ARCENG
INTERNATIONAL JOURNAL OF ARCHITECTURE AND ENGINEERING

ISSN
2822-6895

Article Arrival Date
15.03.2024

Article Type
Research Article

Article Published Date
20.06.2024

CIRCULAR ECONOMY POLICIES IN ITALY AND POLAND

Hamza KORKMAZ

Yeditepe University, Social Sciences Institute, Faculty of Economics and Administrative Sciences, Economy Department, Istanbul, Turkey

ORCID Code: 0000-0001-7102-8199

ABSTRACT

The world economy rises in the energy sector; with its strategic leadership in economic growth. While global development and population increase continues, the demand and need for energy scale up. This is the end of the "below average growth" era. With the impact of developing technology, renewable energy cost goes down and the transformation process is sped up by government incentives for environmentalist energy production. But; it seems that for long years, still, fossil fuels system will continue. Developments in fossil fuel-possessing countries, especially oil, have a direct impact on energy prices. As a result; the global trend for energy demand is towards clean (green) energy sources. The fight against CO2 release and climate change will become more important. Although in the predictable future, the supremacy of fossil fuels will continue; government policies and incentives will be shaped in support of works to minimize their negative impacts on nature. Demand for energy and natural resources has been increasing due to economic and population growth. Over recent years, the country has experienced the fastest surge in energy demand among OECD countries, and according to the International Energy Agency (IEA) forecasts is set to double its energy use over the next decade. will provide value to literature by increasing the importance of renewable energy sources for nature, humans, and the world. The study aims to reveal whether there is a bidirectional interaction between the renewable energy production of countries in Italy and Poland and their gross domestic product. In this study, the relationship between renewable energy production and gross domestic product was investigated bidirectionally.

Keywords: Energy, Sustainable Development, Renewable Energy, Natural Resource Economics

Jel Codes: F53 International Agreements and Observance . International Organizations, G18 Government Policy and Regulation, O1 Economic Development, Q2 Natural Resources including Energy, Natural Resources Renewable, Z13 Economic Sociology . Economic and Social Stratification,

1. INTRODUCTION

World economy rises on energy sector; with its strategic leadership in economic growth. While global development and population increase continuesly, the demand and need for energy scales up. The fight against CO2 release and climate change will become more important. Although in predictable future, supremacy of fossil fuels will continue; government policies and incentives will be shaped in support of works to minimize their negative impacts to nature.

ISSN
2822-6895

Demand for energy and natural resources has been increasing due to economic and population growth in Turkey. Over recent years, the country has experienced the fastest surge in energy demand among OECD countries, and according to the International Energy Agency (IEA) forecasts, is set to double its energy use over the next decade. The projections of the Ministry of Energy and Natural Resources confirm that this trend will continue for the medium and long term.

In my study, I will provide a value to literature by increasing importance of renewable energy sources for nature, human and world. I will try to look the impact of renewable energy on economic growth specific to Italy. Using clean, renewable energy is one of the most important actions you can take to reduce your impact on the environment. Electricity production is our first source of greenhouse gases, more than all of our driving and flying combined, and clean energy also reduces harmful smog, toxic buildups in our air and water, and the impacts caused by coal mining and gas extraction. But replacing our fossil-fuel infrastructure will take time—and strong, consistent support from both state and federal mandates to build renewable energy generation and demand for clean energy from consumers and businesses. Renewable energy sources can be used to produce electricity with fewer environmental impacts. It is possible to make electricity from renewable energy sources without producing carbon dioxide (CO2), the leading cause of global climate change. Renewable energy provides reliable power supplies and fuel diversification, which enhance energy security, lower risk of fuel spills, and reduce the need for imported fuels. Renewable energy also helps conserve the nation's natural resources.

Turkey has a substantial amount of renewable energy potential, and utilization of this potential has been on the rise over the last decade.

2. LITERATURE REVIEW

Renewable energy has become very hot topic for 20 years. Renewable energy has been analysed in different aspects, data and methodology. However, the most attractive topic has become searching the relationship between the growth and the renewable energy. They are summarized below.

Rafiq, Salim and Bloch (2014) by the method of multi variable vectoral error correction model are studied in China dnd India between 1972-2011. India’s renewable energy Technologies contribution to its development; and China’s clean Technologies adoption related to production and carbon emission, have impact on their sustainable development.

Akar, (2016), Dynamic parallel data analysis is applied to Balkan countries between 1998-2011. It is determined that there is a negative and meaningfull relation between economic growth and renewable energy consumption.

Cadoret and Padovana (2016), Paralel data analysis is applied to 26 EU countries between 2004-2011. It is studied that manufacturing industry loby activities delay renewable energy management. In addition, according to environment and energy policies analysis income per capita has a negative impact on renewable energy distribution.

Lin, Omoju and Okonkwo (2016), Time series analysis and Vectoral error correction are applied to study in China between 1980 and 2011. It is concluded that in China, financial development has positive impact on renewable energy’s share on electricity consumption; as

ISSN
2822-6895

well as in GDP and foreign investment.

Papiez, Smiech and Frodyma (2018); simple linear regression analysis is applied to EU countries sample group between 1995-2014. As per this research, renewable energy growth is the main indicator to define the components of energy sources mix. These are the GDI, SWI and energy consumption cost of fossil fuel.

Hondroyiannis, (2002) He has worked on the correlation between Greece's energy consumption and economic growth between 1960-1996, by the mean of vectoral error correction model. Empirical evidences show that in long run considered variables are co-integrated, and energy consumption has a significant role in economic growth.

Lau vd (2018), Co-integration analysis, Autoregressive distributed delayed boundries test, Granger causality test, are applied to Malaysia between 1980-2015. According to this study, economic growth and direct foreign investment are the main components of renewable electricity consumption. It is determined that renewable electricity consumption has negative impact on trade deficit in long run.

The second attractive topic related to renewable energy is efficiency and utilization. They are mainly conducted by Rafiq and Alam (2010), Mehrara, Rezaei and Razi (2015), Marwues vd. (2011) and ALTAS, (1998).

Rafiq and Alam (2010) by using Parallel data and time series analysis he analysed Brasil, China, India, Indonesia, Philippines and Turkey as sample group between 1980-2006. This study comes to the conclusion that developping countries efforts to decrease carbon density is related to their increase of renewable energy efficiency.

Mehrara, Rezaei and Razi (2015), using Average most smaller squares technique and Bayesci model average technique, OECD countries are studied bewteen 1992-2011. It is stated that rural population, enviromental institutions and human capital are the most important variables affecting renewable energy consumption. Also, adverse effect of CO2 emmission have impact on its utilization increase.

Marwues vd. (2011), by the mean of Dynamic data analysis, 24 countries (21 EU countries and Turkey, Switzerland and ıceland) are sampled between 1990 and 2006. In this study it is stated that , especially at the beginning, encouriging policies to endorse the utilization of renewable energy sources should be supported against pressures from fossil fuel lobies.

3. METHODOLOGY

In this study about the impact of renewable energy on economic growth, ARDL boudary test; developped by Pesaran (2001) will be utilized. This test is more convenient in comparison to co-integration methods, developped by Engle & Granger (1987) and Johansen (1988). The reason is that, it is able to test the existace of co-integration relation give that series stability level is different.

In order to detect an existance of co-integration relation between series, by the mean of ADRL boundary test, first; an unlimited error correction model is to be builted. Evidences about the existance of co-integration between variables will be obtained and, accordingly, short term and long term ARDL models will be created.

Economic analysis suggests that there is a long run relationship between variables under consideration as stipulated by theory. This means that the long run relationship properties are intact. In other words, the means and variances are constant and not depending on time.

ISSN
2822-6895

However, most empirical researches have shown that the constancy of the means and variances are not satisfied in analyzing time series variables.

In the event of resolving this problem most cointegration techniques are wrongly applied, estimated, and interpreted. One of these techniques is the Autoregressive Distributed Lag (ARDL) cointegration technique or bound cointegration technique. Hence, this study reviews the issues surrounding the way cointegration techniques are applied, estimated and interpreted within the context of ARDL cointegration framework. The study shows that the adoption of the ARDL cointegration technique does not require pretests for unit roots unlike other techniques. Consequently, ARDL cointegration technique is preferable when dealing with variables that are integrated of different order, I(0), I(1) or combination of the both and, robust when there is a single long run relationship between the underlying variables in a small sample size.

In this study about the impact of renewable energy on economic growth, also Granger Causality test will be applied. Causality between two variables X and Y can be proved with the use of the so-called Granger causality test, named after the British econometrician Sir Clive Granger. This test makes use of Student's t-statistic and F-statistic tests and testifies when values of the variable X provide statistically significant information about the evolution of the future values of the variable Y. Let us assume that Y and X are two variables having stationary time series of data or observations. To test the null hypothesis that X does not Granger-cause Y, we first find the appropriate p lagged values of Y (the order p of the AR(p) process) to include in an AR (autoregression) process of Y.

In order to detect an existance of causal inference relation between series, Granger Causality test will be applied. It was fairly quickly understood that, unlike correlation, regression has a natural direction: the regression of Y on X does not pro- duce coefficient estimates that are the algebraic inverse of those from the regression of X on Y. The direction of regression should respect the direction of causation.

We should once again distinguish between correlation and causality. Correlation is the existence of a mutual relationship or connection between two or more processes or phenomena that tend to vary, be associated, or occur together in a way not expected on the basis of chance alone. Causality (referred to also as cause and effect) is the rational relationship between two processes, the first of which (the cause) is partially or totally responsible for the second, while the second is partially or totally dependent on the first. A process can have many causes, which beginning from the past can determine quantitatively the evolution of effects in the future. Causality cannot exist without a form of correlation; however, any correlation does not mean the existence of causality. In addition, causality cannot exist unless the cause happens prior to its effect and moreover it provides statistically significant information about its effect

The null hypothesis that variable X does not Granger-cause variable Y is accepted when no lagged values of the variable X are retained, after the application of t-statistic and F-statistic tests, in Eq. (7.4). Otherwise, we reject the null hypothesis in favor of the alternative, and we conclude that variable X Granger-cause variable Y and thus the future values of variable Y are depended on the present values of variable X.

ISSN
2822-6895

Annual renewable energy sources of wind power energy, hdyro power energy and sun power energy production capacity data series from 2010 to 2020, eligibility threshold and market openness data series from 20010 to 2020 will be used in the study. On the other side Gross Domestic Product (GDP) growth, Capital and Labor series will be used in the study. The main data series are mostly taken from Ember, EWEA, GWEC, WWEA and others.

Hypothesis;

H0: There is no relationship between economic growth and renewable energy sources

H1: There is a relationship between economic growth and renewable energy sources

The dependent variable, GDP (Production), will be explain with the help of following independent variables;

The independent variable, Renewable Energy Sources (Wind Power Production+Sun Power Production+Hydro Power Production)

Labor

Capital,

Standard error (ui)

$$GDP = \beta_0 + \beta_1 W + \beta_2 S + \beta_3 H + \beta_4 K + \beta_5 L + ui$$

Independent Variables are RES (renewable energy sources) items as S (solar), W (wind) and H (hydro) additionally labor and capital are also taken as independent variable. GDP (gross domestic product) is dependent variable and yearly datas of dependent and independent variables will be used.

RES S+W+H & L & K independent variable

GDP dependent variable

Firstly t test and F test will be applied after test results will demonstrate the number of variables are decreased or increased. Therafter I will try to apply Granger Causality and ADRL Test for my hypothesis conclusion.

The main purpose of this study is to examine the effects of renewable energy sources and some macroeconomic indicators on gross dometic products in Italy and POoand for period 1990-2020 by using ARDL bound testing approach, Granger Causality testing, Vector Error Correction Model(VECM)

VECM, Error Correction Model, time series It is a type of econometric model used in analysis.

ISSN
2822-6895

This model long-term balance between variables that are interdependent deals with relationships. Error correction model, between variables rapid short-term fluctuations and long-term differences between these variables. It combines forward balance relations.

The error correction model is usually derived from the VAR (Vector Autoregression) model is derived. VAR model calculates past values of a set of variables. It is used to predict future values using. However, VAR model deals with long-term equilibrium relationships between series can't get it.

The error correction model adds a correction term (error) to the VAR model (correction term). This term refers to the long-run equilibrium between series represents their relationships. The model uses this long-term relationship between variables tries to return to equilibrium relations, that is, between the series tries to correct errors caused by deviations.

The error correction model is usually expressed as:

$$\Delta Yt=\alpha(Yt-1-\beta Xt-1)+\sum i=1p-1\phi i\Delta Yt-i+\epsilon t$$

Here, Δ denotes the first difference of the variables, Yt and Xt

variables represent the series at time t, α is the long-run equilibrium

relationship, β is the error correction term, ϕi is the short-term dynamics and ϵt is

represents the error term.

Error correction model, long-term relationships between series understanding, identifying temporary fluctuations and future values used to predict. error correction model with short term questions the status of long-term convergence of knowledge. The error correction coefficient being negative and significant indicates short-term It results in the trend getting closer to cointegration in the long run. That's exactly the purpose.

Macroeconomic indicators which used in this study are: Capital, Labor, gross domestic product (GDP). Renewable Energy Sources indicators which used in this study are: hydro, sun and wind.

Hypothesis;

H0: There is no relationship between economic growth and renewable energy sources

H1: There is a relationship between economic growth and renewable energy sources

The dependent variable, GDP (Production), will be explain with the help of following independent variables;

The independent variable, Renewable Energy Sources (Wind Power Production+Solar Power Production+Hydro Power Production), labor and capital

ISSN
2822-6895

In this study, the determinants of gross domestic products in Italy and Poland for the period of 1990-2020 empirically questioned. The model established for this purpose is as follows.

gross domestic product (GDP)

Labor(L),

Capital(K),

Wind(W),

Sun(S),

Hydro(H),

Standard error (ui)

Gdp, labor and capital are macroeconomic indicators these dataset obtained from the World Bank Development Indicators (World Bank, 2020)

Hydro, wind and sun are renewable energy sources these dataset obtained from Italian Ministry of Energy and Polish Ministry of Energy

In the model, datas were taken as per capita and logarithmic (ln) transformations of all data were made.

$$GDP = \beta 0 + \beta 1W + \beta 2S + \beta 3H + \beta 4L + \beta 5K + ui$$

4. METHODS and FINDINGS

Firstly t test and F test will be applied after test results will demonstrate the number of variables are decreased or increased. Therafter I will try to apply Granger Causality and ADRL Test for my hypothesis conclusion.

The main purpose of this study is to examine the effects of renewable energy sources and some macroeconomic indicators on gross dometic products in Italy and POoand for period 1990-2020 by using ARDL bound testing approach, Granger Causality testing, Vector Error Correction Model(VECM)

VECM, Error Correction Model, time series It is a type of econometric model used in analysis. This model long-term balance between variables that are interdependent deals with relationships. Error correction model, between variables rapid short-term fluctuations and long-term differences between these variables. It combines forward balance relations.

ISSN
2822-6895

4.1. SHORT-TERM – LONG-TERM CAUSATION WITH ARDL TEST

For Italy, ARDL(1, 1, 1, 1, 0, 2, 1, 2) ARDL model independent variable delays were taken as max 2 due to the large number of independent variables.

The process of determining the lags of independent variables in the ARDL model has a complex structure. Because there are many independent variables involved in the model, it is important to determine lag times appropriately. In this context, the maximum number of delays was preferred as 2 due to the large number of independent variables.

Additionally, the process of determining appropriate lag times for each independent variable included in the model was carried out by the automatic configuration of the model. This is an adjustment made to ensure that the model achieves the best performance by considering the historical values, interactions and dynamics of each independent variable over a 2-period time period. In this way, it is aimed that the model adapts better to the data set and predicts future values more accurately.

H0: There is no cointegrated relationship between variables.

HA: There is a cointegrated relationship between variables.

Since the 9.276057 f statistic value remains above the I1 bound critical value at 10%, 5%, 2.5% and 1%, the hypothesis of no cointegration is rejected. There is a long-term relationship between variables.

According to the Bounds test results, the F statistic of 9.276057 exceeds the critical value at the 1% significance level. This provides statistically significant evidence that independent variables causally affect dependent variables in the short run.

That is, bounds test results, which evaluate the short-term effects of independent variables, show that the relationships in the model are statistically significant. This shows that the effects of independent variables on the dependent variable are evident at the short-term level, as predicted by the model. This analysis is an important tool for evaluating and understanding the model's short-term causal relationships.

For Poland, ARDL(2, 2, 1, 1, 2, 1, 2) ARDL model independent variable lags were taken as max 2 due to the large number of independent variables, and the lag of all independent variables included in the model was determined by the model as 2.

The process of determining the lags of independent variables in the ARDL model has a complex structure. Because there are many independent variables involved in the model, it is important to determine lag times appropriately. In this context, the maximum number of delays was preferred as 2 due to the large number of independent variables. Additionally, the process of

ISSN
2822-6895

determining appropriate lag times for each independent variable included in the model was carried out by the automatic configuration of the model.

H0: There is no cointegrated relationship between variables.

HA: There is a cointegrated relationship between variables.

Since the 7.259646 f statistic value remains above the I1 bound critical value at 10%, 5%, 2.5% and 1%, the hypothesis of no cointegration is rejected. There is a long-term relationship between variables.

According to the Bounds test results, the F statistic of 7.259646 exceeds the critical value at the 1% significance level. This provides statistically significant evidence that independent variables causally affect dependent variables in the short run.

That is, bounds test results, which evaluate the short-term effects of independent variables, show that the relationships in the model are statistically significant. This shows that the effects of independent variables on the dependent variable are evident at the short-term level, as predicted by the model. This analysis is an important tool for evaluating and understanding the model's short-term causal relationships.

4.2. DIAGNOSTICS TESTS

For Italy,

Ramsey Reset Test:

H0: Model Specification is Correct.

HA: Model Specification is Incorrect.

Since the probe value is 0.4267>0.05, H0 hypothesis cannot be rejected. There is no Specification error in the model. The model is set up correctly.

Breusch-Godfrey Serial Correlation LM Test:

H0: There is no serial autocorrelation among errors.

HA: There is Serial Autocorrelation Among Errors.

According to the Breusch-Godfrey LM test result, the hypothesis that there is no serial autocorrelation between errors cannot be rejected. (PROB>0.05) = There is no autocorrelation

ISSN
2822-6895

problem in the series.

Heteroskedasticity Test:

H0: There is no heteroscedasticity between errors.

HA: There is Heteroscedasticity Among Errors.

According to the Heteroskedasticity ARCH test result, the hypothesis that there is no heteroscedasticity between errors cannot be rejected (prob>0.05) = There is no heteroscedasticity problem in the series.

Jarqua-Bera test:

H0: Residuals are suitable for normal distribution.

HA: Residuals Do Not Suit Normal Distribution.

According to the Jarqua-Bera test result, the hypothesis that the residues are suitable for normal distribution cannot be rejected. (prob>0.05). Residues Suit Normal Distribution.

Cusum Squares:

According to the results of Cusum Squares, the parameters have met the stability condition. There is no relationship between the variances.

For Poland,

Breusch-Godfrey Serial Correlation LM Test:

H0: There is no serial autocorrelation among errors.

HA: There is Serial Autocorrelation Among Errors.

According to the Breusch-Godfrey LM test result, the hypothesis that there is no serial autocorrelation between errors cannot be rejected. (PROB>0.05) = There is no autocorrelation problem in the series.

Heteroskedasticity Test:

ISSN
2822-6895

H0: There is no heteroscedasticity between errors.

HA: There is Heteroscedasticity Among Errors.

According to the Heteroskedasticity ARCH test result, the hypothesis that there is no heteroscedasticity between errors cannot be rejected (prob>0.05) = There is no heteroscedasticity problem in the series.

Ramsey RESET Test:

H0: Model Specification is Correct.

HA: Model Specification is Incorrect.

Since the probe value is 0.9920>0.05, H0 hypothesis cannot be rejected. There is no Specification error in the model. The model is set up correctly.

Cusum Squares:

According to the results of Cusum Squares, the parameters have met the stability condition. There is no relationship between the variances.

4.3. VECM TEST

For Italy;

The CointEq(-1) coefficient in the short-term balance model represents the error correction coefficient with a value of -0.693307. The probe value of this coefficient is expected to be less than 0.05. The value of the coefficient is negative and the probe value appears to be negative. This shows that the error correction mechanism is working. It can be said that -0.693307 of the error in the model will be eliminated at the end of a period.

When controlled for the short term, the K coefficient appears to be insignificant. All other coefficients are significant. It seems that the CO2, H, D coefficients are delayed by one period and the W coefficient is positive, and the coefficients other than these coefficients are negative. It can be understood that especially the large CO2 coefficient has a high impact on GDP in the short term. Again, the magnitude of the S, W and W(-1) coefficients leads to the same interpretation.

When we control for the long-term effects of the independent variables, only the independent variables H and K appear to be insignificant. Other independent variables are significant. In particular, the coefficients of the independent variables E, H, L, S are negative.

ISSN
2822-6895

Evaluating the relationship between increases in CO2 emissions and economic growth, this analysis examines the effects of various independent variables on the dependent variable GDP. In particular, the coefficient of the CO2 variable, 49862.237783, shows that the effect of this variable on GDP is quite strong and significant. Increasing CO2 emissions cause a positive impact on GDP in the long term. This indicates the significant effects of environmental factors on economic performance.

It is seen that the value of the E variable is negative and the probe value is significant. Its impact on GDP appears to be positive but low.

The coefficient of the independent variable L is negative and statistically significant at the 5% level. However, it is observed that the impact of this variable on GDP is not high. This suggests that the L variable has a more limited effect on economic growth than other factors.

The coefficient of the independent variable S is negative and appears statistically significant. When the long-term effect of the S variable on GDP is controlled, it appears to be -2997.63. This is a fairly high amount. Its effect is high.

The negative coefficient of the independent variable W indicates that the effect of this variable on GDP is positive. When the coefficient is checked, it appears to be 12594.55. This is again a very high amount.

Table 1

Long Run Coefficients for Italy

Long Run Coefficients

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
CO2	49862.237	9373.87273	5.319278	0.0002
E	-0.051322	0.009792	-5.241055	0.0002
H	-72.86660	152.776893	-0.476948	0.6420
K	0.000000	0.000000	0.387807	0.7050
L	-0.007776	0.003075	-2.528738	0.0265
S	-2997.635	478.197003	-6.268621	0.0000
W	12594.553	2254.19241	5.587169	0.0001
C	76573.060	54945.1329	1.393628	0.1887

For Poland;

The CointEq(-1) coefficient in the short-term balance model represents the error correction coefficient with a value of -0.229776. The probe value of this coefficient is expected to be less than 0.05. The value of the coefficient is negative and the probe value appears to be negative. This shows that the error correction mechanism is working. It can be said that -0.229776 of the error in the model will be eliminated at the end of a period.

When the short-term impact information is checked, it appears that the variables CO2, E and W are insignificant, and the coefficients of all other variables and their lags are significant. It is seen that the short-term effect of a one-period lag of the CO2 variable on GDP is quite high. It can be seen that the effect of the K variable is almost 0.

When controlled in the long term, all independent variables' probe values appear to be insignificant. Any interpretation is not valid on the Dependent variable because it is meaningless.

Table 2

ISSN
2822-6895

Long Run Coefficients for Poland

Long Run Coefficients				
Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
CO2	12889.014	15191.889	0.848414	0.4143
E	-0.048506	0.054457	-0.890724	0.3921
H	23669.883	18369.3163	1.288555	0.2240
K	0.000004	0.000003	1.274834	0.2286
L	-0.037186	0.032297	-1.151352	0.2740
W	2217.0001	1766.7977	1.254813	0.2356
C	618316.43	536018.488	1.153536	0.2731

4.4. EVALUATION

It seems that the effects of the Renewable Energy usage amounts of the Italy which are considered as Developed Countries, on the GDP amounts have a long-term effect. It seems that the correction coefficient of the Vector Error Correction Model in the GDP model of Italy is negative and significant. This shows that increasing the use of Renewable Energy has a positive impact on GDP in the long term.

ISSN
2822-6895

It seems that the effects of Renewable Energy usage amounts on the GDP amounts of Poland which are considered as developing countries, have a long-term effect. It seems that the correction coefficient of the Vector Error Correction Model in the GDP model of Poland is negative and significant. This shows that increasing the use of Renewable Energy has a positive impact on GDP in the long term. It appears that the ARDL hypothesis was rejected in countries. It seems obvious that Renewable Energies have an impact on GDP.

The effect of renewable energy production in the Italy and Poland economies has been examined with ARDL, Causality and VECM models.

Boundary tests were performed for ARDL models established to explain the GDP per capita variable in both countries and the existence of cointegration was demonstrated. According to this result, it has been shown that even if the data are not stationary, they act co-holistic together in the long run. Again, ARDL models established in both countries can successfully pass all assumption tests.

When the long-term coefficients explaining the Italy GDP per capita variable are examined, it is seen that the Capital and Libor variables do not have a long-term effect on the GDP, but Solar and Wind energy production from renewable energy sources is relatively effective.

For the model established to identify the determinants of gross domestic product, when the ARDL limit test results, which passed some diagnostic tests, are examined, the variables. The hypothesis that there is a long-run relationship between variables.

Considering the results of Cusum of Squares and Cusum tests, which investigated whether there was a structural break or not, the hypothesis that there was no structural break between the 1990-2020 periods in the variables in the model is accepted.

5. RESULT

When the developed countries and developing countries selected as examples are checked, it is seen that the effects of renewable energy use on GDP are generally positive. In other words, if the amount of renewable energy usage increases, it will provide a positive increase in the GDP of the countries. Especially the fact that the coefficients of the CO2 type have high and significant coefficients in almost all samples shows that CO2 is an important variable. Although there is no clear distinction between developed countries and developing countries, it can be said that the results of the countries are generally in direct proportion to each other. Considering the effects of the amount of each country's own investments, it is seen that the GDP effects of the variables vary among themselves. However, when controlled at level, it can be said that the effects are generally positive.

In order to understand the effect of renewable energy sources on economic growth in Italy, the

ISSN
2822-6895

stationarity of the data was first investigated in order to avoid the possibility of producing spurious regressions in the simple linear regression approach. It was observed that all data were stationary at 1st difference, except for the wind variable. First of all, it was tried to prove the existence of cointegration in non-stationary data, since the difference equations eliminate long-term trend relationships and highlight short-term relationships. In this way, regression can be established with the normal state of the data by avoiding the phenomenon of spurious regression. The existence of cointegration was demonstrated by the Johansen approach in the tests performed. Finally, traditional econometric tests were performed on the reduced models and the 1-period lags of the residuals were included in the model as a variable for autocorrelation correction.

In the final model that meets the econometric assumptions, the Capital variable and the Solar variable entered the model significantly. Since the variable coefficients are interpreted, a 1% unit increase in the Solar variable (as the model variable is ln(solar)) leads to an increase of 0.03 units on economic growth.

When the data in Poland is examined, the data are not static, as in Italy. And all except Solar are stationary at 1 differences. Co-integration test was performed before going to the difference equations, but unlike the ARDL performed in the 1st section, a cointegration test could not be detected with the Johansen test. Therefore, in order to avoid the phenomenon of spurious regression, the model was established with the 1st order differences of the data. Appropriate and meaningful regression model was investigated with the backward method of difference equations and unlike the ARDL approach made in the first chapter, no significant variable could be found that could show the effect of renewable energy sources on economic growth. The main reason for this situation may be the low number of observations in the sample data and the investments made in renewable energy sources in Poland accelerated much later than in Italy.

SOURCES

1. Altinay, G., & Karagol, E. (2005). Electricity consumption and economic growth: evidence from Turkey. Energy economics, 27(6), 849-856.
2. Chien, T., & Hu, J. L. (2007). Renewable energy and macroeconomic efficiency of OECD and non-OECD economies. Energy Policy, 35(7), 3606-3615.
3. Chontanawat, J., Hunt, L. C., & Pierse, R. (2008). Does energy consumption cause economic growth?: Evidence from a systematic study of over 100 countries. Journal of policy modeling, 30(2), 209-220.
4. Apergis, N., & Payne, J. E. (2010). Renewable energy consumption and growth in Eurasia. Energy economics, 32(6), 1392-1397.
5. Menyah, K., & Wolde-Rufael, Y. (2010). Energy consumption, pollutant emissions and economic growth in South Africa. Energy economics, 32(6), 1374-1382.
6. Bayraktutan, Y., Yılgör, M., & Uçak, S. (2011). Renewable electricity generation and economic growth: Panel-data analysis for OECD members.
7. Menegaki, A. N. (2011). Growth and renewable energy in Europe: A random effect model with evidence for neutrality hypothesis. Energy economics, 33(2), 257-263.
8. Al-Mulali, U., Fereidouni, H. G., Lee, J. Y., & Sab, C. N. B. C. (2013). Examining the bi-directional long run relationship between renewable energy consumption and GDP growth. Renewable and sustainable energy reviews, 22, 209-222.

9. Pempetzoglou, M. (2014). Electricity consumption and economic growth: A linear and nonlinear causality investigation for Turkey. International Journal of Energy Economics and Policy, 4(2), 263-273.
10. Sebri, M. (2015). Use renewables to be cleaner: Meta-analysis of the renewable energy consumption–economic growth nexus. Renewable and Sustainable Energy Reviews, 42, 657-665.
11. Shahbaz, M., Loganathan, N., Zeshan, M., & Zaman, K. (2015). Does renewable energy consumption add in economic growth? An application of auto-regressive distributed lag model in Pakistan. Renewable and Sustainable Energy Reviews, 44, 576-585.
12. Alper, A., & Oguz, O. (2016). The role of renewable energy consumption in economic growth: Evidence from asymmetric causality. Renewable and Sustainable Energy Reviews, 60, 953-959.
13. Dai, H., Xie, X., Xie, Y., Liu, J., & Masui, T. (2016). Green growth: The economic impacts of large-scale renewable energy development in China. Applied energy, 162, 435-449.
14. Zaman, K., bin Abdullah, A., Khan, A., bin Mohd Nasir, M. R., Hamzah, T. A. A. T., & Hussain, S. (2016). Dynamic linkages among energy consumption, environment, health and wealth in BRICS countries: green growth key to sustainable development. Renewable and Sustainable Energy Reviews, 56, 1263-1271.
15. Koçak, E., & Şarkgüneşi, A. (2017). The renewable energy and economic growth nexus in Black Sea and Balkan countries. Energy Policy, 100, 51-57.
16. Rafindadi, A. A., & Ozturk, I. (2017). Impacts of renewable energy consumption on the German economic growth: Evidence from combined cointegration test. Renewable and Sustainable Energy Reviews, 75, 1130-1141.
17. Halicioglu, F., & Ketenci, N. (2018). Output, renewable and non-renewable energy production, and international trade: Evidence from EU-15 countries. Energy, 159, 995-1002.
18. Ohlan, R. (2018). The relationship between electricity consumption, trade openness and economic growth in India. OPEC Energy Review, 42(4), 331-354.
19. Sohag, K., Taşkın, F. D., & Malik, M. N. (2019). Green economic growth, cleaner energy and militarization: Evidence from Turkey. Resources Policy, 63, 101407.
20. Dogan, E., Altinoz, B., Madaleno, M., & Taskin, D. (2020). The impact of renewable energy consumption to economic growth: a replication and extension of. Energy Economics, 90, 104866.
21. Munir, Q., Lean, H. H., & Smyth, R. (2020). CO2 emissions, energy consumption and economic growth in the ASEAN-5 countries: a cross-sectional dependence approach. Energy Economics, 85, 104571.
22. Okumus, I., Guzel, A. E., & Destek, M. A. (2021). Renewable, non-renewable energy consumption and economic growth nexus in G7: fresh evidence from CS-ARDL. Environmental Science and Pollution Research, 28(40), 56595-56605.
23. Salari, M., Kelly, I., Doytch, N., & Javid, R. J. (2021). Economic growth and renewable and non-renewable energy consumption: Evidence from the US states. Renewable Energy, 178, 50-65.
24. Alataş, S. (2022). Green Economıc Growth and Renewable Energy Consumption: Empirical Evidence From Emerging Countries. Uluslararası Yönetim İktisat ve İşletme Dergisi, 18(1), 1-14.
25. Wang, Q., Wang, L., & Li, R. (2022). Renewable energy and economic growth revisited: The dual roles of resource dependence and anticorruption regulation. Journal of Cleaner Production, 130514.
26. Apergis, N., & Payne, J. E. (2012). Renewable and non-renewable energy consumption-growth nexus: Evidence from a panel error correction model. Energy economics, 34(3), 733-738.

27. Inglesi-Lotz, R. (2016). The impact of renewable energy consumption to economic growth: A panel data application. Energy economics, 53, 58-63.
28. Altinay, G., Karagol, E., 2004. Structural break, unit root, and the causality between energy consumption and GDP in Turkey. Energy Economics 26, 985–994.
29. Abbasi, K. R., Shahbaz, M., Zhang, J., Irfan, M., & Alvarado, R. (2022). Analyze the environmental sustainability factors of China: The role of fossil fuel energy and renewable energy. Renewable Energy, 187, 390-402.
30. Bekun, F. V., Alola, A. A., & Sarkodie, S. A. (2019). Toward a sustainable environment: Nexus between CO2 emissions, resource rent, renewable and nonrenewable energy in 16-EU countries. Science of the Total Environment, 657, 1023-1029.
31. Pata, U. K., & Caglar, A. E. (2021). Investigating the EKC hypothesis with renewable energy consumption, human capital, globalization and trade openness for China: evidence from augmented ARDL approach with a structural break. Energy, 216, 119220.
32. Ecevit, E., Çetin, M., & Yücel, A. G. Türkiye'de Yenilenebilir Enerji ve Sağlık: Eşbütünleşme ve Nedensellik Analizi. Erciyes Akademi, 36(1), 138-156.
33. Ali, Q., Yaseen, M. R., Anwar, S., Makhdum, M. S. A., & Khan, M. T. I. (2021). The impact of tourism, renewable energy, and economic growth on ecological footprint and natural resources: A panel data analysis. Resources Policy, 74, 102365.
34. Bulut, U. (2021). Environmental sustainability in Turkey: an environmental Kuznets curve estimation for ecological footprint. International Journal of Sustainable Development & World Ecology, 28(3), 227-237.
35. Oguzturk, B. S., & Özbay, F. (2022). The Relationship between Green Innovation, CO2 Emissions, Gross Domestic Product, and Renewable Energy Supply: A Panel Data Analysis for BRICS Countries and Turkey. Istanbul Business Research, 51(1).
36. Fatih, O. K. U. R., & Yılmaz, H. An Investigation of The Relationship Between Individual Energy Consumption And Economic Growth: The Future Perspective By Using The ANN Method. JOEEP: Journal of Emerging Economies and Policy, 7(1), 137-148.
37. Oğuz, Ö. C. A. L., & Volkan, H. A. N. (2022). How does Financial Development and Economic Growth affect Energy Consumption; The Panel VAR Analysis of 5 Turk Countries. Cumhuriyet Üniversitesi İktisadi ve İdari Bilimler Dergisi, 23(1), 385-402.
38. Koçak, E., & Okyay, U. Ç. A. N. Yenilenebilir Enerji ile İstihdam Arasındaki İlişki. Niğde Ömer Halisdemir Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 3(1), 99-112.
39. Özeş Özgür, Ü. R., & Çağatay, S. (2022). Yenilenebilir enerji kullanımı ve büyüme-su tüketimi-sera gazı salımı ilişkisi: sektörel bir analiz. International Journal of Management Economics & Business/Uluslararasi Yönetim Iktisat ve Isletme Dergisi, 18(1).
40. Khajehpour, H., Miremadi, I., Saboohi, Y., & Tsatsaronis, G. (2020). A novel approach for analyzing the effectiveness of the R&D capital for resource conservation: Comparative study on Germany and UK electricity sectors. Energy Policy, 147, 111792.
41. Miao, Y., Razzaq, A., Adebayo, T. S., & Awosusi, A. A. (2022). Do renewable energy consumption and financial globalisation contribute to ecological sustainability in newly industrialized countries?. Renewable Energy, 187, 688-697.
42. Ullah, A., Ahmed, M., Raza, S. A., & Ali, S. (2021). A threshold approach to sustainable development: Nonlinear relationship between renewable energy consumption, natural resource rent, and ecological footprint. Journal of Environmental Management, 295, 113073.
43. Wen, J., Okolo, C. V., Ugwuoke, I. C., & Kolani, K. (2022). Research on influencing factors of renewable energy, energy efficiency, on technological innovation. Does trade, investment and human capital development matter?. Energy Policy, 160, 112718.
44. Yasmeen, R., Tao, R., Jie, W., Padda, I. U. H., & Shah, W. U. H. (2022). The repercussions of business cycles on renewable & non-renewable energy consumption structure: Evidence from OECD countries. Renewable Energy, 190, 572-583.

45. Türkmen, A., Yarbaşı, İ. Y., & Emsen, Ö. S. Mekânsal Panel Veri Analizleri Vasıtasıyla, Enerji Tüketiminde Yakınsamanın İl Düzeyinde Tespiti: Türkiye Örneği. MANAS Sosyal Araştırmalar Dergisi, 11(2), 572-587.
46. Bouyghrissi, S., Berjaoui, A., & Khanniba, M. (2021). The nexus between renewable energy consumption and economic growth in Morocco. Environmental Science and Pollution Research, 28(5), 5693-5703.
47. Bakirtaş, İ., & Çetin, M. (2016). Yenilenebilir enerji tüketimi ile ekonomik büyüme arasındaki ilişki: G-20 ülkeleri. Sosyoekonomi, 24(28), 131-146.
48. Durğun, B., & Durğun, F. (2018). Yenilenebilir enerji tüketimi ile ekonomik büyüme arasında nedensellik ilişkisi: türkiye örneği. International Review of Economics and Management, 6(1), 1-27.
49. Mukhtarov, S. (2022). The relationship between renewable energy consumption and economic growth in Azerbaijan. International Journal of Energy Economics and Policy, 12(1), 416-419.
50. Basri, R., Ferdous, J., Ali, M. R., & Basri, R. (2021). Renewable Energy Use, Real GDP, and Human Development Index in Bangladesh: Evidence from Simultaneous Equation Model.
51. Darvishi, H., & Varedi, S. (2018). Assessment of the Contemporaneous Impacts of Gross Domestic Product and Renewable Energy Consumption, Applying the Dynamic Panel Data: Evidence from Developed Countries. International Journal of Energy Economics and Policy, 8(1), 159-166.
52. Cvijović, J., Obradović, T., & Knežević, S. (2020). A literature survey on relationship between renewable energy consumption and economic growth. Економика пољопривреде, 67(3), 991-1010.
53. Busu, M. (2020). Analyzing the impact of the renewable energy sources on economic growth at the EU level using an ARDL model. Mathematics, 8(8), 1367.
54. Chen, C., Pinar, M., & Stengos, T. (2020). Renewable energy consumption and economic growth nexus: Evidence from a threshold model. Energy Policy, 139, 111295.
55. Brożyna, J., Mentel, G., & Szetela, B. (2017). Renevable energy and economic development in the European Union. Acta Polytechnica Hungarica, 14(7), 11-34.
56. Neagu, O., Haiduc, C., & Anghelina, A. (2021). Does Renewable Energy Matter for Economic Growth in Central and Eastern European Countries? Empirical Evidence from Heterogeneous Panel Cointegration Analysis. Studia Universitatis Vasile Goldiș Arad, Seria Științe Economice, 31(1), 34-59.
57. Li, R., & Leung, G. C. (2021). The relationship between energy prices, economic growth and renewable energy consumption: Evidence from Europe. Energy Reports, 7, 1712-1719.
58. Zhou, A., & Li, J. (2019). Heterogeneous role of renewable energy consumption in economic growth and emissions reduction: evidence from a panel quantile regression. Environmental Science and Pollution Research, 26(22), 22575-22595.
59. Sohag, K., Husain, S., Hammoudeh, S., & Omar, N. (2021). Innovation, militarization, and renewable energy and green growth in OECD countries. Environmental Science and Pollution Research, 28(27), 36004-36017.
60. Ben Jebli, M., & Ben Youssef, S. (2015). Economic growth, combustible renewables and waste consumption, and CO2 emissions in North Africa. Environmental Science and Pollution Research, 22(20), 16022-16030.
61. Recepoğlu, M., & Doğanay, M. A. (2022). Renewable Energy Consumption, CO2 Emissions and Economic Growth: A Comparative Analysis on G7 and BRICS-T Countries. Current Debates on Sustainable Development, 273.
62. Singh, N., Nyuur, R., & Richmond, B. (2019). Renewable energy development as a driver of economic growth: Evidence from multivariate panel data analysis. Sustainability, 11(8), 2418.

ISSN
2822-6895

63. Šimelytė, A., & Dudzevičiūtė, G. (2017). Consumption of renewable energy and economic growth. In Contemporary issues in business, management and education'2017: 5th international scientific conference, 11-12 May 2017, Vilnius Gediminas Technical University: conference proceedings (pp. 1-10). VGTU Press.
64. Wu, Z., Hou, G., & Xin, B. (2020). The causality between participation in GVCs, renewable energy consumption and CO2 emissions. Sustainability, 12(3), 1237.
65. Cengiz, O., & Manga, M. The causal lınkages between renewable energy consumptıon, economıc growth, oıl prıces and co2 emıssıons in selected oecd countrıes. Verimlilik Dergisi, (3), 165-183.

Note: Uluslararası Akdeniz Bilimsel Çalışmalar Kongresi 08-09 Haziran 2024 tarihinde bildiri olarak yayinlanmistir.