

Article

Demographic Dependency and the Future of the European Workforce: A Spatial–Temporal Forecasting Approach

Cristina Lincaru ¹ , Adriana Grigorescu ^{2,3,4,*} , Camelia Speranta Pirciog ¹ and Gabriela Tudose ¹

¹ National Scientific Research Institute for Labor and Social Protection (INCSMPS), Povernei Street 6, 010643 Bucharest, Romania; cristina.lincaru@yahoo.de (C.L.); pirciog@incsmips.ro (C.S.P.); gabriela_tudose@yahoo.com (G.T.)

² Faculty of Public Administration, National University of Political Studies and Public Administration, Expozitiei Boulevard, 30A, 012104 Bucharest, Romania

³ Academy of Romanian Scientists, Ilfov Street 3, 050094 Bucharest, Romania

⁴ National Institute for Economic Research “Costin C. Kiritescu”, Romanian Academy, Casa Academiei Române, Calea 13 Septembrie nr. 13, 050711 Bucharest, Romania

* Correspondence: adriana.grigorescu@snsa.ro

Abstract

This research paper examines the spatial and time variation of demographic dependency in Europe in a 30-year horizon of the evolution of the demographic dividend regarding the economic dependency ratio (ADR1). We used the Curve Fit Forecast tool to estimate the trends of ADR1 in each of the EU Member States using data on Eurostat projections and a sophisticated geostatistical analysis tool developed in ArcGIS Pro 3.2.2. The findings indicate that the dependency in all countries has increased significantly in a statistically significant manner as the Gompertz function has appeared as the best curve in a third of the cases. It is an S-shaped asymptotic behaviour of this function that effectively describes the nonlinear patterns of acceleration and saturation of demographic ageing. As indicated in the analysis, the European regions are increasingly moving apart, with the southern and eastern nations such as Romania demonstrating the most alarming decline in ADR1. These trends highlight the need to reform labour market policies and social protection mechanisms to an ageing population. The paper combines the curve-fitting, descriptive statistics (median, skewness, interquartile range (IQR)) with time clustering (value, correlation, and Fourier) to provide an effective, replicable approach to early warning and policy prioritisation. Overall, the results highlight the importance of integrating predictive spatial modelling and demographic economics to support anticipatory and evidence-based policy decisions. The proposed approach proves to be a robust and transferable framework, applicable to a wide range of socio-economic phenomena characterised by inertia and structural change. Future research should extend the analysis to subnational levels, incorporate additional explanatory variables, and develop scenario-based simulations, including multivariate Gompertz-type models, to further enhance both predictive accuracy and policy relevance in the context of emerging structural labour scarcity.

Keywords: demographic dividend; age dependency ratio; Gompertz model; curve fit forecasting; spatiotemporal analysis; time series clustering; demographic transitions; labour market sustainability; structural labour scarcity



Academic Editor: Michael R. Greenberg

Received: 20 March 2026

Revised: 20 April 2026

Accepted: 27 April 2026

Published: 1 May 2026

Copyright: © 2026 by the authors.

Licensee MDPI, Basel, Switzerland.

This article is an open access article distributed under the terms and conditions of the [Creative Commons Attribution \(CC BY\)](https://creativecommons.org/licenses/by/4.0/) license.

1. Introduction

The demographic dividend is a terribly complicated and ambivalent phenomenon that stands at the centre of the modern discussions on the socio-economic sustainability of Eu-