

The Effects of Population Aging on Public Services in Romania: An Econometric and Spatial Approach

Extended Abstract

Introduction

Demographic transformations represent one of the most profound structural challenges for European states in the 21st century. Changes in population structure, labor market dynamics, and the sustainability of social protection systems are interconnected and mutually reinforcing, creating institutional pressures with long-term effects. In Romania, these processes are particularly intense: the post-December period has been marked simultaneously by accelerated demographic decline, massive emigration, and structural aging. Unlike other European countries where these trends occurred gradually, in Romania they overlapped within a relatively short period, generating demographic imbalances of unusual magnitude.

The decline in fertility below the generational replacement level, predominantly young population emigration, and increasing life expectancy have led to structural imbalances in the ratio of the active population to the dependent population. The demographic dependency ratio is a synthetic indicator of the pressure exerted on the working-age population and public budgets. An increase in this indicator does not reflect a simple statistical change but signals a structural transformation in the relationship between taxpayers and beneficiaries of public systems, with direct implications for the funding of essential services.

The motivation for this study derives from the need to move beyond purely descriptive approaches to demographic phenomena, favoring an integrated analysis that investigates institutional and territorial implications. Depopulation and aging do not affect the national territory uniformly but generate distinct regional patterns influenced by economic development levels and migration intensity. Without a thorough understanding of these spatial differences, public policies risk being insufficiently calibrated to local realities, leading to inefficient resource allocations and deepening regional disparities. The strategic nature of this topic is amplified by the fact that demographic trends are slow, cumulative, and difficult to reverse in the short term, making scientific grounding of public decisions a structural necessity.

According to demographic transition theory, declining fertility and increasing life expectancy lead to structural changes in the population pyramid, increasing the proportion of elderly people and reducing the active labor force. In the absence of compensatory migration flows or significant productivity increases, this transformation erodes the fiscal base and compromises the sustainability of redistributive systems. From a public economics perspective, the increase in the dependency ratio amplifies budgetary pressure through two simultaneous mechanisms: on one hand, increased demand for medical and social services generated by a larger elderly population; on the other hand, a relative reduction in fiscal revenues due to a shrinking active population. This combination can generate persistent structural imbalances, especially in regions with moderate productivity, low investment, and limited savings.

Spatial economic aspects add an essential territorial dimension to this analysis. A reduction in the active population leads to lower investment, deterioration of available services, and reduced territorial attractiveness, which in turn amplifies migration and accelerates depopulation—a dynamic described in the literature as a downward spiral. Rural and mono-industrial areas are particularly vulnerable to this cumulative mechanism. At the same time,

the social dimension of aging—manifested through loneliness, isolation, and the loss of informal support networks—exerts additional indirect pressures on public services through increased incidence of chronic diseases, cognitive decline, and mental health issues.

Objectives

The general objective of the research is to evaluate the impact of depopulation and demographic aging on the functioning and sustainability of public services in Romania by integrating classical econometric analysis with spatial statistics methods. The study aims to highlight both causal relationships between demographic indicators and public expenditures, as well as the territorial distribution of these phenomena, focusing on identifying areas with a high risk of demographic vulnerability.

Specifically, the research analyzes the evolution of the demographic dependency ratio and the aging index from 1990 to 2023, investigates the relationship between these indicators and per capita public spending in health and social services, tests for spatial autocorrelation, and estimates spatial regression models to capture regional interdependencies. The central hypothesis of the study is that aging and depopulation exhibit a non-random territorial distribution and generate differentiated effects on public services depending on the local socio-economic context.

Research Methodology

The study uses a database compiled from information provided by the National Institute of Statistics (INS), Eurostat, and the Ministry of Public Finance for the period 1990–2023. Data are aggregated at the NUTS 3 level, allowing the analysis of internal territorial disparities and identification of regional patterns. This spatial granularity is a significant methodological advantage, as it allows capturing demographic and economic heterogeneity that would be masked by nationally aggregated data.

The main dependent variable is per capita public expenditure, broken down by relevant sectors: health and social services. Independent variables include the demographic dependency ratio, the elderly dependency ratio, and the aging index. Control variables included in the model are county-level GDP per capita, population density, and net migration rate. The base econometric model is estimated using the OLS method, with verification of classical assumptions: stationarity, absence of multicollinearity, and homoscedasticity.

The spatial dimension of the analysis is performed using GeoDa at the NUTS 3 level. Thematic maps are constructed to highlight territorial concentration of the phenomenon. Global spatial autocorrelation is tested using Moran's I indicator: a positive and statistically significant coefficient confirms the existence of spatial clustering. Local analysis is performed using LISA (Local Indicators of Spatial Association), which identifies cluster types—High-High, Low-Low—and potential spatial outliers.

Expected Results

It is expected that the results will indicate the presence of positive spatial autocorrelation of the demographic dependency ratio, suggesting the formation of persistent regional clusters of

aging and depopulation. These clusters will likely be concentrated in rural areas of Moldova, Oltenia, and Muntenia, as well as regions affected by intense external migration, where contraction of the active population was more pronounced.

Econometric analysis is expected to show a positive and statistically significant relationship between the demographic dependency ratio and public expenditures on health and social services, reflecting increased demand for services specific to the elderly population. This relationship may be moderated by county-level GDP per capita, indicating that the fiscal impact of aging is amplified in counties with lower economic development: the poorest counties simultaneously face an older population and more limited budgetary resources—a paradox of compound vulnerability.

Conclusions

The study has a high strategic relevance as it provides a solid empirical foundation for decisions regarding public resource allocation and social service planning. In the context of persistent demographic decline, institutional adaptation is no longer an option but a structural necessity. Integrating econometric analysis with spatial statistics allows precise identification of the most vulnerable areas and differentiated targeting of public interventions, surpassing the limits of uniform national approaches.

The practical utility of the results manifests at multiple decision-making levels. At the central level, ministries responsible for public health, social protection, and public finance can use the findings to calibrate policies according to territorial demographic realities and to avoid uniform allocations unrelated to regional disparities. At the local level, county and municipal authorities can benefit from the identification of high-risk areas to prioritize investment in service infrastructure and develop administrative capacity adapted to the needs of the elderly population. Non-governmental organizations active in social services can also use these data to guide community interventions efficiently.

Relevant stakeholders include central and local public administration, European institutions concerned with territorial cohesion, healthcare and social service providers, and local communities affected by depopulation. In the context of the European Union's demographic priorities and associated funding instruments, such a study provides a rigorous analytical basis for the optimal use of structural and cohesion funds aimed at reducing regional disparities.

In conclusion, integrating econometric analysis with spatial statistics contributes to an in-depth understanding of the relationship between demographic changes and the functioning of public services in Romania. The research highlights the need for regionally differentiated policies and emphasizes the importance of scientifically grounded decision-making in the context of demographic dynamics characterized by accelerated decline and aging, phenomena whose effects can be effectively managed through proactive, well-calibrated public policies anchored in the specific territorial realities of each region.