İzmir İktisat Dergisi
İzmir Journal of Economics

E-ISSN: 1308-8505 **Year:** 2024 **Vol:** 39 **No:** 2 **Pages:** 361-374
Received: 28.09.2023 **Accepted:** 26.01.2024 **Published Online:** 05.04.2024 **Doi:** 10.24988/ije.1368048
RESEARCH ARTICLE

Impact of Global Climate Change on The Labour Market: Evidence from Türkiye*

Olcay BESNİLİ MEMİŞ [1] , Faruk SAPANCALI [2]

Abstract

In the literature, the relationship between climate change and the labour market is discussed in terms of whether climate policies create employment opportunities or increase unemployment. Therefore, whether the transition to renewable energy will increase unemployment or create employment opportunities is an important research topic. This study aims to investigate the relationship between unemployment and the use of renewable energy by focusing on the Turkish labour market. In the study, the Augmented Autoregressive Distributed Lag test is applied to determine the short and long-run relationships of the variables with annual data for the period 1990-2019 obtained from the International Energy Agency and TurkStat databases. The results of the study show that in the long-run, a 1% increase in non-renewable energy reduces unemployment by 1.64%, while renewable energy reduces unemployment by 2.03%. In the short-run, every 1% increase in the use of renewable energy reduces unemployment by 1.06%, while a 1% increase in the use of non-renewable energy reduces unemployment by 1.31%. In this context, it is possible to say that non-renewable energy sources have a greater impact on unemployment in the short-run. The results of the research suggest that climate policies focussing on energy in Turkey can help fight unemployment.

Keywords: *Renewable energy, unemployment, labour market, ARDL, Türkiye*
Jel Codes: *Q28, J64, C32*

Küresel İklim Değişikliğinin İşgücü Piyasasına Etkisi: Türkiye'den Kanıtlar

Özet

Literatürde, iklim değişikliği ve işgücü piyasası arasındaki ilişki iklim politikalarının iş fırsatları yaratması ve işsizliği artırması üzerinden tartışılmaktadır. Bu nedenle, yenilenebilir enerji geçişinin işsizliği artırıp artırmayacağı veya istihdam fırsatları yaratıp yaratacağı önemli bir araştırma konusu olarak karşımıza çıkmaktadır. Bu çalışma, Türkiye işgücü piyasasına odaklanarak işsizlik ile yenilenebilir enerji kullanımı arasındaki ilişkiyi incelemeyi amaçlamaktadır. Çalışmada, Uluslararası Enerji Ajansı ve TÜİK veri tabanlarından elde edilen 1990-2019 dönemindeki yıllık verilerle değişkenlerin kısa ve uzun vadeli ilişkilerini belirlemek için Augmented Autoregressive Distributed Lag testi uygulanmaktadır. Araştırmanın sonuçları, uzun dönemde yenilenemeyen enerjideki %1'lik bir artışın işsizliği %1,64 azalttığını, ancak yenilenebilir enerjinin işsizliği %2,03 azalttığını göstermektedir. Kısa dönemde ise yenilenebilir enerji kullanımındaki her %1'lik artış, işsizlik oranını %1,06 azaltırken, yenilenemeyen enerji kullanımındaki %1'lik artış işsizlik oranını %1,31 azaltmaktadır. Bu bağlamda, kısa vadede yenilenebilir olmayan enerji kaynaklarının işsizlik üzerinde daha büyük bir etkiye sahip olduğunu söylemek mümkündür. Araştırmanın sonuçları, Türkiye'de yenilenebilir enerjiye odaklanan iklim politikalarının işsizlikle mücadeleye yardımcı olabileceğini göstermektedir.

Anahtar kelimeler: *Yenilenebilir enerji, işsizlik, işgücü piyasası, ARDL, Türkiye*
Jel Kodu: *Q28, J64, C32*

CITE (APA): Besnili Memiş, O., Sapancalı, F. (2024). Impact of Global Climate Change on The Labour Market: Evidence from Türkiye. *İzmir İktisat Dergisi*. 39(2). 361-374. Doi: 10.24988/ije.1368048

[1] Dr. Research Assistant, Atatürk University, Faculty of Economics and Administrative Sciences, Department of Labour Economics and Industrial Relations, Erzurum, Türkiye

EMAIL: olcay.besnili@atauni.edu.tr **ORCID:** 0000-0003-1821-2143

[2] Professor Dr., Dokuz Eylül University, Faculty of Economics and Administrative Sciences, Department of Labour Economics and Industrial Relations, Izmir, Türkiye

EMAIL: faruk.sapancali@deu.edu.tr **ORCID:** 0000-0002-7443-6283

* This article is based on the PhD thesis supervised by Prof. Dr. Faruk Sapancalı, which was completed on 07.10.2022 at Dokuz Eylül University Social Sciences Institute entitled "The Impact of Global Climate Change on the Labour Market: An Empirical Assessment in the context of Unemployment in Turkey".

1. INTRODUCTION

The impact of climate change on the labour market varies according to whether jobs depend on ecosystem services and energy consumption preferences. Climate change policies currently focus on reducing carbon emissions and transitioning to renewable energy (REW). In addition to the need to reduce carbon emissions, REW is recognized as an important policy for ensuring the security of energy supply, promoting technological development, facilitating regional development, and creating jobs (Ram, Aghahosseini, and Breyer, 2020). In this sense, it is expected to bring about a fundamental change, especially in the labour market. For the transition to REW to be effective as a climate change policy, carbon-intensive energy sectors should also be subject to certain sanctions. In this sense, policies such as increasing prices or tax burdens to discourage the use of carbon-intensive energy will lead to the destruction of jobs as well as the loss of capital stock (Babiker and Eckaus, 2007; Dechezlepretre and Sato, 2017; Greenstone, 2002; Hafstead and Williams, 2018; Herrera, 2018). However, the transition to REW is relied upon to lead to economies of scale and comparative advantage to compensate for losses in carbon-intensive sectors (Ram et al., 2020). However, some studies suggest that the jobs created by REW investments do not compensate for the jobs lost (Chateau and Saint-Martin, 2010; Doorey, 2017; ILO, 2018a; Martinez-Fernandez, Ranieri, Sharpe, 2014; Montt, Wiebe, Harsdorff, Simas, Bonnet, and Wood, 2018; Morriss, Bogart, Dorchak, and Meiners, 2010; Rivers, 2013). Structural reasons such as labour quality or the general economic situation and type of REW have been proposed as reasons for this situation (Aragón, Rud, and Toews, 2018; Cai, Wang, Chen, and Wang, 2011; Dordmond, Oliveira, Silva, and Swart, 2021; Gueye and Fyfe, 2015; Hafstead and Williams, 2018). The positive effect is transitory and appears during the establishment phase and then continues to increase the unemployment rate (Henriques, Coelho, and Cassidy, 2016; Morriss et al., 2010), and positive employment effects are analysed independently of the region, country, working life culture, and technologies (Lambert and Silva, 2012; Sastresa, Usón, Bribián, and Scarpelleni, 2010).

In this study, an attempt is made to examine the relationship between unemployment levels in the Turkish economy and REW, aiming to reveal the impact of global climate change on the labour market. The paper is organized as follows: Section 1 briefly reviews the literature. Section 2 depicts the methodology and econometric model. Section 3 focuses on empirical results and the short and long-run relationships between the unemployment rate and REW consumption, and the final section presents results and discussions.

2. RELATED LITERATURE: GLOBAL CLIMATE CHANGE AND THE LABOUR MARKET

The dynamics of global climate change on the labour market differ depending on whether jobs depend on ecosystem services or not. When jobs are directly dependent on ecosystem services, such as in the agriculture, fisheries, livestock, forestry, and tourism sectors, they are also directly dependent on factors such as climate, air, soil, water, plants, and animals on which ecosystems depend. In these sectors, job destruction is expected to occur due to the disruption of ecosystem services (ILOa, 2018: 28). Furthermore, while jobs are not directly dependent on ecosystem services, they are undoubtedly dependent on energy consumption. Thus, the change and transformation of energy sources due to climate change is also an important factor affecting the labour market. Climate policy focuses on the consumption of REW as an alternative to polluting fossil energy. The REW sector is concerned with the production of energy from sources such as solar, wind, hydroelectric, biomass, and geothermal. The transition to REW will affect the labour market in two ways. First, as a sector with high growth potential, it will lead to the creation of new jobs in the labour market, especially in engineering, software development, data analysis, and other related fields. (citation) Second, it will lead to the disappearance of jobs in the NREW sector and new regulations that will make this sector unattractive (Deschenes, 2013). Regulations such as increasing fossil fuel prices (Herrera, 2018) or increasing taxes on fossil fuel use (Hafstead and Williams, 2018: 55) may lead to capital stock losses (Greenstone, 2002) or shutdowns, reducing the demand for labour in the relevant sectors and leading to increased unemployment (Babiker and Eckaus: 605). The contraction of employment due to a decrease in labour demand will create a domino effect across all sectors, leading to a larger economic problem. Thus, it will no longer matter whether a sector is dependent on ecosystem services or not (ILOc, 2018: 19).

Sectors are not always expected to shut down as a result of climate change policies; rather, they will be able to transform themselves technically and technologically in order to increase efficiency in the use of natural resources and aim for environmentally-conscious production (ILOa, 2018: 187). This transformation also leads to changes and transformations in structural characteristics, such as the type of production mode, energy preference, or waste management (International Panel on Climate Change (IPCC, 2014: 85). In particular, the transition to REW represents the largest part of this transformation. However, investments in REW depend on significant economic planning and financial support, making it difficult for developing countries to realize this transformation immediately. For this reason, it is expected that the increase in unemployment due to the destruction of jobs and sectors will be more pronounced in such countries (Vona, Marin, and Consoli, 2019: 1023).

While the costly transition to REW leads to an increase in production costs, it ultimately leads to an increase in product prices (Montt et al., 2018: 521-522). Thus, by jeopardising the demand for goods and services that are subject to production, it triggers a demand-driven economic contraction and causes a reduction in employment (Dechezlepretre and Sato, 2017). However, it is expected that the share of electricity generated from REW resources will increase in the generation technologies, and therefore the price of electricity will be higher. Undoubtedly, electricity consumption will be an important expenditure item for consumers, and they will spend most of their disposable income on energy. In this case, consumers' purchasing power will shrink and they will have less demand for goods and services produced in other sectors. As low demand means low production and investment, other sectors may be adversely affected (Frondel, Ritter, Schmidt, and Vance, 2010: 4053). Moreover, as more investment is allocated to the REW sector, investment and development prospects in other sectors will decline. Such a 'crowding out' effect will therefore negatively affect the growth of other industries. Thus, the destruction of other sectors and jobs will intensify and accelerate (Sooriyaarachchi, Tsai, El Khatib, Farid, and Mezher, 2015: 654).

While the transition to REW enables the use of new forms of production, it also leads to a change in the skills that determine the demand for labour. The demand for skills is expected to increase with a focus on soft skills. Despite the job creation potential of REW investments, the supply of labour may not be able to meet the demand for skills. In particular, low-skilled labour employed in carbon-intensive sectors may become unemployed, and for them, unemployment will become structural (Rivers, 2013, Doorey, 2017: 27).

Recent literature explains the relationship between climate change and the labour market through the relationship between REW consumption and unemployment or employment. The studies are generally based on input-output and scenario analysis (Böhringer, Keller, and van der Werf, 2012; Böhringer, Rivers, Rutherford, and Wigle, 2013; Bulavskaya and Reynès, 2018; Cai et al., 2011; Cai, Mu, Wang, and Chen, 2014; Dvořák, Martinát, Van der Horst, Frantál and Turečková, 2017; Hondo and Moriizumi, 2017; Kolsuz and Yeldan, 2017; Küster, Ellersdorfer, and Fahl, 2007; Mu, Cai, Evans, Wang, and Roland-Holst, 2018; Oliveira, Cassidy, and Coelho, 2014; Simas and Pacca, 2014; Wei, Patadia, and Kammen, 2010); time series and panel data analysis methods (Agpak and Ozcicek, 2018; Apergis and Salim, 2015; Bekmez and Agpak, 2016; Dincer and Karakus, 2020; Henriques et al., 2016; Markandya, Arto, González-Eguino, and Román, 2016; Proença and Fortes, 2020; Rafiq, Salim, and Sgro, 2018; Saboori, Gholipour, Rasoulinezhad, and Ranjbar, 2022; Tatli and Barak, 2019; Telli, Voyvoda, and Yeldan, 2008; Yilanci, Islamoglu, Yildirimalp, and Candan, 2020; Zhao and Luo, 2017).

Hillebrand, Buttermann, Behringer, and Bleuel (2006) examined the impact of increasing the share of REW on unemployment in Germany and found that the number of jobs created gradually decreased, increasing costs reduced economic growth, and unemployment increased. Küster et al. (2007) showed that investment subsidies for REW in EU countries increased unemployment rates. Wei et al. (2010) found that the employment effect varied by type of REW in the US from 2009 to 2030. Cai et al. (2011) showed that jobs created as a result of REW solutions in the power generation sector in China increased from 2006 to 2010 and, if supported by an education system that regulates skills, would increase employment by 0.68 percent. Böhringer et al. (2012) found that the REW incentive policy implemented in Ontario, Canada, increased employment as well as the overall unemployment rate and decreased the labour force participation rate. Böhringer et al. (2013) reported that REW solutions for the electricity generation sector in Germany remain limited. Rivers (2013) showed that the transition to renewable electricity generation increased unemployment in the US over the period 2007-2010. Cai et al. (2014) found that REW initiatives in China for the period 2011-2020 increased unemployment, with women being particularly affected.

Oliveira et al. (2014) concluded that the use of REW in the UK did not create the expected number of jobs with projections for 2020. For Portugal between 2008 and 2020, Henriques et al. (2016) reached similar conclusions. Simas and Pacca (2014) found that wind energy only created employment effects during the installation phase. Apergis and Salim (2015) showed the positive effects of REW consumption on unemployment for a sample of 80 countries over the period 1990-2013. Markandya et al. (2016) examined the net employment effects of the transformation of the EU energy sector from NREW to REW between 1995 and 2009 and found that 0.24% of total employment in 2009 was due to the transformation. However, the unemployment situation was interpreted differently for each country. Dvořák et al. (2017) found that investment in REW in the Czech Republic in 2008-2013 was mainly in rural areas, with the highest rates in companies processing biomass and waste energy. Hondo and Moriizumi (2017) reported significant differences in employment effects across nine different production technologies in Japan in 2011, with the highest number of jobs created in the trade, finance, accounting, and insurance sectors. Zhao and Luo (2017) stated that there is insufficient evidence of the impact of REW production on unemployment in China. Bulavskaya and Reynes (2018) predicted that the use of REW in the Netherlands would reduce unemployment by 2030. Rafiq et al. (2018) showed that the use of REW in 41 countries between 1980 and 2014 reduced unemployment in the industrial services sector but increased it in the agricultural sector. Mu et al. (2018) found that the use of solar and wind energy in China did not reduce unemployment, although it has the potential to create jobs. Chen (2019) predicts that REW investment in China will create about twice as many jobs as the same amount of spending on fossil fuels, but more than 70% of jobs in the REW sector will be created through informal economic activities. Dincer and Karakus (2020) showed that there was a co-integration relationship between REW investment and employment in G7 countries over the period 1991-2018. Proença and Fortes (2020) found that every 1% increase in REW generation capacity in EU Member States over the period 2000-2016 leads to a 0.48% increase in employment. Yilanci et al. (2020) found that the employment effect of REW technologies in OECD countries varies across countries. Saboori et al. (2022) found that NREW provided employment in 19 out of 51 states in the US between 1977 and 2017, while REW provided employment in 6 states.

In the literature, one of the first studies on Türkiye, or including Türkiye. First, Telli et al. (2008) concluded that energy taxes would increase unemployment in the period 2006-2020. Bekmez and Agpak (2016) showed that there was a unidirectional causality between REW consumption other than hydropower and employment in low- and middle-income countries and no causality in high-income countries for 80 countries in the period 1991-2014. Kolsuz and Yeldan (2017) showed that renewable technologies, institutional innovations, and environmental taxes could increase employment in Türkiye for 2020 and 2030. Agpak and Ozcicek (2018) showed that there was a negative relationship between REW use and employment in 59 countries in the period 1991-2014.

3. METHOD AND MODELLING

Granger (1981) was the first to introduce the concept of co-integration and give examples of how these series are generated. Granger and Engle (1987) developed the concepts of co-integration ($C_t = C_{p,t} + \mu_t = \beta_1 Y_1 + \mu_t$) and error correction. Error correction shows the short-run dynamics and provides information on the process by which deviations are corrected. They also assumed that all components of an economic vector Xt are I(1) of the same order. Since ignoring lagged values of variables in the Engle and Granger (1987) co-integration test leads to spurious regression, the autoregressive distributed lag (ARDL) model has been developed. ARDL is a test designed to explain the autoregressive relationship between variables. The f-statistic obtained when testing the hypothesis is compared using the Pesaran, Shin, and Smith (2001) table of critical values, which includes lower and upper bounds. However, it is preferable for time series with a small number of observations without taking into account the unit root integration of the variables (Phillips and Perron, 1988). Therefore, it is often used in research as it offers possibilities for non-stationary variables where co-integration is equivalent to an error correction mechanism (Hassler and Wolters, 2016).

In order to empirically analyse the impact of REW consumption on unemployment in Türkiye using ARDL methodology, the data for the period between 1990 and 2019 were used. Regression models with unemployment as the dependent variable and REW and NREW consumption as explanatory variables have been frequently used in the literature (Agpak and Ozcicek, 2018; Apergis and Salim, 2015; Khodeir, 2016; Saboori et al., 2022; Tatli and Barak, 2019). Unlike other studies, the urban population, whose relationship with unemployment has been ignored, was added as a variable (Rafiq et al., 2018). The urban population is recognized as an important variable in terms of both unemployment and climate change. Cities focus on population, energy use, production, and consumption (Creutzig, Agoston, Minx, Canadell, Andrew, Le Quéré, Peters, Sharifi, Yamagata, and Dhakal, 2016). Due to their infrastructural characteristics and the benefits of using these characteristics, they bring higher economic growth, and therefore, their environmental damage is expected to be high (Ahmad, Zhao, and Li, 2019). In addition, carbon emission rates and unemployment rates are high due to rural-urban migration (Creutzig, Baiocchi, Bierkandt, Pichler, and Seto, 2015; Yu, 2021). The model is shown below in simplified form:

$UNEM_T = f(REW_T, NREW_T, URB_T)$

In the model, ($UNEM_T$) represents the unemployment rate in Türkiye, (REW_T) represents the consumption of REW in Türkiye, ($NREW_T$) represents the consumption of NREW in Türkiye, and (URB_T) represents the urban population in Türkiye. In the model, urb is included as an explanatory variable for unemployment. The data on energy were obtained from the International Energy Agency and unemployment and urban population data were obtained from the Turkstat. All variables in the models are in logarithmic form, and their descriptive statistics are presented in the table below.

Table 1: Descriptive Statistics

	$lnUNEM_T$	$lnREW_T$	$lnNREW_T$	$lnURB_T$
Mean	9.590	12.617	14.499	17.628
Median	9.850	12.642	14.477	17.634
Maximum	14.000	12.686	14.995	17.960
Minimum	6.500	12.468	14.007	17.275
Std. Dev.	0.298	0.065	0.306	0.204
Skewness	0.205	-1.089	0.007	-0.043
Kurtosis	2.103	2.882	1.818	1.839
Jarque-Bera	1.488	5.950	1.745	1.691
Probability	0.783	0.151	0.417	0.429

The descriptive statistics of the whole data set are within the expected ranges. Therefore, no significant problem is detected.

4. EMPIRICAL RESULTS

4.1 Unit Root Test Results

In order to obtain reliable results in time series studies, the series must satisfy the condition of stationarity. To this end, an augmented Dickey–Fuller, 1981 (ADF), Phillips-Perron, 1988 (PP), and one-break unit root test developed by Zivot and Andrews, 1992 (ZA) were used to test the stationarity of the variables used in the study.

Table 2: Unit root test ($UNEM_T$, REW_T, $NREW_T$, URB_T)

ADF				
Variables	**Level**		**First Difference**	
	Intercept	Intercept+Trend	Intercept	Intercept+Trend
$lnUNEM_T$	-1.066(0.715)	-2.200(0.471)	-4.766(0.000)***	-4.176(0.003)***
$lnREW_T$	-0.468(0.883)	-2.309(0.415)	-6.686(0.000)	-5.931(0.000)***
$lnNREW_T$	-0.555(0.865)	-5.012(0.001)***	-	-
$lnURB_T$	-1.731(0.404)	-3.572(0.051)**	-	-
PP				
Variables	**Level**		**First Difference**	
	Intercept	Intercept+Trend	Intercept	Intercept+Trend
$lnUNEM_T$	-1.050(0.721)	-2.179(0.482)	-3.879(0.000)***	-3.828(0.000)***
$lnREW_T$	-0.009(0.950)	-2.148(0.499)	-6.948(0.000)***	-9.868(0.000)***
$lnNREW_T$	-0.423(0.892)	-4.999(0.002)***	-	-
$lnURB_T$	-2.637(0.097)*	-3.959(0.022)**	-	-
ZA				
Variables	**Level**		**First Difference**	
	Test statistics	Break date	Test statistics	Break date
$lnUNEM_T$	-3.471	2001	-7.113	2001**
$lnREW_T$	-4.812	2014	-5.078	2014***
$lnNREW_T$	-5.649**	2001	-5.568	1999
$lnURB_T$	-5.591**	2001	-9.095	2001
Notes: The symbols *,**,*** denote the variables at 10%, 5%, 1%, respectively. It expresses the significance at the level of significance.				

The lag length was chosen as 2, as the data are annual time series (Johnston and Dinardo, 1997). According to the ADF and PP tests, while urban population and $NREW_T$ are stationary at level, REW_T and unemployment contain a unit root. When the ZA test is taken into account, it gives results that support the traditional ADF test, and it is understood that the test statistic is greater than the critical values and the structural breaks are insignificant. It is observed that the urban population becomes stationary only in the model with constants and trends. In this context, it should be noted that the study should be constructed with ARDL models with trend. Accordingly, the ARDL model with a constant and restricted trend is as shown in the equation below:

$$lnUNEMT_t = \alpha_0 + \alpha_1 t + \sum_{i=0}^{p} \psi lnUNEMT_{t-i} + \sum_{j=0}^{q1} \beta_{1j} lnREWT_{t-j} + \sum_{j=0}^{q2} \beta_{2j}\, lnNREWT_{t-j} + \sum_{j=0}^{q3} \beta_{3j} lnURBT_{t-j} + \varepsilon_t$$

In the equation, α_0 is the constant term, α_1 is the linear trend coefficient, ψi is the lagged coefficient of the dependent variable, k is the independent variable's lagged coefficient, and ε_t is the error term.

4.2 ARDL Test Results

In order to estimate the long-run and short-run coefficients and compute the f-bounds test, the ARDL (2,0,0,1) model was constructed as shown in the equation below. The results of the model are presented in the table below.

Table 3: Estimation and co-integration results of ARDL (2,0,0,1)

Variable	Coefficient	t- statistics	Prob.
$lnUNEM_T$ (-1)	0.668	4.453	0.000***
$lnUNEM_T$ (-2)	-0.314	-2.004	0.058*
$lnREW_T$	-1.062	-2.210	0.038**
$lnNREW_T$	-1.314	-4.570	0.000***
$lnURB_T$	-45.767	-3.235	0.004***
$lnURB_T$ (-1)	38.503	2.999	0.007***
C	167.648	1.917	0.069*
@TREND	0.223	1.910	0.070*
Diagnostic Tests			
Breusch-Godfrey LM	1.136 (0.343)		
Jargue-Bera	0.600 (0.970)		
Breusch-Pagan-Godfrey	1.389(0.263)		
RESET Test	0.592 (0.451)		
Co-integration Results			
Significance	**Critical Values**		
% 1	4.3	5.23***	
% 5	3.38	4.23**	
F – statistics	**8.75**		
Notes: The symbols *,**,*** denote the variables at 10%, 5%, 1%, respectively. It expresses the significance at the level of significance			

As can be seen in the table, the series are normally distributed, there is no problem of autocorrelation and changing variance, and there is no model fitting error in the model. However, it should be noted that the value of the f-statistic (8.75) calculated at the 1% significance level is greater than the upper limit (5.23). In this case, the null hypothesis of no co-integration is rejected. In other words, it is established that there is a co-integration relationship between the variables.

4.3. Long-run and Short-run Estimates

Identifying the co-integration relationship allows the determination of the model's long and short-run coefficients. The ARDL (2,0,0,1) model was analysed to determine the long-run relationship between the variables. The results of the analysis are presented in the table below.

Table 4: Long-run estimates of ARDL (2,0,0,1)

Variable	Coefficient	t- statistics	Prob.
lnREW_T	-2.036	-2.855	0.009***
ln$NREW_T$	-1.645	-2.124	0.046**
lnURB_T	-11.250	-1.618	0.121
@TREND	0.345	2.134	0.045**

Notes: The symbols**, and *** denote the variables at 5% and 1%, respectively. It expresses the significance at the level of significance.

ARDL (2,0,0,1) model presented in the table; a long-run relationship was found for all variables except the urban population. According to the long-run coefficients, REW_T is significant at 1%, while $NREW_T$ is significant at 5%. Accordingly, with a 5% margin of error, a 1% increase in $NREW_T$ is estimated to reduce unemployment in Türkiye by 1.64%. Similarly, with a 1% margin of error, a 1% increase in REW_T is estimated to reduce by 2.03%.

After determining the long-run coefficients, the error correction model of the ARDL (2,0,0,1) model was estimated, and then the short-run coefficients were analysed. The table below shows the results of the error correction model.

Table 5. Error Correction Model and Short-run Estimates of ARDL (2,0,0,1)

Variable	Coefficient	t- statistics	Prob.
C	167.871	7.263	0.000***
D(ln$UNEM_T$)(-1)	0.314	2.484	0.022**
D(lnREW_T)	-1.062	-2.210	0.038**
D(ln$NREW_T$)	-1.314	-4.570	0.002***
D(lnURB_T)	-45.767	-4.605	0.000***
CointEq(-1)	-0.645	-7.246	0.000***

Notes: The symbols**, and *** denote the variables at 5% and 1%, respectively. It expresses the significance at the level of significance.

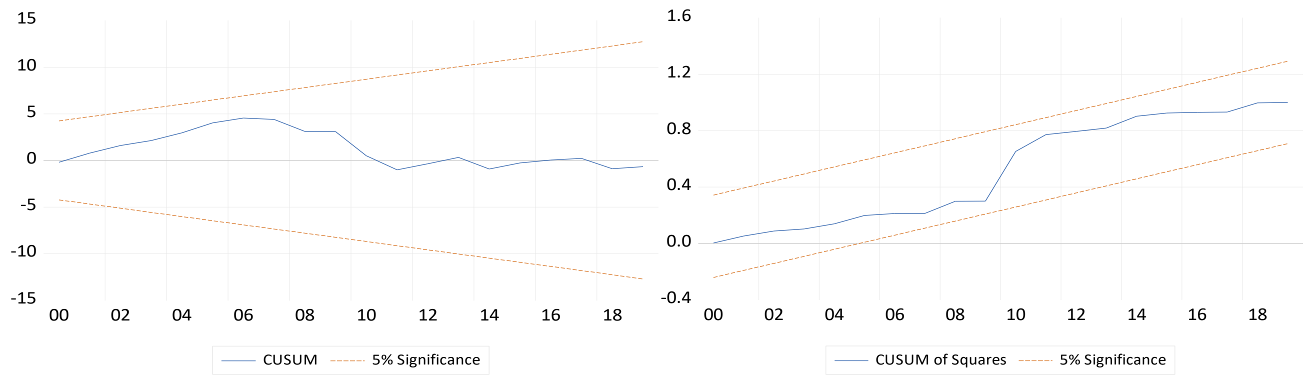
The table above shows the results of the error correction model. In the model, the coefficient of the error term takes a value between 0 and -1 (-0.645) and is statistically significant at the 1% level. Thus, the long-run analysis is considered reliable, and it is estimated that about 64% of the short-run imbalances will approach the equilibrium level within each period. Thus, the imbalances are corrected at the end of a total of 1.5 periods (100/64).

According to the short-run estimates, a 1% increase in REW_T reduces unemployment by 1.062%, while a 1% increase in $NREW_T$ reduces unemployment by 1.314%. As can be seen, unemployment is more sensitive to $NREW_T$ in the short-run. And also, a 1% increase in urban population reduces unemployment by 45%. According to the short-run estimates of the ARDL (2,0,0,1) model, the null hypothesis that there is no relationship between unemployment and REW in Türkiye is rejected with a 5% margin of error.

4.4 Stability Results

Cusum and Cusum-sq values were calculated to test whether the ARDL (2,0,0,1) model contains structural breaks and whether the results obtained are stable.

Figure 1. Plots for the CUSUM and CUSUM of Squares ARDL (2,0,0,1)



In the figure, the results of the CUSUM and CUSUM of Squares tests show the parameter estimates of the model within 95% confidence limits (dashed lines). If the curves obtained as a result of the parameters are within the critical limits at the 5% significance level, the estimated parameters are stable and do not contain structural breaks. The figure shows that there is no structural break in the ARDL (2,0,0,1) model. Therefore, it can be said that the regression coefficients are stable and there is no problem with the test.

5. CONCLUSION

Research investigating the effects of climate change on unemployment has focused on whether the transition to REW has created job opportunities or contributed to unemployment. Arguments supporting rapid employment growth often assume perfect competition, where wages are flexible, and the labour market is fluid. However, the inflexibility imposed by job-specific skills could hinder the labour's ability to adapt to economic changes, such as sectoral shifts. Therefore, it cannot be assumed that investments in REW would necessarily offset lost jobs (Wei et al., 2010). Thus, it is crucial to understand the impact of the transition to REW on the labour market.

This paper investigates this issue within the context of the Turkish labour market, presenting empirical evidence through a model with cointegrated relationships. The model included variables such as unemployment, REW and NREW, and urban population, which aligns with existing literature. In the long-run, the unemployment rate in the Turkish labour market is more sensitive to REW_T than $NREW_T$ and will reduce unemployment more. In the short-run, unemployment is slightly more sensitive to $NREW_T$. The fact that $NREW_T$ reduces unemployment more than REW_T in the short-run. Therefore, the initial response of the Turkish labour market to the expected increase in REW_T due to climate change policies was limited in the short-run, and a decline in unemployment is anticipated in the long-run. Moreover, the long-run decrease in unemployment resulting from REW_T, compared to $NREW_T$, suggests that concerns about unemployment in REW investments may be unfounded in the Turkish labour market. These results are consistent with empirical literature that indicates REW_T reduces unemployment (Bulavskaya and Reynes, 2018; Cai et al., 2011; Dincer and Karakus, 2020; Dvořák et al., 2017; Henriques et al., 2016; Kolsuz and Yeldan, 2020; Proença and Fortes, 2020; Yilanci et al., 2020).

The transition to REW is considered a crucial investment as it offers the potential to replace jobs lost in carbon-intensive industries and mitigate the negative impacts of climate change on unemployment. Turkey is making significant efforts to transition to REW. This research does not allow for conclusions to be drawn on the duration or sustainability of employment generated by REW consumption. To ensure continuity in the literature, future research should focus on theoretical explanations and empirical evidence related to this issue. The existing literature suggests that employment in the REW sector may be temporary (Henriques et al., 2016). Therefore, it is recommended that energy and labour market policies be implemented simultaneously in Turkey, with an understanding that the future of employment is not guaranteed. Reducing foreign dependency in the energy sector and diversifying energy sources should be the top priority policy for the development of the REW transition. Encouraging citizens and investors to adopt REW sources can contribute to environmental protection. Incentives such as subsidies, low-interest loans, tax rebates, and exemptions can stimulate investments in the REW sector. Supporting local entrepreneurs to use national REW sources can increase domestic production.

Labour market policies should align with fundamental human rights and decent work criteria. To achieve this, establishing a social dialogue environment is crucial. Determining working conditions with qualifications that are environmentally and socioeconomically fitting, broadening the scope of social protection, planning education policies that incorporate green skills, and instituting measures to enhance job security and income justice are imperative.

REFERENCES

Agpak, F., and Ozcicek, Ö. (2018). Bir İstihdam Politikası Aracı Olarak Yenilenebilir Enerji. Ömer Halisdemir Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 11(2), 112-128.

Ahmad, M., Zhao, Z. Y., and Li, H. (2019). Revealing stylized empirical interactions among construction sector, urbanization, energy consumption, economic growth and CO2 emissions in China. Science of The Total Environment, 657, 1085-1098.

Apergis, N., and Salim, R. (2015). Energy consumption and unemployment: evidence from a sample of 80 countries and nonlinear estimates. Applied Economics, 47(52), 5614-5633.

Aragón, F. M., Rud, J. P., and Toews, G. (2018). Resource shocks, employment, and gender: Evidence from the collapse of the UK coal industry. Labour Economics, 52, 54-67.

Babiker, M. H., and Eckaus, R. S. (2007). Unemployment effects of climate policy. Environmental Science & Policy, 10(7–8), 600-609.

Bekmez, S., and Agpak, F. (2016). Non-Hydro Renewable Energy and Employment: A Bootstrap Panel Causality Analysis for Countries with Different Income Levels. Journal of Business & Economic Policy, 3(1), 32-45.

Böhringer, C., Keller, A., and van der Werf, E. (2013). Are green hopes too rosy? Employment and welfare impacts of renewable energy promotion. Energy Economics, 36, 277-285.

Böhringer, C., Rivers, N. J., Rutherford, T. F., and Wigle, R. (2012). Green Jobs and Renewable Electricity Policies: Employment Impacts of Ontario's Feed-in Tariff. The B.E. Journal of Economic Analysis & Policy, 12(1), 1-38.

Bulavskaya, T., and Reynès, F. (2018). Job creation and economic impact of renewable energy in the Netherlands. Renewable Energy, 119, 528-538.

Cai, W., Wang, C., Chen, J., and Wang, S. (2011). Green economy and green jobs: Myth or reality? The case of China's power generation sector. Energy, 36(10), 5994-6003.

Cai, W., Mu, Y., Wang, C., and Chen, J. (2014). Distributional employment impacts of renewable and new energy–A case study of China. Renewable and Sustainable Energy Reviews, 39, 1155-1163.

Chen, Y. (2019). Renewable energy investment and employment in China. International Review of Applied Economics, 33(3), 314-334.

Creutzig, F. Baiocchi, G., Bierkandt, R., Pichler, P. P., and Seto, K. C. (2015). Global typology of urban energy use and potentials for an urbanization mitigation wedge. PNAS, 112, 6283–6288.

Creutzig, F., Agoston, P., Minx, J.C., Canadell, J.G., Andrew, R.M., Le Quéré, C., Peters, G.B., Sharifi, A., Yamagata, Y., and Dhakal, S. (2016). Urban infrastructure choices structure climate solutions. Nature Climate Change, 6, 1054–1056.

Dechezlepretre, A., and Sato, M. (2017). The Impacts of Environmental Regulations on Competitiveness. Review of Environmental Economics and Policy, 11(2), 183-206.

Deschenes, O. (2013). Green Jobs. IZA Policy Paper No. 62, Germany.

Dickey, D. A., and Fuller, W. A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. Econometrica, 49(4), 1057-1072.

Dincer H., and Karakus, H. (2020). Yenilenebilir Enerji Yatırımları ile İstihdam Arasındaki İlişkinin Belirlenmesi: G7 Ülkeleri Üzerine Ekonometrik Bir Analiz. İstatistik ve Uygulamalı Bilimler Dergisi, 1(1), 40-49.

Doorey, D. J. (2017). Just Transitions Law: Putting Labour Law to Work on Climate Change. Journal of Environmental Law and Practice 201, 30(2), 1-49.

Dordmond, G., de Oliveira, H. C., Silva, I. R., and Swart, J. (2021). The complexity of green job creation: an analysis of green job development in Brazil. Environment, Development and Sustainability, 23, 723–746.

Dvořák, P., Martinát, S., Van der Horst, D., Frantál, B., and Turečková, K. (2017). Renewable energy investment and job creation; a cross-sectoral assessment for the Czech Republic with reference to EU benchmarks. Renewable Sustainability Energy Review, 69, 360–368.

Engle, R. F., and Granger, C. W. J. (1987). Co-Integration and Error Correction: Representation, Estimation, and Testing. Econometrica, 55(2), 251-276.

Fragkos, P., and Paroussos, L. (2018). Employment creation in EU related to renewables expansion. Applied Energy, 230, 935-945.

Frondel, M., Ritter, N., Schmidt, C. M., and Vance, C. (2010). Economic impacts from the promotion of renewable energy Technologies: The German experience. Energy Policy, 38(8), 4048-4056.

Greenstone, M. (2002). The Impacts of Environmental Regulations on Industrial Activity: Evidence from the 1970 and 1977 Clean Air Act Amendments and the Census of Manufactures. Journal of Political Economy, 110(6), 1175-1219.

Gueye, M. K., and Fyfe, A. M. (2015). Decent Jobs in a Safe Climate: ILO Solutions for Climate Action. International Labour Office, Geneva.

Hafstead, M. A. C., and Williams III, R. C. (2018). Unemployment and environmental regulation in general equilibrium. Journal of Public Economics, 160, 50-65.

Hassler, U., and Wolters, J. (2006). Autoregressive distributed lag models and cointegration. Allgemeines Statistisches Archive, 40, 59-74.

Henriques, C. O., Coelho, D. H., and Cassidy, N. L. (2016). Employment impact assessment of renewable energy targets for electricity generation by 2020—An IO LCA approach. Sustainable Cities and Society, 26, 519-530.

Herrera, A. M. (2018). Oil price shocks, inventors, and macroeconomic Dynamics. Macroeconomic Dynamics, 22(3), 620-639.

Hillebrand, B., Buttermann, H. G., Behringer, J. M., and Bleuel, M. (2006). The expansion of renewable energies and employment effects in Germany. Energy Policy, 34(18), 3484-3494.

Hondo, H., and Moriizumi, Y. (2017). Employment creation potential of renewable power generation technologies: A life cycle approach. Renewable and Sustainable Energy Reviews, 79, 128-136.

IEA, Energy Statistics, available at: https://www.iea.org/data-and-statistics/data-tools/energy-statistics-data-browser?country=TURKEY&fuel=Energy%20consumption&indicator=TFCbySource, (accessed 12.05.2023).

ILOa, (2018). World Employment and Social Outlook 2018 Greening with jobs. International Labour Office, Geneva.

ILOb, (2018). The future of work in a changing natural environment: Climate change, degradation and sustainability. International Labour Organization, Geneva.

ILOc, (2018). The employment impact of climate change adaptation. Input Document for the G20 Climate Sustainability Working Group, International Labour Office, Geneva.

IPCC, (2014). Climate Change 2014: Mitigation of Climate Change. Working Group III Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, (Ed. R.K. Pachauri and L.A. Meyer), IPCC, Geneva, Switzerland.

Kolsuz, G., and Yeldan, E. (2017). Economics of climate change and green employment: A general equilibrium investigation for Turkey. Renewable and Sustainable Energy Reviews, 70, 1240-1250.

Küster, R., Ellersdorfer, I. R., and Fahl, U. (2007). A Cge-Analysis of Energy Policies Considering Labor Market Imperfections and Technology Specifications. Nota di Lavoro, No. 7.2007, Fondazione Eni Enrico Mattei (FEEM), Milano.

Lambert, R. J., and Silva, P. P. (2012). The challenges of determining the employment effects of renewable energy. Renewable and Sustainable Energy Reviews, 16(7), 4667-4674.

Markandya, A., Arto, I., González-Eguino, M., and Román, M. V. (2016). Towards a green energy economy? Tracking the employment effects of low-carbon technologies in the European Union. Applied Energy, 179, 1342-1350.

Martinez-Fernandez, C., Ranieri, A., and Sharpe, S. (2014). Green skills for a low-carbon future. Greener Skills and Jobs, OECD Publishing, Paris.

Montt, G., Wiebe, K. S., Harsdorff, M., Simas, M., Bonnet A., and Wood, R. (2018). Does Climate Action Destroy Jobs? An Assessment of the Employment Implications of the 2-Degree Goal. International Labour Review, 157(4), 521-522.

Morriss, A. P., Bogart, W. T., Dorchak, A., and Meiners, R. E. (2010). Green Job Myths. University of Illinois Law and Economics Research Paper Series No: Le09-001.

Mu, Y., Cai, W., Evans, S., Wang, C., and Roland-Holst, D. (2018). Employment impacts of renewable energy policies in China: A decomposition analysis based on a CGE modeling framework. Applied Energy, 210, 256-267.

Oliveira, C., Cassidy, N., and Coelho, D. (2014). Employment effects of electricity generation from renewable energy technologies in the UK. 22nd International Input-Output Conference & 4th Edition of the International School of IO Analysis, 14, Portugal.

Pesaran, M. H., Shin, Y., and Smith, R. J. (2001). Bounds Testing Approaches to the Analysis of Level Relationships. Journal of Applied Econometrics, 16(3), 289-326.

Phillips P. C. B., and Perron, P. (1988). Testing for a unit root in time series regression. Biometrika, 75, 335-346.

Proença, S., and Fortes, P. (2020). The social face of renewables: Econometric analysis of the relationship between renewables and employment. Energy Reports, 6(1), 581-586.

Rafiq, S. Salim, R. and Sgro, P. M. (2018). Energy, unemployment and trade. Applied Economics, 50(47), 5122-5134.

Ram, M., Aghahosseini, A., and Breyer, C. (2020). Job creation during the global energy transition towards 100% renewable power system by 2050, Technological Forecasting and Social Change, 151, 1-19.

Rivers, N. (2013). Renewable energy and unemployment: A general equilibrium analysis. Resource and Energy Economics, 35(4), 467-485.

Saboori, B., Gholipour, H. F., Rasoulinezhad, E., and Ranjbar, O. (2022). Renewable energy sources and unemployment rate: Evidence from the US states. Energy Policy, 168, 1-12.

Sastresa, E., Usón, A., Bribián, I., and Scarpelleni, S. (2010). Local impact of renewables on employment: assessment methodology and case study. Renewable and Sustainable Energy Reviews, 14, 679-690.

Sequeira, T. N., and SerraSantos, M. (2018). Renewable energy and politics: a systematic review and new evidence. Journal of Cleaner Production, 192, 553-568.

Simas, M., and Pacca, S. (2014). Assessing employment in renewable energy technologies: A case study for wind power in Brazil. Renewable and Sustainable Energy Reviews, 31, 83-90.

Sooriyaarachchi, T. M., Tsai, I. T., El Khatib, S. Farid, A. M., and Mezher, T. (2015). Job creation potentials and skill requirements in, PV, CSP, wind, water-to-energy and energy efficiency value chains. Renewable and Sustainable Energy Reviews, 52, 653–668.

Sulich, A., and Sołoducho-Pelc, L. (2022). The circular economy and the Green Jobs creation. Environmental Science and Pollution Research, 29, 14231–14247.

Tatli, H., and Barak, D. (2019). The Relationship Between Female Unemployment and Energy Consumption: The Case of OECD Countries. Uluslararası İktisadi ve İdari İncelemeler Dergisi, 24, 215-232.

Telli, C., Voyvoda E., and Yeldan, E. (2008). Macroeconomics of twin-targeting in Turkey: Analytics of a financial computable general equilibrium model. International Review of Applied Economics,22(2), 227-242.

TURKSTAT, MEDAS, available at: http://biruni.tuik.gov.tr/medas/?kn=72&locale=tr, (accessed 12.05.2023).

Vona, F., Marin, G., and Consoli, D. (2019). Measures, Drivers, and Effects of Green Employment: Evidence from US Local Labor Markets, 2006-2014. Journal of Economic Geography, 19, 1021–1048.

Wei, M., Patadia, S., and Kammen, D. M. (2010). Putting renewables and energy efficiency to work: How many jobs can the clean energy industry generate in the US?. Energy Policy, 38(2), 919-931.

Yilanci, V., Islamoglu, E., Yildirimalp, S., and Candan, G. (2020). The Relationship between Unemployment Rates and Renewable Energy Consumption: Evidence from Fourier ADL Cointegration Test. alphanumeric journal, 8(1), 17-28.

Yu, B. (2021). Ecological effects of new-type urbanization in China. Renewable and Sustainable Energy Reviews, 135, 1-14.

Zhao, X., and Luo, D. (2017). Force of rising renewable energy in China: Environment, regulation and employment. Renewable and Sustainable Energy Reviews, 68(1), 48-56.

Zivot, E., and Andrews, D. W. K. (1992). Further Evidence on the Great Crash, the Oil-Price Shock, and the Unit-Root Hypothesis. Journal of Business & Economic Statistics, 20(1), 25-44.