Enhancing comparability of local population turnovers

Bitonti F.[1], Ghio D.[2], Mazza A.[3]

Background

Population change has always been of primary interest in the realm of macro-demography. Whereas, for decades, a large body of research has emphasized the long-run consequences of population change on economic development (Bloom et al., 2003; Hansen, 2018) and the environment (Bartlett, 1994; Lee, 2001; Ray & Ray, 2011; Weber & Sciubba, 2019), the intensity of change –has gained relevance quite recently (Billari, 2015; Billari, 2022). While the natural drivers of population change affect the population size at a slow pace, the migratory components intended as internal and international movements (Friedlander, 1969) can produce abrupt population variations.

In recent times, most developed countries have been experiencing a sharp fall in the natural increase due to birth rates dropping well below replacement level and death rates either remaining consistently low or increasing slightly. Given the current stagnation in fertility and mortality, the size and intensity of migration flows are expected to strongly affect population change. This is particularly evident at sub-national levels, where urbanization and counter-urbanization processes, displacing mostly the individuals in their reproductive age in a short time, can strongly influence the intensity of change and the size of a population directly, by increasing or reducing the number of individuals; or indirectly, by affecting the composition of the local population in both receiving and sending areas (Dennett & Stillwell, 2008).

To assess the pace and composition of local population change in relation to the territorial variation in population density, we compute the Population Turnover Rate (PTR) and the Migration Share of Turnover (MST) for the provinces of Italy (NUTS-3 level) during 2011-2020, categorized according to the degree of urbanisation "DEGURBA" 2020 (Eurostat, 2021). Direct standardization has been applied to rule out the compositional effects due to the different local population structures. The heterogeneities in the corrections yielded by the standardization according to the geographical location of the provinces and their degree of urbanization highlight compositional differences in local population change and shed novel insights into the demographic conditions of Italy's urban, intermediate, and rural areas.

Methods and data

The PTR, widely exploited in ecology (Schoener & Spiller, 1987), organizational demography (Stewman, 1988), and geography (Dieleman & Clark, William A.V. Deurloo, 2000), has also gained attention in the areas of demography (Billari, 2022; Dennett & Stillwell, 2008) and economics (Brown & Tousey, 2020) to measure the intensity of population change. For a specific area, PTR considers the total in- and out-flows to the reference population, namely births, deaths, immigrations, and emigrations. For a given area j, during the period (0, t), the PTR can be formalized as follows:

$$PTR_j(0,t) = b_j(0,t) + d_j(0,t) + i\_mob_j(0,t) + i\_migr_j(0,t) + e\_mob_j(0,t) + e\_migr_j(0,t) \quad (1)$$

Where $b_j(0,t)$ is the crude period birth rate, $d_j(0,t)$ is the crude period death rate, $i\_mob_j(0,t)$ is the crude period internal immigration rate, $i\_migr_j(0,t)$ is the crude period international immigration rate, $e\_mob_j(0,t)$ is the crude period internal emigration rate, and $e\_migr_j(0,t)$ is the crude period international emigration rate. The share of PTR due to internal and international movements can be measured by the MST, defined as:

$$MST_j(0,t) = \frac{i\_mob_j(0,t)+i\_migr_j(0,t)+e\_mob_j(0,t)+e\_migr_j(0,t)}{PTR_j(0,t)} \quad (2)$$

[1] University of Catania, Department of Economics and Business; email: francesca.bitonti@unict.it
[2] University of Catania, Department of Political Sciences; email: daniela.ghio@unict.it
[3] University of Catania, Department of Economics and Business; email: a.mazza@unict.it

The MST ranges, by definition, between 0 and 100. PTR and MST have been standardized through a direct method (Rowland, 2006) based on the age structure of the total Italian population to enable comparisons across different populations.

The PTR and MST have been computed exploiting the population data coming from the Italian National Institute for Official Statistics (Istat) and referring to the total population, births, deaths, and movements by age classes (and age class of the mother for births) in the 110 Italian provinces (NUTS-3 level) during the period 2011-2020.

Preliminary results

The cartographic representation of PTR and MST revealed a North-South gradient, with the northern provinces (especially those located in the North-West) recording higher turnover rates (Subfig. 1.a) and higher migration shares of turnover (Subfig. 1.b). The spatial duality in the speed of population change persisted over time. Migration accounts for the largest share of population change, reaching peaks of about 70% in the provinces up North and in South Sardinia (the large island in the West). From the MST decomposition in its internal and international components, it emerged that the first one follows the same spatial gradient of MST and accounts for its largest share. In contrast, the second one is residual and is characterized by a more heterogeneous spatial distribution (these results are not shown here for brevity's sake). However, population change in some southern provinces was predominantly driven by the natural component of the PTR (NST) or almost equally determined by the MST and NST (see the darkest coloured provinces in Subfig 1.b).

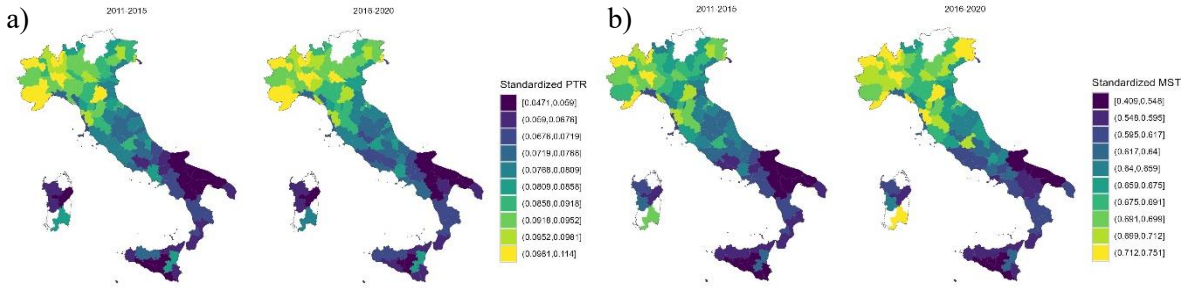

Figure 1 – Standardized PTR and MST in the provinces of Italy during 2011-2015 and 2016-2020. Source: authors' elaboration on Istat data. Note: NAs in white.

Standardization of PTR provided negative adjustments in provinces located along the Italian Appennines, a ridge that runs across central and southern Italy (Figure 2). Over time, areas with negative adjustments extended to more southern internal regions. Adjustments applied to the MST also show a spatial pattern, with positive adjustments in the Centre-North and negative adjustments in the South and North. The spatial clustering of the corrections reflects a population structure gradient due to the territory's morphology.

The classification of all the provinces according to the European classification of administrative units based on the degree of urbanisation "DEGURBA" 2020 (Eurostat, 2021) allowed assessing the relation between the corrections after standardization and the characteristics of the provinces in terms of population density.

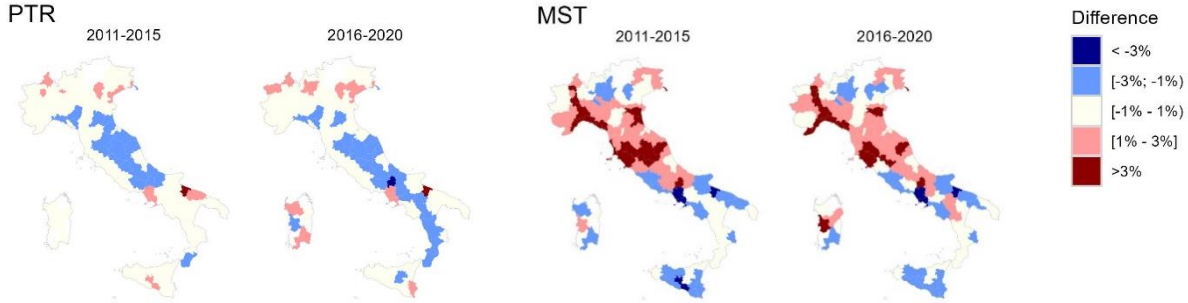

Figure 2 – Percentage change in PTR and MST after standardization in the Italian provinces during the periods 2011-2015, 2016-2020. Source: authors' elaboration on Istat data.

The standardization of the PTR produced different variations in the index according to the DEGURBA classification and the geographic macro-area where the provinces are located (Table 1). The urban provinces registered a general increase in the PTR from North to South, whereas the rural ones were interested in a generalized decrease, except for the North-east. Conversely, the intermediate provinces showed a polarity with PTR increasing in the Northern areas and decreasing in the Centre, South, and Islands. Apart from the South and Islands, the corrections were mostly due to the compensation for the strong incidence of the natural component of the PTR over the migratory one, as reflected in the MST increases. The extreme increases (>1%) in PTR were registered in the North and South and Islands for the urban provinces. On the other hand, extreme PTR reductions emerged for the majority of rural and intermediate provinces in the Centre, South, and Islands. No rural provinces were interested in large PTR increases anywhere (columns 6-7 in Table 1). Moreover, while several urban and intermediate provinces exhibited both high MST increases in the Centre-North and decreases in the South, large percentages of rural ones accounted for high MST increases in all the macro-areas but no extreme reductions anywhere (columns 10-13 in Table 1).

Table 1 – Percentage PTR and MST mean variations (columns 2-5) in the Italian provinces according to the DEGURBA 2020 classification and macro-area. Percentages of the provinces recording an increase/decrease greater than 1 in the PTR and MST after standardization over the total number of provinces belonging to the same DEGURBA class (columns 6-13) in the macro-area. Periods: 2011-2015, 2016-2020.

Urban

Macro-area	PTR mean var. (%)		MST mean var. (%)		PTR increase (>1%)		PTR decrease (>1%)		MST increase (>1%)		MST decrease (>1%)	
	2011-2015	2016-2020	2011-2015	2016-2020	2011-2015	2016-2020	2011-2015	2016-2020	2011-2015	2016-2020	2011-2015	2016-2020
North-east	-0.1	0.1	2.4	2.0	50.0	50.0	25.0	25.0	50.0	50.0	0.0	0.0
North-west	0.3	0.2	0.7	0.8	9.1	27.3	9.1	9.1	27.3	36.4	27.3	27.3
Centre	-0.3	-0.1	1.0	0.6	0.0	0.0	0.0	0.0	50.0	50.0	25.0	25.0
South	1.3	1.2	-2.9	-2.9	50.0	37.5	0.0	0.0	0.0	0.0	87.5	75.0
Islands	0.7	0.4	-2.1	-2.0	16.7	33.3	0.0	0.0	0.0	0.0	100	100

Intermediate

Macro-area	PTR mean var. (%)		MST mean var. (%)		PTR increase (>1%)		PTR decrease (>1%)		MST increase (>1%)		MST decrease (>1%)	
	2011-2015	2016-2020	2011-2015	2016-2020	2011-2015	2016-2020	2011-2015	2016-2020	2011-2015	2016-2020	2011-2015	2016-2020
North-east	-0.4	0.1	1.2	0.8	7.1	14.3	28.6	14.3	50.0	50.0	7.1	14.3
North-west	0.5	0.5	1.3	1.4	20.0	20.0	0.0	0.0	60.0	60.0	10.0	10.0
Centre	-1.2	-0.9	2.5	2.3	0.0	0.0	61.5	61.5	92.3	92.3	7.7	7.7
South	-0.6	-1.0	0.0	0.3	0.0	0.0	27.3	54.5	18.2	18.2	18.2	18.2
Islands	-0.1	-0.3	-0.6	-0.5	0.0	20.0	0.0	20.0	0.0	0.0	40.0	20.0

Rural

Macro-area	PTR mean var. (%)		MST mean var. (%)		PTR increase (>1%)		PTR decrease (>1%)		MST increase (>1%)		MST decrease (>1%)	
	2011-2015	2016-2020	2011-2015	2016-2020	2011-2015	2016-2020	2011-2015	2016-2020	2011-2015	2016-2020	2011-2015	2016-2020
North-east	0.0	0.6	2.5	2.3	0.0	0.0	0.0	0.0	100	100	0.0	0.0
North-west	-0.3	-0.4	2.1	2.0	0.0	0.0	0.0	0.0	100	50.0	0.0	0.0
Centre	-1.1	-1.0	2.5	2.2	0.0	0.0	60.0	60.0	100	60.0	0.0	0.0
South	-1.3	-2.0	1.4	1.9	0.0	0.0	40.0	100.0	40.0	80.0	0.0	0.0
Islands	-0.3	-0.9	1.4	2.7	0.0	0.0	0.0	50.0	50.0	100	0.0	0.0

Expected findings

Italian population changes at two different speeds: the faster in the Centre-North, the slower in the South. The main driver of change is represented by internal movements almost everywhere. The incidence of the NST gains relevance only in some southern provinces. The heterogeneities in the extent of the PTR and MST corrections produced by the standardization showed different patterns of population change depending on the degree of urbanization of the provinces. While the standardization of the PTR in the urban and intermediate provinces compensated for the large incidence of the NST in the North and Centre, it compensated for the larger MST weight in the South and Islands. This reveals that NST and MST in the most densely populated provinces of the country affect population change differently from North to South. Conversely, the extreme MST increases yielded by the standardization

in the rural provinces of all the macro-areas evidenced the strong contribution of the natural component to population change in the Italian countryside. Given the fall in fertility occurring in Italy during the last decades (Billari & Kohler, 2004) and the aging and depopulation processes affecting rural and internal areas of the country (Vendemmia et al., 2021), it is justified to wonder whether the excess mortality characterising the sparsely populated provinces was the main factor influencing the PTR correction downwards and the large MST increases. These considerations spawn particular concern for the future demographic sustainability of the Italian rural areas. The next extensions of this preliminary analysis involve the comparison with other European countries and a sensitivity check of the standardization with different reference populations.

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