Journal of Environmental Management 389 (2025) 126111

Contents lists available at ScienceDirect

Journal of Environmental Management

journal homepage: www.elsevier.com/locate/jenvman

Research article

An analysis of climate impacts on agriculture production: Evidence from Türkiye by BMA and A-ARDL approaches

Ahmet Emrah Tayyar [a], Nijat Gasim [b], Ömer Faruk Biçen [c], Shahriyar Mukhtarov [d,e,f,g,*]

[a] Department of Economics, Yalova University, 77200, Yalova, Türkiye
[b] International Scientific Research Center, Baku State University, 1005, Baku, Azerbaijan
[c] Department of Economics, Balıkesir University, Çağış Campuss, 10145, Balikesir, Turkiye
[d] Faculty of Business and International Relations, Vistula University, Warsaw, Poland
[e] Department of Economics, Korea University, Seoul, 02481, South Korea
[f] BEU-Scientific Research Center, Baku Engineering University, Baku, Azerbaijan
[g] UNEC Empirical Research Center, Azerbaijan State University of Economics (UNEC), Baku, Azerbaijan

ARTICLE INFO

Keywords:
Agriculture
Agricultural production
Climate change
Global warming
Bayesian model averaging
Augmented ARDL
Türkiye

ABSTRACT

This study investigates the impact of climatic factors on agricultural output between 1970 and 2022 in Türkiye. The Bayesian Model Averaging (BMA) method was utilized to select the independent variables for the model. The augmented ARDL (A-ARDL) approach was employed to analyze the cointegration relationship between the variables. Then, the CCR, DOLS, and FMOLS techniques were applied to assess the long-term dynamics. The key findings of the study are as follows: (i) The BMA analysis identified the carbon dioxide emissions, cultivated agricultural area, minimum average temperature, and 10 cm ground temperature as the significant independent variables. (ii) The A-ARDL results indicate a long-term association between the selected variables. (iii) The minimum average temperature is positively associated with the agricultural sector's share in GDP. (iv) Increases in carbon dioxide emissions, 10 cm ground temperature, and cultivated agricultural area were found to decrease the agricultural sector's share in GDP. In summary, the findings of study confirms the multi-dimensioned and non-linear character of climate-agriculture relations, challenging overly simplistic interpretations. From a policy perspective, the evidence puts emphasis on the need for climat-smart agricultural policies that bind together temperature regulation, emissions reduction, and efficient land use. Such insights are particularly significant for nations such as Türkiye that experience both extreme climatic volatility as well as structural challenges within their agricultural systems.

1. Introduction

From the Industrial Revolution to the present, 2023 has been recorded as the hottest year in terms of instrumental global surface temperature measurement (Copernicus Climate Change Service - CCCS, 2024). Advanced climate models predict that average temperatures will rise by 1.4–5.8 Celsius by the end of the century. (Intergovernmental Panel on Climate Change – IPCC and Masson – Delmotte, 2021). All these increases show that uncontrolled anthropogenic greenhouse gas emissions are causing global climate change. Long-term global climate change includes regional temperature increases and changes in meteorological factors like precipitation patterns, pressure systems, and humidity (Karl and Trenberth, 2003). The distribution of climatic condition deviations is said to be heterogeneous across nations. (IPCC, 2014). The frequency and severity of extreme weather events are predicted to rise in the upcoming years if nothing is done. Therefore, it is crucial to look at how the negative externality driven by climate change affects economic processes.

The agricultural sector is one of the most impacted by climate change when it comes to economic activities (Rosenzweig and Parry, 1994; Randhir and Hertel, 2000; Deschenes and Greenstone, 2007). Technological advancements in agriculture have an impact on productivity, but they are strongly correlated with climate and agricultural subsectors. Climate-related anomalies are known to reduce agricultural production and cultivable land (Aggarwal et al., 2010; Karahasan and Pınar, 2023), reduce farmer incomes (Mishra and Sahu, 2014), shift agricultural employment (Kjellstrom et al., 2009), raise adaptation costs (International Food Policy Research Institute – IFPRI, 2009), and cause

* Corresponding author. Faculty of Business and International Relations, Vistula University, Warsaw, Poland.
E-mail address: s.mukhtarov@vistula.edu.pl (S. Mukhtarov).

https://doi.org/10.1016/j.jenvman.2025.126111
Received 3 January 2025; Received in revised form 14 May 2025; Accepted 4 June 2025