ECONOMIC AND FINANCIAL ANALYSIS

OF GLOBAL AND NATIONAL DEVELOPMENTS

Editor
Şahin KARABULUT

ekin

Editor
Şahin KARABULUT

ECONOMIC AND FINANCIAL ANALYSIS OF GLOBAL AND NATIONAL DEVELOPMENTS

ekin

EKİN Basım Yayın Dağıtım
Şehreküstü Mah. Cumhuriyet Cad.
Durak Sk. No: 2 Osmangazi / BURSA
Tel.: (0224) 220 16 72 - 223 04 37
Fax: (0224) 223 41 12
e-mail: info@ekinyayinevi.com

Sipariş
www.ekinkitap.com

ISBN: 978-625-8117-38-7

ECONOMIC AND FINANCIAL ANALYSIS OF GLOBAL AND NATIONAL DEVELOPMENTS

Editor
Şahin KARABULUT

EKİN
Basım Yayın Dağıtım
2022

Sertifika No: 48743

e_ISBN: 978-625-8117-38-7

Kapak Tasarımı: Aslı AYRANCI

EKİN **Basım Yayın Dağıtım**

Şehreküstü Mah. Cumhuriyet Cad.

Durak Sk. No: 2 Osmangazi / BURSA

Tel .: (0.224) 220 16 72 - 223 04 37

Fax.: (0.224) 223 41 12

e-mail: info@ekinyayinevi.com

www.ekinkitap.com

FOREWORD

Developments in the economic and financial fields are influential in many anthropic, social, legal and political fields. For this reason, it is very important to follow economic and financial developments closely in terms of maintaining social peace as well as economic development. Monetary and real variables are generally considered when making analyses in the field of economics and finance. Only drawing attention to these effects and ignoring other effects will cause policy implementations to yield unsuccessful results. Scientific studies of researchers in these areas are necessary to produce healthy economic policies.

The book *Economic and Financial Analysis of Global and National Developments* has been prepared with the contributions of 46 different authors from 33 different university and institutions, including Ağrı İbrahim Çeçen University, Anadolu University, Atatürk University, Aydın Adnan Menderes University, Başkent University, Beykent University, Bilecik Şeyh Edebali University, Burdur Mehmet Akif Ersoy University, Bursa Uludağ University, Cyprus Science University, Çankırı Karatekin University, Erciyes University, Eskişehir Osmangazi University, Gümüşhane University, İskenderun Technical University, İstanbul Aydın University, İstanbul Gelişim University, İstanbul Esenyurt University, İstanbul Technical University, İstanbul Ticaret University, İstanbul University, Kayseri University, Koç University, Marmara University, Mersin University, Ondokuz Mayıs University, Recep Tayyip Erdoğan University, Republic of Türkiye Ministry of National Education, Sakarya University, Siirt University, University of Westminster, Zonguldak Bülent Ecevit University.

Şahin KARABULUT

CHAPTER AUTHORS

Prof.Dr.	Bülent GÜLOĞLU	İstanbul Technical University
Prof.Dr.	Cüneyt KOYUNCU	Bilecik Şeyh Edebali University
Prof.Dr.	Fuat ERDAL	Anadolu University
Prof.Dr.	Jülide YALÇINKAYA KOYUNCU	Bilecik Şeyh Edebali University
Assoc.Prof.Dr.	Arzu ALVAN	Cyprus Science University
Assoc.Prof.Dr.	Aslı AYBARS	Marmara University
Assoc.Prof.Dr.	Burçak POLAT	Siirt University
Assoc.Prof.Dr.	Ebru DEMİRCİ	İstanbul University
Assoc.Prof.Dr.	Eda BOZKURT	Atatürk University
Assoc.Prof.Dr.	Hakan ACAROĞLU	Eskişehir Osmangazi University
Assoc.Prof.Dr.	Meral FIRAT	İstanbul Aydın University
Assoc.Prof.Dr.	Reyhan CAFRI	İskenderun Technical University
Assoc.Prof.Dr.	Yunus AÇCI	İskenderun Technical University
Assoc.Prof.Dr.	Yüksel OKŞAK	Bursa Uludağ University
Asst.Prof.Dr.	Bersu BAHTİYAR	Zonguldak Bülent Ecevit University
Asst.Prof.Dr.	Eda ÇINAROĞLU	Erciyes University
Asst.Prof.Dr.	Eda ÖZEN	Bilecik Şeyh Edebali University
Asst.Prof.Dr.	Emre EKİNCİ	Koç University
Asst.Prof.Dr.	Fulya ZARALI	Kayseri University
Asst.Prof.Dr.	Gerçek ÖZPARLAK	Beykent University
Asst.Prof.Dr.	Güven GÜNEY	Atatürk University
Asst.Prof.Dr.	Mehtap ÖNER	Marmara University
Asst.Prof.Dr.	Murat GÜVEN	Sakarya University
Asst.Prof.Dr.	Mürşit RECEPOĞLU	Gümüşhane University
Asst.Prof.Dr.	Nurhan TOĞUÇ	İstanbul Esenyurt University
Asst.Prof.Dr.	Özge BOLAMAN AVCI	Aydın Adnan Menderes University
Asst.Prof.Dr.	Özgür ÇETİNER	Bilecik Şeyh Edebali University
Asst.Prof.Dr.	Özlem AYTAÇ	Başkent University
Asst.Prof.Dr.	Süreyya KOVACI	Burdur Mehmet Akif Ersoy University
Asst.Prof.Dr.	Tuğba BAŞ	İstanbul Gelişim University
Lect.Dr.	Hüseyin YILMAZ	Siirt University
Lect.Dr.	Onur KÖKTÜRK	Çankırı Karatekin University

Lect.Dr.	Serhat ALPAĞUT	Ağrı İbrahim Çeçen University
Lect.Dr.	Tülin TUNÇ	Mersin University
Res.Ass.Dr.	Gülsüm AKARSU	Ondokuz Mayıs University
Res.Ass.Dr.	Melike TORUN	İstanbul University
Res.Ass.Dr.	Sümeyra UZUN	İstanbul University
Res.Ass.Dr.	Tunahan HACIİMAMOĞLU	Recep Tayyip Erdoğan University
Lect.	Sheeja SIVAPRASAD	University of Westminster
PhD.	Uğur URSAVAŞ	Zonguldak Bülent Ecevit University
PhD.	Mustafa GÜLLÜ	Republic of Türkiye Ministry of National Education
PhD.	Tezer PALACIOĞLU	İstanbul Ticaret University
Res.Asst.	Büşra KESİCİ	İstanbul University
Res.Asst.	Harun SARAÇ	Recep Tayyip Erdoğan University
PhD Candidate	Ehsanullah SEDIQI	Cyprus Science University
MA	Buse BARIŞ KATI	İstanbul University

The authors are listed alphabetically according to their titles.

CONTENTS

Bonuses and Turnover: Evidence from the Panel Study of Income Dynamics...... 1
Emre EKİNCİ

Trade Weighted Dollar Index and Financial Markets 9
Arzu ALVAN, Ehsanullah SEDIQI

Unemployment, Trade Openness and Renewable Energy: A Study for OECD Countries 21
Burçak POLAT, Hüseyin YILMAZ

Employment, FLFP, and Productivity: A Long-run Analysis for Turkey 29
Eda ÖZEN, Jülide YALÇINKAYA KOYUNCU

Poverty and Female Labor Force Participation in Turkey 41
Yüksel OKŞAK, Cüneyt KOYUNCU

Convergence in Electricity Consumption Across Regions in Turkey 59
Uğur URSAVAŞ

Economic Complexity and Tourism Development: Panel Quantile Regression Analysis... 65
Gülsüm AKARSU

Climate Change and Financial Policies.. 77
Meral FIRAT

The Nexus Between Immigration and Employment: Symmetric and Asymmetric Panel Causality Analysis on Major Developed Countries.................. 87
Mürşit RECEPOĞLU

The Relationship Between Inflation, Public Revenues and Public Expenditure: A Panel Analysis on European Countries 99
Serhat ALPAĞUT

Is The Skill-Biased Technological Change Hypothesis Valid for Selected Developed and Developing Countries?... 115
Reyhan CAFRI, Yunus AÇCI

Empirical Analysis of the Relationship Between Financial Markets and the Real Sector 125
Güven GÜNEY, Eda BOZKURT

ICTs Sector and Economic Growth: A Kaldorian Approach................................. 132
Tülin TUNÇ

The Relationship Between Social Capital and Economic Growth: A Panel Data Analysis on G-20 Countries 143
Bersu BAHTİYAR

Challenges That Monetary Easing Brings for Emerging Market Borrowers **155**
Özlem AYTAÇ

Bubble Creating Mechanism: Bitcoin **165**
Özge BOLAMAN AVCI

The Effect of Renewable and Non-Reenergy Energy on Sustainable Development: An Application on G7 Countries **175**
Tunahan HACIİMAMOĞLU, Harun SARAÇ

The Causal Nexus Between Employment, Export and Economic Growth: Evidence from the USA **187**
Büşra KESİCİ

The Impact of Agriculture, Renewable Energy and Economic Growth on Carbon Emissions in Turkey **201**
Mustafa GÜLLÜ, Hakan ACAROĞLU

A Different Approach to Capital Theory: Capital as Power **213**
Özgür ÇETİNER

The Empirical Analysis of Role of Institutions in the Economic Development **227**
Süreyya KOVACI

Evaluation of Financial Performance in Public Capital Banks **245**
Fulya ZARALI, Eda ÇINAROĞLU

Financial Sector in the Last Epoch of the Ottoman Empire **257**
Sümeyra UZUN, Melike TORUN

Lunar Effect on Markets: A Statistical Research on the Post-Covid Term of BIST **267**
Buse BARIŞ KATI, Ebru DEMİRCİ

An Overview of the Financial Inclusion: International Perspective **273**
Mehtap ÖNER, Aslı AYBARS

Does ESG Disclosure of Companies Impact on Their Financial Performance? **283**
Gerçek ÖZPARLAK

Securitization Tokenization and Popularization **295**
Nurhan TOĞUÇ

The Relationship Between Financial Efficiency and Risk in The Borsa Istanbul Industry Index **307**
Onur KÖKTÜRK

An Analysis of Global Foodstuffs Trade and Turkey **315**
Tezer PALACIOĞLU

Investigating the Income and Consumption Convergence Across Turkish Regions: Evidence from Spatial Dynamic Panel Model **343**
Murat GÜVEN, Bülent GÜLOĞLU, Fuat ERDAL

An Exploratory Insight into the Impact of Covid-19 on the Travel and Tourism Sector: UK Evidence **355**
Tuğba BAŞ, Sheeja SIVAPRASAD

THE IMPACT OF AGRICULTURE, RENEWABLE ENERGY, AND ECONOMIC GROWTH ON CARBON EMISSIONS IN TURKEY

Mustafa GÜLLÜ[1]

Hakan ACAROĞLU[2]

1. INTRODUCTION

With the increasing global warming, sensitivities about the environment through the scientific research activities for a probable solution have increased in recent years. To this end, the issue of environmental sustainability has become an important agenda of many countries in which carbon dioxide (CO2) emissions and other greenhouse gases that are a major contributor to environmental degradation are tried to be reduced (Abbasi et al., 2021). As woodland continues to shrink worldwide, concerns about environmental degradation have increased as farmland increases, as a result, governments, think tanks, and researchers have begun to monitor sustainable performance and seek solutions to balance economic growth with the environment (Chopra, 2022). According to the 2007 International Plant Protection Convention (IPCC) report, the agriculture sector is the source of approximately 10-12% of global greenhouse gas (GHG) emissions, and this is caused by the use of agricultural equipment, animal breeding in closed facilities and nitrogen-rich fertilizer applications (Yurtkuran, 2021).

Agriculture plays an important role in climate change by affecting net CO2 emissions from agricultural soils, forestry and other land uses, including methane (CH4) and nitrous oxide (N2O). 15% of the increase in global non-CO2 emissions from agriculture has been originated from developing countries. However, there has been some reduction in non-CO2 emissions through production efficiency improvements in OECD countries (OECD, 2019: 12). While, the situation in Turkey is as follows: total GHG emissions in Turkey were 520.9 million tons of carbon dioxide equivalent (Mt CO2-eq) in 2018, with 72% of these emissions related to energy, 13% from industry process emissions and 12% originates from agriculture (IEA, 2021:35). Aggregated GHG emissions by sector are given in Table 1 at below.

Table 1. Turkey's Greenhouse Gas Emissions by Sector (Mt CO2 Eq.).

Sector	1990	1995	2000	2005	2010	2015	2016	2017	2018
Total (exc. LULUCF)	219.37	247.76	298.76	337.14	398.88	472.60	497.74	523.75	520.94
Energy	139.60	166.32	216.05	243.96	287.05	340.91	359.67	379.90	373.10
IPPU	22.84	25.25	26.23	33.63	48.15	57.08	61.12	63.61	65.20
Agrİculture	45.85	43.85	42.14	42.23	44.15	55.76	58.51	62.85	64.87
Waste	11.08	12.35	14.34	17.31	19.54	18.84	18.44	17.40	17.76
LULUCF	-55.78	-57.38	-61.55	-74.66	-73.42	-97.27	-95.94	-99.88	-94.57

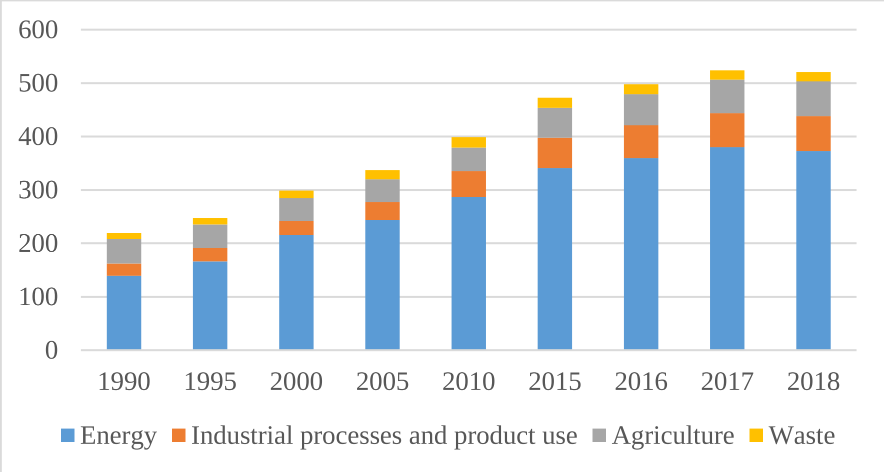
Source: (Turkish Statistical Institute, 2020: 26).

The part shown in Table 1 with IPPU is the industrial processes and product use; The part indicated by LULUCF is emissions and removals from land use, land use change and forestry; and the part shown with Total (exc. LULUCF) is total GHG emissions, excluding the LULUCF sector. Figure 1 shows the evolution of GHG emissions by sector.

[1] Dr. Republic of Turkey Ministry of National Education, mustafagullu@hotmail.com, ORCID: 0000-0001-7546-2400.

[2] Assoc. Prof., Eskisehir Osmangazi University, Faculty of Economics and Administrative Sciences, Department of Economics, hacaroglu@ogu.edu.tr, ORCID: 0000-0001-6757-2140.

Figure 1. Turkey's GHG Emission Development by Sectors.



Source: Adapted from Turkish Statistical Institute, (2020) by authors.

According to Figure 1, when the development of Turkey's GHG emissions are examined, it is seen that the energy sector has a major role in GHG emissions, but the share of energy decreases with the increase in renewable energy consumption in 2018. The contribution of the agricultural sector to GHG emissions were 64.87 Mt CO2 eq. in 2018, with an increase from 45.85 Mt CO2 eq. in 1990. As in the rest of the world, studies on emissions reduction are carried out in Turkey as well. Related to agriculture in Turkey, in order to reduce CO2 emissions and fuel consumption from tractors, the Ministry of Agriculture and Forestry, General Directorate of Agricultural Research and Policies (TAGEM) carries out some studies as follows:

- In order to reduce CO2 emissions from tractors, creation of the National Electric Tractor Prototype,
- Research and Development (R&D) studies for the use of renewable energy in agricultural production,
- R&D studies for the sustainable agricultural production,
- Machines using renewable energy sources for the livestock industry,
- Solar powered bovine milking machine (IEA, 2021: 91).

Although there are studies in the literature examining the relationship between agriculture and the environment on different countries or groups of countries in the world, there is no study in Turkey that examines the effects of both agricultural added value, agricultural area and environmental quality of renewable energy, thereby, this study aims to fill this gap in the literature.

In line with above-mentioned, this study uses the Autoregressive Distributed Lag (ARDL) method. While CO2 emissions are chosen as the dependent variable and agriculture, forestry, and fishing, value added; agricultural land; renewable energy and real gross domestic product (GDP) are selected as independent variables between 1971 to 2018. Findings reveal that a 1% increase in agriculture, forestry, and fishing, value added and agricultural land in Turkey reduces CO2 emissions by 0.63% and 2.33%, respectively. Furthermore, a positive relationship is found between economic growth and CO2 emissions, and it is found that there is a 0.58% increase in CO2 emissions with an increase of 1% in economic growth.

In the following part of the study, a summary of the literature review is given in Section 2; The description of data, the model estimation, and methodologies are given in Section 3;

Empirical results follow with the subtitles of unit root tests and ARDL test results in Section 4; Conclusions and policy recommendations are given in Section 5.

2. LITERATURE REVIEW

There are many studies in the literature that focus on the relationship between carbon emissions, renewable energy, gross domestic product (GDP) and agriculture from different aspects. The period, locations, methodology, variables used and results of these studies are shown in Table 2 at below.

Table 2. Literature Review by Author(s), Period/Place, Method(s), Variables, And Results.

Author(s)	Period/Place	Method(s)	Variables	Results
Li & Haneklaus (2021)	1990-2020 China	ARDL	CO2, REN, NREN, URB, GDP	REN ↓CO_2 long REN ↑CO_2
Adekoya et al. (2022)	1996-2015 African Countries	Panel ARDL	CO2, REN, GDP, AGR and RENTS	REN ↓CO_2 GDP ↑CO_2 AGR ↑CO_2 short
Chopra et al. (2022)	ASEAN Countries	Panel cointegration test	AGR, CO2, FOREST, REN, Natural resources, Regional integration	CO2 ↓AGR Forest area ↓AGR Natural resource ↓AGR REN ↑AGR
Jebli & Youssef (2017)	1980-2011 North Africa Countries	Panel cointegration Granger causality	CO2, GDP, NREN,AGR	GDP ↑CO_2 REN ↑CO_2
Khan, et al. (2018)	1981-2015 Pakistan	Toda and Yamamoto	GHG,AGR,COAL,HYDRO,REN,FOREST, VEGETABLE PRODUCTION	REN ↓GHG AGR ↓GHG VEG ↓GHG FOREST ↓GHG
Usman & Makhdum (2021)	1990-2018 BRICS-T	Panel unit root, cointegration	EFP, AGR, FOREST, NREN, REN,FID	AGR ↑CO2 NREN ↑CO2 FID↑CO2 REN ↓CO2 FOREST ↓CO2
Waheed et al. (2018)	1990-2014 Pakistan	ARDL	CO2,REN, AGR, FOREST	REN ↓CO_2 FOREST ↓CO_2 AGR ↑CO_2
Yurtkuran (2021)	1970-2017 Turkey	Gregory Hansen cointegration test, Bootstrap ARDL	CO2,REN,AGR,KOFE economic, social, and political KOF Globalization indices	AGR ↑CO_2 REN ↑CO_2 KOF ↑CO_2
Zaman et al. (2022)	1991-2015 Pakistan	ARDL	CO2,AGR,REN, FEMALE EMPLOYMENT	REN ↓CO_2 AGR ↓CO_2 FEM ↓CO_2
Abbasi et al. (2021)	1980-2019 selected 22 countries	NARDL	CO2, ENC, AGR, LAND, FOREST, GDP	AGR ↓CO_2 FOREST ↓CO_2
Aydoğan & Vardar (2020)	1990-2014 E7 countries	Panel cointegration, existence of EKC hypothesis	CO2, GDP, NREN, REN, AGR	GDP ↑CO_2 NREN ↑CO_2 AGR ↑CO_2 REN ↓CO_2
Bas et al. (2021)	1991-2019 Turkey	Existence of EKC hypothesis	CO2,AGR,REN,NREN, Merchandize, Export	AGR ↓CO_2 EXPORT ↓CO_2 Total Energy↑CO_2 Merchandize ↑CO_2
Eyuboglu & Uzar (2020)	1995–2014 Colombia, India,	Panel cointegration	CO2, ENERGY USE, REN, AGR, GDP, TRADE OPENNESS	AGR ↑CO_2 REN ↓CO_2 TRADE ↓CO_2

	Indonesia, Kenya, Malaysia, Mexico, and Poland			GDP $\uparrow CO_2$ ENERGY USE$\uparrow CO_2$
Koondhar et al. (2021)	1998-2018 China	ARDL	CO2, REN, FOREST, AGR	FOREST $\downarrow CO_2$ REN $\downarrow CO_2$ Short
Liu et al. (2017a)	1970-2013 ASEAN countries	Existence of EKC hypothesis	CO2, GDP, REN, NREN, AGR	REN $\downarrow CO_2$ AGR $\downarrow CO_2$ NREN $\uparrow CO_2$
Liu etc. (2017b)	1992-2013 BRICS	Panel cointegration test	CO2, GDP, REN, NREN, AGR	NREN $\uparrow CO_2$ AGR $\uparrow CO_2$ REN $\downarrow CO_2$ ECONOMIC DEVELOPMENT $\downarrow CO_2$
Pata, (2021)	1971-2016 BRIC countries	Fourier cointegration	EFP, CO2, REN, KOF (Globalization Index), AGR	REN $\downarrow CO_2$ Brazil china. Does not affect in Russia and India.
Raihan et al. (2022)	1990-2019 Malaysia	ARDL	CO2, ENC, LAND, FOREST	ENC$\uparrow CO_2$ LAND$\uparrow CO_2$ FOREST $\downarrow CO_2$
Raihan & Tuspekova (2022)	1990-2018 Peru	ARDL	CO2, GDP, REN, LAND	REN $\downarrow CO_2$ Land$\uparrow CO_2$ EconomicGrowth$\uparrow CO_2$
Ridzuan et al. (2020)	1978-2016 Malaysia	ARDL	CO2, GDP, REN, AGR, URB	EconomicGrowth$\uparrow CO_2$ URB$\uparrow CO_2$ Livestock$\uparrow CO_2$ REN $\downarrow CO_2$ Crops $\downarrow CO_2$ Fisheries$\downarrow CO_2$

Abbreviations for Table 2:

AGR: Agriculture	GDP: Gross Domestic Product
CO2: Carbon dioxide Emission	GHG: Greenhouse Gases
EFP: Ecological footprint	LAND: Agricultural Land
ENC: Energy consumption	NREN: Non-renewable Energy
EKC: Environmental Kuznets curve	REN: Renewable Energy
FID: Financial development	URB: Urbanization

Considering the methodologies of the studies in the literature, panel data studies on a country group are seen such as Adekoya et al. (2022), Jebli & Youssef (2017), Aydoğan & Vardar (2020), Eyuboglu & Uzar (2020) and Liu et al. (2017b). But it is also seen such studies (i.e., Waheed et al. (2018), Yurtkuran (2021), Zaman et al. (2022), Ridzuan et al. (2020), Raihan & Tuspekova (2022) and Raihan et al. (2022)) that take a single country and apply ARDL methodology. In addition, although CO2 emissions are taken as carbon emissions in the general majority of the studies, Khan etc. (2018) preferred greenhouse gas emissions, and Pata (2021) preferred ecological footprint.

In most of the studies in the literature, carbon emissions were taken as the dependent variable and the effect of agriculture on emissions was examined. But in some studies, such as Chopra et al. (2022), agriculture was taken as the dependent variable and the effects of emissions on agriculture were examined, and it was concluded that carbon emissions reduced agricultural production.

When it is checked the results of studies examining the relationship between renewable energy and carbon emissions, Adekoya et al. (2022), Khan et al. (2018), Usman & Makhdum

(2021), Liu et al. (2017a), Liu et al. (2017b), Raihan & Tuspekova (2022), and Aydoğan & Vardar (2020) have concluded that renewable energy reduces carbon emissions, but studies such as Jebli & Youssef (2017) and Yurtkuran (2021) conclude that renewable energy increases carbon emissions. On the other hand, Li & Haneklaus (2021), concluded that renewable energy increases emissions in the short run, but reduces it in the long run. Among the studies examining the relationship between non-renewable energy and carbon emissions, Aydoğan & Vardar, (2020), Liu et al. (2017a), Liu et al. (2017b), and Usman & Makhdum, (2021) concluded that renewable energy increases carbon emissions in their studies.

In the studies examining the effect of agricultural production on carbon emissions, variables such as agricultural area, agricultural added value, vegetable production, livestock, crops, and fisheries were considered. When it is checked the results of the relationship between agriculture and emissions, Khan, et al. (2018), Liu et al. (2017a), Zaman, et al. (2022), Abbasi, et al. (2021) and Bas, et al. (2021), concluded that agriculture reduces emissions. Despite these results, Usman & Makhdum, (2021), Waheed, et al. (2018), Yurtkuran (2021), Aydoğan & Vardar, (2020), Eyuboglu & Uzar (2020) and Liu et al. (2017b) concluded that agriculture increases carbon emissions. Adekoya et al. (2022) found that agriculture increases emissions only in the short run. Regarding agricultural land, Raihan et al. (2022) and Raihan & Tuspekova (2022) concluded that agricultural land increases carbon emissions. In the literature reviewed on forestry, there is complete consistency on the results of the relationship between forestation and carbon emissions. Khan, et al. (2018), Usman & Makhdum, (2021), Waheed, et al. (2018), Abbasi, et al. (2021), Raihan et al. (2022), and Koondhar et al. (2021) concluded that forested areas reduce carbon emissions.

When it is checked the relationship between GDP and emissions, Adekoya et al. (2022), Jebli & Youssef (2017), Aydoğan & Vardar, (2020) and Eyuboglu & Uzar (2020) concluded that GDP increases carbon emissions.

3. METHODOLOGY

3.1.Data

In this study, data from Turkey between 1970 to 2018 were used to investigate the relationship between CO2 emissions, real GDP, renewable energy consumption, agriculture and agricultural land. The variables in the analysis used for this purpose are as follows: CO2 emissions (CO2 emissions (kt)); GDP (GDP per capita (current US$)); renewable energy (Renewable Installed Capacity, MW), agriculture (Agriculture, forestry, and fishing, value added (current US$) and Agricultural land (Agricultural land (sq. km)). The variable expressed as agricultural land refers to the area of land in arable, under permanent crops and pastures. The variable expressed as agriculture, forestry and fishing, refers to the added value obtained from cultivation of crops and livestock production as well as forestry, hunting and fishing.

Table 3. Variables With Units and Data Sources.

Variables	Description	Units	Source
CO2	CO2 emissions	Kilotons (kt)	WDI
GDP	GDP per capita	Current US$	WDI
REN	Renewable Installed Capacity	Megawatts (MW)	TEIAS
AGR	Agriculture, forestry and fishing, value added	Current US$	WDI
LAND	Agricultural land	Square Kilometers (Sq. km)	WDI

Source: CO2, GDP, AGR and LAND data are obtained from the World Development Indicator (WDI), REN data is obtained from Turkish Electricity Transmission Corporation (TEIAS).

The logarithms of the variables were taken and the names were changed to LCO2, LGDP, LREN, LAGR, LLAND and included in the analysis. Table 4 shows descriptive statistics and correlation of variables.

Table 4. Descriptive statistics and correlation of variables.

Description	LCO2	LGDP	LREN	LAGR	LLAND
Mean	11.934	8.027	12.875	8.823	23.943
Std Dev.	0.630	0.953	0.027	1.078	0.647
Maximum	12.938	9.442	12.929	10.636	24.967
Minimum	10.660	6.120	12.813	6.586	22.527
Correlation of Variables					
LCO2	1.000				
LGDP	0.966	1.000			
LREN	0.315	0.267	1.000		
LAGR	0.987	0.939	0.319	1.000	
LLAND	0.916	0.980	0.215	0.887	1.000

According to Table 4, the highest standard deviation is in the LAGR variable, and the lowest standard deviation is in the LREN variable.

3.2. The Model Estimation

This article follows the previous studies by Abbasi, etc. (2021), Jebli & Youssef (2017) and Raihan & Tuspekova (2022), a similar model is taken and it is established as in equation (1).

$$LCO2_t = f(GDP_t, LREC_t, LAGR_t, LLAND_t) \quad (1)$$

After expressing the variables, then the equation form is constructed as follows: In Eq. (2) while β_0 indicates the constant term; β_1, β_2, β_3, and β_4 represent the coefficients of the independent variables, where t = 1970-2018 denotes the time period; ε_t indicates the estimated residuals.

$$LCO2_t = \beta_0 + \beta_1 LGDP_t + \beta_2 LREC_t + \beta_3 LAGR_t + \beta_3 LLAND_t + \varepsilon_t \quad (2)$$

3.3. Methodology

At the beginning of the analysis, a unit root analysis should be done first. As a result of applying the ARDL method that is improved by Pesaran et al. (2001), it is necessary to determine the integration degrees of the variables (Ahmed, et al., 2021). In the ARDL bounds test, none of the variables should be I(2) and the variables can be I(1) or I(0). In addition, the ARDL method is more flexible than traditional cointegration approaches such as Engle & Granger (1987), Johansen & Juselius (1990) for the analysis of cointegration between predicted variables. The set up ARDL model examining the relationship between carbon emission, GDP, renewable energy, agricultural added value and agricultural land is as follows:

$$\begin{aligned}\Delta lnCO2 = \beta_0 &+ \sum_{i=1}^{n1} \beta_{1i} \Delta lnCO2_{t-i} + \sum_{i=1}^{n2} \beta_{2i} \Delta lnGDP_{t-i} + \sum_{i=1}^{n3} \beta_{3i} \Delta lnAGR_{t-i} \\ &+ \sum_{i=1}^{n4} \beta_{4i} \Delta lnLAND_{t-i} + \lambda_1 \Delta lnCO2_{t-i} + \lambda_2 \Delta lnGDP_{t-i} + \lambda_3 \Delta lnAGR_{t-i} \\ &+ \lambda_4 \Delta lnLAND_{t-i} + \upsilon_1 t\end{aligned} \quad (3)$$

In the above-mentioned equation (3), Δ is the first difference operator and $\upsilon_1 t$ is the error term. In the rest of the analysis, the bounds test will be applied and the F statistic (Wald

Test) will be calculated and the comparison of this calculated statistic with the lower and upper limit values will give the decision of cointegration. When the calculated F statistical upper limit is greater than the critical value, the variables are cointegrated, if the lower limit is below the critical value, there is no cointegration between the variables, and if it falls between the critical value band, the result of the inference is not certain (Nkoro & Uko, 2016). If the result that the F statistic is greater than the upper bound critical value, that is, if the cointegration confirmation is provided, the short-run model is set up as in the equation (4) at below.

$$lnCO2_t = \gamma_0 + \sum_{j=1}^{p1} \gamma_{1i} \Delta lnCO2_{t-i} + \sum_{j=1}^{p2} \gamma_{2i} \Delta lnGDP_{t-i} + \sum_{j=1}^{p3} \gamma_{3i} \Delta lnAGR_{t-i} + \sum_{j=1}^{p4} \gamma_{4i} \Delta lnLAND_{t-i} + \psi ECT_{t-1} + \vartheta t \quad (4)$$

Here ECT_{t-1} denotes the error correction term added to the equation. ECT_{t-1} indicates that the convergence speed of the linkage from short-term to long-term equilibrium (Li & Haneklaus, 2021: 789).

4. EMPRICAL RESULTS

In this section, firstly, unit root test findings, i.e. ADF and PP unit root results for the variables are given. Then, the model selected for the appropriate lag length for ARDL and ARDL bounds test diagnostic test results are included. Finally, there are ARDL long-term and short-term coefficients and CUSUM and CUSUM of squares graphs.

4.1.Unit Root Tests

Before starting the ARDL analysis, unit root tests are applied to determine whether the series are stationary or at what level they are stationary. Augmented Dickey Fuller (ADF) and Phillips and Perron (PP) unit root test logarithms have been taken, applied to the series and has been examined as with intercept. Unit root tests are applied to the series at level and first difference level. The results are presented in the Table 5 as follows: I(0) means the series are stationary at the level; I(1) means they are not stationary at the level and becomes stationary at the first difference.

Table 5. ADF and PP Unit Root Test Results for The Variables.

Variables	ADF Unit Root Test Results				PP Unit Root Test Results				
	Level		First difference		Level		First difference		
	t-Stat.	Prob.	t-Stat.	Prob.	t-Stat.	Prob.	t-Stat.	Prob.	Result
LCO2	-1.81 (0)	0.371	-6.69 (0)	0,000	-1.99 (5)	0.289	-6.74 (5)	0,000	I(1)
LGDP	-1.63 (0)	0.458	-6.73 (0)	0.000	-1.62 (2)	0.464	-6.78 (3)	0,000	I(1)
LREN	-1.75 (0)	0,399	-5.21 (0)	0,001	-1.63 (1)	0,459	-5.12 (5)	0,001	I(1)
LAGR	-1.89 (0)	0.330	-7.00 (0)	0,000	-1.89 (2)	0.330	-7.03 (3)	0,000	I(1)
LLAND	-1.45 (0)	0.549	-5.74 (0)	0,000	-1.59 (1)	0.475	-5.73 (3)	0,000	I(1)

Note: The lag lengths for the ADF test in parenthesis has been defined according to Schwarz Information Criterion and critical values have been taken from MacKinnon (1996). The maximum lag length has been assigned as 10. The values in parenthesis are ADF lag values. The lag lengths for the PP test in parenthesis have been defined as minimum lags where autocorrelation doesn’t exist according to Newey-West Bandwidth Criterion.

According to the ADF and PP unit root test given in the results of Table 5, all series are stationary at their first difference.

4.2.ARDL Test Results

ARDL test was applied to examine the long-term and short-term relationships between CO2 emissions, economic growth, renewable energy, agricultural added value and agricultural land in Turkey. Before starting the test, the Akaike Information Criterion (AIC) was used to determine the lag length to help select the most appropriate ARDL model.

Table 6. ARDL Model Suitable Lag Length Detection.

	Model	LogL	AIC*	BIC	HQ	Choice
CO2	2462	85.185725	**-3.252699**	-2.770922	-3.073097	**ARDL(1, 0, 1, 2, 3)**
GDP	2487	84.080492	**-3.248022**	-2.806393	-3.083387	ARDL(1, 0, 0, 2, 3)
REN	2387	87.671363	**-3.229838**	-2.627618	-3.005336	ARDL(1, 0, 4, 2, 3)
AGR	2494	80.425497	**-3.218911**	-2.897727	-3.099177	ARDL(1, 0, 0, 1, 1)
LAND	1837	85.389682	**-3.217319**	-2.695394	-3.022751	ARDL(2, 0, 1, 2, 3)

Note: The most suitable lag according to AIC has been shown as * , AIC: Akaike information criterion, BIC: Bayes information criterion, HQ: Hannan-Quinn information criterion.

According to Table 6, the most suitable model was selected as ARDL(1,0,1,2,3). The ARDL Bounds test applied according to the model established by estimating the appropriate lag length and ARDL Bounds test results and diagnostic test results are presented in Table 7.

Table 7. ARDL Bounds Test Diagnostic Test Results.

F-statistic	k value	Finite Sample: n=50	Lower Bounds I(0)	Upper Bounds I(1)
5.979	4	%10	2.372	3.32
		%5	2.823	3.872
		%1	3.845	5.15
Diagnostic Test Results				
		F-statistic	**Prob**	**Decision**
Breusch-Pagan-Godfrey Test		0.712	0.718	No heteroskedasticity
Breusch-Godfrey-LM Test		0.618	0.545	No serial correlation
Normality Test		0.556	0.756	Residuals are normally distributed
Ramsey RESET Test		1.59	0.966	Model is correctly specified

According to the results in Table 7, since the calculated F statistic is 5.979 and this value is higher than the critical upper limit at all significance levels, it is concluded that there is a cointegration relationship between the series. In addition, it is determined that there is no heteroskedasticity problem according to the Breusch-Pagan-Godfrey test, no autocorrelation problem according to the Breusch-Godfrey-LM test, no model specified problem according to the Ramsey RESET test, and the residuals of the model are normally distributed. In the next part of the study, the results and comments about the long-term and short-term coefficients of the selected ARDL(1,0,1,2,3) model are included.

Table 8. ARDL Long-Term Coefficients.

	Coefficients	Std. Error	t-Statistics	Prob.
LGDP	0.585802	0.149516	3.918001	0.0004
LREN	0.441043	0.059444	7.419447	0.0000
LAGR	-0.630037	0.203395	-3.097605	0.0039
LLAND	-2.337034	0.971092	-2.406605	0.0217

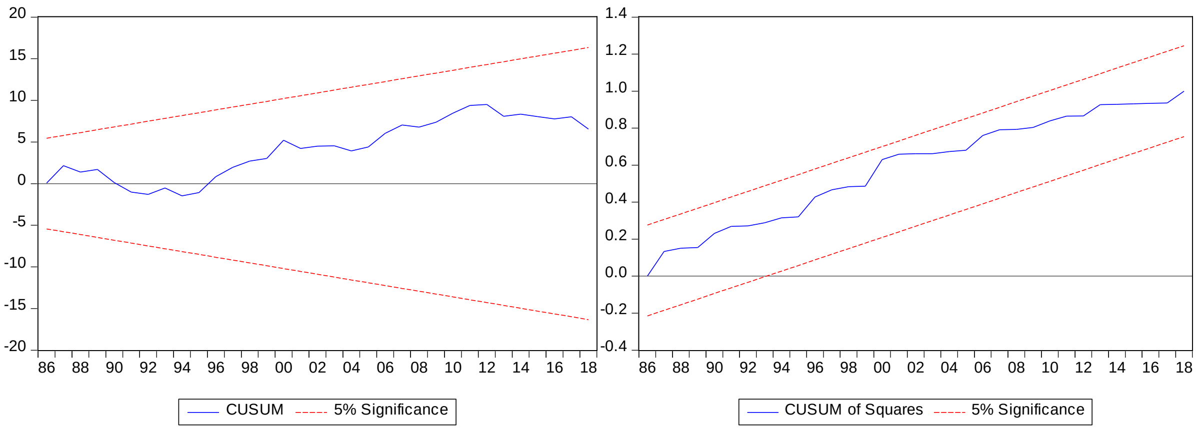
According to the long-term results of the ARDL model, in which carbon emissions selected as the dependent variable and renewable energy; GDP; agriculture, forestry, and fishing, value added and agricultural land selected as the independent variable, a positive relationship was determined between economic growth and carbon emissions, and it is found that a 0.58% increase in carbon emissions with an increase of 1% in economic growth. Also, a positive relationship was found between renewable energy and carbon emissions, and it was concluded that there is a 0.44% increase in carbon emissions with 1% increase in renewable energy. A negative relationship was determined between agricultural added value and agricultural area and carbon emissions. According to these results, it has been determined that a 1% increase in agriculture, forestry, and fishing, value added variable reduces carbon emissions by 0.63%. It has been found that a 1% increase in agricultural land reduces carbon emissions by 2.33%. Afterwards, ARDL short-term coefficients results are included in the analysis.

Table 9. ARDL Short-Term Coefficients.

	Coefficients	Std. Error	t-Statistics	Prob.
D(LREN)	0.014429	0.069099	0.208811	0.8358
D(LREN(-1))	-0.208221	0.090307	-2.305694	0.0274
D(LAGR)	-0.120613	0.046775	-2.578580	0.0144
D(LAGR(-1))	0.075257	0.035220	2.136783	0.0399
D(LAGR(-2))	0.081686	0.033751	2.420266	0.0210
D(LLAND)	-1.741418	0.515738	-3.376555	0.0019
CointEq(-1)	-0.423575	0.066027	-6.415181	0.0000

According to ARDL short-term results, agriculture, forestry, and fishing, value added and agricultural land variables were found to be statistically significant in the short term. In the short-term, it has been determined that a 1% increase in the agriculture, forestry, and fishing, value added variable reduces carbon emissions by 0.12%. Again, it was concluded that a 1% increase in agricultural land in the short-term reduces carbon emissions by 1.74%. In addition, the error correction term (ECT, CointEq(-1)) is also negative and statistically significant, indicating that 42% of the short-term shocks will disappear in a month and the long-term balance can be reached in approximately 2.5 months. The graph of CUSUM and CUSUM of Squares tests performed to examine the stability of the ARDL model is given in Figure 2.

Figure 2. CUSUM and CUSUM of Squares graphs.



According to the CUSUM and CUSUM of Squares graphs, it was concluded that the coefficients were stable at the 5% significance level, since the blue colored graphs remained in the range of the red lines.

5. CONCLUSIONS AND POLICY IMPLICATIONS

Climate change and global warming have been among the most important problems of the world that humankind is facing for the last decades. Whilst, carbon emissions, are the key point of these problems, and a large part of it arises as a result of human-based activities. While, the agriculture in Turkey which has advantages such as a source of nutrition, an important component of exports, and a source of employment is an indispensable sector for the country. The added value consisting of agriculture, forestry, fishing, hunting and livestock production and agricultural land variables of this sector are widely used in the literature. With the increasing concerns about climate change, the relationship between these variables and carbon emissions has gained importance in the literature.

There are many factors that also affect carbon emissions, and this study examines the impacts of agriculture, agricultural land, renewable energy, and economic growth on carbon emissions. In line with above-mentioned, carbon dioxide emissions are chosen as the dependent variable and agriculture, forestry, and fishing, value added; agricultural land; renewable energy and real gross domestic product are selected as independent variables in this study. By using the ARDL method that is conducted in the period 1971-2018, it is concluded that a 1% increase in agriculture, forestry, and fishing, value added and agricultural land in Turkey reduces carbon emissions by 0.63% and 2.33%, respectively. A positive relationship is found between economic growth and carbon emissions, and it is found that there is a 0.58% increase in carbon emissions with an increase of 1% in economic growth. Also, in the short-term, it is concluded that a 1% increase in the agriculture, forestry, and fishing, value added reduces carbon emissions by 0.12%. In addition to this, a 1% increase in agricultural land in the short-term reduces carbon emissions by 1.74%.

Furthermore, it can be concluded that renewable energy installation is not at an enough level to reduce carbon emissions in Turkey. Until the 2000s, Turkey only benefited from hydroelectricity in renewable energy use, and after these years, the country has been started to diversify and increase renewable energy sources. According to the result of the analysis, it is necessary to make more renewable energy investments to reduce carbon emissions, to reduce non-renewable energy consumption, and to encourage the private sector to contribute to the diversification and increasing of renewable energy sources. The agricultural sector will help reduce carbon emissions with alternatives such as implementing more environmentally friendly practices instead reducing the practices that will harm carbon emissions in agricultural practices, reducing the use of mineral fertilizers, reducing methane emissions with efficient feed use in livestock, and improving arable land.

REFERENCES

Abbasi, K. R., Adedoyin, F. F., Radulescu, M., Hussain, K., & Salem, S. (2021). The role of forest and agriculture towards environmental fortification: designing a sustainable policy framework for top forested countries. Environment, Development and Sustainability, 1-28.

Adekoya, O. B., Ajayi, G. E., Suhrab, M., & Oliyide, J. A. (2022). How critical are resource rents, agriculture, growth, and renewable energy to environmental degradation in the resource-rich African countries? The role of institutional quality. Energy Policy, 164, 112888.

Ahmed, Z., Zhang, B., & Cary, M. (2021). Linking economic globalization, economic growth, financial development, and ecological footprint: Evidence from symmetric and asymmetric ARDL. Ecological Indicators, 121, 107060.

Aydoğan, B., & Vardar, G. (2020). Evaluating the role of renewable energy, economic growth and agriculture on CO2 emission in E7 countries. International Journal of Sustainable Energy, 39(4), 335-348.

Bas, T., Kara, F., & Alola, A. A. (2021). The environmental aspects of agriculture, merchandize, share, and export value-added calibrations in Turkey. Environmental Science and Pollution Research, 28(44), 62677-62689.

Chopra, R., Magazzino, C., Shah, M. I., Sharma, G. D., Rao, A., & Shahzad, U. (2022). The role of renewable energy and natural resources for sustainable agriculture in ASEAN countries: Do carbon emissions and deforestation affect agriculture productivity?. Resources Policy, 76, 102578.

Engle, R. F., & Granger, C. W. (1987). Co-integration and error correction: Representation, estimation, and testing. Econometrica, 55(2), 251–276.

Eyuboglu, K., & Uzar, U. (2020). Examining the roles of renewable energy consumption and agriculture on CO2 emission in lucky-seven countries. Environmental Science and Pollution Research, 27(36), 45031-45040.

IEA (2021). Turkey 2021, Energy Policy Review; International Energy Agency: Paris, France.

Jebli, M. B., & Youssef, S. B. (2017). The role of renewable energy and agriculture in reducing CO2 emissions: Evidence for North Africa countries. Ecological indicators, 74, 295-301.

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration – With applications to the demand for money. Oxford Bulletin of Economics and Statistics, 52(2), 169–210.

Khan, M. T. I., Ali, Q., & Ashfaq, M. (2018). The nexus between greenhouse gas emission, electricity production, renewable energy and agriculture in Pakistan. Renewable Energy, 118, 437-451.

Koondhar, M. A., Shahbaz, M., Ozturk, I., Randhawa, A. A., & Kong, R. (2021). Revisiting the relationship between carbon emission, renewable energy consumption, forestry, and agricultural financial development for China. Environmental Science and Pollution Research, 28(33), 45459-45473.

Li, B., & Haneklaus, N. (2021). The role of renewable energy, fossil fuel consumption, urbanization and economic growth on CO2 emissions in China. Energy Reports, 7, 783-791.

Liu, X., Zhang, S., & Bae, J. (2017a). The impact of renewable energy and agriculture on carbon dioxide emissions: investigating the environmental Kuznets curve in four selected ASEAN countries. Journal of cleaner production, 164, 1239-1247.

Liu, X., Zhang, S., & Bae, J. (2017b). The nexus of renewable energy-agriculture-environment in BRICS. Applied energy, 204, 489-496.

Nkoro, E., & Uko, A. K. (2016). Autoregressive Distributed Lag (ARDL) cointegration technique: application and interpretation. Journal of Statistical and Econometric methods, 5(4), 63-91.

OECD (2019). Enhancing Climate Change Mitigation through Agriculture, OECD Publishing, Paris, https://doi.org/10.1787/e9a79226-en.

Pata, U. K. (2021). Linking renewable energy, globalization, agriculture, CO2 emissions and ecological footprint in BRIC countries: A sustainability perspective. Renewable Energy, 173, 197-208.

Pesaran, M.H., Shin, Y., Smith, R.J., 2001. Bounds testing approaches to the analysis of level relationships. J. Appl. Econ. 16 (3), 289–326.

Raihan, A., & Tuspekova, A. (2022). The nexus between economic growth, renewable energy use, agricultural land expansion, and carbon emissions: new insights from Peru. Energy Nexus, 100067.

Raihan, A., Begum, R. A., Nizam, M., Said, M., & Pereira, J. J. (2022). Dynamic impacts of energy use, agricultural land expansion, and deforestation on CO2 emissions in Malaysia. Environmental and Ecological Statistics, 1-31.

Ridzuan, N. H. A. M., Marwan, N. F., Khalid, N., Ali, M. H., & Tseng, M. L. (2020). Effects of agriculture, renewable energy, and economic growth on carbon dioxide emissions: Evidence of the environmental Kuznets curve. Resources, Conservation and Recycling, 160, 104879.

Turkish Statistical Institute (2020). Turkish Greenhouse Gas Inventory 1990 - 2018, National Inventory Report for submission under the United Nations Framework Convention on Climate Change, April, 2020,

Usman, M., & Makhdum, M. S. A. (2021). What abates ecological footprint in BRICS-T region? Exploring the influence of renewable energy, non-renewable energy, agriculture, forest area and financial development. Renewable Energy, 179, 12-28.

Waheed, R., Chang, D., Sarwar, S., & Chen, W. (2018). Forest, agriculture, renewable energy, and CO2 emission. Journal of Cleaner Production, 172, 4231-4238.

Yurtkuran, S. (2021). The effect of agriculture, renewable energy production, and globalization on CO2 emissions in Turkey: A bootstrap ARDL approach. Renewable Energy, 171, 1236-1245.

Zaman, S., uz Zaman, Q., Zhang, L., Wang, Z., & Jehan, N. (2022). Interaction between agricultural production, female employment, renewable energy, and environmental quality: Policy directions in context of developing economies. Renewable Energy, 186, 288-298.