

# DEPOPULATING AREAS IN EUROPE IN THE SECOND DECADE OF THE 21<sup>ST</sup> C.

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## INTRODUCTION. DATA. METHODS.

• **Depopulation** is defined as a decrease in an area's population represented by negative total population change, which may be caused by a negative natural population rate (resulting from more deaths than births), a negative net migration rate (when more people leave an area to live elsewhere than enter it), or both these factors at the same time.

• **Objectives:** to identify long depopulating areas in European countries and to compare their populations in terms of age structure;

• **Long-term depopulation:** a real population loss in all years of the period under study;

• **Source:** Eurostat data;

• **Areas of interest and periods of analysis:** European countries (2011-2015, 2016-2020, 2011-2020) and NUTS 3 units (2015-2019);

• **Measures and formulas:**

Crude rate of natural change (NCR)    Crude rate of net migration (NMR)    Crude rate of total population change (TCR)

$$NCR = \frac{\sum_{t=1}^n NC_t}{\sum_{t=1}^n P_t} \cdot 1000 \quad NMR = \frac{\sum_{t=1}^n NM_t}{\sum_{t=1}^n P_t} \cdot 1000 \quad TCR = \frac{\sum_{t=1}^n TC_t}{\sum_{t=1}^n P_t} \cdot 1000$$

where  $NC_t$ ,  $NM_t$ ,  $TC_t$ ,  $P_t$  – natural change, net migration, total population change and average population in year  $t$ , respectively. NCR, NMR and TCR were calculated for whole periods.

Proportion of population aged 65+ years (%65+)

$$\frac{P_{65+}}{P_{total}} \times 100\%$$

Ageing index

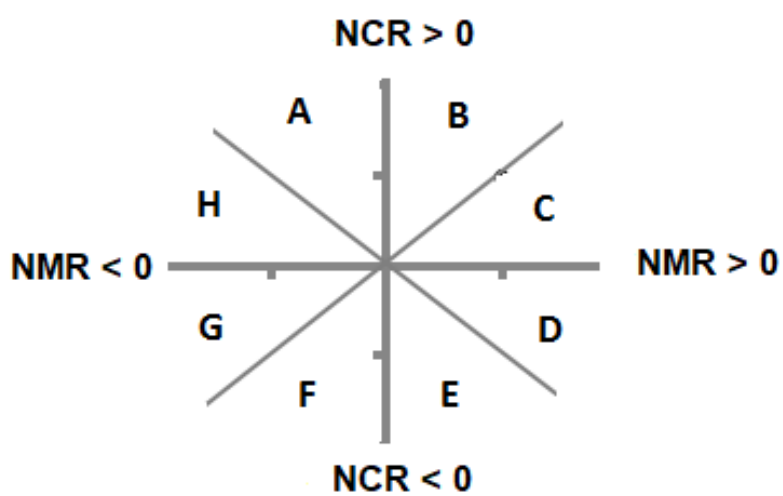
$$\frac{P_{65+}}{P_{0-14}} \times 100$$

where  $P_{0-14}$ ,  $P_{65+}$  and  $P_{total}$  – populations aged 0-14 years, >65 years, and the total population, respectively.

• **Methods:**

• **Webb's method** (Webb 1963) - was used to determine the causes of depopulation in the areas under consideration. Based on relations between the crude rate of natural change (NCR) and the crude rate of net migration (NMR), eight types of population change (four involving increases and four declines) were identified.

Fig. 1. Webb's typology



Types: A, B, C, D — areas with a positive total population change (increase)  
Types: E, F, G, H — areas with a negative total population change (decrease)

Source: Developed by the author based on Webb (1963), Jagielski (1978)

• **Ward's method** (Ward 1963) with the Euclidean distance matrix;

"Ward's method is agglomerative; thus, it partitions elements into a dedicated number of clusters in several steps. First, each element is independent, and then step by step, more elements will be ordered to a cluster. At each step, the method includes those elements which are the 'closest' (according to a metric) to the existing clusters. The number of steps may reach from 1 to  $n$  (number of analysed elements). In [the] case of 1, only one single cluster contains all elements, while in the case of  $n$ , all elements form [their] own cluster. Once a cluster is created as a result of a step, the elements of the new cluster cannot be separated again. The algorithm tries to find the optimal number of clustering steps" (Eszergár-Kiss, Caesar 2017, p. 26).

## CONCLUSIONS

• Depopulation (especially one that persists for a long time and has both natural and migratory causes) entails many demographic, social and economic problems for the affected areas, such as changes in populations' age and sex structure, an accelerating pace of population ageing, the dwindling of potential labour resources (the working-age population), and a rising number of old people with disabilities who have no relatives to take care of them and need institutional care.

• The general findings of the study are as follows: eight countries (Bulgaria, Croatia, Greece, Hungary, Latvia, Romania, Serbia and Ukraine) had negative crude rates of total population change in all years between 2011 and 2020. In four of them (Bulgaria, Croatia, Latvia and Romania), the population decrease was driven by natural as well as migratory factors (types F and G; see Tab. 1). In Albania, Lithuania and Portugal, population declines occurred in almost all years between 2011 and 2020, excluding one or two years.

• Regarding the regional level units, 554 out of 1441 NUTS3 had negative crude rates of total population change in all sample years. Most of them lay in Romania, Portugal, Poland, Hungary, Latvia, Croatia, Spain, Greece, Germany, and Bulgaria (see Fig. 3-4).

• Most long depopulating NTS3 units with the oldest populations in 2019 lay in Portugal, Spain, Greece, Italy and Germany (see Fig. 5).

• The majority of long depopulating countries were similar in the population age structure (see Fig. 6).

• The long depopulating NTS3 units with similar population age structures concentrated in the same country or in adjacent countries (see Fig. 7).

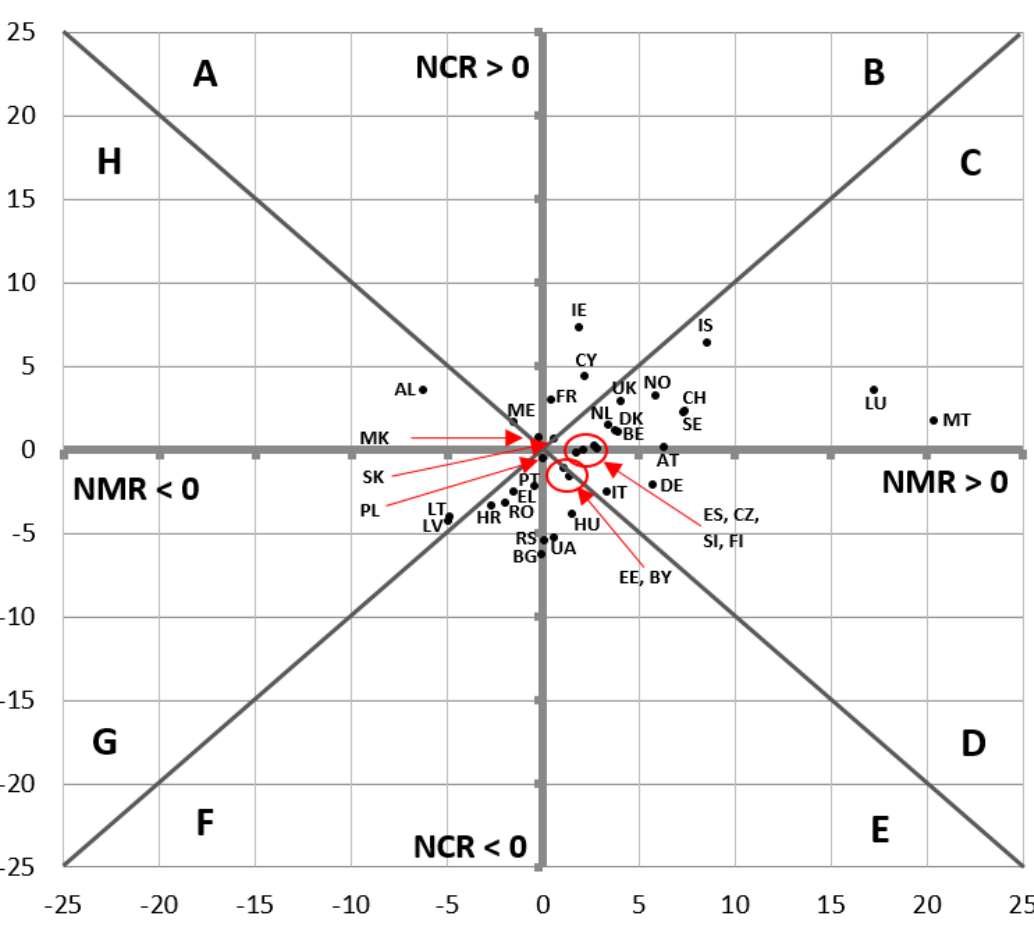
## RESULTS

Tab. 1. European countries by crude rate of natural change, net migration, total population change, Webb's type, percentage of people aged 65+, and ageing index in the sub-periods and individual years between 2011 and 2020

	Natural population change rate (NCR)			Net migration rate (NMR)			Total population change rate (TCR)			Webb's type			Proportion of people aged 65+(%)			Ageing index (per 100 population)		
	2011-2015	2016-2020	2011-2020	2011-2015	2016-2020	2011-2020	2011-2015	2016-2020	2011-2020	2011-2015	2016-2020	2011-2020	2011	2015	2020	2011	2015	2020
Albania (AL)	4.8	2.3	3.6	-7.0	-5.5	-6.3	-2.2	-3.2	-2.7	H	H	H	11.0	12.4	14.8	50.9	65.3	88.1
Austria (AT)	0.1	0.1	0.1	7.5	5.1	6.3	7.7	5.3	6.4	C	C	C	17.6	18.5	19.0	119.7	129.4	131.9
Belarus (BY)	-1.6	-1.7	-1.6	1.6	1.1	1.4	0.0	-0.5	-0.3	D	E	E	13.8	14.2	15.2	92.6	88.8	89.9
Belgium (BE)	1.6	0.5	1.1	3.9	4.0	3.9	5.6	4.5	5.0	C	C	C	17.1	18.1	19.1	100.6	106.5	113.0
Bulgaria (BG)	-5.5	-7.0	-6.3	-0.4	0.3	-0.1	-5.9	-6.8	-6.3	F	F	F	18.5	20.0	21.6	140.2	143.9	150.0
Croatia (HR)	-2.7	-4.1	-3.4	-1.9	-3.5	-2.7	-4.7	-7.5	-6.1	F	F	F	17.7	18.8	21.0	115.7	127.9	146.9
Cyprus (CY)	4.7	4.0	4.3	-2.7	6.9	2.2	2.0	10.9	6.5	A	C	B	12.7	14.6	16.3	75.6	89.0	101.9
Czechia (CZ)	0.1	-0.2	-0.1	1.2	3.0	2.1	1.3	2.8	2.0	C	D	D	15.6	17.8	19.9	107.6	117.1	124.4
Denmark (DK)	0.9	1.3	1.1	4.3	3.3	3.8	5.2	4.6	4.9	C	C	C	16.8	18.6	19.9	93.9	109.4	121.3
Estonia (EE)	-1.1	-1.3	-1.2	-1.3	3.4	1.1	-2.3	2.1	-0.1	G	D	E	17.4	18.8	20.0	113.7	118.2	121.2
Finland (FI)	1.2	-1.0	0.1	2.9	2.7	2.8	4.1	1.7	2.9	C	D	C	17.5	19.9	22.3	106.1	121.3	141.1
France (FR)	3.8	2.1	2.9	0.6	0.3	0.4	4.4	2.4	3.4	B	B	B	16.7	18.4	20.4	89.8	98.9	114.0
Germany (DE)	-2.3	-1.9	-2.1	7.2	4.3	5.7	4.8	2.4	3.6	D	D	D	20.7	21.0	21.8	152.2	159.1	159.1
Greece (EL)	-1.6	-3.4	-2.5	-4.6	1.5	-1.6	-6.2	-1.9	-4.1	G	E	F	19.3	20.9	22.3	132.2	144.1	155.9
Hungary (HU)	-3.8	-3.9	-3.9	1.2	1.9	1.5	-2.6	-2.0	-2.3	E	E	E	16.7	17.9	19.9	114.4	123.4	137.2
Iceland (IS)	7.1	5.6	6.3	1.6	15.0	6.5	8.7	20.8	14.9	B	C	C	12.3	13.5	14.4	58.9	66.2	77.0
Ireland (IE)	8.7	6.0	7.3	-2.0	5.5	1.9	6.7	11.5	9.2	A	B	B	11.5	12.9	14.4	54.0	60.3	70.9
Italy (IT)	-1.6	-3.6	-2.6	5.9	0.7	3.3	4.3	-2.9	0.7	D	E	D	20.5	21.7	23.2	145.4	157.2	178.5
Latvia (LV)	-4.0	-4.6	-4.3	-6.5	-3.3	-4.9	-10.5	-7.9	-9.2	G	F	G	18.4	19.4	20.5	129.6	129.3	128.1
Lithuania (LT)	-3.6	-4.4	-4.0	-7.5	-2.1	-4.9	-11.1	-6.6	-8.9	G	F	G	17.9	18.7	19.9	120.1	128.1	131.8
Luxembourg (LU)	3.9	3.2	3.5	19.7	15.1	17.3	23.6	18.3	20.8	C	C	C	13.9	14.2	14.5	79.0	85.0	90.6
Malta (MT)	2.0	1.5	1.7	14.6	25.6	20.4	16.5	27.1	22.1	C	C	C	15.7	18.2	18.5	104.7	127.3	138.1
Montenegro (ME)	2.3	1.0	1.6	-1.5	-1.5	-1.5	0.8	-0.5	0.1	A	H	A	12.8	13.7	15.6	66.7	74.1	87.2
Netherlands (NL)	2.0	0.9	1.4	1.8	4.9	3.4	3.8	5.8	4.8	B	C	C	15.6	17.8	19.5	89.1	106.5	124.2
North Macedonia (MK)	1.7	-0.2	0.7	-0.3	-0.1	-0.2	1.4	-0.2	0.6	A	F	A	11.7	12.7	14.5	66.9	75.6	89.5
Norway (NO)	3.6	2.8	3.2	7.8	4.0	5.9	11.4	6.8	9.1	C	C	C	15.1	16.1	17.5	80.7	89.4	101.2
Poland (PL)	-0.2	-1.0	-0.6	-0.3	0.3	0.0	-0.5	-0.7	-0.6	G	E	F	13.6	15.4	18.2	88.9	102.7	118.2
Portugal (PT)	-1.8	-2.7	-2.2	-2.6	1.8	-0.4	-4.4	-0.8	-2.6	G	E	F	18.7	20.3	22.1	123.8	141.0	162.5
Romania (RO)	-2.9	-3.6	-3.2	-1.5	-2.3	-1.9	-4.4	-5.9	-5.1	F	F	F	16.1	17.0	18.9	101.9	109.7	120.4
Serbia (RS)	-5.0	-5.9	-5.4	0.1	0.0	0.1	-4.9	-5.9	-5.4	E	E	E	17.2	18.5	21.0	119.4	128.5	146.9
Slovakia (SK)	0.7	0.5	0.6	0.5	0.7	0.6	1.2	1.2	1.2	B	C	B	12.6	14.0	16.6	81.8	91.5	105.1
Slovenia (SI)	1.0	-0.7	0.2	0.3	5.0	2.7	1.4	4.3	2.8	B	D	C	16.5	17.9	20.2	116.2	120.9	133.8
Spain (ES)	0.9	-1.3	-0.2	-1.8	5.3	1.8	-1.0	4.1	1.6	H	D	D	17.1	18.5	19.6	114.0	121.7	135.2
Sweden (SE)	2.4	2.2	2.3	6.6	8.2	7.4	9.1	10.4	9.7	C	C	C	18.5	19.6	20.0	111.4	113.3	112.4
Switzerland (CH)	2.3	2.2	2.3	9.0	5.8	7.3	11.3	8.0	9.6	C	C	C	16.9	17.8	18.7	111.9	119.5	124.7
Ukraine (UA)	-3.6	-5.9	-4.7	0.7	0.3	0.5	-3.0	-5.6	-4.2	E	E	E	15.3	15.6	17.1	107.7	103.3	111.8
United Kingdom (UK)	3.6	2.2	2.9	3.7	4.4	4.1	7.4	6.6	7.0	C	C	C	16.4	17.7	18.4	93.2	100.0	102.8

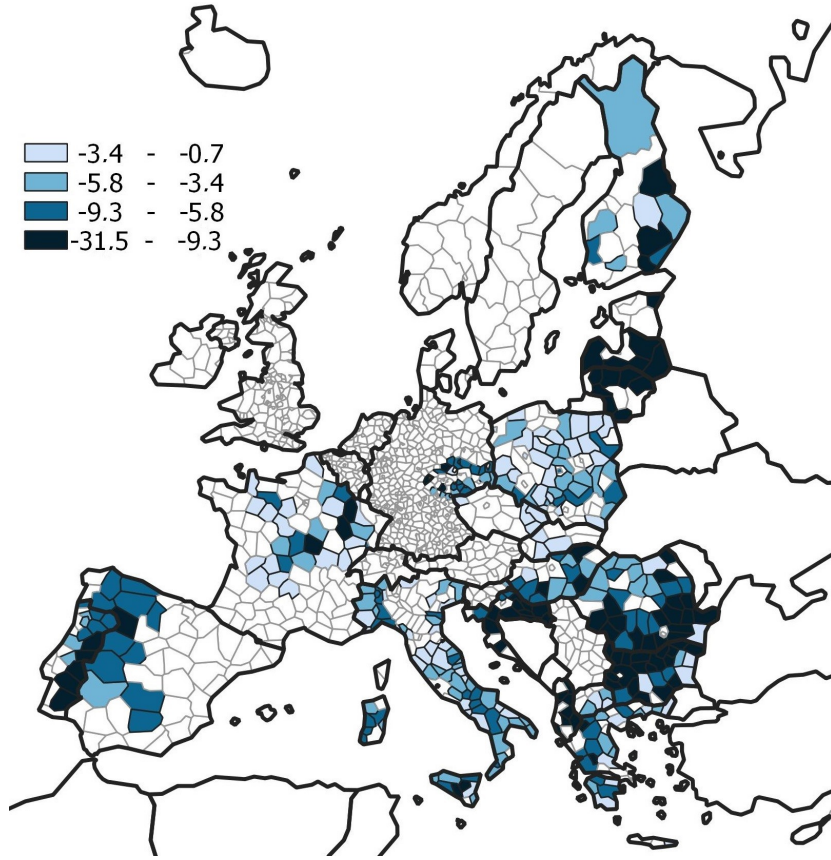
Note 1: Orange, green and blue cells mark long depopulating countries in periods 2011-2015, 2016-2020 and 2011-2020, respectively.  
Note 2: United Kingdom and Belarus: data from 2010-2014, 2015-2019 and 2010-2019.  
Source: EUROSTAT data; developed by the author

Fig. 2 Countries plotted by NCR, NMR and Webb's type in 2011-2020



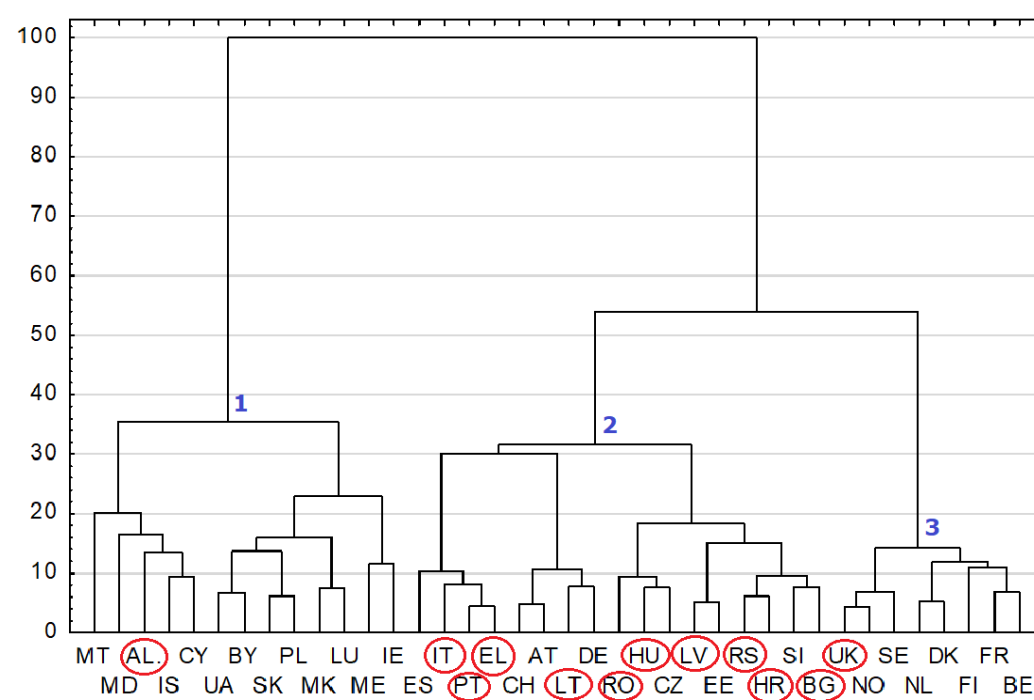
Note 1: For the symbols of the countries see Tab. 1.  
Note 2: See note 2 in the Tab. 1.  
Source: EUROSTAT data; developed by the author

Fig. 4 Long depopulating NTS3 units by TCR (per 1,000 population), 2015-2019



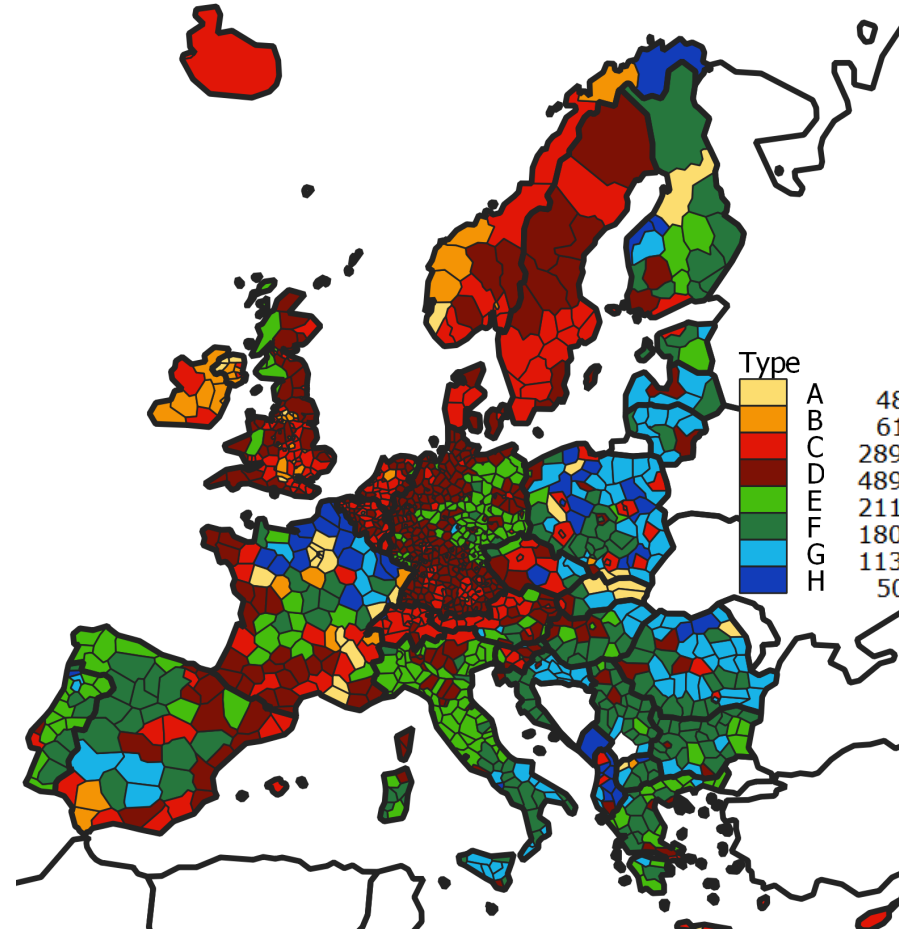
Note 1: see Note in the Fig. 3  
Note 2: min=-31.5; Q1=-9.3; Q2=-5.8; Q3=-3.4; max=-0.7  
Source: EUROSTAT; developed by the author

Fig. 6 European countries agglomerated by Ward's method according to the population age structure, 2020



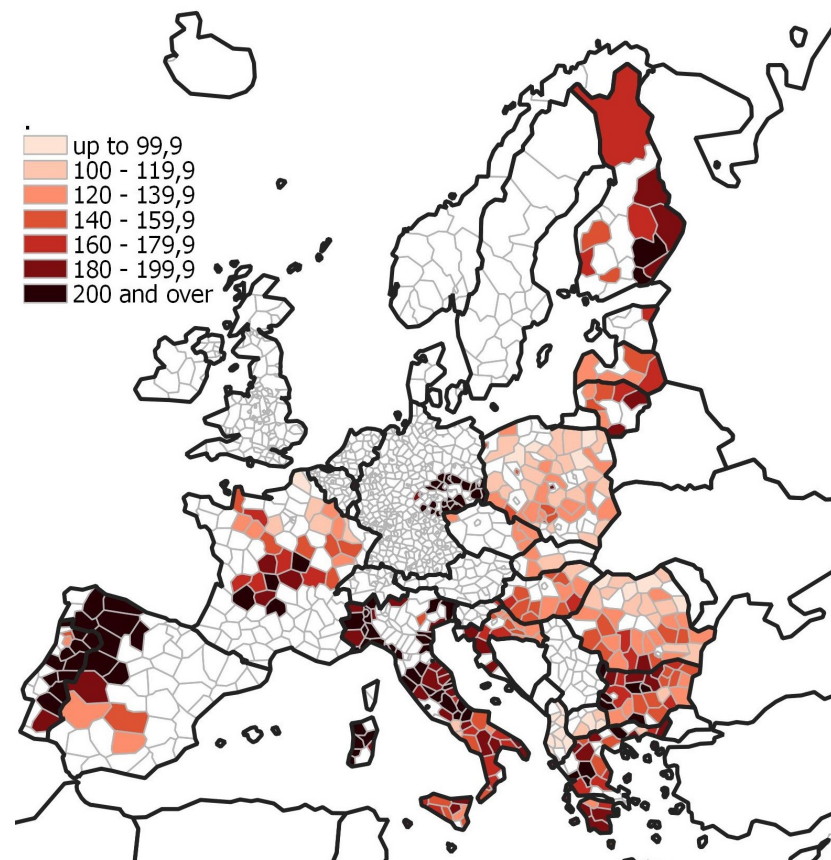
Note: Circled symbols denote the long-depopulating countries.  
Source: EUROSTAT; developed by the author

Fig. 3 NTS3 units by Webb's type in 2015-2019



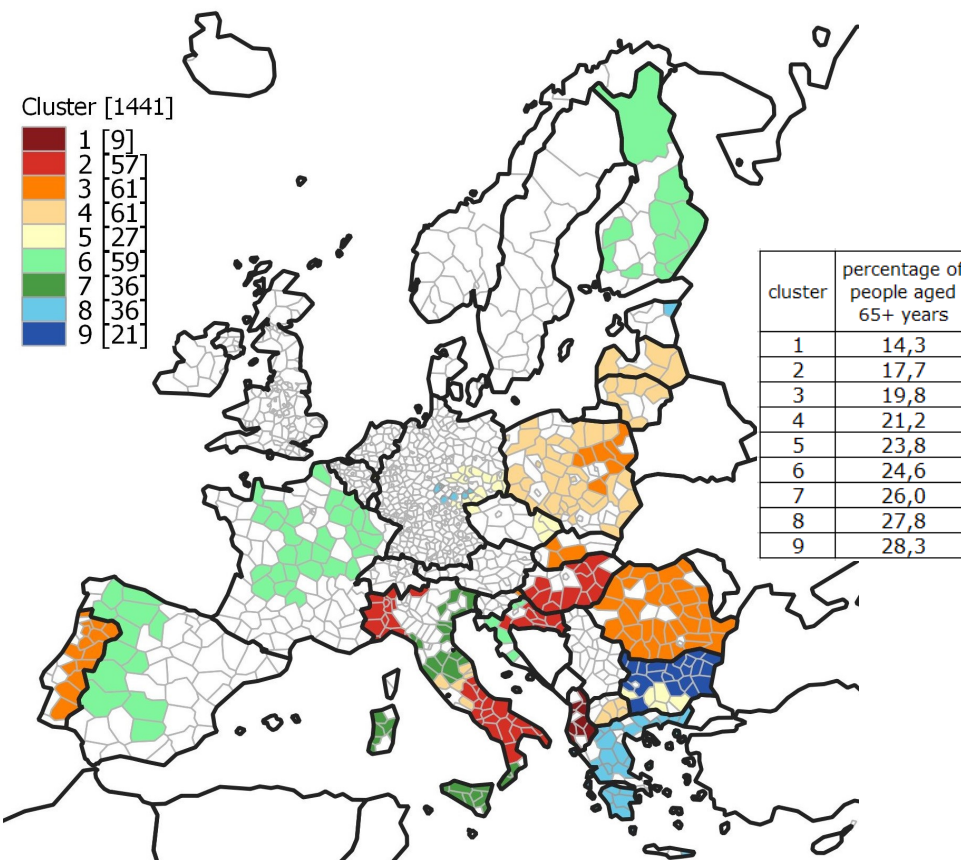
Note: United Kingdom: 2014-2018 data (UKM7, UKM8 and UKM9 data from 2017-2018 data); Serbia: 2017-2018 data;  
Source: EUROSTAT; developed by the author

Fig. 5 Long depopulating NTS3 units by ageing index (per 100 population), 2019



Note: see the Fig. 3  
Source: EUROSTAT; developed by the author

Fig. 7 Long depopulating NTS3 units agglomerated by Ward's method according to population age structure, 2019



Note: see note with the Fig. 3  
Source: EUROSTAT data; developed by the author

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