that does not have a single determining factor. When studying this issue, the availability of primitive household goods and services is one of the many indicators of social development. Such concepts are often expressed by artificially created indices, since there is no physical or economic value behind them, that is, measurement is not explicitly possible.

In reality it is difficult to clearly understand how to measure energy poverty, as this indicator can be characterized by a lack of electricity, water, lighting, warmth, by using harmful

types of fuel, dampness, impossibility of modern communication tools usage. In scientific world several researches exist, devoted to quantitative measurement of socio-economic processes. In some of them the problem of energy poverty is considered narrowly, for example, using only one one-dimensional indicator of energy accessibility. This approach cannot give an objective estimation of the problem because of its incompleteness. Nussbaumer, Nerini, Onyeji and Howells (2013) suggest a new approach to energy poverty measurement – complex measurement, based on several indicators. This is an absolute advantage of their study. Multidimensional index, they described, takes all the main causes of energy poverty appearance and development into account: access to electricity, way of cooking (including type of fuel), using of communication tools. Obviously, all components of this index cannot influence the indicators of energy poverty equally. For making a correction authors apply a weight system, which allow to set larger significance for more important indicators. To determine, if a household is energy poor or not, threshold values should be set. Authors note that it is possible to make corrections for this indicator depending on the socio-economic situation in the region under consideration. Thus, multidimensional energy poverty index (MEPI) can be applied as a quantitative measurement of energy poverty.

2.3 Econometric Researches

As it was noted, researching of energy poverty determinants is possible using tools of econometrics – building a regression model, where energy poverty is a dependent (explainable) variable. A set of explanatory variables can vary depending on the purpose of study, level of economic development in considered region, geographic and cultural features of households.

However, it is important to note that the investigation of energy poverty requires not only predefined highly informative measurement, but it is also impossible without qualitative data. One of the most way to analyze is to use households' microdata (Thomson, Bouzarovski, Snell (2017)). Such data can be used as a source of explanatory variables. It should be noted that a number of studies dealing with the problem of energy poverty has increased lately. Nowadays such researches may be consulted to the subject of energy poverty in African countries, that are affected by this problem to a large degree, in Caribbean.

The problem of energy poverty in Caribbean is illustrated by the study, prepared by Bagnoli, Bertoméu-Sanchez and Estache (2020). In this study the classical logit model was used to predict the probability of energy poverty appearance taking into account properties of households in context of country features. In this study a share of electricity costs was taken as an energy poverty measurement, explaining it by a number of rooms in a dwelling, gender of

a household head, his or her age, number of members in a household, their education, type of an inhabited locality (urban or rural). Results show that households characteristics can be used as explanatory determinants of energy poverty. At the same time included legislative framework in that case has a significance level too, what support statement that both general and special indicators should be used in energy poverty explanation.

A similar research was conducted for Ecuador, conducted by Pablo, de La Paz Paloma and Francisco (2019). In case of this South American country an approach of European Union Energy Poverty Observatory (EPOV) was taken as basement for the model. Following this approach three indicators related to problems with energy services payments and their proportion were used. Additionally, a share of expenditures on electricity was added into energy poverty index. This approach showed a general overview of this problem in Ecuador and its results are correlated with empiric data.

Relevance of this problem for African continent is proven by Ogwumike and Ozughalu (2016). Their logit model considers energy poverty as a complex phenomenon, describing the importance of such indicators like household size, age of the head, education. In addition, this model uses location and general poverty as indicators. This is largely due to the local peculiarity and the level of economic development. As an energy poverty indicator, the Multidimensional Energy Poverty Index, considered earlier, is taken. Similar approach was taken by Lin and Okyere (2020), what shows a high significance of education for African countries as one of key determinants.

Similar models are applicable not only for countries where the issue of energy poverty can be considered extremely important. In Europe, where, at first glance, there are no problems with energy poverty, it is also necessary to study this issue in order to control the situation and determine the trend of changes in energy poverty. Despite this, there is an acute problem in Europe related to energy poverty. This is especially true for the countries of Southern Europe, for example, Cyprus, Portugal, Greece. According to research, conducted by Thomson, Bouzarovski and Snell (2017), proportion of people suffering from energy poverty in these countries are 35.2, 32.3, 28.3 per cent respectively. In total about 9 per cent of the EU population have problems with heating, about 15 per cent have problems with their houses construction that do not allow to provide high living standards (Mzavanadze (2018)).

A number of studies have been carried out to investigate this process in Europe. Thus, Maxim, Mihai, Apostoaie, Popescu, Istrate, Bostan (2016) expanded the scope of energy poverty research to the entire European Union and built a classical regression model similar to those previously considered, where indicators of housing quality (heating, type of housing) and

social household situation (poverty status, energy availability) were taken. The effectiveness of such a model has been proven in this study. A significant difference of this model is the use of a non-standard Compound Energy Poverty Indicator, which is based on the indicator of interruptions (energy supply, payment for services by households), which is supplemented by the characteristics of the premises (heat). This indicator is not comprehensive and does not reflect all possible characteristics of energy poverty, but at the same time, when justifying its use, it can also be used to measure energy poverty.

Possibility of Multidimensional Energy Poverty Index application for a developed country was proven by Sokołowski, Lewandowski, Kiełczewska and Bouzarovski (2020), who considered energy poverty problem in Poland, taking subjective factors typical for a specific country into account. This research demonstrates a set of practices for applying the results obtained in economic policy, confirming the importance of such studies.

At the same time, it is important to develop a model for countries where energy policy differs from region to region. In such countries the problem of energy poverty cannot be considered for the whole country because of the insufficient informativeness. In fact, there are not so many countries that can be characterized by significant differences from region to region. Russia can be regarded as such example.

Research about the energy efficiency policy in Russia, conducted by Mukhametshin, Kryukova, Beloborodova, Grinenko, Popova (2019), show that a significant diversity in energy production and energy consumption exists. In consideration of the heterogeneity of people settlement in Russia, the problem of energy efficiency is relevant. That can cause imbalance in households' energy consumption and, therefore contribute to an increase in energy poverty. Authors also pay attention to the structure of energy consumption, nothing the importance of this factor. But this research gives a general overview of the situation with energy production and energy consumption in Far Eastern regions of Russia, what does not demonstrate the potential problem with energy access for people living in different regions. To obtain a detailed overview of energy consumptions and, as a result, energy poverty in the Russia it is important to conduct a general concept research that gives a possibility to consider regions separately.

As and additional determinant of energy poverty in Russia climate and infrastructure can be taken into consideration. This factor is described by Mitrova, Melnikov (2019), who consider these factors through the prism of high energy intensity of industrial production in Russia.

General concept of energy poverty measuring in case of Russia is described by Eliseeva (2013). A relatively small study is devoted to the problem of energy poverty measuring general

characteristics of households with respect to regional circumstances of Russia. As a main method correlation analysis is used that shows mutual dependence between explanatory variables. This study is based on the Household Budget Survey, which is held in Russia annually. This dataset can be used for further researches, as it contains a significant number of households' everyday life measurements.

For Asian and Post-Soviet countries this problem is quite unexplored but at the same time not less actual. Some of the results, obtained from European studies can be also applied for other countries and regions.

A sufficient number of similar studies were made in European Union. European Commission publishes reports about the situation with energy poverty in Europe on regular basis. Also, there are several researches devoted to this phenomenon conducted on the example of Eastern European countries. Bouzarovski and Herrero (2017) pay attention to microdata about households, claiming that these indicators are more informative. Thus, households' budget indicators can be considered as potential determinants of energy poverty. At the same time, they noted that the problem of energy poverty can be determined by the general supply of energy services. The income factor can be taken as significant only in complex with high level of energy services supply.

Model analysis follows that there are some typical indicators that can act as main determinants of energy poverty. Nevertheless, as it was noted, every region has its own characteristics that can describe this phenomenon too. Including these indicators into analysis is necessary for understanding of the process in complex. The detailed description of model and indicators, that can potentially characterize region under consideration, will be presented further.

3 Data and methodology

The general concept of a model under analysis can be presented as a set of explanatory variables (potential determinants) and a dependent variable (Multidimensional Energy Poverty Index). As it was already noted, MEPI a complex index that contains several weighted indicators. Depending on the features of the region under consideration and available data, indicators and weights can be chosen in different ways. In case of Russia there is no specific mathematically measured indicator connected with energy, but at the same time a sufficient data on household consumption is available. Taking previous researches into account and on my personal opinion five indicators were chosen: gas, electricity, heating and hot water accessibility, utility payment status. Household should be assumed as energy poor in case of

gas inaccessibility, hot water inaccessibility, heating inaccessibility, electricity inaccessibility and having unpaid utility bills. These factors can be true together or separately. As all the indicators are not specific, weights are the same and equal to 0.2. A table with indicators is presented below.

Table 1. MEPI components.

Indicator	Weight	Energy poor, if …
Gas availability	0.2	false
Electricity availability	0.2	false
Hot Water availability	0.2	false
Heating availability	0.2	false
All the bills for utilities are paid	0.2	false

Source: author's calculations.

As in the original dataset the value of "1" means presence and "0" means absence, for MEPI calculation all the indicators are replaced with opposite ones (subtracted from 1). All the indicators are taken with equal weights equal to 0.2. Calculation formula is presented below.

$$\boldsymbol{MEPI = 0.2 \times (1 - Gas) + 0.2 \times (1 - Heating) + 0.2 \times (1 - Hot\ Water) + 0.2 \times (1 - Electricity) + 0.2 \times (1 - Paid\ Utilities)}$$

Every year Federal State Statistics Service of the Russian Federation publish a report on Sample Survey of Household Budgets. These surveys are published on Federal State Statistics Service official website. Each annual dataset contains a significant variety of different indicators on provision of households with household appliances, means of communication and transport; structure of income and expenses; availability of subsidies and benefits; information about members of households (age, gender, education, employment status and others); some analytical indicators about households.

The subjects of the Sample Survey of Household Budgets are households themselves or individual members of households. The survey is conducted quarterly in all regions of the Russian Federation. The results of the surveys are published in several tables, grouped according to the thematic affiliation of the indicators. To consider the data in a complex, it is required to combine tables by using a unique household identifier assigned to each of them during the survey period. The data is published in the public domain as a file with data package in the Nesstar system. The specialized software Nesstar Explorer is used to open each dataset. This study uses a sample for two periods: the 1st and the 3rd quarters of 2019 (Sample Survey of Household Budget, 2019). All households living in the regions presented in Table 2 were selected for the analysis. The volume of the resulting sample is significant and amounts to

29292 records for the 1st quarter of 2019 and 29406 records for the 3rd quarter of 2019. To work with the data, preliminary preparation of the dataset is important, since some of the indicators are divided over sub-indicators, which is unnecessary for this study.

Table 2. Investigated regions of the Russian Federation.

Region	Federal District	Region	Federal District
Altai Krai	Siberian	Oryol Oblast	Central
Krasnodar Krai	Southern	Penza Oblast	Volga
Krasnoyarsk Krai	Siberian	Perm Krai	Volga
Primorsky Krai	Far Eastern	Pskov Oblast	Northwestern
Stavropol Krai	North Caucasian	Rostov Oblast	Southern
Khabarovsk Krai	Far Eastern	Ryazan Oblast	Central
Amur Oblast	Far Eastern	Saratov Oblast	Volga
Arkhangelsk Oblast	Northwestern	Sakhalin Oblast	Far Eastern
Astrakhan Oblast	Southern	Sverdlovsk Oblast	Ural
Belgorod Oblast	Central	Smolensk Oblast	Central
Bryansk Oblast	Central	Tambov Oblast	Central
Vladimir Oblast	Central	Tomsk Oblast	Siberian
Volgograd Oblast	Southern	Tula Oblast	Central
Vologda Oblast	Northwestern	Tyumen Oblast	Ural
Voronezh Oblast	Central	Ulyanovsk Oblast	Volga
Nizhny Novgorod Oblast	Volga	Chelyabinsk Oblast	Ural
Ivanovo Oblast	Central	Zabaykalsky Krai	Far Eastern
Irkutsk Oblast	Siberian	Chukotka Autonomous Okrug	Far Eastern
Republic of Ingushetia	North Caucasian	Yaroslavl Oblast	Central
Kaliningrad Oblast	Northwestern	Republic of Adygea	Southern
Tver Oblast	Central	Republic of Bashkortostan	Volga
Kaluga Oblast	Central	Republic of Buryatia	Far Eastern
Kamchatka Krai	Far Eastern	Republic of Dagestan	North Caucasian
Kemerovo Oblast	Siberian	Kabardino-Balkar Republic	North Caucasian
Kirov Oblast	Volga	Altai Republic	Siberian
Kostroma Oblast	Central	Republic of Kalmykia	Southern
Samara Oblast	Volga	Republic of Karelia	Northwestern
Kurgan Oblast	Ural	Komi Republic	Northwestern
Kursk Oblast	Central	Mari El Republic	Volga
Saint Petersburg	Northwestern	Republic of Mordovia	Volga
Leningrad Oblast	Northwestern	Republic of North Ossetia-Alania	North Caucasian
Lipetsk Oblast	Central	Karachay-Cherkess Republic	North Caucasian
Magadan Oblast	Far Eastern	Republic of Tatarstan	Volga
Moscow	Central	Tuva Republic	Siberian
Moscow Oblast	Central	Udmurt Republic	Volga
Murmansk Oblast	Northwestern	Republic of Khakassia	Siberian
Novgorod Oblast	Northwestern	Chechen Republic	North Caucasian
Novosibirsk Oblast	Siberian	Chuvash Republic	Volga
Omsk Oblast	Siberian	Sakha (Yakutia) Republic	Far Eastern
Orenburg Oblast	Volga	Jewish Autonomous Oblast	Far Eastern

Source: author's elaboration.

For an analysis to be conducted several indicators were considered. The detailed list with variables and descriptions is presented below.

Table 3. Indicators.

Variable	Description	Designation
Period	Period under consideration (quarter and year)	Period
Region	Numeric designation of the region of Russia	Region
Region name	The verbal name of the region of Russia	Region_W
Federal District	Name of a Federal District	FD

Type of locality	Urban area (1) or countryside (2)	TypeOfLocality
Household identifier	Household reference number	HHnum
Household size	Number of members in a household	HHsize
Humber of children in a household	Number of children in a household	NumChild
Income	Income of a household for a specified period (in Russian rubles)	Income
Services expenditures	Amount of money spent on utility services (in Russian rubles)	ServicesExpend
Pension status	Presence of retied people in a household (0 – no; 1 – yes)	Pension
Number of working members in a household	Number of working members in a household	WorkingMembers
Household dwelling area	Household dwelling area (in square meters)	Sq
Paid utilities and dwelling	Presence of payment for housing and utilities for the last three months (0 – no; 1 – yes)	Paid
Autonomous gas	Autonomous gas availability	Gas
Network gas	Gas availability from the pipe	GasNet
Hot water	Hot water availability	HotWater
Electricity	Electricity availability	Electr
Heating	Availability of heating in a dwelling	Heating
Gender	Average gender for the household (sum divided by number, 1 - male; 2 - female)	Gen
Age	Average age of household members	Age
Education	Average education indicator for a household (the education indicator is measured as a whole number for each household member, the higher the education level, the higher the value)	Educat
Type of Ownership	Who owns a dwelling (1 – state; 2 – household; 3 – other ownership type; 4 – rented)	OwnType

Source: author's elaboration.

Indicators of gender, age and education are calculated for each household member, and an aggregated average is calculated for the household. All these indicators are constituent parts of MEPI or explanatory variables.

All the indicators described above can be defined as data, but it is necessary to gain information from this dataset. It can be done by building an econometric model. Econometrics has several tools of analysis as its disposal, each of them possesses a number of features and can be applied while working with a specific data. In case under consideration target indicator is represented by Multidimensional Energy Poverty Index, which can be measured from 0 to 1, where 0 – an absence of energy poverty, 1 – its absolute presence. As a rule, scientists choose a certain threshold value, that determines a state, when a household is energy poor or not. I have chosen a threshold value equal to 0.6, meaning that a household with a MEPI larger than 0.6 are considered as energy poor. This choice is conditioned by the fact, that for this research it is reasonable to choose a sensitive indicator, close to 0.5. In my opinion, the value of 0.6 is

suitable. Thus, according to the value of MEPI the status of a household is defined as energy poor or not, what leads to a binary result: 1 – energy poor, 0 – otherwise. Such a datasets in econometrics can be described with logistic regressions. This particular model is taken for conducting an analysis in this research.

As some of indicators are represented for each member of a household, it is necessary to preliminarily calculate an aggregated value for all the households. Such manipulations with data are carried out using table processor Microsoft Excel.

Model building can be carried out with of many packages for statistical analysis. For this research I have chosen a programming language, intended for statistical data processing, and the development environment for writing codes – RStudio.

Thus, data sources and methods of analysis are determined. Next section is devoted to analysis process description and its results.

4 Empirical Analysis

For a comprehensive understanding of the energy poverty problem in case of Russia several models were built. Each of the model, presented below, refers to different periods, having no distinction in set of variables, methods of analysis, data source chosen. All the methodological fundamentals correspond to the research and specifications presented in part 3 of this thesis.

To get an objective view on the situation with energy poverty in Russia descriptive statistics and results of econometric models are presented based on the 1st and 3rd quarters of 2019. These periods approximately correspond to winter and summer seasons. Taking climatic diversity into account for some regions it is highly important to estimate if households face energy difficulties more in winter than in summer. That gives a complex overview for the energy poverty problem in the country, its determinants and influencing factors, supported by the dynamic aspect.

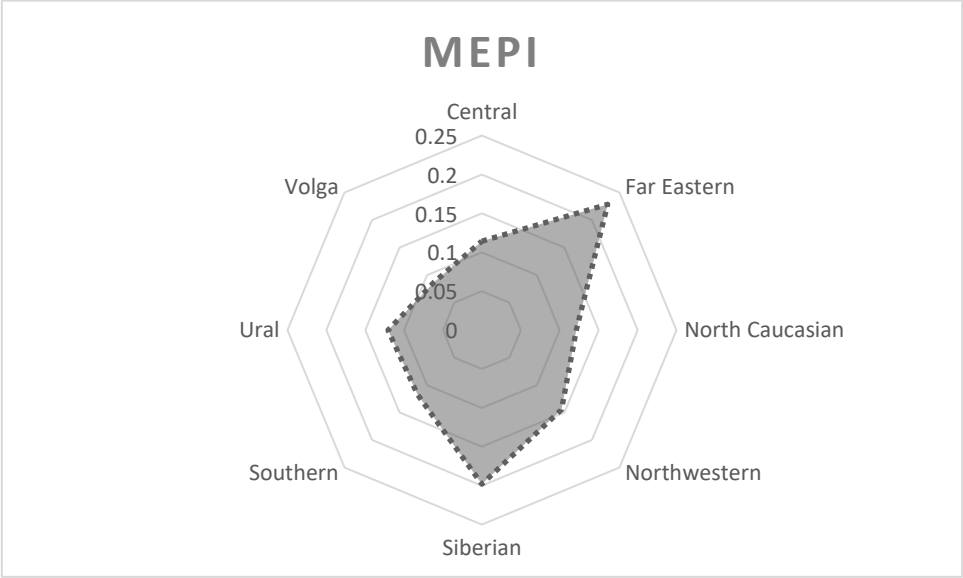
The key step of this research is to build an econometric model. As it was described in part “Methods and Data” the logit model is used is this case. The main feature of the logistic regression and the logit model is that a dependent variable is a binary variable related to the probability of an event implementation, what can be described by MEPI.

The problem of energy poverty in Russia is closely connected with the geographical features of the country. Russia is the country that stretches over a vast distance both from the North to the South and from the West to the East. That makes climate in Russia different. People living in distant regions of the country live in different climate condition, that can affect

energy poverty. There are more than 80 regions in Russia, some of them are relatively small, located close to each other. For this reason, it is not expedient to conduct an analysis based on all the regions. There are 8 groupings of regions in Russia, called Federal Districts: Central, Northwestern, Southern, North Caucasian, Volga, Ural, Siberian and Far Eastern. These districts unite regions geographically and economically. Based on the above, classification of regions by Federal Districts can be taken as a geographical factor for the further analysis.

Before analyzing results of the model estimation, it is necessary to pay attention to the descriptive statistics. All the regions were preliminary divided into groups based on Federal Districts. On the diagram below the average level of energy poverty by regions is presented.

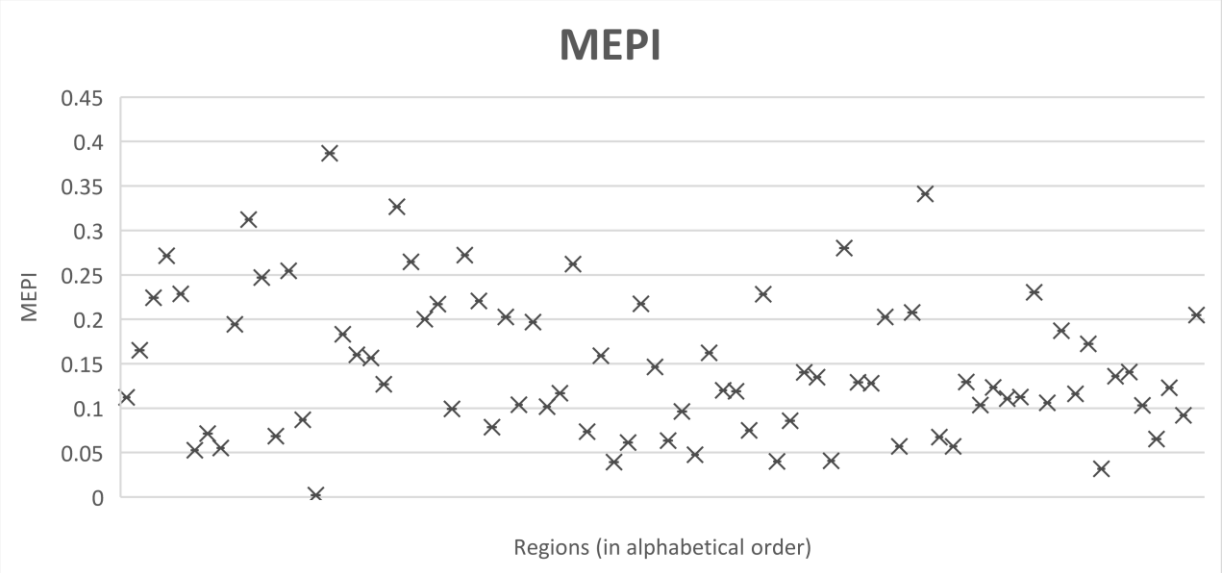
Figure 1. Average MEPI by regions in the 1st quarter, 2019.



Source: author's elaboration.

This diagram shows a significant difference of energy poverty between Federal Districts from 0.09 in Volga to 0.23 in Far Eastern. Siberian and Far Eastern Federal Districts are the most affected by energy poverty, while Volga and North Caucasian this phenomenon can be described as negligible. Obviously, the key reasons for such a situation are climatic differences and population density. Southern regions, regions with relatively high population density, where many large urban agglomerations are located, regions with high economic activity are less affected by energy poverty. Siberia and Far East are climatically, in terms of transport and economically more difficult. So, it can cause energy poverty within population. The same results can be obtained from the diagram of energy poverty by regions that is presented below.

Figure 2. MEPI by regions in the 1st quarter, 2019.



Source: author's elaboration.

The diagrams above were composed using RStudio tools and Microsoft Excel software.

Given descriptive statistics show that a geographical factor should be included in the model as probably it can explain the energy poverty phenomenon in Russia.

The next step of the analysis is a model building process in RStudio using R. All the logistic regressions described in this research are built using glm() function, where MEPI is a dependent variable. The summary of the built model is presented below.

Table 4. Summary (1st quarter, 2019).

	Dependent variable: MEPI	
factor(TypeOfLocality)2	1.534***	(0.099)
factor(FD)Far Eastern	2.258***	(0.195)
factor(FD)North Caucasian	-15.635	(470.946)
factor(FD)Northwestern	2.561***	(0.174)
factor(FD)Siberian	1.961***	(0.191)
factor(FD)Southern	-15.177	(349.170)
factor(FD)Ural	1.068***	(0.241)
factor(FD)Volga	0.055	(0.229)
HHsize	0.468***	(0.076)
NumChild	-0.431***	(0.116)
Income	-0.00002***	(0.00000)
UtilityExpInIncome	-14.365***	(0.681)
Pension	-0.007	(0.239)
WorkingMembers	-0.028	(0.099)
Sq	0.010**	(0.004)
factor(OwnType)2	0.105	(0.195)
factor(OwnType)3	-0.564***	(0.141)
factor(OwnType)4	0.675**	(0.334)
Gen	0.253	(0.190)
Age	-0.0	(0.005)
Educat	-0.364***	(0.064)
Constant	-0.095	(0.564)
Observations	29,292	
Log Likelihood	-1,904.363	
Akaike Inf. Crit.	3,852.726	
Note:	*p<0.1; **p<0.05; ***p<0.01	

Source: author's calculations.

This table shows that it is vitally important to pay attention to the region (Federal District) and type of locality. People who live in Far Eastern, Siberian, Northwestern, and Ural Federal Districts have higher probability to be energy poor. The same tendency is also valid for households living in the countryside. It is also worth noting other significant variables that lead to an increase in the probability of being in a state of energy poverty: number of members in a household, dwelling area, and the factor that a dwelling is not owned, but rented. Higher number of children in a household, higher income, share of utility bills, education and the factor that a dwelling is owned by subject different from the state, household and not rented lead to a decreasing in energy poverty probability.

These results are logically perceived. As it was already mentioned, Far East, Siberia and Northern regions of Russia have differences in access to energy. Not all the regions have gas pipelines due to climatic conditions. Cold climate makes it more problematic to keep houses warm. That is the reason, that some regions are more affected by energy poverty. From this point of view, it is necessary to take region into account and it can be accepted as a determinant.

At the same time, people who live in the countryside are affected by energy poverty more than city dwellers. Rural areas are less equipped with infrastructure, some of households have to use different kinds of fuel. City dwellers do not need to be puzzled about the way of getting energy, in most cases they have a centralized gas and electricity for a moderate price. Type of locality can be taken as a determinant too.

Also, it should be noted that the more members a household has the more demand for the energy is. So, it is more difficult to satisfy demand of all the household's members. The same explanation can be applied for the square of a house or apartment. In some cases, households do not own their houses renting having mortgage obligations. This case can be described by a factor that a dwelling is owned by a private company (bank) or other individuals. In case when a household do not have own dwelling, they have to pay not only for the utility, but also a renting fee. In some cases, they have higher tariffs for the utilities. All these leads to a higher risk of energy poverty. At the same time there is no difference between state owned dwelling and dwelling owned by a household. In this case, there is no difference in expenses – such households pay for utilities only. Due to this fact, this factor is not significant.

Factors connected with income and educations describe a household, that have more or less high position in society, more opportunities and better living conditions. These factors help to decrease a risk of energy poverty and the probability of energy poverty is lower. At the same time, children can be identified as responsibility. Households that have more children have

more free resources and, as a result, have guarantee an access to energy. But people, who pay more for utilities can be out of energy poverty. The reason for that is a compensation for utilities with other expenses and needs.

Thereby, considering the model of energy poverty on different factors for the 1st quarter of the 2019, it is possible to distinguish region, type of locality, size of a household, number of children in a household, income, share of utilities in expenses, square of a dwelling, ownership type and education as determinants that influence the state of energy poverty for a household. The connection between energy poverty and gender, age, number of working or retied members was not found.

The model presented was chosen by comparison of models with a different set of explanatory variables guiding by the Akaike information criterion (AIC). The less the value of this criterion is the better model was built. The presented model has the lowest value of 3853. At the same time of the most important criterion for logit models is McFadden's pseudo R^2. According to Hemmert, Schons, Wieseke, and Schimmelpfennig (2018) pseudo R^2 with a value greater than 0.2 corresponds to a good model that reflects real data. This criterion was also calculated for a given model using function pR2(). The resulting value is equal to 0.39, that describes a good model. Analyzing logit model, it is not possible to clarify the degree of influence of the explanatory variables by the coefficients from the summary table in the same way as for a linear regression model. At a first glance, only the sign in front of the coefficient and its significance can be interpreted. To calculate marginal effects, it is necessary to calculate odds ratios. This can be done by finding exponential values of all the coefficients from the summary table. Odds ratios for the 1st quarter are presented in the table below.

Table 5. Odds ratios (1st quarter, 2019).

(Intercept) 9.097613e-01	factor(TypeOfLocality)2 4.634547e+00
factor(FD)Far Eastern 9.561556e+00	factor(FD)North Caucasian 1.621063e-07
factor(FD)Northwestern 1.294301e+01	factor(FD)Siberian 7.106478e+00
factor(FD)Southern 2.562010e-07	factor(FD)Ural 2.908778e+00
factor(FD)Volga 1.057030e+00	HHsize 1.596198e+00
NumChild 6.500926e-01	Income 9.999799e-01
UtilityExpInIncome 5.774877e-07	Pension 9.929407e-01
WorkingMembers 9.721301e-01	Sq 1.009559e+00
factor(OwnType)2 1.111134e+00	factor(OwnType)3 5.688587e-01
factor(OwnType)4 1.964661e+00	Gen 1.287350e+00
Age 9.926290e-01	Educat 6.947290e-01

Source: author's calculation.

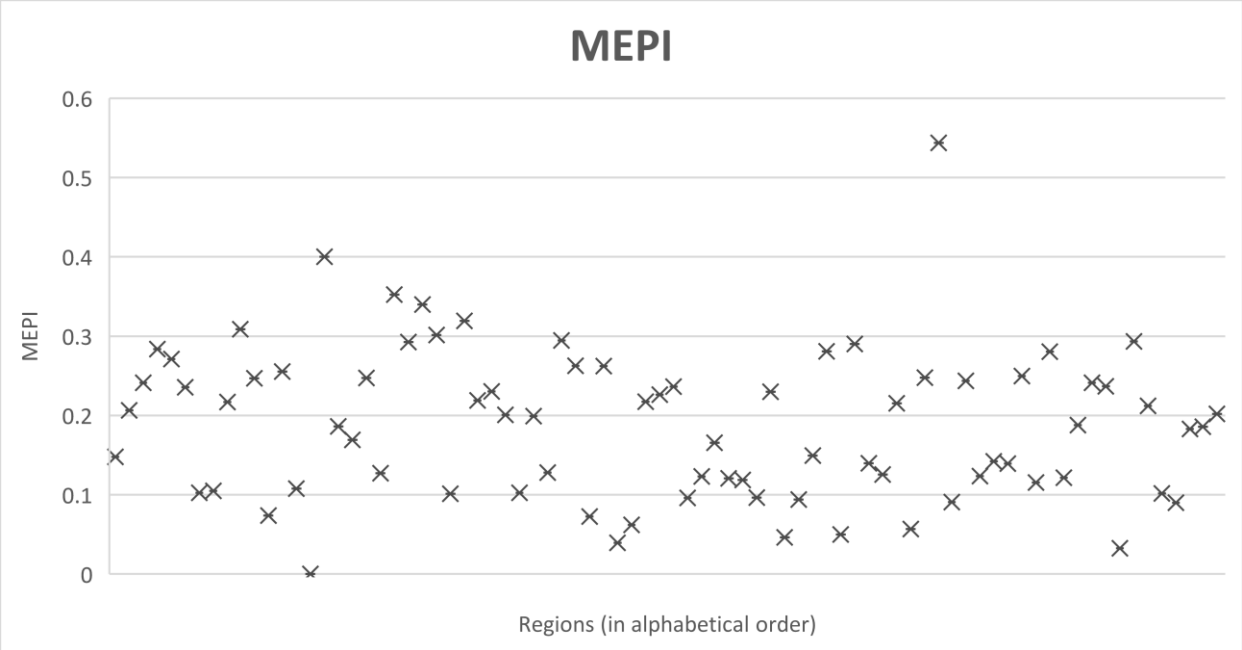
This table show, that households from Far Eastern regions have 10 times higher chance to be energy poor than households from Central Russia. For Siberian regions odds are 7 times higher, for Ural are 3 times higher. Households living in rural areas are more likely to be energy poor than urban households with a difference of five times. Also, with a value of 1.6 size of a household influences the probability of being energy poor. Additional member of a households increases odds to be energy poor by 1.6 times. Also, there is a 0.5 times lower risk to be energy poor for households having mortgages, while it is almost 2 times higher for renting households, that do not have their own dwelling. At the same time odds ratios for square of a dwelling and income are not so high, while the value for education is meaningful, what shows that education can be considered as an indicator of a wealth and social status.

To sum up, it can be noted, that geographical factor is one of the most important determinant of an energy poverty with such factors as number of members, ownership type, education.

Thus, the model of MEPI and its potential determinants was conducted, determinants were defined for the 1st quarter of 2019. To understand the problem completely it is necessary to conduct the same analysis for the 3rd quarter of 2019, that corresponds to the summer in Russia – a warm season that eases heating difficulties. Such an analysis is presented below.

The diagram on the figure demonstrates the same tendency as the data for the 1st quarter – high spread of indicators between regions.

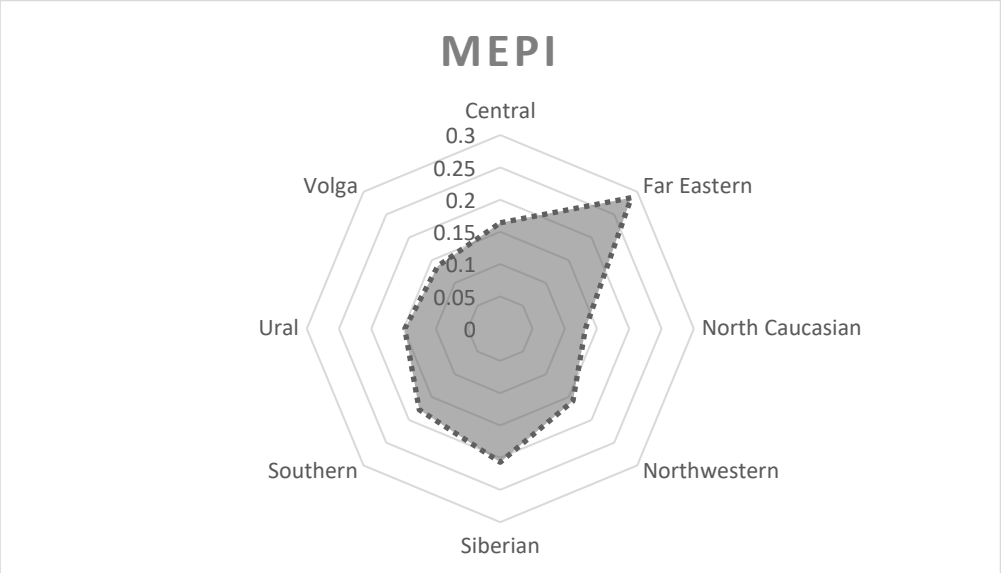
Figure 3. MEPI by regions in the 3rd quarter, 2019.



Source: author's elaboration.

Considering the diagram of MEPI distribution among Federal Districts it can be noted that for Ural, Volga, Central, North Caucasian, Northwestern and Southern the trend is still the same - low indexes, describing the normal level of energy poverty. In Far Eastern region the trend also matches with the data observed in the 1st quarter. The main and only significant difference was found for Siberian Federal District. For this region the level of energy poverty decreased significantly in the summer. In fact, it can be explained by a huge gap between temperatures in summer and in winter (Climate Change Knowledge Portal).

Figure 4. Average MEPI by regions in the 3rd quarter, 2019.



Source: author's elaboration.

Table 6. Summary (3rd quarter, 2019).

	Dependent variable: MEPITF	
factor(TypeOfLocality)2	1.588***	(0.074)
factor(FD)Far Eastern	3.399***	(0.141)
factor(FD)North Caucasian	-13.669	(188.621)
factor(FD)Northwestern	2.317***	(0.141)
factor(FD)Siberian	1.777***	(0.157)
factor(FD)Southern	-1.516***	(0.518)
factor(FD)Ural	1.244***	(0.184)
factor(FD)Volga	-0.339*	(0.201)
HHsize	0.223***	(0.059)
NumChild	-0.328***	(0.090)
Income	-0.00001***	(0.00000)
UtilityExpInIncome	-7.212***	(0.451)
Pension	0.088	(0.181)
WorkingMembers	-0.002	(0.077)
Sq	-0.006**	(0.003)
factor(OwnType)2	0.916***	(0.145)
factor(OwnType)3	-0.300***	(0.114)
factor(OwnType)4	0.994***	(0.275)
Gen	0.398***	(0.136)
Age	-0.006*	(0.003)
Educat	-0.216***	(0.047)
Constant	-2.565***	(0.414)
Observations	29,406	

Log Likelihood	-3,514.301
Akaike Inf. Crit.	7,072.602

Note: *p<0.1; **p<0.05; ***p<0.01

Source: author's calculations.

Regarding the model build using the data for the 3rd quarter of 2019, it can be found that for type of locality the trend is the same – people from countryside are more likely to be energy poor, than people from urban areas. In Far East, Northwestern and Southern regions, Siberia and Ural the probability of being energy poor is higher than in Central Federal District. Southern, Volga and North Caucasian the probability is lower.

At the same time increasing the number of children in the household, income, proportion of utility bills in costs, square and education lead to decreasing in probability of being energy poor. The reasons and trends can be described in the same way as for the 1st quarter.

In case of data for the 3rd quarter of 2019 the type of property ownership is significant in all cases. When a dwelling is owned by government the probability of being energy poor is lower, what can be explained by the fact, that in winter some of the utilities can be additionally subsidized by the state.

Comparing the differences between determinants in the 1st and 3rd quarter of 2019 it can be found that gender and age are significant only in the 3rd quarter. That can be due to the fact, that climate does not influence the level of energy poverty in summer as much as in winter. That can be the reason for additional determinants appearance, that play a more significant role in energy poverty determining.

Table 7. Odds ratios (3rd quarter, 2019).

(Intercept) 7.688360e-02	factor(TypeOfLocality)2 4.896197e+00
factor(FD)Far Eastern 2.992991e+01	factor(FD)North Caucasian 1.157812e-06
factor(FD)Northwestern 1.014322e+01	factor(FD)Siberian 5.914581e+00
factor(FD)Southern 2.194847e-01	factor(FD)Ural 3.468306e+00
factor(FD)Volga 7.127324e-01	HHsize 1.250311e+00
NumChild 7.205496e-01	Income 9.999938e-01
UtilityExpInIncome 7.375552e-04	Pension 1.091653e+00
WorkingMembers 9.983873e-01	Sq 9.942973e-01
factor(OwnType)2 2.500175e+00	factor(OwnType)3 7.411579e-01
factor(OwnType)4 2.700708e+00	Gen 1.489506e+00
Age 9.935590e-01	Educat 8.054303e-01

Source: author's calculations.

Calculation of odds ratios shows that the highest value refers to Far East region, gender, ownership type and type of locality. Far East has the value of almost 30, what means that the odds of being energy poor here is 30 higher than in Central region. Also, one of the most affected factors is a type of locality: odds of being energy poor in rural areas are almost 5 times higher. It is obvious that in winter households, who live in state owned dwelling, are in a better position, while odds of being energy poor for owners are higher.

So, for the summer period type of locality, region, income, utility expenses, size of a household, number of children, square of dwelling, age, gender, education, owner of a dwelling can be considered as determinants of energy poverty in Russia. This model also reflects the data as its pseudo R^2 is equal to 0.28.

So, empirical analysis of the data was conducted, main determinants of the energy poverty in Russia are defined. Further in part 5 these results will be considered in terms of practical application and use.

5 Discussions and implications

So, the previous section was devoted to the building of models regarding dependencies between socio-economic indicators, that reflect the activities of households, and the indicator of energy poverty. Taking the fact that energy poverty is an indicator of the life quality into account, it should be considered for social and economic policy implementation. For Russia this issue is even more actual, because living standards, mores and traditions are different from region to region. From the results obtained it is obvious that southern and central regions are least affected by energy poverty. Reasoning about causes of such a situation it is necessary to pay attention to the climatic factor. In regions of the Russian south, republics of the Northern Caucasus a number of sunny days per year is more than in other regions of the Far North or the Far East. The sun is a natural energy source, that allows to produce energy by each household individually using solar panels. This method of supplying energy leads to the obtaining of conditionally free energy by a household, which does not require regular payments. This potentially reduces the level of energy poverty, decreasing dependence on tariffs and income levels. At the same time the sun is a source of heat. Due to that households are in need of heating during a shorter period of time, what also reduces a general level of energy poverty. Thus, considering the main households' needs as demand for hot water, heating and electricity, southern regions are in a better position with lower centralized energy and heating needs.

Relatively low level of energy poverty in regions of central Russia is explained by a higher population density, in comparison with Ural, Siberian and Far Eastern regions, what

provides a better transport accessibility for energy transportation. In table 5 a volume of energy production by Federal Districts according to the Ministry of Energy of the Russian Federation (Main characteristics of the Russian electric power industry, 2019) is presented.

Table 8. Electricity production in Russia by energy zones in 2019, billion kWh.

Energy Zone	**2019**
Central Interconnected Power System	236,3
Northwestern Interconnected Power System	112,8
Volga Interconnected Power System	110,2
Southern Interconnected Power System	103,1
Ural Interconnected Power System	265,7
Siberian Interconnected Power System	208,7
Eastern Interconnected Power System	43,8
Total (Russia)	**1 080,6**

Source: Main characteristics of the Russian electric power industry (2019).

This table shows the leaders in energy production in Russia. It is obvious that these leaders are Central, Ural and Siberian Energy Zones. But in the Ural and Siberian Energy Zones, due to the low population density and insufficient infrastructure, many households do not have access to electricity and the generated electricity is supplied to neighboring regions, including the regions of central Russia, without providing the local population. Thus, insufficient energy supply, its inaccessibility leads to a significant increase in price. Income, as one of the main energy poverty determinants, does not allow to use more expensive energy resources for households, being energy poor.

Taking into account the determining factors of energy poverty, the main direction in the prevention of its rising is the aspiration to increase the income of the population, which allows households to ensure an adequate level of their energy needs satisfaction. This can be achieved with increasing in real income of the population or with households supporting instruments, such as subsidizing energy costs and utility payments. Equally important direction are the development of infrastructure and allocation of additional resources for its expansion and modernization. As countryside residents are more affected by energy poverty, it is necessary to note the problem regarding the energy accessibility in the countryside and find a complex solution with respect to infrastructure and energy resources prices. Also it is necessary to pay respect to a number of children in a household. Large families receive subsidies more often than other social groups, what generates a certain inequality in energy consumption conditions. Less protected segments of the population require support. Also, one of the notable factors is a structure of the ownership. Homeowners are more affected by energy poverty as this type of property is not receiving subsidies. So, there is a need to support homeowners, people having

mortgages, who do not have profits regarding energy consumption. At the same time, some people do not have their own dwelling at all – this social group should be also supported.

The development of infrastructure and increasing the energy accessibility were already proposed. Of course, this issue can rather be a separate study. But within the framework of this study, it is necessary to emphasize that a significant step in achieving this goal is the additional power lines construction to increase geographical accessibility and the introduction of alternative energy types. It is necessary in order to diversify energy production. Each energy type has its own advantages and disadvantages; therefore, it is necessary to choose the most rational and optimal energy production method for all the regions.

Considering the structure of energy production, there is a noticeable significant lag in the regions of the Far East. This situation can be largely explained by a lack of power stations in this region. Because of a higher seismic activity, it is not recommended to build nuclear power stations there. There are no huge deep rivers, what does not allow to build hydroelectric power plants. Several problems in transport accessibility of Far Eastern regions (for example, Kamchatka Krai and Magadan Oblast) do not allow to provide supply with cheap and affordable energy. In that case building geyser power plants can be assumed as a solution for this problem, that gives a possibility for local consumers to get cheap energy relatively to their income.

Thus, the problem of energy poverty is explained by a number of factors, whose solutions largely depend on a unique attitude to each region, consideration of its unique features and providing regional policy, including in terms of households' support from risk groups, which are defined by the determinants, described in this research.

6 Conclusions

So, this research is devoted to the problem of energy poverty in the Russian Federation. Gaining popularity among researchers around the world, energy poverty is increasingly on the agenda for many scientists. In recent years a significant number of studies, connected with the energy poverty defining problem and its features in different countries, appeared. But all the same at the moment there is a lack of researches in the sphere of energy poverty for Eastern Europe, including the Russian Federation. This research brings a significant contribution to the main factors of energy poverty defining, forming the basis for further researches. Energy poverty factors, which were considered in this study, clearly define the scope of the problem, reasons for its development and the subjects it affects. This research, devoted to the specific region, complements a general understanding of this problem in the world. Using the example of Russia, it was determined that the presence of energy poverty is significantly influenced by the geographical factor, type of locality factor, type of property, and household size. Of course, this study considers a big country as a single element of a research. Taking into account the scale of Russia, the development of this study can be devoted to each region separately, which will provide a more detailed overview of the problem. Some energy poverty factors in Russia can become a base for understanding the sources of energy poverty problem development and, therefore, directions for the government policy and business. The factors characterize groups of risk and regions that require more attention from the state, define regions with a low level of business competition in this area, that is, are open to the development of the energy sector. Thus, the main aim of this study has been achieved.

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Energiavaesuse tegurid Venemaal

Kokkuvõte

Energeetikasektori arengute ja ümberkujunemise tähtsust pole võimalik alahinnata seoses väga suure rolliga, mida energeetika omab meie igapäevases elus. Käesolevas uurimuses autor avab energiavaesuse temaatika. Uurimuse eesmärgiks on täiendada varasemaid selleteemalisi regionaalseid uuringuid läbi energiavaesuse olukorra analüüsimise Vene Föderatsioonis, kus see probleem on väga oluline seoses klimaatilise mitmekesisuse ja energiaressursside ebavõrdse jaotusega. Uurimuses antakse ülevaade varasematest selleteemalistest uuringutest, tuuakse välja teema vähene kaetus Ida-Euroopa riikide kontekstis ja kirjeldatakse erinevaid lähenemisi energiavaesuse mõõtmisele. Käsolevas töös kasutatakse energiavaesuse fenomeni mõõtmiseks multidimensionaalset energiavaesuse indeksit. Uurimuses kasutatakse ökonomeetrilisi meetodeid, sh logit mudelit, analüüsimaks igal uuritaval perioodil umbes 30,000 vaatluse suurust valimit Vene Föderatsiooni Riikliku Statistikaameti leibkonna eelarve uuringust. Käesolevas uurimuses analüüsitakse selle andmestiku 2019. aasta esimese ja kolmandat kvartali andmeid, mis võimaldab eristada energiavaesuse tegureid suve- ja talveperioodil. Mudelite hindamise tulemused annavad meile infot energiavaesust mõjutavate tegurite kohta, nagu elukoht, leibkonna suurus, sissetulekute tase, mitmekesiste klimaatiliste tingimustega riigis nagu Venemaa. Uurimustöö tulemused võimaldavad tuvastada energiavaesuse suhtes kõige haavatavamad grupid Venemaal, millele on lai praktiline tähtsus sotsiaal- ja regionaalpoliitika kontekstis.

Võtmesõnad: energia, energiavaesus, multidimensionaalne energiavaesuse indeks, Venemaa, logit mudel.

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