Locating 'left-behindness' in the EU15: a regional typology

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Abstract

Recent debates about 'left behind' places have opened up new opportunities to understand the interconnected challenges faced by many regions in the Global North. At the same time, the application of this label to a wide variety of places with different characteristics has been accused of obscuring as much as it reveals. In this paper, we shed light on the variegated nature of 'left behind' regions through a cluster analysis of NUTS3 regions in the EU15. We identify six types of areas, of which three can be described as 'left behind' based on their performance on a range of economic, demographic and social variables. There are important differences between these three types of regions, strengthening the argument for policy responses adapted to local circumstances.

Keywords: 'left behind' places, regional inequalities, economic divergence, demographic decline, peripheralisation

1. Introduction

In recent years, expressions of 'discontent' such as the election of Donald Trump, Brexit, and the rise of populist/anti-establishment parties in many parts of the Global North, have reawakened concerns about the gap between prosperous and struggling places. The latter have, in the Anglophone world at least, often been referred to as 'left behind' (Dijkstra et al., 2020; Kemeny & Storper, 2020; Martin et al., 2021; Rodríguez-Pose, 2018). However, a wide variety of regions are subsumed under this label, from small rural communities experiencing population decline and brain drain (Ulrich-Schad & Duncan, 2018; Wuthnow, 2018) to former industrial cities adapting to structural change (Flint & Powell, 2021), which obscures their different circumstances and needs. Additionally, the questions "in relation to what or who should places be seen as 'left behind'?", and "what is the temporality of 'left-behindness'" are often glossed over (Pike et al., n.d.). There is, therefore, a lack of clarity about exactly what it means to be 'left behind', and which places are most affected.

In response, this paper provides an attempt to measure 'left-behindness' empirically, while doing justice to its heterogeneity. Using k-means cluster analysis, and incorporating a range of economic, demographic and social variables, we develop a typology of all NUTS3[1] regions in the EU15[2]. We find multiple clusters that could be described as 'left behind', as well as clusters characterised by relative prosperity and growth. The typology offers insights into the differential characteristics of lagging and marginalised regions, and so respond to a need for a

greater differentiation between various kinds of 'left behind' places (Martin et al., 2021; Nilsen et al., 2022).

In the next section we review how the dimensions, geographic scale and temporality of 'left-behindness' are constructed in the literature. Section 3 describes the data and methods used in our analysis. Section 4 provides a description of results, and in section 5 we discuss the implications of our findings. The final section concludes the paper.

2. 'Left behind 'how', 'where', 'when', and 'in relation to what'?

The use of the term 'left behind places', originating in the Anglophone world, has accelerated since the 2008 global financial crisis and is used across the Global North to label territories that have been negatively affected by globalisation, economic and technological change and are facing economic, demographic, social and political challenges (Pike et al., n.d.).

The construction of 'left-behindness'

In contrast to terms such as 'lagging' or 'less favoured', which tend to have a narrower economic interpretation, the label 'left behind' appears to refer to a more broadly-defined condition including important demographic and social elements (Dijkstra et al., 2020; Martin et al., 2018; Rodríguez-Pose et al., 2021).

Among economic geographers, 'left behind' places are framed as territories that have failed to benefit from the economic shifts and dominant growth paradigms of recent decades. Globalisation and technological change have reduced demand for certain skills and industries, which has led to job losses and economic decline, as well as to a sense of lost purpose and status, particularly in regions with large manufacturing sectors (Iammarino et al., 2017; Martin et al., 2018; McCann & Ortega-Argilés, 2021; Rodríguez-Pose, 2018). Differences in economic prosperity and dynamism, as measured through measures of economic growth, productivity and employment creation, are thus central to understand 'left behind' places. Additionally, the experience of disruptive economic change, notably deindustrialisation, is strongly linked to the idea of a 'left behind' region.

Though these economic processes are seen as central, literature in this area, particularly that exploring the 'geographies of discontent', moves beyond a purely economic focus. For instance, reports that lack of education, low incomes, and income inequality played a role in events like the Brexit vote and election of Donald Trump, have heightened concern over issues such as poverty and inequality among economic geographers (e.g. Rodríguez-Pose, 2018). Such political events have been interpreted as expressions of discontent, taking various forms ranging from political disenchantment and distrust of elites to broader feelings of marginalisation. The observation that these expressions of discontent are overrepresented in particular territories is arguably leading to more holistic considerations of the interplay between economic, demographic, social and cultural factors in 'left behind' places.[3]

A prominent demographic feature seen in accounts of 'left behind' places is outmigration, and the subsequent population decline that this can cause (Iammarino et al., 2017; Jennings &

Stoker, 2019; Rodríguez-Pose et al., 2021). As argued in theories of 'shrinking cities', though population decline is often brought on by economic causes, once instigated this demographic shrinkage can exacerbate the economic challenges and result in a vicious circle that is difficult to break out of (Martinez-Fernandez et al., 2012; Wolff et al., 2021). The literature on urban shrinkage additionally describes how population decline often has a negative effect on the provision and maintenance of local services and infrastructure (Béal et al., 2019; Cauchi-Duval et al., 2016; Franklin, 2021; Martinez-Fernandez et al., 2012; Wolff & Wiechmann, 2018). Population shrinkage and its associated effects (vacant housing, withdrawal of services) can in turn affect people's perceptions of the vitality of their territory (Hollander, 2011), and thus, contribute to feelings of being 'left behind'.

Demographic decline is particularly an issue of concern in rural and peripheral areas. Perhaps even more so than urban regions, such areas are often framed as 'left behind'. We can see this in the narrative of a growing economic divide between large 'superstar' cities and smaller towns, villages and rural areas (Iammarino et al., 2019; Kemeny & Storper, 2020), as well as by those who frame rural and peripheral areas as sites of discontent, economic misfortune, and poverty (Förtner et al., 2021; Guilluy, 2015).

However, while many remote rural areas certainly face challenges, recent contributions have questioned the tendency to treat peripheries as a static spatial category, instead emphasising the dynamic and relational nature of the process by which places are rendered peripheral over time (Kühn & Weck, 2013; Lang, 2012; Leibert & Golinski, 2016). According to this perspective, peripheries are made and unmade as a result not just of economic shifts but of decisions by public and private actors (Kühn, 2015; Leibert & Golinski, 2016; Pugh & Dubois, 2021). Key aspects in the peripheralisation process are: out-migration, infrastructure and knowledge network disconnection, dependence upon larger cites for funding and services, and discursive marginalisation (Kühn & Weck, 2013; Leibert & Golinski, 2016).

By conceptualising peripheralisation as a dynamic process involving relationships between actors, this concept challenges the idea that sparsely populated or remote regions are, by nature, destined to become 'left behind'. It allows us to see how similar processes of marginalisation can be observed in regions that are not peripheral in a traditional geographical sense. As such, designating regions as 'left behind' based on their settlement structure or distance from 'core' regions seems inappropriate.

The multidimensionality of 'left-behindness'

The notion of 'left-behindness' thus clearly incorporates multiple dimensions. However, the various processes discussed above have different implications for regions and their residents. Moreover, not all dimensions will affect all 'left behind' regions to the same extent. Places may lag behind on one measure, but much less so on another (Martin et al., 2021).

For instance, literature on urban shrinkage points out that population loss can result from several different processes, each with different implications. Whereas population loss caused by declining birth rates is often part of a broader national trend rather than reflecting purely local conditions, extensive out-migration, especially of younger and more highly-educated

groups, is more likely to be a response to region-specific factors such as economic decline or a lack of amenities (Cauchi-Duval et al., 2016; Wiechmann & Pallagst, 2012). The latter may also have more direct impacts on the region's available workforce and its level of human capital (McCann, 2017).

This literature additionally reminds us that while economic and demographic decline are interlinked, this relationship is not straightforward (Cauchi-Duval et al., 2016; Haase et al., 2016). As argued by Wolff and Wiechmann (2018), similar economic drivers may have different effects on population trends across different regions. Similarly, population loss is not uniformly a cause for (further) economic decline (Bartholomae et al., 2017; Hartt, 2018).

The multitude of related but only partially overlapping dimensions presents difficulties in terms of categorising areas as 'left behind. We argue that, instead of picking a single indicator of 'left-behindness' or combining multiple indicators into an overall index, 'left behind' regions can usefully be seen as encompassing a variety of conditions, characterised by different combinations of issues. In this we follow the example of recent literature exploring 'varieties of shrinkage' (Haase et al., 2016; Karp et al., 2022; Ribant & Chen, 2020). This literature describes how shrinkage can have different underlying causes, and has different effects on local housing markets and infrastructure depending on the national and regional context.

In this paper we similarly emphasise the issue of variegation by developing a typology of European regions, using cluster analysis based on measures designed to capture the key features of economic, social and demographic marginalisation discussed above. This typology does not neatly separate 'left behind' places from other regions in a simple dichotomy. Rather, our approach emphasises the variety of regional conditions and performance across the EU15.

The scale of 'left-behindness'

Because the underlying processes rendering territories 'left behind' act on different scales, determining the scale at which 'left-behindness' manifests itself is complicated. Economic processes such as deindustrialisation play out at the regional level whereas geographies of poverty and wealth are more "fractal" in nature (Dorling & Pritchard, 2010, p. 90), with income levels varying substantially between neighbourhoods. Glossing over the different scales at which these inequalities play out can contribute to a sense of confusion about who or where is (most) 'left behind', with some pointing out that even economically successful cities such as London contain substantial areas of deprivation (Eaton, 2021).

The interplay of these micro and macro processes makes it difficult to choose an appropriate spatial scale for analysis. In previous studies, scales range from NUTS1 regions to smaller local and neighbourhood-level geographies (Bolton et al., 2019; Dijkstra et al., 2020; Pilati & Hunter, 2020; Rodríguez-Pose, 2018). An area deemed 'left behind' on a lower scale might disappear as left behind on larger scales of analysis, as Pugh & Dubois (2021) discuss in relation to peripheries. For the purposes of this paper, we use NUTS3 regions. Though relatively small, NUTS3 regions remain meaningful geographies for economic measures such

as output growth and industrial change, which are central to the concept of being 'left behind'. They moreover offer data covering multiple dimensions and allow for international comparison.

The pan-EU scope of the present study additionally raises questions regarding the reference point to be used to determine whether a place is 'left behind'. We argue that the national context is the most salient in shaping perceptions of being 'left behind', particularly when it comes to economic measures and those related to living standards. This is because for the most part the nation remains a more important 'imagined community' than the European Union, and perceptions of social reality remain strongly nation-centric (Anderson, 2006; Malešević, 2019). As such, the national is likely to be the most important scale at which people evaluate the relative prosperity of their local or regional area. Given large differences in levels of economic development between countries (Pilati & Hunter, 2020), this calls for an approach that takes into account national variations of certain measures.

The temporal nature of 'left-behindness'

A further important distinction is between current conditions, and processes of change over time. As argued by several authors (Carreras et al., 2019; Essletzbichler et al., 2018; Rodríguez-Pose et al., 2021) a key cause of the dissatisfaction felt in many communities is not their current economic status, but the perception that their relative position in society has declined compared to their past. In a similar vein, Pilati and Hunter (2020) argue that when it comes to territories with a lower level of economic development, it is important to distinguish between regions in the process of catching up to national or EU levels, and regions that have growth rates at or below the national or EU rate and can therefore truly be described as 'lagging'. A dynamic perspective is therefore important in understanding 'left behind' areas.

At the same time, territorial inequalities in cross-sectional terms are arguably equally important given there is often a desire in public policy to target support at the areas that are currently 'worst off'.

We therefore argue that both dynamic and cross-sectional measures should be taken into account. Inclusion of both measures is necessary as the regions that have experienced the most (economic) decline over the past four decades are not necessarily the same as the areas currently located at the bottom of the distribution (Iammarino et al., 2020; Kilroy & Ganau, 2020).

A second question, particularly when it comes to evaluating growth or decline over time, is regarding the appropriate timeframe. Pilati & Hunter (2020), Rodríguez-Pose (2018) and Iammarino et al. (2020) examine changes in GDP, employment and/or population over, respectively, the period 2000-2018, the period 1990-2014 and the period 2000-2014. In this study, we evaluate change between 1991 and 2018, given the importance of long-term economic change in shaping perceptions/feelings of being 'left behind', and 1991 being the first year with data availability for all territories in the EU15.

3. *Data and methods*

We conduct a cluster analysis of all NUTS3 regions in the EU15, using a k-means approach. The aim of the cluster analysis is to identify groups of regions that share similar features with respect to the various dimensions of 'left-behindness' outlined above. The clusters are then evaluated in terms of their distinctive characteristics, and we discuss to what extent, and in what way, each conforms to the idea of a 'left behind' region.

Variables and data sources

Following the discussion above, we use a mix of cross-sectional (point-in-time) and dynamic measures to be able to explore the differential importance of each for different regions. Table 1 provides a summary of all ten variables used in the analysis and their data source.

To capture the economic dimension of 'left-behindness', we use regional gross domestic product (GDP) per head in 2018 as a measure of the level of economic development of each region. To account for substantial national variations in per capita GDP across the EU15, we express each region's GDP per head as a percentage of national GDP per head, thus evaluating a region's level of development relative to that of the member state to which it belongs. To measure long-run economic growth, we calculate growth in GDP per head since 1991. Again, this is expressed relative to national growth in GDP per head (by subtracting the national from the regional growth rate), to produce an indicator of the extent to which the region has managed to track, exceed, or fall behind, national growth over the period 1991–2018.

Along with these two GDP-based measures, we include employment growth over the period 1991–2017 as an indicator of the region's long-run ability to generate jobs. Employment growth for each region is expressed as the deviation from the national rate of employment growth. The final economic indicator is a measure of industrial employment loss (or gain) over the period 1991–2017. We calculate the change in employment in the industrial sector as a share of overall regional employment (i.e., the proportion of total regional employment that is accounted for by the industrial sector in 2017, minus the proportion of total regional employment that is accounted for by the industrial sector in 1991). This measure is a proxy for the extent to which the overall composition of regional employment was affected by deindustrialisation between 1991 and 2017. Both are workplace-based measures.

To capture the demographic dimension, we calculate the average annual rate of net migration over the five-year period from January 2014 to January 2019. We are only able to cover this more recent period due to incompleteness of the relevant data series for years before 2014.[4] This indicator therefore performs a similar function as the other point-in-time measures, in that it captures conditions in the more recent pre-Covid period. Since net migration can fluctuate strongly from year to year, we average over multiple years to get a more representative estimate. To capture longer-term demographic trends, we calculate the average annual rate of population growth from 1991 to 2018. We subtract the national rate of population growth from the regional rate to account for substantial country-level differences in population growth and

to capture regions that experienced unfavourable demographic development relative to the national rate.

Aside from overall net migration and demographic shrinkage, the out-migration of young people, and population ageing are seen as key facets of peripheralisation (Kühn & Weck, 2013; Leibert & Golinski, 2016). We construct an old-age dependency ratio (the ratio of over 65s to 15–64-year-olds) in 2018, as well as a proxy indicator of youth migration. The latter is calculated as the difference between the number of 15–19-year-olds living in the region in 2014 and the number of 20–24-year-olds living in the region in 2019, expressed as a proportion of the total population. Given the generally low mortality rates among these age groups, the main reason for any shortfall or excess of 20–24-year-olds over the number of 15–19-year-olds is likely to be migration.

Thirdly, to capture the social dimension, we employ data from two projects commissioned by the European Observation Network for Territorial Development and Cohesion (ESPON). From the ESPON TiPSE project (Copus, 2014) we use estimated at-risk-of-poverty rates (ARoP rates). Poverty has been suggested as an explanatory factor in the rise of discontent across Europe and north America (Iammarino et al., 2019; Rodríguez-Pose, 2018), and is more generally seen as a feature of 'left behind' and peripheral regions (Leibert & Golinski, 2016; Lichter & Schafft, 2016). Because neither EU-SILC or any other EU-wide household dataset has sufficiently large samples to produce reliable estimates at NUTS3 level, the ESPON TiPSE project produced estimated ARoP rates for NUTS3 regions using a variety of approaches, including use of national statistics and area-based modelling (Melo & Copus, 2014). The at-risk-of-poverty rate is defined as the estimated proportion of regional households with equivalised household income below 60% of the national median, and the data on which the estimates are based are mainly from 2011.

Lastly, we assess the accessibility of services across EU15 regions, using travel time data produced as part of the ESPON PROFECY project (Noguera et al., 2017). Though the project calculated travel times to a wide range of services, in this paper we only use supermarkets and convenience stores (referred to as 'shops' in the remainder of this paper). Unlike some of the other services, shops are services of everyday use, and long travel times to these services are likely to present more significant challenges for individuals and families than long travel times to cinemas or hospitals. Moreover, travel times to shops are highly correlated with travel times to other essential services such as primary schools and banks (Royer et al., 2022). ESPON provides travel times for each cell in a 2.5km by 2.5km grid covering the whole of the EU. Based on this gridded data we calculated, for each NUTS3 region, the population-weighted median travel time to the nearest shop.[5] These travel times are for journeys by car only and so will not reflect the experiences of individuals without access to a car. Nonetheless, they provide an indication of the relative degree of accessibility of everyday services across different regions

Other potentially relevant variables that were not available at NUTS3 scale for the whole of the EU15 for 1991-2018 include average household income levels, labour market participation and unemployment rates, and skill levels.

Table 1 Summary of variables used in cluster analysis

Dimension	Indicator	Point-in-time or dynamic	Year or time period	Data source
Economic	GDP per head relative to national GDP per head	P	2018	ARDECO (2021)
	Growth in GDP per head relative to growth in national GDP per head	D	1991–2018	ARDECO (2021)
	Change in the industrial sector as a share of regional employment	D	1991–2017	ARDECO (2021)
	Employment growth relative to national employment growth	D	1991–2018	ARDECO (2021)
Demographic	Population growth relative to national population growth	D	1991–2018	ARDECO (2021)
	Average annual rate of net migration (per 1,000 population)	P	2014–2019	Eurostat (2021a)
	Old-age dependency ratio	P	2018	Eurostat (2021b)
	Proxy youth migration indicator (implied net migration among 15–24-year-olds, per 1,000 population)	P	2014-2019	Eurostat (Eurostat, 2021b)
Social	At-risk-of-poverty rate	P	2011	ESPON (2015)
	Population-weighted median travel time to shops	P	2016	ESPON (2016)

Methodology

For clustering, we use the Hartigan & Wong algorithm (Hartigan & Wong, 1979; Morissette & Chartier, 2013), which assigns each data point (i.e., each region) to a cluster centroid, and iteratively repositions centroids and reassigns data points in order to minimize the squared distances between the cluster centroid and the data points belonging to that cluster. In other words, it finds clusters that are as internally similar to each other as possible. To minimize the sensitivity to the initial centroids chosen, a 'multi-start' option was implemented (Fränti & Sieranoja, 2019).

The clusters obtained through the above approach were compared with the results of using a hierarchical clustering approach (the Ward method), and the k-means approach was found to produce a greater between-cluster separation as indicated through a higher total between-cluster sum of squares for any given number of clusters.

Because k-means clustering is sensitive to outliers, we eliminate the most extreme multivariate outliers as identified using the Mahalanobis distance (Mahalanobis, 1930). Seven outliers are identified in this way (more information about these outliers can be found in appendix A). After their removal, 1083 regions are left.

The average Silhouette width (Rousseeuw, 1987) and gap statistics (Tibshirani et al., 2001) were examined to determine the optimal number of clusters.

4. Results

A six-cluster solution provides a suitable compromise between the proportion of the overall variance in the data accounted for by the clusters, and the degree of cluster separation. Below, we describe the clusters based on their mean score on each of the different indicators (see Table 2) for summary statistics for each cluster and appendix B for results for all regions). It has to be remembered that there remains substantial within-cluster heterogeneity, and so what is true on average for a cluster may not necessarily correspond to the characteristics of each region in that cluster to the same extent.

Cluster 1: Long-term economic prosperity (85 regions)

Regions in this cluster tended to have high levels of GDP per head in 2018 compared to their country overall, as well as high rates of net migration between 2014 and 2018. Probably in part because of the substantial net in-migration of younger age groups, old-age dependency ratios in 2018 were on average very low and accessibility of services was on the whole very high for this cluster. Employment and population growth in these regions also tended to outpace national rates of growth between 1991 and 2018. On the other hand, this cluster tended to see modest growth in GDP per head over this same period, on average even slightly trailing behind the national rate of growth (though the population growth seen by many of these regions means that they still saw reasonable growth in aggregate output). The average estimated poverty rate for this cluster was slightly higher than that of the average EU15 region.[6] Regions belonging to this cluster are mostly found in Germany and the UK,

with some examples in France, the Netherlands, and Austria. It is predominantly made up of large and medium-sized cities

Cluster 2: High growth (188 regions)

This cluster is composed of regions with very high rates of GDP growth between 1991 and 2018 compared to their country as a whole, as well as very strong employment and population growth. In recent years, net migration also tended to be strongly positive for these regions. Levels of GDP per head in 2018 tended to be close to the national level, suggesting that these regions experienced impressive economic growth from a position of below-average GDP per capita in 1991 in order to catch up with national levels. On average these regions had low rates of poverty and relatively low old-age dependency ratios. The regions in this cluster are more evenly spread between countries than those in cluster 1, but are nonetheless overrepresented in particular parts of the EU15: Flanders, Luxembourg, Austria, western and southern Germany, central parts of England and the Netherlands outside the main cities. Most of these regions are located in the EU core area or the so called 'Blue Banana' (Brunet & Boyer, 1989).

Cluster 3: Relative economic and demographic stability (313 regions)

Regions in this large cluster are characterised by fairly average values across most of the indicators. Economically, regions in this cluster tended to have GDP per capita somewhat below the national level in 2018, and between 1991 and 2018 they on average slightly underperformed the national rate of per capita GDP growth. Still, their economic performance was better than that of most regions in clusters 4, 5 and 6. Rates of population growth between 1991 and 2018 tend to have roughly followed the national average, and in recent years these regions have on the whole seen modestly positive net migration. The only variables on which this cluster deviates to some extent from this overall moderate or 'middling' profile are the estimated poverty rate, which tends to be substantially lower than for the average EU15 region, and net youth migration, which tends to be negative. Geographically, cluster 3 is fairly widespread, it being the most prevalent cluster in Austria, Belgium, Denmark, France, Italy and the Netherlands. Interestingly, neither Spain nor Portugal have regions belonging to this cluster.

Cluster 4: Economic decline and deindustrialisation (232 regions)

This cluster is composed of regions that have seen a strong deterioration in their economic position relative to their country overall, as indicated by rates of per capita GDP growth strongly below the national rate between 1991 and 2018. Economic output per head in 2018 tended to be somewhat below the national level for these regions. Additionally, regions in this cluster tend to have been affected by a severe decrease in industrial employment as a share of overall regional employment, alongside lacklustre overall employment growth. The typical estimated poverty rate in these regions is also above that of the average for the EU15. On the other hand, many of these regions experienced a net influx of young people in recent years, and net migration overall was similarly positive. It is the dominant cluster in the UK, Ireland, and Spain, and also accounts for a substantial number of regions in Belgium, France

(particularly northern France), the Netherlands and Portugal. Significant pockets of cluster 4-regions are also found in eastern Germany and the Ruhr area. This attests to the important impact that economic decline, and in many cases deindustrialisation, have had on regions within these countries.

Cluster 5: Demographic decline and ageing (164 regions)

These regions generally had very low rates of GDP per capita relative to their country as a whole in 2018, and failed to keep up with national GDP growth between 1991 and 2018. But perhaps the most notable characteristics of these regions are the very strong population decline and employment decline seen from 1991 to 2018. Most of these regions experienced not just relative, but absolute decreases in population between 1991 and 2018 (see appendix C). Though in recent years overall net migration was on average moderately positive for this cluster, younger age groups seem to have left in net terms, which is probably a contributing factor to the very high old-age dependency ratios seen in these regions. Overall, the story seems to be one of substantial demographic decline and population ageing. These regions are much more prevalent in northern and central parts of the EU15 – in Sweden, Finland, Denmark, Germany (particularly eastern Germany), France, and parts of the UK. To the extent that this cluster is found in southern-European countries, it tends to be in the northern parts of these countries (e.g. northern Spain and Italy).

*Cluster 6: Disconnected, high poverty (101 regions)*

Regions in this cluster share similarities with those in cluster 5, in the sense of being characterised by low levels of GDP per head, lacklustre economic growth, and population decline (again, most regions in this cluster lost population in absolute and not just relative terms). What sets this cluster apart, however, are the high estimated rates of regional poverty, and the very high travel times to the nearest shop found in these regions. The overall impression of this cluster is therefore one of disconnected regions with low service accessibility and a high prevalence of poverty. Population ageing was not as severe in most of this cluster as in the regions belonging to cluster 5, and the rate of (relative) population loss is also less extreme – though these regions tend to have experienced negative net migration in recent years. In contrast to cluster 5, this cluster is prevalent in the Mediterranean countries. A fifth of Spanish regions, almost a third of (mostly southern) Italian regions, almost half of Greece's regions, and three-quarters of Portuguese regions belong to cluster 6.

Table 2: Summary statistics for the six clusters

mean score on each indicator	Cluster 1 Long-term economic prosperity	Cluster 2 High growth	Cluster 3 Relative economic and demographic stability
GDP per head	1.50	1.05	0.80
Growth in GDP per head	-2.1	24.6	-5.0
Change in industrial employment share	-9.0	-5.5	-5.5
Employment growth	6.5	21.9	0.4
Population growth	6.0	13.1	1.5
Net migration	72.1	67.1	46.2
Old-age dependency ratio	25.1	30.1	35.5
Net youth migration	34.1	1.7	-3.4
Poverty rate	18.5	13.0	13.8
Median travel time to shops	1.4	2.8	3.3
Number of regions	85	188	313
% of total regions	7.8	17.4	28.9
Population (2018)	39,893,159	83,852,968	91,111,543
% of total population	9.9	20.8	22.7

mean score on each indicator	Cluster 4 Economic decline and deindustrialisation	Cluster 5 Demographic decline and ageing	Cluster 6 Disconnected, high poverty
GDP per head	0.84	0.75	0.73
Growth in GDP per head	-13.6	-3.6	-3.3
Change in industrial employment share	-12.2	-7.3	-2.5
Employment growth	-7.6	-26.1	-11.7
Population growth	-1.4	-19.5	-9.8
Net migration	32.2	17.2	-6.0
Old-age dependency ratio	30.3	41.8	36.7
Net youth migration	2.8	-4.0	-1.4
Poverty rate	19.6	17.2	28.2
Median travel time to shops	2.0	3.5	5.8
Number of regions	232	164	101
% of total regions	21.4	15.1	9.3
Population (2018)	119,738,620	36,408,477	31,191,441
% of total population	32.0	9.7	8.3

Source: Authors' analysis based on ARDECO, Eurostat and ESPON data.

Figure 1: Spatial distribution of clusters across NUTS3 regions in the EU15
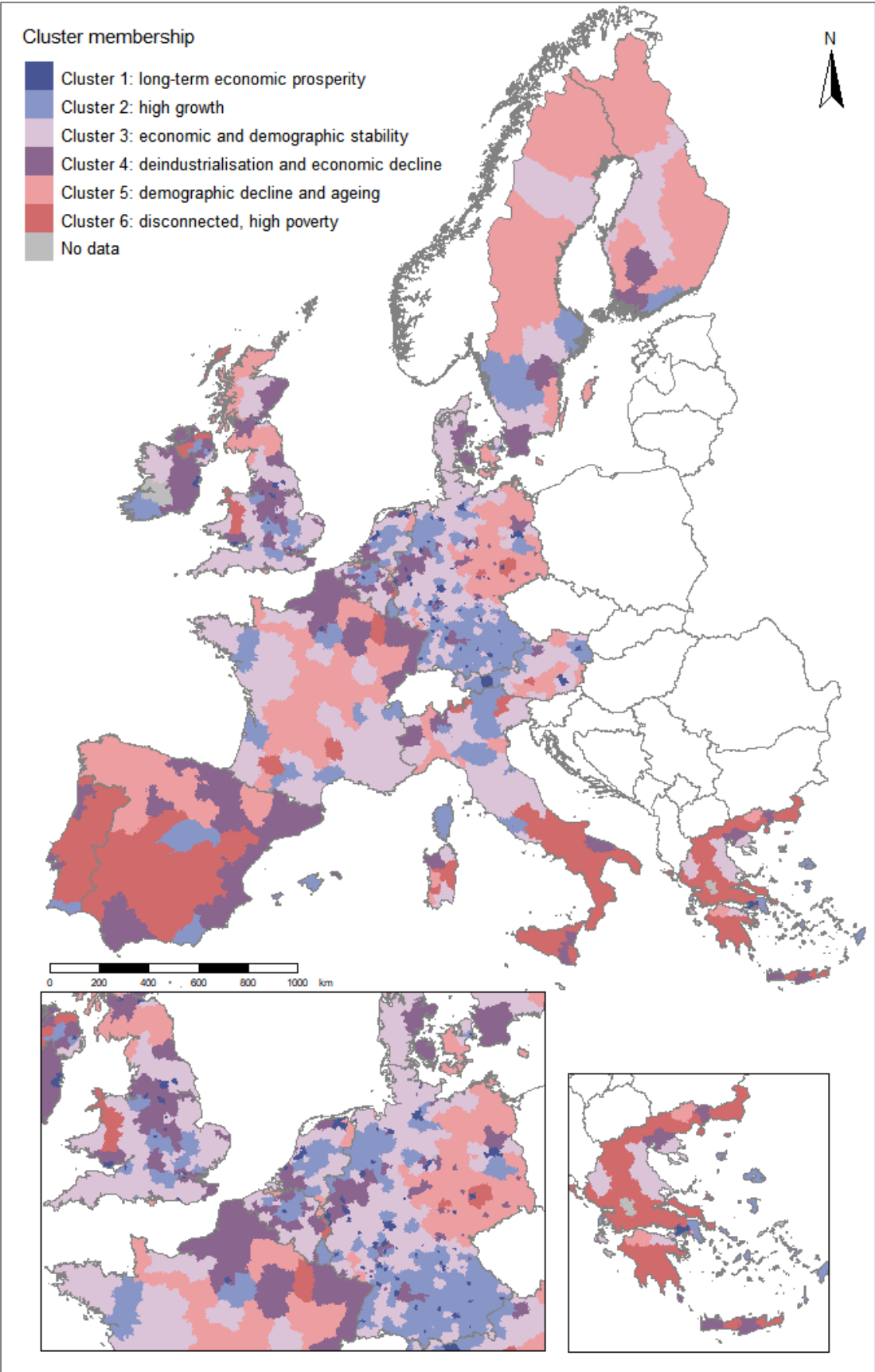
Source: Authors' analysis based on ARDECO, Eurostat and ESPON data. Boundaries are from EuroGraphics.

5. Discussion

Out of the six clusters, clusters 1, 2, and 3 do not appear to be particularly 'left behind'. Clusters 1 and 2 are characterised by high levels of relative economic development and/or strong economic growth, alongside moderate to high employment and population growth. An exception to this overall positive picture is the relatively high average estimated poverty rate in cluster 1, which highlight the importance of the spatial scale at which 'left-behindness' is considered. Approached at a smaller scale, areas of deprivation within otherwise economically successful regions could be seen as 'left behind'. However, at the regional scale, the wider economic context within which areas of poverty are located becomes visible, reflecting the imperfect correspondence between economic performance and living standards.

One reason for this disconnection is that residential geographies are not contiguous with geographies of employment and economic production, meaning income generated in one region may be 'exported' to another through commuting (Segessemann & Crevoisier, 2016). This may also explain the low rates of poverty found in cluster 3, despite levels of GDP per capita lagging behind the national average in many of these regions. The relative absence of poverty is one of the reasons why cluster 3, taken overall, does not fit the description 'left behind'. In addition, most of these regions did not experience substantial economic or demographic decline over the past four decades.

On the other hand, clusters 4, 5 and 6 have several of the features commonly associated with 'left behind' places. Regions in all three clusters tend to have low levels of economic development compared to their country overall, and moreover tend to have lagged behind national rates of economic growth over the past few decades, potentially pointing to a process of economic de-coupling (Kühn & Weck, 2013). Rates of population and employment growth also tend to have been below the national rate for each of these three clusters, with lower rates of net migration than seen in the first three clusters, alongside relatively high rates of poverty.

But there are important differences between these three clusters, suggesting they can be interpreted as representing different varieties of 'left-behindness' (Haase et al. 2016). These varieties differ both in terms of the dimensions on which they are 'left behind' and in terms of the temporality of their 'left behind' condition.

For clusters 5 and 6, demographic decline is a major feature, with most regions in these clusters having experienced substantial population shrinkage over past decades. In cluster 4 on the other hand, the economic decline and, in many cases, deindustrialisation that occurred over the period 1991 – 2018 was not in general accompanied by notable population decreases, though some of these regions may have experienced episodes of population decline prior to 1991. As such the challenges faced by these regions are mainly economic, rather than demographic, in nature. These findings suggest that, while demographic shrinkage often has economic causes (Haase et al., 2016), (ongoing) economic decline doesn't necessarily lead to (further) large-scale population loss. As Kühn (2015) points out, though

different dimensions of peripheralisation often reinforce each other, they can also remain apart.

Another substantive issue that doesn't seem to be a major problem for cluster 4, nor for most regions in cluster 5, is accessibility of key services. Service accessibility is, however, a challenge faced by a substantial number of regions in cluster 6, with 39 per cent of regions having a median travel time to the nearest shop of more than 6 minutes by car. Service accessibility in these regions is likely to be dependent on decisions regarding the location of public and private services made by faraway actors (Kühn & Weck, 2013), who will often be making such decisions based on efficiency considerations and the size of local markets. With population declining in many of these regions, they may be particularly susceptible to further service withdrawal and disconnection, furthering the peripheralisation process.

There are also contrasts between the clusters in terms of the temporal expression of their 'left behind' condition. This can be most clearly seen when it comes to the economic dimension. Whereas cluster 4 is characterised by strong relative decline in terms of per capita GDP – these regions on average having started out with levels of economic development not far below the national average but having seen their relative position deteriorate over time – clusters 5 and 6 are characterised by a trend of long-term economic stagnation from an already low base in 1980. We can also see a contrast between the stable economic prosperity of cluster 1, and the strong economic growth experienced by most regions in cluster 2. This is potentially indicative of the emergence of new regional 'core' areas of innovation and growth to rival, or perhaps even supplant, older financial and administrative centres, and a reminder that core-periphery relations are always in flux (Kühn & Weck, 2013).

Conclusion

This paper addresses the conceptual vagueness that plagues the notion of 'left-behind' regions (Pike et al., n.d.) through an empirical analysis of 'left-behindness' in the EU15. Drawing on related theories and concepts including uneven economic development, shrinkage and peripheralisation, we use multiple economic, demographic and social indicators of 'left-behindness' to construct a typology of NUT3 regions. Out of the six clusters identified, clusters 4, 5 and 6 ('economic decline and deindustrialisation', 'demographic decline and aging' and 'disconnected, high poverty') could be argued to describe different types of 'left-behindness', each with their own set of characteristics. Unlike studies that focus more narrowly on economic indicators such as economic growth or convergence, we deliberately incorporate a wider set of variables. And in contrast to studies of population shrinkage, we move beyond a focus on demographically shrinking regions by identifying a group of regions that have been relatively unaffected by population loss over the past several decades, despite being economically 'left behind'.

This group of regions (cluster 4) provides food for thought with regards to the concept of peripheralisation. Debates about peripheralisation are often linked to demographic decline. According to Kühn and Weck (2013), out-migration should even be seen as a core indicator of peripheralisation. Yet we find that there is a large group of regions (cluster 4) that, on the

basis of our (imperfect) indicators, do not appear to be particularly affected by (net) out-migration or population loss more generally. Yet these regions have been subject to several negative trends over recent decades, including deindustrialisation, economic decline, and lacklustre employment growth. Underlying these trends, they have probably been subject to some of the same key elements of peripheralisation as demographically shrinking regions, such as economic and infrastructural de-coupling and increasing dependency on external centres of innovation and decision-making. This suggests that the process of peripheralisation will vary considerably between regions and may not always be associated with out-migration and population decline.

The analysis presented in this paper has several limitations. One of which is that several aspects of 'left behind' regions, such as skill levels, average incomes, social attitudes, could not be incorporated due to the lack of comparable, EU-wide data on social indicators at NUTS3 level. Analysis at a national level may enable more detailed insights into these aspects due to greater data availability. Additionally, our approach to evaluating regional change by measuring growth between two time-points inevitably obscures the more intricate trajectories of growth and decline that regions have been subject to, something we focus on in other work (Le Petit-Guerin et al., n.d.).

Nonetheless, the analysis presented here adds to ongoing discussions about 'left behind' places by demonstrating the variegated nature of these territories. While the term has a degree of empirical validity, in the sense that it is possible to identify regions affected by the (combinations of) processes invoked in characterisations of 'left behind' places, it is important to consider the differences between such places and not regard them as homogenous. More broadly, if terms such as 'left behind places' are to have any real analytical and theoretical value, it is important to clearly define what we mean by them. We argue that using the conceptual building blocks of dimensions ('what'), scale ('where') and temporality ('when') is a useful way of doing this.

6. Endnotes

[1] Nomenclature of territorial units for statistics – level 3.
[2] Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and the United Kingdom.
[3] Though these expressions of discontent, are important symptoms of the conditions in 'left behind' regions, the focus of this paper is not discontent but the underlying processes – economic decline and stagnation, population shrinkage, loss of services – that appear to have resulted in feelings of disaffection in many regions.
[4] Because data are missing for 16 Scottish regions and all 11 Northern Irish regions prior to 2017, for these regions we calculate the average migration rate for 2017 and 2018.
[5] See Royer et al. (2022) for more information on calculation of median travel times.
[6] Bear in mind that poverty rates are based on national income distributions.

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