

Understanding the Trajectories of Population Decline Across Rural and Urban Europe: A Sequence Analysis

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Summary

Our paper acknowledges the projected reversal of European population growth and the diversity of population trajectories amongst sub-national areas across the continent. Though population decline in Europe is a recognised phenomenon, its spatial and temporal dynamics are considerably less developed. We use annual population count estimate data to understand the various trajectories of sub-national population decline across rural and urban Europe. To this end, we apply a novel methodology in sequence analysis. We identify a typology of population decline distinguishing seven distinct pathways to depopulation and chart their geographies, highlighting differentiated patterns of population decline across the rural-urban continuum.

KEYWORDS: Population Decline, Population Trajectories, Spatial Demography, Europe, Sequence Analysis

Abstract

Europe is projected to become the first continent to undergo a unique demographic transition - population decline. Latest population prospects review expects the continental population to be in a state of decline by 2025 (UN 2019). Population decline is not, however, expected to occur uniformly across the continent as significant differences in the rate and direction of population change are set to persist, further exacerbating regional and country demographic imbalances (UN 2019). At present, population decline has begun in 17 European territories, but is expected that a total of 33 will be in decline by 2050 (UN 2019). Depopulation at this scale is a previously unrecognised demographic phenomenon and will thus impose a wealth of novel challenges (Coleman & Rowthorn 2011).

Despite the urgency of European population decline, significant gaps in our knowledge remain. Particular research deficiencies relate to the geographic scope of studies, or lack thereof, and the overlooking of temporal processes of decline. Studies that have examined decline in comparative analyses over large geographical areas have highlighted specificities in the trajectories of decline (Haase et al., 2016, Wolf & Weichman 2018). However, these studies are typically concerned with rural or urban decline exclusively. The presence of a rural/urban dichotomy within the literature has complicated efforts to conceptualise decline in national and international settings. Further gaps in our knowledge stem from the infrequent consideration of temporal processes of decline. Rather, studies tend to only consider the direction of population change between two points in time, ignoring potential fluctuations in the direction and rate of change. This study seeks to address these shortcomings by examining trajectories of population decline across the entirety of the wider European region, in a total of 33 territories. Its main contribution is the production of a typology in which various pathways of decline are presented. This will be attained through the novel application of sequence analysis.

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Data & Methodology

This study looks at the temporal sequence of population decline in 696 sub-national areas in 33 European territories. Areas correspond to the NUTS3 Eurostat territorial classification system. A database was collated, using data from both Eurostat and national statistics offices, containing annual population count estimates for 19 years from 2000 to 2018. Additional data on the population distribution by settlement type was acquired from Eurostat and national statistics agencies to construct a rural-urban typology.

The methodological procedure is composed of four stages. Briefly, the first stage involves the conversion of population count data to a categorical format required to perform sequence analysis. Annual percentage change was calculated to inform a set of five categorical states that represent various degrees and directions of population change. Trajectories of population change are represented by the chronological ordering of these states. Five states were distinguished in this study (Table 1). The second stage includes all steps relating to the application of sequence analysis, including the creation of a sequence object and the implementation of a dissimilarity metric to compare sequences of population change. The third stage involves the creation of a typology of population decline trajectories using an agglomerative hierarchical clustering procedure. Finally, the fourth stage involves the mapping of the clusters and the implementation of a rural-urban typology to further analyse cluster compositions.

State	Definition (annual % change)
Decline	≤ -0.99
Moderate Decline	$> -0.99 \text{ \& } \leq -0.3$
Stability	$> -0.3 \text{ \& } < 0.3$
Moderate Growth	$\geq 0.3 \text{ \& } < 0.99$
Growth	≥ 0.99

Table 1 – Defined states of population change for sequence analysis.

Results

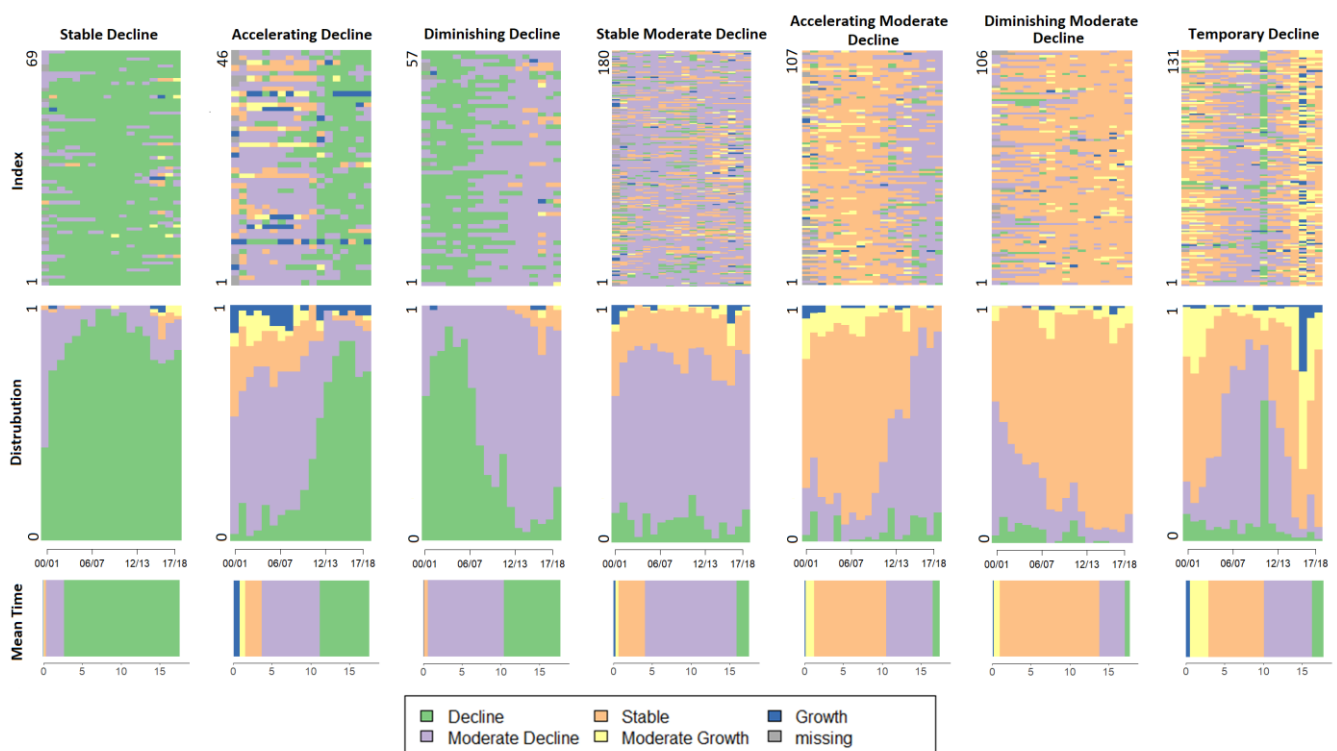


Figure 1 –State index plots (top), state distribution plots (middle) and mean time plots (bottom)

Figure 1 presents the state index plots, state distribution plots and mean time plots of 7 clusters representing different pathways to depopulation. The clusters are described in detail below.

Cluster 1 – Stable Decline. Displays a pattern of sustained decline greater than 1% annually. Areas within this cluster are located exclusively in eastern and southern Europe - with the exception of areas in the former East Germany (figure 2). Considering the persistent and rapid nature of decline, it is probable that areas grouped within this trajectory cluster are already experiencing consequences of population decline. As such, these areas are of greatest concern.

Cluster 2 – Accelerating Decline. Describes a trajectory of escalating population decline with areas transitioning from moderate decline to decline. This represents an increase in the pace of decline. Predominantly located in Southern Europe, chiefly in the Balkan countries of Croatia and Romania. Areas grouped within this trajectory cluster should be perceived as in great risk as, unless their trajectory is reversed, negative consequences of depopulation will be unleashed in a short time frame.

Cluster 3 – Diminishing Decline. Details a transition from the highest rate of decline to a moderate rate. This represents a decrease in the pace of decline though the direction population of change remains in decline. With few exceptions, areas in this cluster are located within eastern Europe in countries formerly belonging to the Soviet Union - particularly in Belarus, Estonia, Russia and Ukraine. These areas are of particular significance to research concerning the mitigation of depopulation since these areas have demonstrated the potential to reduce the rate of decline.

Cluster 4 – Stable Moderate Decline. This cluster is defined by persistent moderate decline. This cluster is abundantly distributed across Europe in a total of 25 European territories and is the predominant pathway of decline Austria, Finland, Hungary, Moldova, Poland, Romania, and Serbia.

Cluster 5 – Accelerating Moderate Decline. Describes a trajectory of accelerating decline following an extended period of stability. Areas in this cluster represent the expansion of population decline in Europe. This cluster is over-represented in Southern Europe and is the most common trajectory of decline in the countries of France, Greece, Italy, Romania, Spain, Slovenia, and Portugal. These areas are at risk of experiencing further decreases in the rate of population growth and thus accelerating the process of depopulation.

Cluster 6 – Diminishing Moderate Decline. Displays a trajectory of diminishing moderate population decline to stability, signalling the end of decline. Areas in this cluster are predominantly found within central and eastern Europe and are most prevalent in Czechia, Slovakia, Sweden and the UK. These areas demonstrate the potential to reverse population decline trajectories and are therefore of utmost significance to policy driven research into depopulation. Such areas should be studied in greater detail in an effort to understand the underlying processes of decline reversal to formulate intervention policies that can be applied across the continent.

Cluster 7 – Temporary Decline. This cluster is characterised by two transitions, and is unique in this regard. Both transitions concern stability and moderate decline, with the first describing the ascendancy of moderate decline and the second detailing its withdrawal. Of the 131 areas grouped in this cluster, 101 are located within Germany.

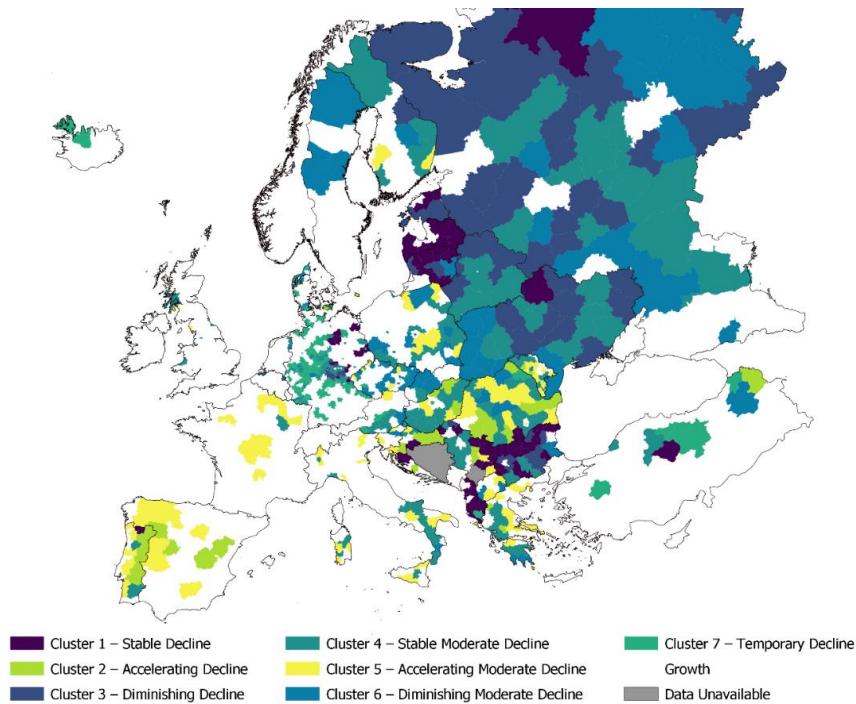


Figure 2 – Geographic Distribution of population decline trajectories

Decline by Area Classification

The final stage of the analysis offers an investigation into the distribution of decline trajectories by area classification. Using the classification established in the Eurostat Urban-Rural typology, all areas were sorted into three categories; urban, rural, and intermediate. In addition to this, population size was considered to further distinguish between areas. The product is a typology that enables a more rigorous analysis of population decline by considering both area classification and size.

We observe critical differences in cluster compositions. Firstly, urban areas are most prevalent in clusters detailing diminishing and temporary declines and least prevalent in clusters where decline is accelerating. This implies that the pace of urban population decline across Europe has decelerated in the past twenty years. Secondly, rural areas are dominant in trajectories that depict accelerating population decline. This has two major implications; that rural decline in Europe has accelerated since 2000 and that the observed expansion of European population decline is chiefly concentrated in rural areas. Thirdly, clusters of diminishing decline are most prevalent amongst areas with large populations ($> 500,000$), indicating that a deceleration in the pace of decline has taken place in areas with large populations. Finally, clusters detailing trajectories of accelerating population decline are chiefly composed of small and mid-sized areas.

Conclusion

Taken together, the analyses of this study portray a picture of heterogeneity with regards to trajectories of population decline and their geographic distribution. In an attempt to summarise, this study recognises significant regional contrasts that extend beyond simple growth/decline regimes. Generally, population decline in the East of Europe is more widespread, severe in regards to pace and magnitude, and a more long-standing feature than in the West of Europe. Further analysis shows that rural decline is considerably more common than urban decline in the European context, with decline more long-standing and fast paced than urban decline. Conversely, urban decline is shown to be largely

decelerating across Europe. Similar findings are reported when looking at population decline by area size, with examples of accelerating decline abundant in areas with small and mid-sized populations and evidence pointing to a deceleration of decline in larger areas. In all, these findings reveal that the drivers of expanding European population decline are rural areas with small populations.

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Biographies

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