

## **COMPOSITE INDICATOR FOR MEASURING THE DEPOPULATION OF ITALIAN MUNICIPALITIES BY THE PERMANENT POPULATION CENSUS RESULTS<sup>1</sup>**

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**Abstract.** The study aims to measure, through synthetic indices, the depopulation of Italian municipalities from demo-social indicators calculated on the basis of the results of the first 4 editions of the Permanent Population Census.

Since 2018, the Census has become Permanent, meaning it is conducted every year on a sample of municipalities and households and whose output, referring to the entire population, is disseminated annually. The new census strategy is based on the integration of data available in administrative sources and collected in the field. Outputs covering population structure by gender, age and citizenship (Italian-Foreigner/Stateless) and educational attainment are considered for the analysis, for the 2018-2021 period. The analysis focuses on a small group of municipalities, those belonging to the peripheral and ultra-peripheral Inner Areas, to highlight critical issues in these areas. Some indicators are produced on 1,756 Italian municipalities. The composite indicator Adjusted Mazziotta Pareto Index (AMPI) is constructed to summarize multidimensionality in space and time and allow comparisons on depopulation levels.

In addition, groups of municipalities with similar characteristics emerged through the calculation of the CHAID (Chisquared Automatic Interaction Detector) classification tree. The AMPI is the dependent variable, while the independent variables are administrative subdivisions, some geographic characteristics, and the municipality demographic size.

Finally, by representing on a map the municipalities of the best and worst nodes over the 4 years, it is observed that among the municipalities in the most peripheral Areas, the phenomenon evolves negatively quickly. Critical situations are also noted in the North, particularly in the Northeast: municipalities, even in the wealthy areas of the country, are at a risk of depopulation as much as those in the South and Islands.

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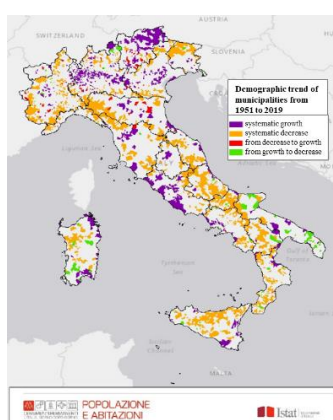
<sup>1</sup> The article is exclusively expressing the authors' opinions. Sections are attributed as follows: paragraphs 4 to Valeria Quondamstefano, paragraphs 1, 2 and 3 to Mariangela Verrascina. Paragraphs 5 and 6 are written jointly by the authors and can not be divisible.

## 1. Introduction

Depopulation is defined as a gradual decrease in the population of a place.

In Italy, many territories have experienced population loss in recent decades. A cartographic representation of the demographic trend between the 1951 Population Census and the 2019 Permanent Census (Figure 1) shows how many municipalities/territories have suffered a systematic decrease, from census to census, since the first post-war one (in orange in the map).

**Figure 1** – *Demographic trend of municipalities from 1951 to 2019.*



Source: <https://gis.censimentopopolazione.istat.it/apps/dashboard>

There are many causes that determined and still determine the reduction in the size of municipalities, linked mainly to demographic components, but not only. The phenomenon mainly involves small territories. The most appropriate way to study the phenomenon is to use the information at the finest administrative territorial level; so, we consider outputs available per municipality.

The Permanent Population Census comes to our aid in this; the Census had traditionally been carried out on the entire population until 2011, but since 2018 a paradigm shift has been applied. Since then, the Census is conducted annually on a sample of municipalities and households, with results referring to the entire population. So, while until 2011 very fine spatial level data (down to the sub-municipal level) was available every 10 years, with the new strategy a reduced set of data is available every year for all municipalities.

The objective of this work is to measure the depopulation of Italian municipalities starting from socio-demographic indicators computable with the results of the first four editions (2018, 2019, 2020 and 2021) of the Permanent Census of Population and Housing. The focus is on a small group of municipalities, the most marginalised ones, those included in some Inner Areas (Peripheral and Ultra-peripheral Areas).

Starting from the disseminated data, a number of indicators are calculated and then synthesised into a composite Indicator. Through a further Classification Tree analysis we highlight differences and similarities between municipalities in Peripheral and Ultra-peripheral Areas in the census years considered, also to identify where the municipalities most at risk of depopulation are and what structural/demographic characteristics they have.

## 2. Context

Depopulation derives from a combination of factors, from the reduction of births to emigration, mainly of young people who leave their place of origin for centres that may offer more opportunities for education and work, and who are unlikely to return (return migration). Studies have shown that there is a link between ageing and depopulation: the ageing process of the population has contributed to the subsequent depopulation, and depopulation has emphasised the ageing of the population, creating a vicious circle. (Reynaud and Miccoli, 2018)

Depopulation, population ageing, emigration and low birth rate lead to a different population distribution in the Italian territories and a modified age structure of the population in the different Italian areas. Populations that remain in the places of origin have an altered age structure. These phenomena affect more rural, already penalized and marginalized areas.

The Inner Areas<sup>2</sup> are the country's most peripheral territories in terms of access to basic public services. They are more than 20 minutes' travel time away from a pole that plays the role of a centre of supply of fundamental services relating to education, mobility and health care. (Dipartimento per lo sviluppo e la coesione economica, 2014).

The municipalities of Areas 4 (Intermediate), 5 (Peripheral), 6 (Ultra-peripheral) are 4,055 out of the total of 7,903<sup>3</sup> municipalities existing in Italy in 2021: they comprise more than half of the municipalities, cover about 60.0% of the entire surface area of the national territory and have more than a fifth of the total population (12,690,730 on 59,030,133 i.e. 21.5%).

For each area, the number of municipalities that lost population is calculated; depopulation is considered here as negative numerical change in the population of municipalities, continuous since the beginning of the Permanent Census (Table 1).

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<sup>2</sup> The definition of Inner Areas dates back to 2014, when the Department for Development and Economic Cohesion (DPS), now the Agency for Territorial Cohesion, launched a "National Strategy for Inner Areas" (SNAI) as part of the strategic options for the programming of EU funds 2014-2020.

<sup>3</sup> The municipality of Misiliscemi born from Trapani in 2021 is not considered, the population was counted together with Trapani.

**Table 1** – Number of municipalities and municipalities with a negative trend for Inner Area.

Area	Municipalities		Municipalities with Negative trend	
	AV	%	AV	%
1-Poles	217	2.7	100	46.1
2-Intermunicipal poles	122	1.5	49	40.2
3-Belt areas	3,509	44.4	981	28.0
4-Intermediate areas	2,288	29.0	952	41.6
5-Peripheral areas	1,475	18.7	734	49.8
6-Ultra-peripheral areas	292	3.7	171	58.6
<b>Total</b>	<b>7,903</b>	<b>100.0</b>	<b>2,987</b>	<b>37.8</b>
<i>Areas 5 and 6</i>	<i>1,767</i>	<i>22.4</i>	<i>905</i>	<i>51.2</i>

Analysing the phenomenon area by area, it can be seen that the municipalities in Area 3 have the smallest negative trend, fewer municipalities have steadily lost population since 2018 (28.0%, 981 municipalities), while the municipalities that have experienced population loss are in Area 5 half (49.8%, 734 municipalities), the share reaches 58.6% in Area 6 (171 out of 292 municipalities). Taking Peripheral and Ultra-peripheral areas together, more than half of the municipalities lose population from year to year. Only 51 municipalities in Areas 5 and 6 show a positive trend (overall in Italy 453).

To better understand the evolution of depopulation and aging in Italian territories (in absolute and relative terms) we consider the percentage of population over 65 years old and the aging index (Table 2).

**Table 2** – Percentage of population over 65 years old and the aging index for Italy, Areas 5 and 6 and municipalities with negative trend – Years 2018, 2019, 2020, 2021.

	Nr Municipalities	% Population over 65 years old				Aging index			
		2018	2019	2020	2021	2018	2019	2020	2021
Italy	7,903	22.9	23.2	23.5	23.8	174.0	179.3	182.6	187.6
Areas 5 and 6	1,767	24.4	24.9	25.4	25.7	204.3	211.5	216.4	222.4
Areas 5 and 6 - Negative trend	905	25.6	26.1	26.7	26.9	223.9	232.2	238.2	245.4

Thus, if we consider the share of the population over 65 years old we can see how between 2018 and 2021 the value increases slowly but inexorably from 22.9% to 23.8%, an increase of one point over the four-year period. If we go on to consider only the 1,767 municipalities belonging to the peripheral and ultra-peripheral areas, we go from 24.4% to 25.7%. Reducing the number of municipalities to those that have recorded a negative trend among the most peripheral municipalities, there is an increase of 1.3% but the share of over-65s increases further, 25.6% in 2018 and will be close to 27.0% in 2021. It should be noted, confirming the increase in the share of the elderly in recent years, that at the 2011 Census the over-65s were one fifth of the population (20.8%) while in 2001 they were 18.7%.

While the percentage of the population over 65 expresses the weight of the elderly in absolute terms in the total population, an index that represents the weight of the elderly in relative terms is the Ageing index. It is a relative index because it relates the elderly population to the population of the younger age groups. It is an indicator that synthetically represents the degree of by taking into account a part of the age structure of the population. It is a synthetic index of ageing of the population but also a dynamic one, which exalts the effect of ageing because there is usually a concomitant increase in the number of elderly people and a decrease in the number of young people, so the numerator and denominator change in opposite directions.

At the 2001 Census, there were 131.4 over-65s for every 100 young people, in 2011 this figure rose to 148.7. With the start of the Permanent Census, there is a further increase in the value from 174.0 in 2018 to 187.6 in 2021. Analysing the value for the more peripheral municipalities, the 200 threshold is exceeded, if in 2018 it was 204.3 in 2021 it reaches 222.4. An extremely critical situation is observed for the municipalities in Areas 5 and 6 with the negative trend (905 municipalities that have lost population steadily over the last four years): the values are 224 elderly people for every 100 young people and almost 2.5 over 65 years for every young person under 15 years.

These numbers confirm, if any were needed, the very close link between the ageing of the population and the depopulation of the territories. And they also confirm how in the most peripheral municipalities, those that are experiencing depopulation and hence ageing, the age structure of the population is altered, with a significant weight of the elderly. This is why we decided to focus the analysis on a small group of municipalities, those belonging to the Peripheral and Ultra-peripheral Areas, in order to highlight the critical aspects of these areas.

### 3. Data and variables

An interpretation of depopulation at the local level is carried out using a few simple and non-redundant indicators characterising the population remaining in the municipality. We also consider the resident foreigners because the phenomenon of immigration has characterised the demographic change from the mid-1990s to the present and in some territories of the country has reduced the intensity of population ageing. We have calculated some indicators representing the demographic and socio-economic characteristics of the population residing in the municipalities:

- A. *Proportion of foreign population (per thousand persons)* calculated as the ratio of foreign population to total resident population per thousand inhabitants;
- B. *Proportion of population aged 0-17 years (percentage)* calculated as the ratio of the population aged under 18 to the total resident population per hundred inhabitants;

- C. *Proportion of foreign population aged 0-17 years (percentage)* calculated as the ratio of the foreign population aged less than 18 years out of the total resident foreign population per hundred inhabitants (how many young foreigners out of the total foreign population);
- D. *Young age dependency ratio (percentage)* calculated as the ratio of population under 15 to the working age population (15-64) per hundred inhabitants (how many young people out of the working population);
- E. *Old age dependency ratio (percentage)* calculated as the ratio of the population over 65 years of age to the population of working age (15-64) per hundred inhabitants (the burden of the elderly on the working population);
- F. *Labour force turnover ratio (percentage) (revised)* calculated as the ratio of the 65-69 year-old population over the 20-24 year-old population per hundred inhabitants (the population about to leave the labour market over the population about to enter it<sup>4</sup>);
- G. *Percentage of population with diploma of upper secondary education* calculated as the ratio of population with diploma of upper secondary education or vocational qualification over the population aged 9 years and over per hundred inhabitants;
- H. *Percentage of population with master's degree or second level academic diploma and Research Doctorate (PhD)* calculated as the ratio of population with bachelor's degree, master's degree and PhD over the population aged 9 years and more per hundred inhabitants.

The indicators described are calculated for the 4 editions of the Permanent Census of Population and Housing (Istat, 2022; Istat, 2021; Istat, 2020).

The territory taken into account refers to the municipalities existing in 2021: 1,756<sup>5</sup> municipalities belonging to Inner Areas Peripheral and Ultra-peripheral.

## 4. Methodology

### 4.1. Composite Indicator

In recent years, the measurement of multidimensional phenomena has become increasingly relevant in the scientific community. Socio-economic phenomena cannot be measured by a single descriptive indicator but should be represented with multiple dimensions.

<sup>4</sup> Compared to the standard indicator that considers the population 60-64 years old and 15-19 years old, the indicator has been revised in light of the changes and lengthening of the age of exit from the labour market and the lengthening of the age of entry.

<sup>5</sup> 11 municipalities were excluded because they did not have values at some denominators, therefore some indicators could not be calculated.

“A composite index is a mathematical combination (or aggregation as it is termed) of a set of single indicators (or variables) that represent the different components of a multidimensional phenomenon to be measured (e.g., development, well-being or quality of life). Therefore, the composite indices are used for measuring concepts that cannot be captured by a single indicator” (Mazziotta and Pareto, 2018).

The individual indicators used are summarised through the Adjusted Mazziotta Pareto Index (AMPI). It is a partially non-compensatory composite indicator based on a standardization of the individual indicators, at the reference time, that makes the indicators independent from the unit of measure (De Muro et al., 2011). By choosing this composite indicator, comparisons in both space and time can be ensured. The individual indicators are converted into a scale with a range in the open interval (70;130), where the base value is that of Italy in the first year of analysis (2018).

#### 4.2. Descriptive data analysis AMPI

For the analysis, it is very important to identify the individual indicators that most influence the AMPI and the resulting ranking of the municipalities. In our case, the most influential indicators over the years in the Inner Areas (i.e. the one that is added or removed shifts on average most positions) are for the first 3 years the ‘Population aged 0-17 years’ (134, 130, 130, 125 in 2018, 2019, 2020 and 2021 respectively) and for the last year 2021 the ‘Population (over 9 years old) with master’s degree or second level academic diploma and PhD’ (119, 118, 129, 135). In contrast, the least influential indicator is the ‘labour turnover ratio (revised)’ (33, 34, 34, 34).

Having calculated the AMPI, we proceeded with the correlation analysis. It can certainly be said that there is no correlation between the composite indicator and the individual indicators. In fact, the highest value of the Pearson index is found for the indicator ‘Population with diploma of upper secondary education’ in all years of analysis (-0.407; -0.424; -0.429; -0.415). Figure 2 shows correlation matrix for 2018.

Figure 2 – Correlation matrix (Areas 5 and 6) – Year 2018

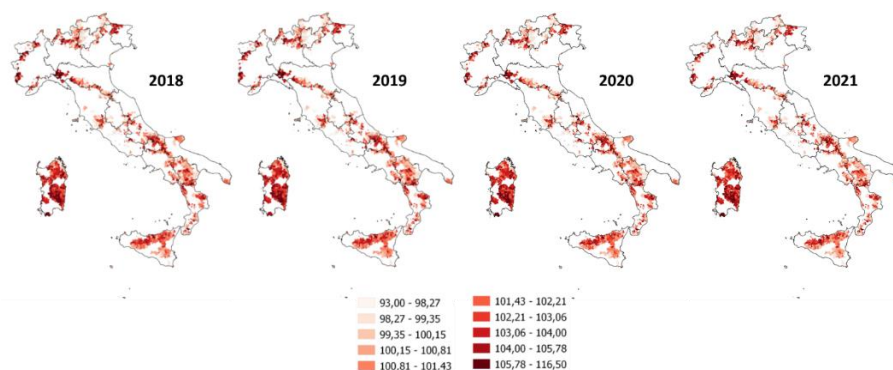
Correlation 2018										Indicator	Description
	A	B	C	D	E	F	G	H	AMPI		
A	1.00	0.04	0.03	0.13	-0.07	0.08	0.11	0.04	-0.36	A	Average population per 1,000 inhabitants
B	0.04	1.00	0.36	0.05	-0.13	0.20	0.10	0.10	-0.22	B	Population aged 0-17 years (%)
C	0.03	0.36	1.00	0.34	-0.13	0.10	0.18	0.18	-0.22	C	Score (0 population aged 0-17 years (0))
D	0.13	0.05	0.34	1.00	-0.02	0.26	0.16	0.09	-0.21	D	Young age dependency ratio (%)
E	-0.07	-0.13	-0.02	-0.02	1.00	0.08	0.10	0.01	-0.40	E	Old age dependency ratio (%)
F	0.08	0.20	-0.13	0.26	0.08	1.00	0.09	0.10	-0.24	F	Labour force turnover ratio (%)
G	0.11	0.10	0.18	0.16	0.10	0.09	1.00	0.09	-0.22	G	Population with diploma of upper secondary education (%)
H	0.04	0.10	0.18	0.09	0.01	0.10	0.09	1.00	-0.35	H	Population over 18 years old with master's degree or second level academic diploma (%)
AMPI	0.34	-0.22	-0.22	-0.21	-0.40	-0.24	-0.22	-0.35	1.00		

## 5. Results

### 5.1. AMPI

Figure 3 shows the mapping of Italian municipalities belonging to Areas 5 and 6 for the 4 years considered according to the level of depopulation.

**Figure 3** – AMPI ranking: Maps of Italian municipalities (Areas 5 and 6).



Municipalities with the highest values of AMPI are shown in dark red, while those with the lowest values are shown in light red. Peripheral municipalities are located along the mountain ranges: Alps and Apennines. The municipalities at high risk of depopulation are concentrated: in northern Italy, especially on the borders of Piedmont, in some municipalities in Lombardy, in the internal areas of Sardinia, between Basilicata and Calabria, between Molise and Abruzzo, and in a small area called Four Provinces, on the border between four regions<sup>6</sup> that represent the first northern stretch of the Apennines.

### 5.2. Classification tree

To find out the reasons for this ranking, the analysis continues with the Chisquared Automatic Interaction Detector (CHAID) ‘regression tree’ classification method (Kass, 1980). We hypothesised that certain contextual factors of administrative, geographical and spatial nature may influence depopulation on a local scale and consequently the demographic structure of the remaining population. Close relationships have been found between some contextual factors of a geographical and geomorphological nature and the depopulation of local realities (Reynaud et al., 2020).

<sup>6</sup> Four Provinces refers to a portion of the Ligurian Apennines included in the Italian provinces of: Alessandria, in Piedmont, Genoa, in Liguria, Pavia, in Lombardy, Piacenza, in Emilia-Romagna.



The AMPI is the dependent variable, while the independent variables are the administrative subdivisions (Geographical area, Region, Province/Metropolitan city), certain geographical characteristics (Altitude zone<sup>7</sup>, Population density<sup>8</sup>) and the Demographic size of municipalities class. Since the target variable (the AMPI) is continuous, a F test is used as the criterion of splitting nodes, instead of a chi-squared test (Ritschard, 2013).

The CHAID produces a hierarchical segmentation: disjointed groups (the nodes of the tree) are created, which are internally homogeneous by level of AMPI. In this approach through the dependent variable - the AMPI index - homogeneous groups are constructed within them according to the AMPI values; with the geographical-territorial indicators the municipalities are progressively segmented and 'characterised'. This permits the groups to be read through a distinctive combination of categories of these discriminating variables. All independent variables are influential in the classification, although differently from year to year: in 2018 altitude zone and population density are not influential, in 2019 geographical area, in 2020 and 2021 population density. Variables that are not influential for each year are indicated in red.

For each Census year, we analyse the characteristics of the municipalities belonging to the first two and last two nodes, named respectively 'best nodes' and 'worst nodes'. (Figure 4). The municipalities in the best nodes are medium-large municipalities (between 2,001 and 100,000 inhabitants), mainly in the North-West, North-East and Central Areas. A few municipalities in the South (Campania, Abruzzo, Molise, Basilicata and Calabria) also appear, but there are no municipalities from the Islands. For the years 2018, 2019, 2020 149 municipalities fall into the best nodes, they are 248 for the 2021 Census edition.

In the worst nodes we find small and very small municipalities (up to 1,000 inhabitants). Among the geographical areas, the Centre does not appear. The Regions present are, for the North-West: Liguria, Piedmont, Lombardy; for the North-East: Friuli-Venezia Giulia, Veneto, Emilia-Romagna; for the South: Basilicata and Molise; for the Islands: Sardinia. The number of municipalities in the worst nodes are 109 in 2018, 121 in 2019 and 183 in 2020 and 2021.

Finally, depicting on a map the municipalities of the best and worst nodes over the four-year period, we observe that among municipalities in the most peripheral areas, the phenomenon evolves negatively very quickly (Figure 5). Critical situations are also found in the North, whose municipalities are at risk of depopulation as much as those in the South and the Islands.

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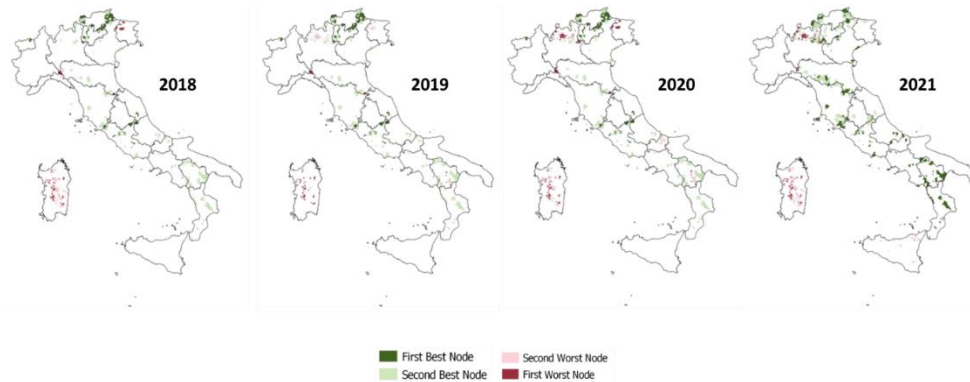
<sup>7</sup> *Altitude zone* derives from the division of the national territory into homogeneous zones resulting from the aggregation of contiguous municipalities on the basis of altimetric threshold values. (Eurostat, 2019)

<sup>8</sup> Relation between the number of inhabitants and the surface of the territory (number of inhabitants per km<sup>2</sup>). (Eurostat, 2019)

**Figure 4 – Characteristics of municipalities in the best and worst nodes.**

	2018 Edition	2019 Edition	2020 Edition	2021 Edition
<b>First Best Node</b>	<b>NODE 14</b> 1-Demographic size of municipalities class: between 2,001 and 5,000 persons 2-Region: Valle d'Aosta, Autonomous Province of Bolzano/Bozen, Autonomous Province of Trento, Marche, Lazio	<b>NODE 14</b> 1-Demographic size of municipalities class: between 2,001 and 5,000 persons 2-Region: Valle d'Aosta, Autonomous Province of Bolzano/Bozen, Autonomous Province of Trento, Marche, Lazio	<b>NODE 22</b> 1-Demographic size of municipalities class: between 2,001 and 5,000 persons 2-Geographical area: North-West, North-East, Centre 3-Region: Valle d'Aosta, Autonomous Province of Bolzano/Bozen, Autonomous Province of Trento, Marche, Lazio	<b>NODE 15</b> 1-Demographic size of municipalities class: between 5,001 and 100,000 persons 2-Region: Lombardy, Autonomous Province of Bolzano/Bozen, Autonomous Province of Trento, Veneto, Emilia-Romagna, Tuscany, Lazio, Campania, Abruzzo, Molise, Basilicata, Calabria
	Number of municipalities: 50	Number of municipalities: 50	Number of municipalities: 50	Number of municipalities: 99
	<b>NODE 15</b> 1-Demographic size of municipalities class: between 5,001 and 100,000 persons 2-Region: Lombardy, Autonomous Province of Bolzano/Bozen, Autonomous Province of Trento, Veneto, Emilia-Romagna, Tuscany, Lazio, Campania, Abruzzo, Molise, Basilicata, Calabria	<b>NODE 16</b> 1-Demographic size of municipalities class: between 5,001 and 100,000 persons 2-Region: Lombardy, Autonomous Province of Bolzano/Bozen, Autonomous Province of Trento, Veneto, Emilia-Romagna, Tuscany, Lazio, Campania, Abruzzo, Molise, Basilicata, Calabria	<b>NODE 15</b> 1-Demographic size of municipalities class: between 5,001 and 100,000 persons 2-Region: Lombardy, Autonomous Province of Bolzano/Bozen, Autonomous Province of Trento, Veneto, Emilia-Romagna, Tuscany, Lazio, Campania, Abruzzo, Molise, Basilicata, Calabria	<b>NODE 16</b> 1-Demographic size of municipalities class: between 2,001 and 5,000 persons 2-Geographical area: North-West, North-East, Centre
	Number of municipalities: 149	Number of municipalities: 149	Number of municipalities: 149	Number of municipalities: 248
<b>Second Best Node</b>	<b>NODE 27</b> 1-Demographic size of municipalities class: between 501 and 1,000 persons 2-Region: Liguria, Veneto, Friuli-Venezia Giulia, Emilia-Romagna, Molise, Puglia, Sardinia 3-Province: Genova, Piacenza, Parma, Sassari, Nuoro, Oristano, Sud Sardegna	<b>NODE 7</b> 1-Demographic size of municipalities class: up to 500 persons 2-Region: Lombardy, Friuli-Venezia Giulia	<b>NODE 20</b> 1-Demographic size of municipalities class: between 501 and 1,000 persons 2-Region: Liguria, Lombardy, Veneto, Friuli-Venezia Giulia, Emilia-Romagna, Molise, Puglia, Basilicata, Sardinia 3-Altitude zone: Hill	<b>NODE 10</b> 1-Demographic size of municipalities class: between 501 and 1,000 persons 2-Geographical area: Islands
	Number of municipalities: 53	Number of municipalities: 69	Number of municipalities: 62	Number of municipalities: 74
	<b>NODE 23</b> 1-Demographic size of municipalities class: up to 500 persons 2-Region: Piedmont, Liguria, Lombardy, Friuli-Venezia Giulia, Emilia-Romagna, Campania, Basilicata, Sardinia 3-Geographical area: North-East, Islands	<b>NODE 9</b> 1-Demographic size of municipalities class: up to 500 persons 2-Region: Emilia-Romagna, Basilicata, Sardinia	<b>NODE 7</b> 1-Demographic size of municipalities class: up to 500 persons 2-Region: Lombardy, Friuli-Venezia Giulia, Emilia-Romagna, Basilicata, Sardinia	<b>NODE 20</b> 1-Demographic size of municipalities class: up to 500 persons 2-Geographical area: North-West, South, Islands 3-Region: Lombardy, Basilicata, Sardinia
	Number of municipalities: 56	Number of municipalities: 52	Number of municipalities: 121	Number of municipalities: 109
<b>Four Worst Node</b>	Number of municipalities: 109	Number of municipalities: 121	Number of municipalities: 183	Number of municipalities: 183

**Figure 5 – Maps of municipalities (Areas 5 and 6) in the best and worst nodes.**



The focus selected municipalities that are already disadvantaged at the start since they are identified on the basis of their belonging to the most peripheral Inner Areas, i.e. those furthest from the centres offering essential services. If when analysing the Italian territory as a whole the North-South dichotomy usually appears, when attention is focused on a small group of municipalities, peculiarities emerge that deviate from the most widespread stereotypes. But municipalities belonging to the two worst nodes have the same demographic and socio-economic characteristics: the non-arrival of foreigners and the exodus of young people from depopulation areas mean that the (less educated) elderly are left alone, far from the centres offering services (especially hospitals), to deal with age-related problems. In the four years,

several municipalities in Sardinia are constantly present and critical situations of municipalities more at risk of depopulation in several southern Italian regions, but also in wealthy areas in the North.

## 6. Conclusions

The low birth rate and significant emigration have as a clear consequence a demographic vulnerability due to an ageing population and an abandonment of the territory. These phenomena are even more striking in some local contexts that are already penalised and marginalised. Depopulation of the territory, particularly when combined with an ageing population, represents a major challenge for society, the economy and politics in the future. It will be necessary to identify situations of demographic distress and implement appropriate anti-depopulation measures.

The analysis described with the available data from the four editions of the Permanent Census is carried out to show the potential of using the annual data and how the yearly municipal dissemination allows a temporal and spatial analysis. In fact, thanks to both longitudinal and territorial analyses, it will be possible to highlight trends and/or criticisms in specific territories and identify sub-populations or areas that are particularly vulnerable or in difficulty, i.e. elements that can support public decision-makers at local level in planning action policies.

With this study, it is not possible to identify a trend because 2021 shows slightly different results from the previous three years, but it does make it possible to identify the territories with situations to be monitored. The different trend relative to the last available census year will be further investigated, the worst nodes after the second will be analysed to identify the position in the ranking occupied by the municipalities that are in the last positions in the first three census years. But the result in 2021 could also be an effect of the pandemic, and only the analysis of trends in the coming years will allow this to be investigated.

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