The Impact of Energy Investments on Employment: The Russian Case

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ABSTRACT

This study aims to analyze the causality relationship between total energy sector investments and employment for the years 1997-2021 in the framework of Russia using the Least Squares method. For this reason, panel analysis was used. First of all, necessary assumption tests were made for the establishment of the model. When the findings are evaluated, a significant relationship has been determined between energy and employment in Russia. In other words, there is a significant relationship between the type of investments made in the energy field and employment in Russia, which has an important patency in the world energy sector. That is, the 1% increase in investments in the energy field in this country means twice as much in explaining the employment rate. This is indeed an expected result for Russia, which has an important share in the world energy sector.

Keywords: Energy Economics, Employment, Investment, Least Squares Method, Russia
JEL Classifications: Q43, E24, O16

1. INTRODUCTION

Energy, both as a concept and as a production factor, has taken its place in the modern economy with the ecological economics approach. Until the understanding of ecological economics, the cycle between the household and the firm, in other words, between labor and capital, and expressed as a neoclassical activity flow, has been seen as a subsystem of the global ecosystem in ecological economics. In ecological economics, the only energy source in the global ecosystem is solar energy. Solar energy is used either directly or indirectly in the ecosystem and is thrown away as low heat. Accordingly, in the understanding of ecological economics, energy is the only primary factor of production (Usta, 2016).

In the energy sector, it is observed that there is a transformation made compulsory by the problem of energy supply security and global climate change. This transformation; With the technological developments and various incentive policies implemented by the governments, it has become dynamic especially after the 90s.

The role of investment is one of the most important issues in the economic development policy of countries. Thanks to new technologies, a new approach to management and some of the opportunities that investments provide, these investments have become in demand not only by developing countries, but also by developed countries. The positive contribution of the private sector has forced many countries that previously had a negative view of private sector investment to overcome these thoughts, and additional investment has had a positive impact on the country's economy. Whether government or private sector investment, growth, employment, inflation and other macroeconomic indicators are under scrutiny (Akbulut, 2009). Investments have an important place not only in the energy sector, but also in different sectors. One of these sectors is tourism (Huseynli, 2022a).

The fact that the unemployment rate is above the natural rate for a long time causes both a decrease in human capital and an increase in social problems. The implementation of policies that increase

employment rates, especially in recent years, is among important issues, just like global warming and climate change.

The question of how energy and its investments affect employment is very important when considered in the context of the purpose of the study. Apart from the already known employment effect of the investments, it is stated that there are important sector-specific requirements in order to benefit from energy resources effectively. At the beginning of these requirements is the establishment of a suitable working team that will ensure the efficiency of production in the designed energy projects. In addition, there is a need for qualified people to provide consultancy services for investment in energy projects. In order to ensure that the relevant projects are implemented within the country, the existence of legal experts with sufficient qualifications is a separate requirement (Lund, 2009). On the other hand, engineers and technicians are needed in the realization of technical studies. In this context, it is a fact that most of the engineering and technician jobs have been directed to the field of renewable energy, especially in recent years (Dinçer and Karakuş, 2020). The existence of such situations shows that energy investments are expected to have effects on employment, especially in certain areas.

With developments such as industrialization, population growth, globalization and urban transformation in the world, energy consumption is constantly increasing. The rapid increase in population also means that energy supply needs to be provided to more people. Energy is vital in many areas of human life and sustainable growth is not possible without energy in today's world (Koçak and Uçan, 2021). Renewable energy, which has become more important due to the depletion of fossil fuel resources, reduces the foreign dependency of countries and the energy sector creates new business potential in the relevant country. Creating employment is one of the most important benefits of renewable energy. Despite the increase in unemployment rates in the world, it is seen that employment in the renewable energy sector is increasing. For this purpose, in the study, the relationship between energy and employment for Russia, which has a large share in the world energy production sector, was examined by panel data analysis. In the first part of the study, the traditional energy and renewable energy issue, which has been frequently mentioned in the economics literature, has been discussed, and the literature part related to the investments made in this field is included. Likewise, the relationship between employment rate and energy investments was first investigated within the framework of the literature. In the continuation of the study, detailed information about the tests applied was given and the results of the analysis were interpreted.

2. LITERATURE REVIEW

In recent years, many studies on energy have been carried out in the economics literature. However, we can say that most of the studies are focused on the determinants of renewable energy. Apart from this, especially the effects of energy on income are among the subjects that are researched. As researches on energy resources become widespread, it should be expected to investigate the different macroeconomic effects of the relevant field.

There are relatively limited examples of studies in the literature on the determination of the effects of energy investments on employment. The majority of the studies, on the other hand, include theoretical rather than analytical determinations. It is thought that this study we have done on the subject will contribute to the elimination of the deficiencies identified in the literature (Afşar and Doğan, 2021).

2.1. Private and Public Sector Investments
In general terms, investment is the changes in the resources and stocks used to protect and increase the existing capital stock in the economy, that is, the production facilities used in the production of goods and services, in a certain period. In other words, investment is a "flow variable" and shows the change in the capital stock over time (Özdemir, 2007). This definition is the definition of total investment and includes both gross fixed capital formations and stock changes. In other words, the concept of total investment consists of durable goods (fixed capital goods) produced in the current period with the aim of producing in the future and postponing intermediate and final consumption to the future (stock change) in the same period (Yılmaz and Yılmaz, 1997). In the mixed economy model, the public and private sectors exist as producers and consumers and have separate decision and preference opportunities. Therefore, it is important for economic development to determine the relationship between the public sector and the private sector in the most accurate way and to maintain this relationship regularly (Tosun, 1996).

Ram (1987) used internationally comparable income and government expenditure data to prove the validity of the Wagner Hypothesis for 115 countries and the period 1950-1980. The results of the study reveal that the time series data supports the Wagner Hypothesis more than the cross-section data. In addition, the hypothesis was not supported in the cross-section sample, which included both underdeveloped and developed countries.

Ansari et al. (1997) tested the Wagner and Keynes Hypotheses for three African countries (Ghana, Kenya and South Africa) using the Granger and Holmes-Hutton statistical tests. According to the Granger test results, while there were findings supporting Wagner Hypothesis for Ghana and Keynes Hypothesis for South Africa, there were no findings supporting neither Wagner nor Keynes Hypothesis for Kenya. According to the Holmes-Hutton test results, it was seen that there was no causal relationship between expenditure and national income in accordance with the Granger test results for Kenya, that is, it was determined that the Keynes Hypothesis was not valid. The test results for Ghana are in the same direction as the Granger test results and support the Wagner Hypothesis. Contrary to the Granger test results, the results obtained from the analysis for South Africa are that there is no causality in either direction and do not support the Wagner or Keynes Hypotheses.

Narayan et al., (2007) examined the relationships between national output and government spending in Fiji using the cointegration test proposed by Johansen (1988) for the period 1970-2002 and found that there was a cointegration relationship between national output and government spending. In addition, according to the results of

Narayan et al., (2007), there is a Granger-Causality relationship from national income to government expenditures in the long run.

Artan and Berber (2004) tested the dynamic interaction between public sector size and economic growth using quarterly data for the 1987-2003 period, using the multiple co-integration technique. Based on the conclusion that the size of the public sector is one of the factors that increase economic growth, they stated that the effect of investment expenditures on economic growth is greater in the long run.

Kar and Taban (2003) analyzed the effects of the distribution of public expenditures (education, health, social security and infrastructure expenditures) on economic growth with the help of the cointegration approach using annual data for the 1971-2000 period. The econometric results of the study are that the effect of education and social security expenditures on economic growth is positive, the effect of health expenditures on economic growth is negative and infrastructure expenditures are statistically insignificant.

The institutional and structural characteristics of capital formation in developing countries (the credit market under pressure), the presence of a strong state, high dependence on foreign currency and instability (both economic and political) have led to increased interest and curiosity in the field of research on the determinants of investments. Investment, and in particular private investment, as a key element in contributing to economic growth, has become more important in the liberalization and deregulation process. Therefore, private investment has become the engine of the economic growth and development process in developing countries (Khan and Khan, 2007; Ribeiro and Teixeira, 1991). Because public investments are basically made by governments for the supply of public goods, while private investments are made by both national and foreign entrepreneurs for commercial and therefore profit purposes.

In recent years, empirical research on the determinants of private investments in the field of economics has gained momentum. When the studies in this field are examined, it is seen that many economic and political factors have important roles. For example, many macroeconomic variables are fundamental, such as economic growth, interest rate, public investment rate, real exchange rate, inflation, financial development (bank loans to the private sector), level of trade openness (share of exports and imports in total GDP) or changes in the terms of trade. are among the economic determinants. However, uprisings and military coups in the country are important political determinants. In this study, the effects of four basic economic determinants such as bank loans to the private sector, level of trade openness, economic growth and public investments are investigated. The expected effects of the related variables on private sector investments can be explained theoretically as follows.

Public investment, on the other hand, has an unpredictable effect on private investment. On the one hand, public investment crowds out private investment (crowding-out), providing increased deficits and competition for high interest rates (Ricardian equivalence theorem) and essential scarce resources (eg skilled labor, raw materials).

However, public investment can also have a complementary (crowding-in) effect with the supply of basic infrastructure (such as transportation, communication, irrigation projects). Therefore, the effect of public investment at the theoretical level is uncertain. In the findings obtained, the negative coefficient will provide evidence for the exclusion effect, and the positive coefficient will provide evidence for complementarity (Atukeren, 2005; Frimpong and Marbuah, 2010).

In a study on Azerbaijan by Huseynli (2023), on Azerbaijan looked at the causation link between economic development, total capital rises in the nation, total capital increases in the oil and gas sector, and income from those two industries. In a study by Günaydin (2006), cointegration and Granger causality tests were applied using GDP, private investments, and public investments data for the 1987-2004 period. In the study, it was determined that public investments affect private investments positively. In another study, Khan and Khan (2007) aimed to determine the private investment demand function for Pakistan using the ARDL test during the 1973-2005 period. The results revealed that most traditional factors do not have a significant impact on private investment. In addition, it has been determined that non-traditional factors such as institutional quality, management, entrepreneurial abilities are prerequisites for private investments.

Ulutürk (2001) tested the effect of public expenditures on economic growth for the period 1963-1994 using the two-sector production function model. The results of the study are that public expenditures influence economic growth and the size of the public sector accelerates economic growth. In addition, in the study, it was concluded that the externality effect of the public sector on the private sector was positive.

In his study, Nısfet (2002) analyzed the effects of public sector size (Public expenditures/GDP) and economic growth for the period 1970-1999 within the framework of the two-sector production function. According to the results of the study, it was observed that there is a negative relationship between the size of the public sector and economic growth, although it is not very strong. Space attributed this to the fact that the increase in public expenditures led to corruption and prevented the effective and efficient use of resources. A positive relationship was found between the increase in public expenditures and economic growth. In other words, the increase in public expenditures accelerates economic growth by creating a suitable environment for private sector investments.

2.2. Employment
Globalization has increased inequality in working conditions between regions, countries, social groups and occupations. Employment was the focus of the entire industry. Some of the things that the public demand and companies that need to find a job provide. If employment opportunities that can reduce unemployment, inequality and poverty can be provided, such a policy will not cause problems and will not lead to extreme injustice in income distribution. In addition, unemployment arises because of inefficient effective demand and jobs that do not create additional jobs. Creating additional jobs will require higher demand for products. It is important to keep the unemployment

rate as low as possible. High unemployment is costly for taxpayers and the government. Every unemployed has two costs to the state. First, the unemployed, whether young or old, will not be able to use the workforce for a long time and will be retrained when they find a job. Secondly, there is a cost to being blatantly deprived of the income tax one may pay at work. Likewise, unemployment has other costs. These costs can be the result of not using and wasting resources. The unemployed, especially young people can impose external costs such as crime on the economy. As a result, every uncountable workforce and person who cannot go to work has a labor cost. Recently, governments have introduced forced jobs in business establishments that can increase productivity and reduce unemployment. The time it takes to complete a job has yet to impact the productivity of the workforce. The components of production are also vital for the productivity of the workforce involved (Çiftçi and Koç, 2013).

It is obvious that unemployment, which is considered as a common issue of the whole world, has similar characteristics in almost every society where it maintains its existence and importance by taking a structural dimension, but the policies to be implemented in terms of the system and working places bring along relative policy practices. In these practices, measures are taken to positively affect employment directly or indirectly. On the one hand, the views that prioritize active employment policies such as structural changes in the labor market, the sectoral distribution of employment, increasing labor demand, increasing labor mobility, efforts to prevent unemployment, re-education, early retirement, and unemployment-limiting measures, on the other hand, suggest that unemployment insurance and unemployment benefits should be implemented. Passive employment policies, which are thought to restore unemployment, and measures taken to combat unemployment emerge (Aktürk, 2003). In addition to these, the obligation to determine employment policies within the framework of the understanding of economic efficiency and productivity, the acceptability of a certain unemployment level, the attempt to reduce it to a bearable level, and those who think that its social dimension is important, liberalist, who proposes that the solution be regulated with automatic stabilizers of the market system without interfering with the functioning of the market mechanism. There are ebb and flow of solutions among the employment policies determined by the approaches, easily solving the unemployment problem and taking measures to mitigate the results. Creating suitable employment climates, job creation programs, workplace training programs, job and training programs, increasing employment by creating employment programs are among the first measures that come to mind (Erkan, 1998). For this reason, on the one hand, it is necessary to eliminate the leaks with reparative, constructive social policies and practices that alleviate the effects of unemployment, and to inject policies and practices that increase employment into the economic fabric together.

Considering the developments in the energy field in recent years, it is seen that the total installed power capacity, which is mostly available in developed countries, has started to shift to developing countries such as China and India, especially after the 2000s. However, one of the biggest problems of developing countries is the increase in the labor force that occurs in parallel with the increasing population. For this reason, developing countries have low employment and high unemployment rates, as they cannot develop an employment capacity in parallel with the increase in labor force (Aksu, 2017).

Considering the increase in energy investments, especially renewable energy investments, in the context of the employment-increasing effect of investments in economic theory, the increase in employment and decrease in unemployment rates in the country where it is applied causes an expectation coming from the theory (Afşar and Doğan, 2021). Between the years 2005 and 2021, Huseynli (2022b) conducted research in Turkey to investigate the link that exists between economic development and the income generated by tourism. According to the findings of the research, it has been discovered that revenues from tourism are an important factor in economic growth in Turkey, and that the tourism sector has a significant role to play in addressing the issue of unemployment that exists within the nation.

2.3. Energy Investments and Employment

Investments made in order to benefit from energy resources have significant effects on national economies. The distribution of non-renewable energy resources is not the same everywhere. Therefore, many countries are forced to import energy. Many energy importing countries reduce their dependence on imports thanks to renewable energy sources. However, it provides energy supply security as it ensures the continuity of energy (Lund, 2007; Chen et al., 2019). In this way, it contributes to the sustainable economic growth and development of countries. Therefore, investments in renewable energy sources are important (Dinçer and Karakuş, 2020).

Several systems are being developed to take full advantage of energy sources, especially renewable energy sources. A working team is formed in order for the designed systems to perform the production in the most efficient way. However, there is a need for people who can advise on investment in renewable energy resources. There is a need for legal experts to ensure that the systems are used within the country (Yüksel et al., 2020). In addition, many of the technical and engineering jobs are shifting to renewable energy fields (Lund, 2009). When all these issues are examined, the effect of renewable energy sources on employment becomes significant.

Fossil resources are resources that are scarce in nature. For this reason, there is a need for resources that are constantly found in nature and constantly meet the energy needs. The sources mentioned are renewable energy sources. Countries using renewable energy sources provide sustainable energy. However, especially developing countries reduce their dependence on imported energy. The relationship between renewable energy sources and employment is important. This issue has been addressed by many researchers in the literature. For example, Hondo and Moriizumi (2017) investigated the effect of renewable energy technologies on employment. Japan was included in the study. As a result, it was determined that there is a relationship between renewable energy production and employment. Production systems developed to benefit from renewable energy

sources are important. Therefore, the development of renewable energy production systems has a positive effect on employment (Zhao and Luo, 2017; Proença and Fortes, 2020).

The transition from fossil sources to renewable energy sources affects current employment rates. There are many studies on this subject in the literature. Renewable energy sources are important in providing sustainable energy. Leaving fossil resources and using renewable energy resources have an increasing effect on employment (Garrett-Peltier, 2017). Like this study, Henriques et al. (2016) investigated the relationship between electricity produced by renewable energy sources and employment. Portugal in the 2008-2020 period was included in the study. However, the study was tested with input-output analysis (IO). As a result, it was determined that the use of renewable energy sources in electricity production is important. On the other hand, it was emphasized that renewable energy production has an employment-increasing effect. Renewable energy sources play a major role in reducing carbon emissions. However, the increase in production capacity has a decisive effect on employment (Lambert and Silva, 2012).

Barros et al. (2017) investigated the effect of renewable energy sources on employment. As a result, it has been determined that renewable energy directly increases employment. There is a relationship between renewable energy and employment. But this relationship exists as direct, indirect, and dissociated. Therefore, the effect of renewable energy on employment needs to be examined in depth (Karaca et al., 2017). In parallel with these studies, Stavropoulos and Burger (2020) evaluated the employment effects in renewable energy sources in their study. The study was tested by regression analysis. It has been determined that renewable energy has direct and indirect effects on employment and these effects are positive.

Dvořák et al. (2017) evaluated the relationship between investments in renewable energy sources and employment. Czech Republic was included in the study. As a result, it has been determined that there is a relationship between investments in renewable energy sources and employment. In addition to these studies, Chen (2019) researched employment and renewable energy in his study. China has been evaluated within the scope of the study. The study was tested with input-output analysis. As a result, it has been determined that investments in solar, wind and biomass energies have more impact on employment. However, Ağpak and Özçiçek (2018) focused on renewable energy, which is considered as an employment policy tool in their study. In the study, 59 countries between the period of 1991-2014 were examined. The study was examined by panel data analysis. It has been determined that investments made in renewable energies have an increasing effect on youth employment.

Baruah (2017) examined female employment in renewable energy production in her study. OECD and developing countries were included in the study. As a result, it has been determined that if OECD and developing countries invest in renewable energy sources, women's employment increases. However, Bekmez and Ağpak (2016) focused on renewable energy and employment. 80 countries were included in the scope of the study and the panel

was tested with causality. It has been determined that the use of renewable energy sources has a greater impact on employment in low- and middle-income countries. In developed countries, it has been emphasized that the effect is less. Unlike these studies, Cau (2018) investigated the effect of the use of renewable energies for the agricultural sector on employment. India was included in the scope of the study. As a result, it has been determined that renewable energies have increased employment in rural and urban areas.

Lehr et al. (2016) investigated the use of renewable energy sources in his study. MENA Region was included in the scope of the review. The study was examined with input-output analysis. As a result, it has been determined that the use of renewable energy sources has positive effects on national economies. It has been emphasized that new business areas have emerged and have a positive effect on employment. Like these studies, Jenniches (2018) examined the impact of renewable energy sources on national economies in his study. The study was supported by a literature review. It has been stated that renewable energy sources have positive effects on national economies and especially on employment. The impact of renewable energy sources on national economies and employment varies in the long and short term. While the short-term effect of the investments made is low; the long-term impact is high (Jaraite et al., 2017; Bulavskaya and Reynès, 2018).

As a result of the literature review, it has been seen that the issue of energy resources and especially renewable energy resources and employment has been discussed by many researchers. Most of the relevant studies have been tested with input-output analysis. However, in some of the studies, a single country is included in the scope of the review; some of them include country groups. In the studies, subjects such as traditional energy sources, renewable energy sources, employment, economic growth were emphasized. In general, it was emphasized that there is a positive relationship between energy resources and employment. Therefore, in this study, it is aimed to examine the relationship between investments in the energy sector in general and employment within the scope of traditional and renewable energy.

3. RESEARCH METHODOLOGY

3.1. Purpose and Data Set
In the study, the relationship between the energy sector investments and employment rates in Russia between 1997 and 2021 was tried to be measured. The information data used in the study was obtained from the World Bank. The logarithmic values of the investments made to get more robust results are included in the analysis. The panel method was chosen for the analysis and the least squares method was analyzed.

3.2. Analysis Method
There are three methods of handling data in econometric analysis. The first is time series, the second is cross-section, and lastly, panel data analyzes allow us to interpret the data by including the first two analyses. In panel data analysis, unlike time series and cross section, there are double subscripts. A panel data model is:

$$Yit = \alpha + Xit\ \beta + uit \qquad (1)$$

i=1,…, N; t=1,…, T

Can be expressed as While *i* represents cross-section units such as households, countries, and firms, *t* represents the time unit. *α* is a fixed number, *β*; *K×1* K: Number of explanatory variables) and *Xit* refers to the itth observation. If the error term is uit;

$$uit = \mu i + \upsilon it \qquad (2)$$

is expressed as. *μi* represents unobserved individual effects, *υit* represents the remaining error terms (Baltagi, 2005). Panel data analysis has advantages and disadvantages compared to other methods. Advantages; As the panel data allows to obtain larger numbers of observations, the degree of freedom increases and the linearity between the explanatory variables decreases, so that the estimation results are more consistent. It also allows testing of more complex behavioral models than time series and cross-section analysis. The fact that panel data analysis allows the comparison of individual effects in time series estimates with one another increases the predictive power by providing more accurate results (Hsiao, 2003). The disadvantages are: Difficulty in collecting data can be listed as measurement errors (deliberately/unintentionally misleading answers by respondents, incorrect recording of answers, inappropriate information sources) and selection problems (unanswered questions, short time interval, cross-section dependency) (Baltagi, 2005). In order to achieve consistent and more precise results in econometric analysis, some pre-tests should be performed, and appropriate analysis methods should be preferred.

3.2.1. Least Squares Method
Regression analysis is one of the most frequently used statistical methods. Where inference is intended in regression analysis, the Least Squares (Least Squares) method is generally used. The LSM method is sensitive to extreme values due to its current assumptions. In the presence of extreme values (outliers), it may lose its effectiveness and effectiveness, which are the characteristics of LSM (Çınar, 2019).

LSM method, which is one of the most common methods used for the estimation of fixed and slope parameters, has been preferred in this study because it gives reliable estimates if it has some assumptions in the econometric analysis to be made in the later parts of the study.

In the multiple linear regression analysis, the model can be estimated by the least squares method only after certain assumptions are provided. There should be no sequential dependency problem between error terms. Durbin-Watson test was used to determine whether there was an autocorrelation problem among the variables used in the study. Durbin Watson test value takes a value between 0 and 4 and if the value is equal to 2, it is understood that there is no autocorrelation between the variables. In regression analysis, the problem that occurs when the variance of the error term differs over time is called the heteroskedasticity problem. The White test was used to determine the variance problem in the study (Gujarati and Porter, 2014).

There should be no multicollinearity problem in the model created in the regression analysis. To detect this problem, the Variance Inflation Factor (VIF) technique was used. According to this technique, Centered VIF values between 1 and 5 show that there is no multicollinearity problem in the model (Bükey and Çetin, 2017).

LSM consists of a functional model that shows the functional relationship between unknown parameters and observations, and a stochastic model that represents the relative accuracies between observations. In some cases, for example, in coordinate transformation, both the observation vector and some elements of the design matrix have stochastic properties. In the classical LSM approach, this is often overlooked and remains an uncertainty in the solution results. With the estimation method called Total Least Squares (LTC), which was introduced in the 1980s to eliminate one of the shortcomings of the LCC estimation method, both the observations and the coefficients matrix can be taken as a whole or a part of the stochastic component. TLSM method is a new method proposed for solving problems where all or some of the design matrix elements contain errors besides the dimensions (Acar, 2009; Akyılmaz et al., 2007).

4. ANALYSES AND RESULTS

A series of necessary assumption tests were applied before the analysis was made. Before proceeding to the analysis, a model was established regarding the variables in the study. The model measuring the relationship between energy sector investments and employment is defined as in equation 3.

$$employment = \beta_0 + \beta_1\ Ltotal\ energy\ investment + \mu \qquad (3)$$

As can be understood from the model, employment rates are considered as dependent variables and total investments made in the energy sector are considered as independent variables in the study. State sector and private sector investments are included in the total investments. Before the analysis, the investment amounts related to the public and private sectors are given in Figures 1-3.

It is necessary to provide a number of assumptions necessary for the panel analysis and to perform the necessary tests regarding

**Table 1: Test results for necessary assumptions**

Likelihood ratio (LR) test results		
Test names	**LR statistics**	**Probability value**
Unit and time impact	0.00	1.00
Unit impact	0.00	1.00
Time effect	1.2e-13	1.00
White test results		
Test statistic	Probability Value	
1.1290	0.5686	
Wooldridge's test results		
Test statistic	Probability Value	
21.058	0.0167	
VIF criteria results		
Variable	**VIF**	**1/VIF**
LTotal energy investment	1.00	1.00
Mean VIF	1.00	

Figure 1: Investment in energy with private participation in Russian Federation (current US dollar)
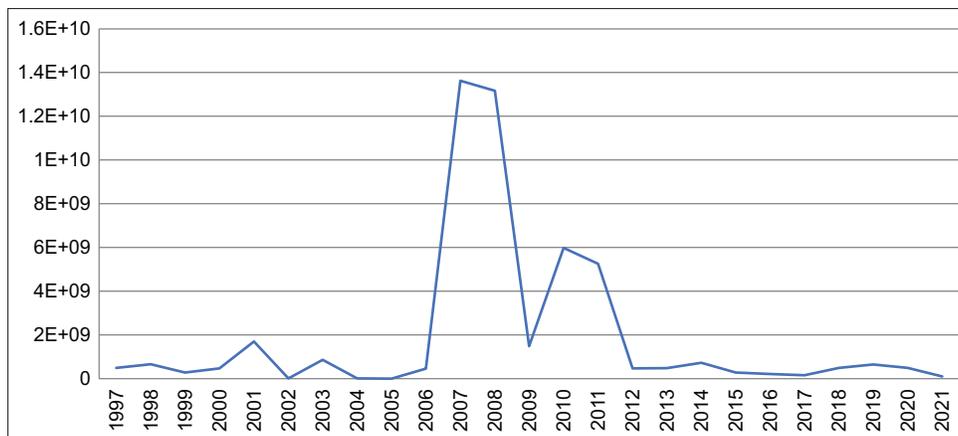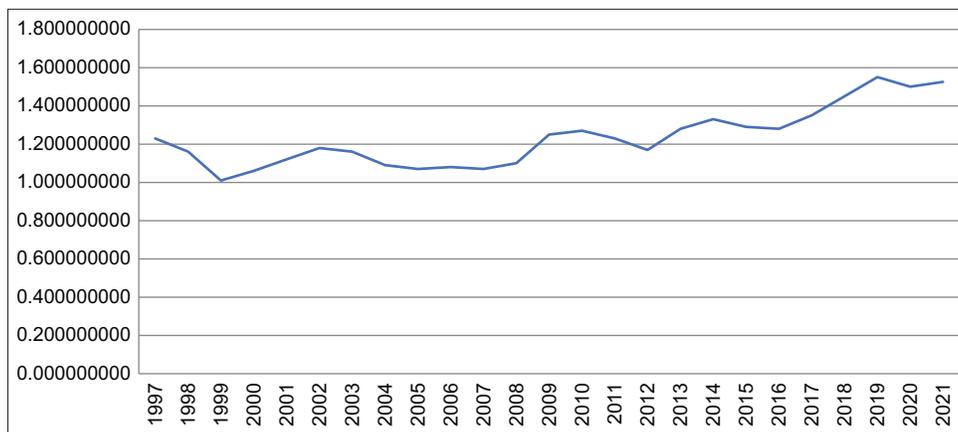

Source: World Bank

Figure 2: Public private partnerships investment in energy in Russian Federation (current US dollar)
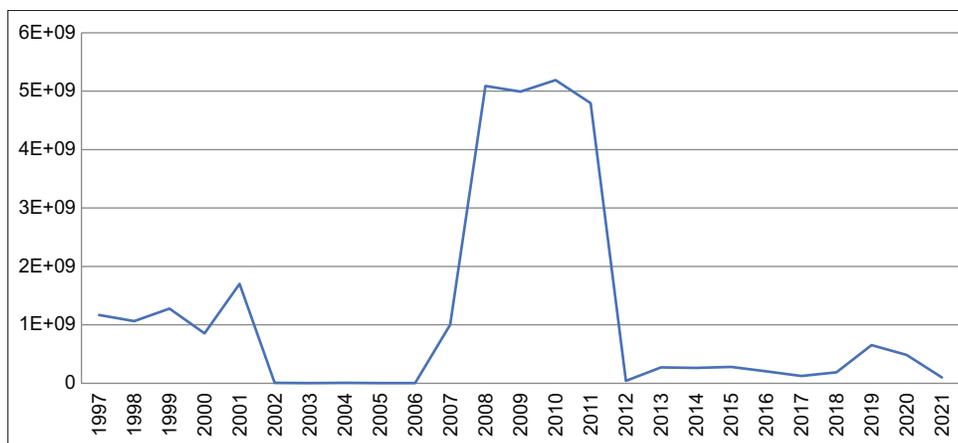
Source: World Bank

Figure 3: Total employers (% of total employment) in Russian Federation (modeled ILO estimate)

Source: World Bank

them. The most important one among these is the application of tests such as F and LR tests, and the first step is to choose which method is appropriate. Within the scope of the study, the LR test was used and it was decided that the classical model, that is, the least squares method, was appropriate within the framework of the results obtained. The White test was applied to see if the problem of varying variance was included. In the model established according to the test result, the fixed variance problem hypothesis is accepted and there is no variable variance problem in the model. Wooldridge Test was used as autocorrelation test. According to the results of the test, the first-order autocorrelation problem hypothesis is rejected in the model and as a result, there is an autocorrelation problem in the model. The VIF test was applied to test the multicorrelation problem. There is no multicollinearity problem in the model based on the data.

Table 2: Least squares estimation test result

R²	Number of Observations			Prob prob>
0.0000	25			0.0479
Employment	Coefficient Values	Robust Standard Errors	T statistics	P>|t|
LTotal energy investment	2.082397	3.0320969	0.08	0.0479
Fixed Coefficient	1.224844	2.2923633	4.19	0.0000

All these analyzes are shown in Table 1. After applying the necessary assumption tests, the least squares model was established (Table 2).

In case of deviations from the assumption, robust resistant coefficient model was preferred. A significant result was obtained because of the model result. Based on the data obtained, there is a significant relationship between the energy sector investments made in the country within the framework of Russia and the employment rates realized in this country. Namely, a 1% increase in the investments in the energy field in this country means twice as much in explaining the employment rate. This really represents an expected result for Russia, which has an important share in the world energy sector.

5. DISCUSSION AND CONCLUSION

The aim of this study is to direct the energy investments of Russia, which has an important share in the world energy industry, to the employment in this country. The least squares method was preferred for the relationship between these variables. According to the data obtained as a result of the study, there is a significant relationship between the energy sector investments made in the country within the framework of Russia and the employment rates in this country. The information obtained as a result of the study, 1% increase in investments in the field of energy in this country means doubling the employment rate. This is indeed an expected result for Russia, which has an important share in the world energy sector. Similarities have been revealed with this study, which has been done in general in the studies given comparatively in the literature.

Dvořák et al. (2017) also obtained results similar to the results of our study. Namely, as a result of the analysis applied on the Czech Republic, it has been determined that there is a relationship between investments in energy resources and employment. Tile was evaluated in the study of Chen (2019). As a result, it has been determined that investments in the energy sector have more impact on employment. In addition to similar results, Ağpak and Özçiçek (2018) studies examined 59 countries between the years 1991-2014. It has been determined that investments in renewable energies have an increasing effect on youth employment. According to the findings of the research that was carried out by Huseynli (2023), there is a link of bidirectional causation between Azerbaijan's economic development and the country's receipt of foreign investments.

Baruah (2017) examined female employment in renewable energy production in her study. OECD and developing countries are included in the study. As a result, it has been determined that female employment increases if OECD and developing countries invest in renewable energy sources. Bekmez and Ağpak (2016) focused on renewable energy and employment. 80 countries were included in the study and the panel was tested for causality. The results of the analysis were similar to our results and it was concluded that there is a significant result between the energy sector, especially the renewable energy sector and employment.

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